Memorandum

Date: March 23, 2021

To: Ryan Stewart, Spokane Regional Transportation Council

From: Tinotenda Jonga, Kara Hall & Chris Breiland, PE, Fehr & Peers

Subject: US 195/I-90 2040 Baseline Conditions

SE19-0695

Introduction

As we begin to evaluate potential mobility improvements for the US 195/I-90 Transportation Study, we must start with an understanding of how the transportation system will operate with the expected growth if no improvements are made. While we understand where improvements are needed today, this evaluation has identified locations where the current system cannot accommodate the expected growth and will serve as a baseline for comparison when identifying the benefits of mobility improvements being evaluated as part of this study.

To evaluate how the system will operate, we first need to understand what the demands on the system will be in 2040. To develop traffic forecasts for 2040, the SRTC Regional Travel Demand Model was used, along with seasonally adjusted traffic data collected in February 2020. The following sections describe the roadway network changes made to the 2040 model, the land use updates based on the market analysis completed for this study, and the methodology used to develop the 2040 traffic forecasts.

Following the development of 2040 traffic forecasts, an operational assessment was completed for the intersections and freeway segments. To facilitate a comparison, we have evaluated the same roadway facilities as were analyzed in the Existing Conditions Report.

Travel Demand Modeling

Consistent with the methodology documented in the Methodology & Assumptions Memorandum prepared for this study, the 2040 traffic forecasts were developed using the SRTC regional travel demand model. To minimize model errors, the growth between the calibrated base year SRTC regional demand model and the 2040 SRTC model was added to our existing traffic volume using and industry-standard approach known as the "difference method."

Roadway Network Update

Updates to the 2040 model began with a review of the funded projects within the study area and the future roadway network. This step relied on a review of projects listed in the Statewide Transportation Improvement Program (STIP), Horizon 2040, the Six Year Transportation Improvement Plan (TIP) for the City of Spokane, and the Spokane County Capital Improvement Plan/TIP. This review was completed to confirm that all funded projects that will construct additional roadway capacity in the study area are reflected in the model. This review also included a comparison to the project list developed for this study to confirm that any projects being evaluated as part of this study were not included in the baseline roadway network.

Within the area reviewed for this study we identified one capacity enhancing project that was coded in the model but is not a potential project to be evaluated as part of the US 195/I-90 Study: Geiger Interchange Improvements with I-90.

Several projects currently on the project list for the US 195/I-90 Study were identified in the model. Those include:

- Full interchange at Hatch Road, including an extension of Meadow Lane Road connecting to Hatch Road west of US 195
- Partial interchange at Meadow Lane Road with access to US 195 northbound and access from US 195 southbound
- S Lindeke Street extension providing two lanes and connecting to Cheney-Spokane Road
- Auxiliary lane between the US 195 interchange and Maple Street interchange on I-90 in the eastbound and westbound direction

These latter four projects were removed from the roadway network for the Baseline 2040 model, removing all projects that would add capacity or reconfigure access along the US 195 corridor.

Land Use Update

An essential component of planning for the future is understanding the growth that the system will need to accommodate in the future.

Land Use Growth

To confirm that the growth being planned for within the study area aligns with the reality of the market, a market analysis was completed for this study. The market analysis for this study looked at the economic market paired with opportunities and barriers for development within the US 195/I-90 study area to determine how much growth can be reasonably expected to occur over the next 20 years, including growth expected to occur in the near term (less than five years). The documentation, including the methodology and findings, is included as **Attachment A** to this

memorandum. A summary of expected employment and household growth is presented in **Table 1** below.

A similar effort was also completed for the West Plains Sub-Area Plan, a study being led by WSDOT, that is evaluating future conditions in the West Plains area, just west of the US 195/I-90 study area around Airway Heights and the Spokane International Airport. To accurately reflect conditions on I-90 and on the local roadway network with connections to the West Plains area the land use developed for that study was also included in the model land use update. A summary of expected growth in the West Plains is also included in **Table 1**, while the documentation and findings for the market analysis are included as **Attachment B**.

Table 1. Market Analysis Summary (Growth Between 2020 and 2040)

Study Area	SRTC Model Growth		Market Analysis Growth		Δ From STRC Model			
	HH	EMP	HH	EMP	HH	EMP	% HH	% EMP
US 195/I-90	4,891	4,491	3,966	1,884	-925	-2,607	-19%	-58%
West Plains	3,644	8,043	4,533	11,981	889	3,938	24%	49%

Notes: HH= Total Households, EMP=Employment

As shown in **Table 1**, the expected growth in the study area based on the market analysis was compared to the growth planned to occur by 2040 in the SRTC travel demand model land use. Within the US 195/I-90 study area, the market analysis indicates that less growth is likely to occur for households and employments than was considered in the 2040 SRTC land use.[1] In the West Plains area, both household and employment growth are expected to exceed land use forecasts previously developed.

Following the completion of the market analysis and the development of how land use is expected to grow over the next 20 years, developing land use inputs for the 2040 SRTC regional model required two steps.

First, because the land use information from the market analysis only accounts for growth expected to occur over the next 20 years, the market analysis land use was added to the base year model land use. This step ensures that when compared to volume data from the base year model (which was validated to 2020 counts), the future year model will accurately reflect growth.

[1] It should be noted that much of the reduction in forecasted employment within the US 195/I-90 study area was concentrated in the downtown Spokane/South Hill area. Along much of US 195, there is not a substantial amount of commercial land for employment growth, as the majority of the corridor is residential.

The second step was the reallocation of land use within the model such that land use totals for each jurisdiction were maintained. As shown in **Table 1**, the market analysis found that growth in the area would vary from the growth allocated in the 2040 SRTC regional travel demand model. As the total land use allocated for each of the jurisdictions included in the model are based on state and countywide allocations, the total land use within each jurisdiction must be maintained for consistency with regional plans and local Comprehensive Plans. **Table 2** presents the land use totals by jurisdiction for both 2015 and 2040 for each of the jurisdictions included in the regional travel demand model.

Table 2. Land Use Summary by Jurisdiction

Jurisdiction	2015		2040	
	Households	Employment	Households	Employment
Airway Heights	1,342	411	3,825	2,857
Cheney	1,588	753	2,058	2,110
Liberty Lake	2,314	5,701	3,582	6,811
Medical Lake	1,204	595	1,877	683
Millwood	751	941	819	1,210
Spokane	81,509	91,942	93,439	107,393
Spokane County	46,075	2,8831	59,342	40,686
Spokane Valley	34,577	42,987	41,303	55,394
Unincorporated Spokane County	24,783	34,094	31,772	47,811

The totals presented above were established as the "control total" for the jurisdictions within the West Plains and US 195/I-90 study area (City of Spokane, Spokane County, and Airway Heights). The difference in land use within the West Plains and US 195/I-90 study area, presented in **Table 1**, was used to determine the amount of land use that needed to be reallocated by jurisdiction. The total presented, for both household and employment, was then reallocated by adding, or removing, this difference to/from Traffic Analysis Zones (TAZs) outside the study area but within the appropriate jurisdictions. The land use was proportionally distributed across the TAZs based on the allocation of land use within the jurisdiction in the 2040 regional travel demand model such that the control totals presented in **Table 2** were maintained. A complete summary of land use allocations within the study area and each jurisdiction can be seen in **Attachment C.** This method is the same approach used in several other planning studies in the region, including

Spokane County's Mead-Mt. Spokane Study and the Northeast Industrial Area study in Spokane Valley.

Trip Generation

As important as confirming that the amount of growth being planned for is accurate is confirming that the number of vehicle trips being generated by that growth is accurate.

To validate the trip generation step of the travel demand model we tested changes in five land use categories to determine if the increase in land use resulted in the expected increase in trip generation. To complete this test, we added 100 dwelling units/employees to TAZs containing the following land use categories:

- Single family households (SFDU)
- Multifamily households (MFDU)
- Non-CBD retail
- Office
- Industrial

This test was completed for TAZs in the West Plains and US 195/I-90 study areas. The results are summarized in **Table 4**. The expected increase in trip generation was calculated using the trip generation rates documented in the Institute of Transportation Engineers (ITE) *Trip Generation Handbook 10th Edition*, which are generally deemed to represent the land uses and urban form typical of the West Plains and US 195/I-90 study areas.

As shown in **Table 4**, the model was found to underestimate trip generation for all land uses tested. Only trip generation rates for the office land use in the US 195/I-90 study area were found to be within 10% of the expected trip generation, with trips for SFDU varying by nearly 50% from the expected number of trips in the West Plains and US 195/I-90 study area.

Table 4. Trip Generation Validation Summary

Study Area	TAZ	Land Use	Trip Generation (Original)	Trip Generation (with added land use)	Trip Generation Increase	Expected Trip Generation Increase	Difference (Expected-Actual)	% Difference
US 195/ I-90	198	SFDU	1,236	1,287	51	99	-48	-48%
		MFDU		1,282	46	56	-10	-18%
	186	Non- CBD Retail	665	789	124	162	-38	-23%
	161	Office	2,351	2,389	38	40	-2	-5%
West Plains	459	SFDU	2,388	2,434	46	99	-53	-54%
	462	MFDU	1,313	1,358	45	56	-11	-20%
	461	Non- CBD Retail	2,100	2,193	93	162	-69	-43%
	549	Office	1,648	1,679	31	40	-9	-23%
	551	Industrial	1,683	1,726	43	49	-6	-12%

Consistent with the methodology documented in the Methodology & Assumptions memorandum and recent planning-level studies completed in the region, a land use multiplier was developed for each land use through an iterative process. The multiplier was developed using the trip generation rate derived from the travel demand model and the expected trip generation increase to determine how much the land use would need to be increased to generate the expected number of trips based on ITE trip rates. The land use multipliers and trip rates used to derive the multipliers are presented in **Table 5**. Application of these multipliers resulted in trip generation within 10% of the expected trips based on ITE trip generation rates for all land uses. Through coordination with WSDOT to maintain consistency between the US 195/I-90 study and West Plains study, the final land use multipliers developed by WSDOT were applied in the West Plains area.

Table 5. Land Use Multipliers

Study Area	TAZ	Land Use	Trip Generation Increase	Model Trip Rate	ITE Trip Rate	Land Use Need to Match ITE	Proposed Land Use Multiplier	Final Land Use Multiplier
US 195/ I-90	198	SFDU	51	0.51	0.99	194	1.9	1.9
		MFDU	46	0.46	0.56	122	1.2	1.2
	186	Retail	124	1.24	1.62	131	1.3	1.3
	161	Office	38	0.38	0.40	105	1.1	1.1
West Plains	459	SFDU	46	0.46	0.99	215	2.2	2.0
	462	MFDU	45	0.45	0.56	124	1.2	1.2
	461	Retail	93	0.93	0.4	174	1.7	1.3
	549	Office	31	0.31	0.49	129	1.3	1.5
	551	Industrial	43	0.43	1.62	114	1.1	1.3

The land use multipliers presented in **Table 5** were applied to the land use within the West Plains and US 195/I-90 study area and were included as the final step of land use updates following the development of the 2040 land use inputs and reallocation of land use to maintain the land use totals. After all land use multipliers were applied, over 50% of the TAZs within the US 195 and West Plains study areas were found to be within 10% of the expected ITE trip generation. Total trip generation within the US 195 study area was within 4% of expected trip generation, while trip generation within the West Plains area was found to be within 1% of expected trip generation. A validation summary for both study areas is included in **Appendix C**.

2040 Forecasts

Traffic forecasts for 2040 were developed for all study roadway segments and intersections. Traffic forecasts were developed using the growth in volume expected to occur based on the base year and future model and applying the difference method. As noted above, the difference method is an industry standard approach for traffic forecasting that is documented in the National Cooperative Highway Research Program (NCHRP) Report 765. Using this method, the growth derived from the future year and base year travel demand models is applied to traffic volume data collected in the field.

Following application of the difference method, post-processing was completed to remove any negative growth and confirm the volume balancing across the study area was reasonable based on volume data collected as part of the existing conditions assessment. This included volume adjustments to confirm that enough growth was forecast by 2040. As documented in the Existing Conditions Report, there were several study segments where the regional travel demand model was not validated based on the seasonally adjusted counts. The primary roadways where the model volume was lower than the count data collected were found to be US 2 and I-90. To account for this and reflect an appropriate amount of growth by 2040, the difference between the base year model volume and existing count volume was added to the model difference as part of the post-processing process.

Table 6 summarizes the annual growth rates for each of the study facilities based on growth forecast using the base year and future year model outputs.

During the AM and PM peak hour, traffic volume growth within the study area is forecast to grow at an average rate of 2% per year over the next 20 years. This level of growth is typical of fairly fast-growing areas. A historical review of traffic volumes along US 195 and I-90 indicate annual growth rates of 2% between 2018 and 2019, confirming that the model forecasts align with recent trends in the study area.

As shown in **Table 6**, there are several locations where the annual growth rate is significantly higher than the 2% per year average within the study area. These locations include:

- S Meadow Lane Road during the AM and PM peak hour
- Marshall Road during the AM and PM peak hour
- Thorpe Road during the AM and PM peak hour
- W 16th Avenue during the AM peak hour
- S Lindeke Street during the AM and PM peak hour
- Inland Empire Way during the AM and PM peak hour
- Hatch Road during the AM peak hour
- Qualchan Road during the PM peak hour

On Marshall Road, the 7% annual growth rate is a result of low volume under existing conditions (less than 10 trips during both peak hours). The large growth rates on W 16th Avenue, S Lindeke Street and Inland Empire Way are a result of local routes becoming more travel time competitive as congestion on I-90 and volume at the northbound US 195 merge increase in the future.

Table 6. Annual Growth Rate for Roadway Segments

	Roadway Segment	AM Peak Hour		PM Peak Hour	
		NB/EB	SB/WB	NB/EB	SB/WB
1	Northbound US 195 south of Hatch Road	1%	0%	1%	0%
	Southbound US 195 south of Hatch Road	0%	1%	0%	1%
2	S Meadow Lane Road west of US 195	6%	5%	6%	5%
3	Cheney-Spokane Road between US 195 and W Qualchan Drive	2%	1%	1%	2%
4	Marshall Road south of Thorpe Road	7%	0%	2%	7%
5	Thorpe Road east of US 195	3%	6%	5%	4%
6	W 16th Avenue between US 195 and S Lindeke Street	1%	5%	3%	2%
7	Westbound I-90 west of Grove Road Interchange	0%	2%	0%	1%
	Eastbound I-90 west of Grove Road Interchange	1%	0%	2%	0%
8	Eastbound US 2 west of I-90	0%	0%	2%	0%
	Westbound US 2 west of I-90	0%	2%	0%	1%
9	S Lindeke Street south of W Sunset Boulevard	4%	1%	4%	4%
10	Northbound US 195 south of I-90	3%	0%	3%	0%
	Southbound US 195 south of I-90	0%	2%	0%	3%
11	Inland Empire Way just north of Thorpe Road	4%	7%	6%	9%
12	S Cedar Street between 16th Avenue and 17th Avenue	1%	1%	1%	2%
13	Hatch Road between Hangman Valley Road and E 57th Avenue	3%	4%	2%	3%
14	Eastbound I-90 east of Division Street Ramps	0%	0%	0%	0%
	Westbound I-90 east of Division Street Ramps	0%	1%	0%	1%
15	W Qualchan Drive	1%	3%	2%	4%

Final forecasts for the study roadway segments are presented in **Table 7**. More detailed model output information is included as **Attachment D**.

Table 7. 2040 Roadway Segment Volume

	Roadway Segment	Existing (2020)				Future (2040)			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
1	Northbound US 195 south of Hatch Road	582	-	389	-	830	-	520	-
	Southbound US 195 south of Hatch Road	-	348	-	591	-	500	-	830
2	S Meadow Lane Road west of US 195	247	95	142	327	1,150	320	630	1,140
3	Cheney-Spokane Road between US 195 and W Qualchan Drive	728	196	272	476	1,140	280	360	750
4	Marshall Road south of Thorpe Road	2	-	6	2	10	-	10	10
5	Thorpe Road east of US 195	55	61	82	79	120	270	290	220
6	W 16th Avenue between US 195 and S Lindeke Street	244	152	207	151	310	500	470	230
7	Westbound I-90 west of Grove Road interchange	-	1,626	-	1,767	-	2,380	-	2,120
	Eastbound I-90 west of Grove Road interchange	2,021	-	2,534	-	2,510	-	3,800	-
8	Eastbound US 2 west of I-90	1,386	-	2,332	-	1,540	-	3,830	-
	Westbound US 2 west of I-90	-	1,736	-	1,806	-	2,760	-	2,100
9	S Lindeke Street south of W Sunset Boulevard	306	78	153	191	850	100	450	540
10	Northbound US 195 south of I-90	1,635	-	707	-	3,370	-	1,340	-
	Southbound US 195 south of I-90	-	518	-	1,638	-	870	-	3,040
11	Inland Empire Way just north of Thorpe Road	233	27	106	58	670	160	450	540
12	S Cedar Street between 16th Avenue and 17th Avenue	613	373	456	604	820	480	660	890
13	Hatch Road between Hangman Valley Road and E 57th Avenue	312	339	438	362	660	830	710	770
14	Eastbound I-90 east of Division Street Ramps	5,504	-	6,166	-	6,150	-	6,940	-
	Westbound I-90 east of Division Street Ramps	-	5,734	-	5,972	-	6,840	-	6,830
15	W Qualchan Drive	31	208	107	61	40	440	180	180

Operational Analysis

Traffic operations analysis was completed for the freeway facilities and intersections within the area to understand how these facilities would operate in 2040 without any improvements in the study area. This assessment was then used to identify areas where the existing network may not

be deficient today but will be by 2040 and will serve as a baseline against which proposed mobility improvements will be measured.

Intersection Operations

By 2040, most study intersections will operate deficiently at LOS E or F during the AM and PM peak hours. This is a result of an increase in traffic volume on primary roadways in the study area including US 195, Meadow Lane Road, Cheney-Spokane Road and Hatch Road. Most intersections along these roadways are side-street stop controlled; therefore, as volume on the main street increases the gaps for side-street traffic decrease causing drivers on the side-streets to experience long wait times.

This is true along the US 195 corridor, where an increase in volume in the northbound direction during the AM peak hour and the southbound direction during the PM peak hour create fewer opportunities for side-street traffic to go, resulting in high levels of delay for local trips attempting to access the US 195 corridor and LOS F operations for all intersections.

Figure 1 and **Figure 2** show the LOS results during the AM and PM peak hour, respectively. Technical calculations can be found in **Appendix E**.

Figure 1. 2040 AM Peak Hour LOS

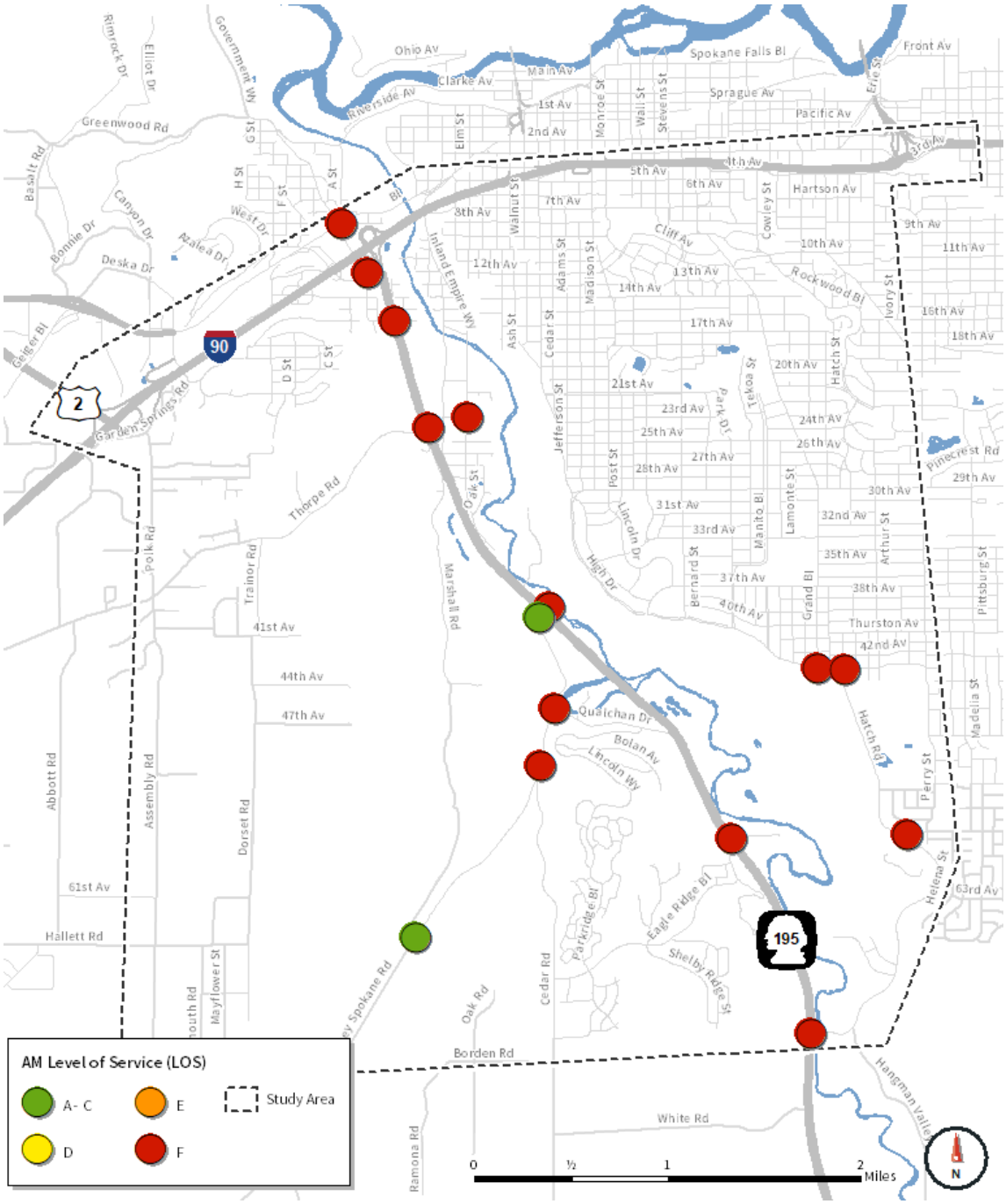
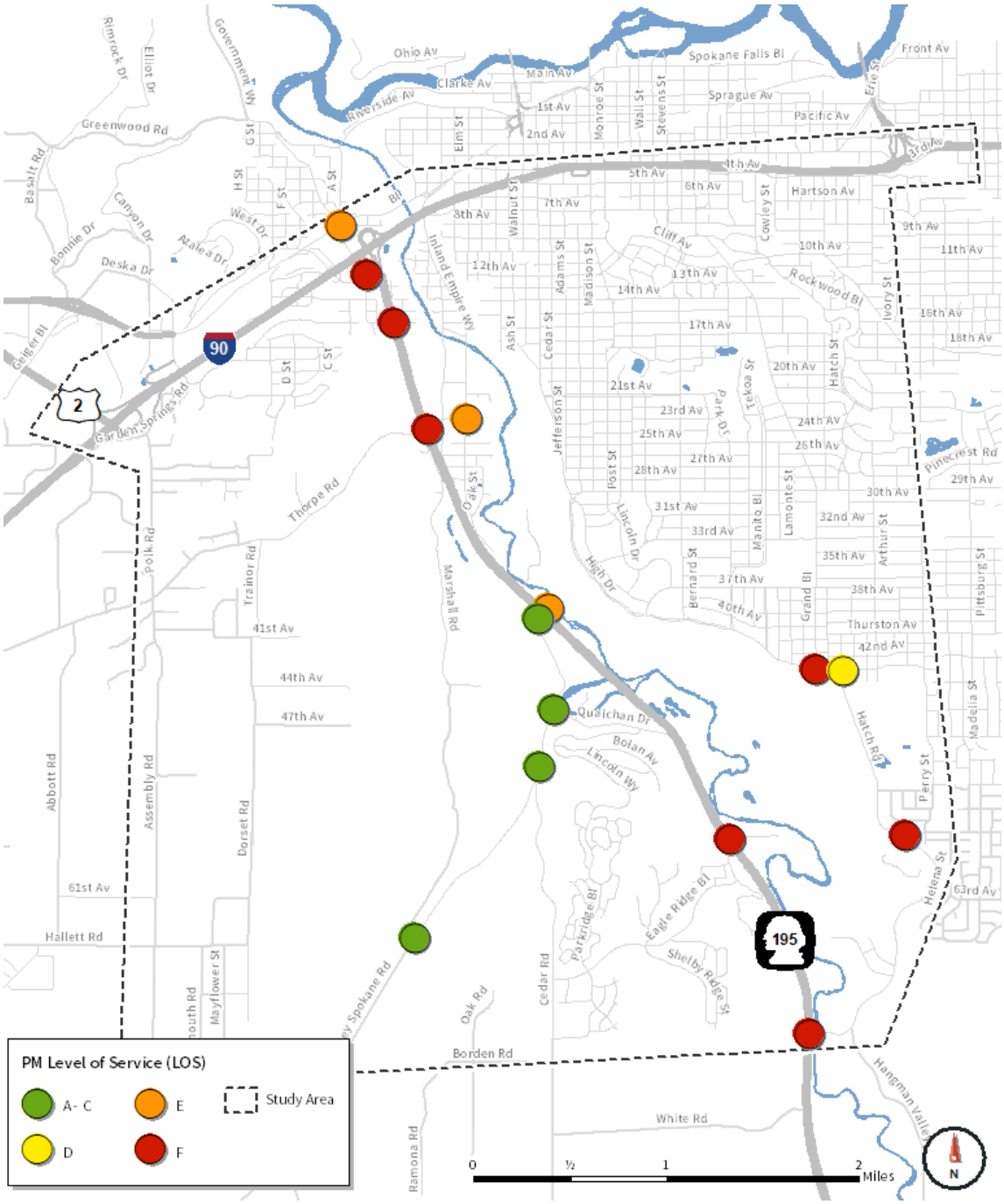


Figure 2. 2040 PM Peak Hour LOS



Freeway Operations

As a key facility within the study area LOS analysis was completed for I-90 between the US 195 diverge and the S. Maple Street Diverge in the eastbound direction. This analysis was completed using the traffic volume presented above and Highway Capacity Software (HCS).

As shown in **Table 8**, during the AM peak hour, the freeway segments analyzed will operate at LOS C or D, which is considered acceptable operations based on WSDOT's standards. Only the northbound US 195 merge with I-90 will operate at LOS E, which is considered unacceptable operations. During the PM peak hour, an increase in demand on I-90 by 2040 will result in unacceptable operations for all freeway segments.

Table 8. 2040 Eastbound I-90 Density & Level of Service

Location	Facility Type	AM Peak Hour			PM Peak Hour		
		Density (pc/mi/ln)		LOS	Density (pc/mi/ln)		LOS
		Freeway	Ramp		Freeway	Ramp	
US 195 Off-Ramp	Diverge	29	31	D	**41**	**40**	**F**
Mainline between US 195 Ramps	Basic	24	-	C	**36**	**-**	**E**
US 195 On-Ramp	Merge	**43**	**39**	**E**	**45**	**38**	**F**
US 195 Off Ramp to S Maple Street/ S Walnut Street	Diverge	40	29	D	**42**	**32**	**F**

Bold font indicates unacceptable operations.

Attachment A. US 195 Market Analysis

LELAND CONSULTING GROUP

US 195/I-90 Study

Date March 24, 2021

To Ryan Stewart, SRTC

From Sam Brookham, Leland Consulting Group

CC Kara Hall, Fehr & Peers

Subject Market Analysis & Development Forecast FINAL

INTRODUCTION

About the Study

Today, the US 195 merge with Interstate 90 (I-90) experiences both operational and safety issues. As the Spokane area grows, challenges facing the local and regional transportation system will also increase. Major residential and employment growth is expected in the West Plains area, and it will increase the number of people and goods traveling east-west between new growth centers in the west and existing centers in the east. With only four options for crossing Latah Creek, pressure on these routes (most notably the I-90 crossing) will intensify.

To address both existing and future challenges related to safety, operations, access, and infrastructure along the US 195 from Hatch Road to the merge with I-90, the Spokane Regional Transportation Council (SRTC) is leading a multi-jurisdictional study. This study is a collaborative effort between SRTC, the Washington State Department of Transportation (WSDOT), the City of Spokane, Spokane County, and Spokane Transit Authority (STA).

Potential strategies for the study will range from coordinated land use planning to access management. The needs of all users will be considered throughout the study, including local trips, regional trips, bicyclists, pedestrians, transit, and freight. Strategies recommend as part of this study will be feasible and able to be implemented within a reasonable timeframe.

About this Market Analysis

This document summarizes Leland Consulting Group's market analysis and development forecast to support the Study. The work ensures that the plan is based on realistic assumptions and forecasts regarding land use and economic development opportunities. Through stakeholder outreach to area agencies, meetings with practitioners from the local development community, a compilation of development projects, and an analysis of demographic and economic data, the resulting forecasts provide market-driven land use projections to identify needed transportation and safety improvements.

The following document includes the methodology, background data, development forecasts, and other information pertaining to these market analysis findings.

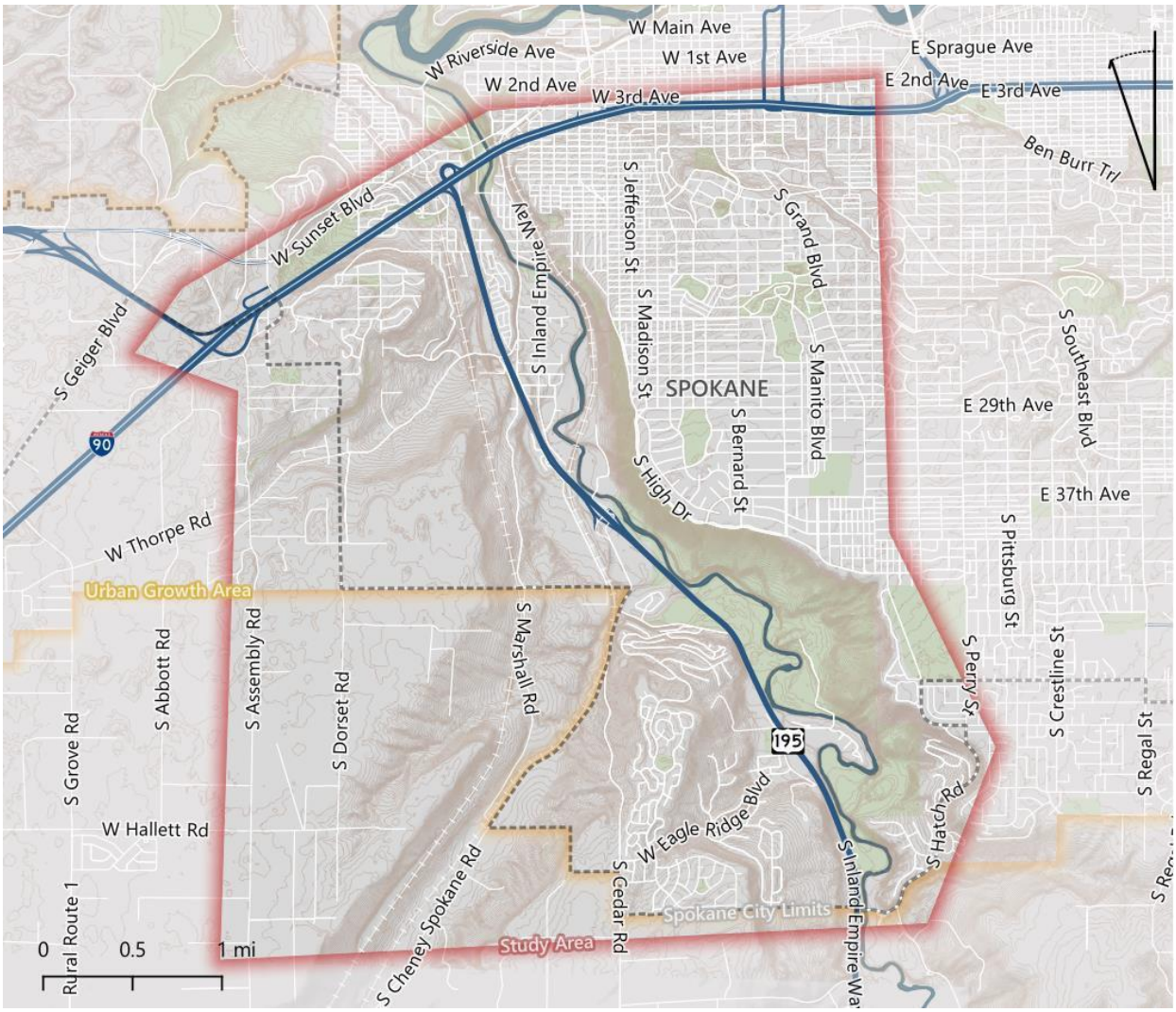
EXECUTIVE SUMMARY

The Study Area

While the study focuses largely on US 195 and I-90, the surrounding areas heavily impact transportation needs along these major transportation routes. The study area, therefore, includes a substantially greater area mostly encompassing the southwest portion of the City of Spokane and a smaller portion of unincorporated Spokane County.

The following map shows the approximate area on which this study centers. Recognizing that topography is one of, if not the defining feature of the study area, the map includes 10-foot contour lines to demonstrate the extent of the slope. Hangman Creek dissects the study area and runs parallel to US 195. Most of the flat land to the west of US 195 is located outside the Urban Growth Area (indicated in yellow).

Figure ES-1. Study Area



Source: TIGER (US Census Bureau), Spokane County, City of Spokane, LCG

The creek and highway separate the east from the west side of the study area, creating two distinct focus areas with unique features and characteristics. These are described below.

West of the River

- Limited transportation connectivity
- Significant topographical and railroad challenges
- Highly underutilized; large tracts of vacant land
- Approximately half within Spokane City Limits; significant portion within unincorporated Spokane County land but outside the UGB

East of the River

- Largely built out with existing residential neighborhoods
- Fewer topographical and physical challenges
- More established transportation grid
- Majority of the population in the study area
- Entirely within Spokane City limits
- Little access from west of the river, except in the south and north

The majority of new development in the study area is expected to occur on the west side of the river, purely because of the sheer amount of vacant land compared to the relatively built-out east-side "South Hill" neighborhood. Opportunities for new development are contingent on utility availability (not covered beyond anecdotal information obtained during stakeholder interviews) and transportation improvements. Given the anticipated growth on the westside versus the relatively limited opportunities for growth on the eastside, this market analysis, and development forecast naturally focuses on conditions and growth opportunities on the west side of the river.

Key Findings

The Study Area, as shown in the previous map, is largely built out to the east and has largely vacant or underutilized areas to the west. Prior to 2000, new development had predominantly been limited to the east in the South Hill neighborhood—a highly desirable area of Spokane. More recently, and as the Spokane market began to attract national investment interest, larger single-family subdivisions and—to a lesser extent—apartment buildings have been constructed to the west, giving rise to significant household growth.

Demographic, economic, and market indicators, coupled with our knowledge of planned new development projects, indicate that continued residential growth and moderate-to-strong residential market demand are likely. Non-residential uses are likely to continue to be secondary to residential uses. Specific findings and considerations that are described in more detail throughout this memorandum are summarized below.

- **Population Growth.** Recent and projected growth rates provide positive indicators for the real estate market going forward. Growth rates in the study area, however, differ significantly for the east and west. Driven by the dwindling supply of vacant land elsewhere in the Spokane market and the continued build-out of several long-established residential subdivisions, growth rates to the west of US 195 are significantly higher than those to the east. Projected growth rates are particularly high among seniors (triple the average annual rate), with significant housing demand implications.
- **Employment.** Some employment diversification can be expected, especially as household growth ramps up and generates demand for services such as grocery stores, restaurants, medical clinics. Recent study area growth and countywide projections also suggest the study area could see moderate growth in office-using industries, including professional services, management of companies, and real estate, rental, and leasing. With this said, employment is generally limited in most industries aside from healthcare and social assistance, so while projected annual growth rates are moderate, the total numbers will remain low within the timeframe of this study.

- **General Development Trends.** Single-family homes and vacant land account for most of the land in the study area. Vacant land is far more prevalent on the west side of the study area (i.e. west of the river and US 195). For these and other reasons, the vast majority of new residential development is expected to occur to the west of US 195, in keeping with the recent population trends. Non-residential uses, on the other hand, are likely to continue clustering primarily in the northeastern portion of the study area, closest to downtown and the highest densities of jobs and households.
- **Residential Market Dynamics.** Supply continues to lag behind demand in the Spokane single-family market, with just a 1.1-month supply of single-family homes on the market. Generally, there is a highly constrained supply of for-sale residential products in the study area with only 0.3 months of inventory on the market, and LCG is bullish about demand going forward. The apartment market is also tight, albeit secondary to single-family, and is projected to deliver a significant number of units to the market in the coming years.
- **Residential Development.** A significant number of single-family subdivisions, multifamily developments, and other residential projects are proposed or planned for the study area. While most of these proposed developments are expected to deliver within the next 20 years, many projects—especially larger—may deliver over multiple phases, with latter phases occurring beyond the 20-year planning horizon. The development forecast presented in the following section reflects these assumptions and is based on a combination of known development trends and a regional-oriented supply and demand analysis.
- **Retail.** Ultimately, rent, vacancy, construction, and absorption data for the past decade give little cause for optimism regarding retail prospects in the study area. Larger scale retail development prospects, particularly along interchanges, may improve as employment growth opportunities are realized in West Plains. Long-term prospects appear more positive given the existing sales leakage from the area, but probably only after substantial residential development.
- **Office and Industrial.** While there is an unprecedented regional and national interest in the Spokane market, it remains vulnerable to significant market disruptions and a potential incoming downturn. Office development in the study area, however, is limited and the area remains more a bedroom community office market consisting of smaller local tenants. Medical office space is the exception and may ramp up in the coming years as a result of the aging population and existing development clusters. Significant industrial employment growth is unlikely, hampering industrial development prospects, but limited light industrial development may occur.

Demand/Development Forecast

The following table shows the summary of the location-specific housing and employment projections for the next 20 years. These projections reflect a market-based approach to forecasting housing units and employment and consider market cycles, construction and absorption trends, the availability of developable land and utility provisions and other physical conditions, regulatory constraints (such as zoning), and high-level financial feasibility. This forecast should, therefore, be considered a reflection of estimated absorption rather than full build-out.

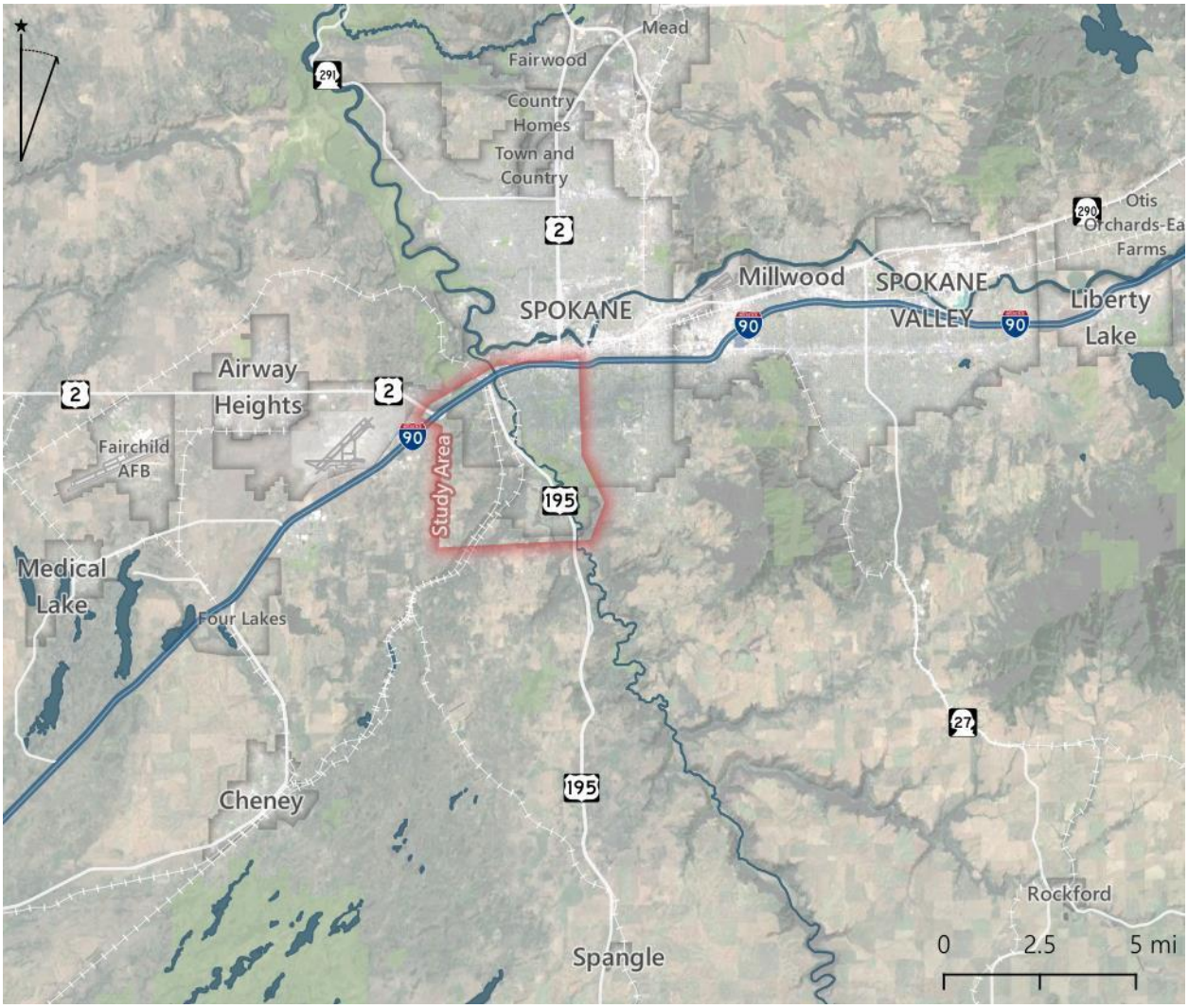
Table ES-1. Study Area Market-Based Growth Projections, 2020-2040

	DWELLING UNITS		EMPLOYMENT (BLDG. SQUARE FEET)					
	Single family	Multi family	Retail	FIRES*	Hotel	Industry	Medical	Office
Units/Sq. Ft.	2,548	1,418	129,500	49,240	270,000	40,000	41,000	68,600
Emps/SF			300	180	600	400	250	160
Est. Jobs			432	271	493	100	164	423
Totals		**3,966 units**						**1,883 jobs**

*Source: LCG; *Denotes Finance, Information, Real Estate Services*

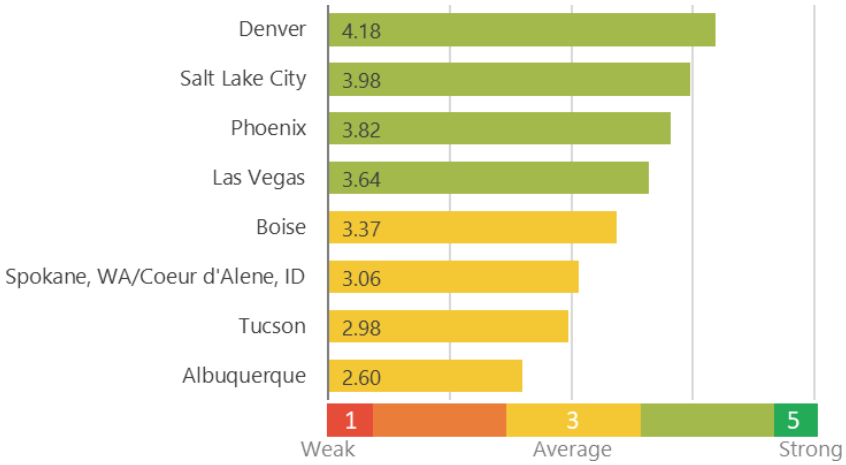
NATIONAL AND REGIONAL CONTEXT

Figure 1. Regional Context



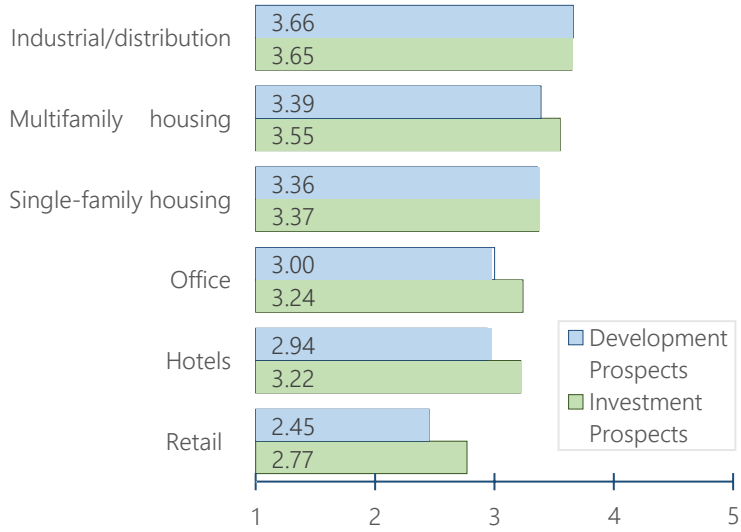
Source: TIGER (US Census Bureau), Spokane County, City of Spokane, LCG

Spokane is a well-positioned inland northwest city in the northeast of Washington. While the Spokane market has not been traditionally considered a hotbed of national investment,[1] Spokane is now attracting interest from national investors and is poised to capitalize on investors from larger cities seeking out higher yields found in tertiary markets, such as Spokane.



Indeed, the Urban Land Institute (ULI)—in its "Emerging Trends in Real Estate" 2019 publication—maintains that the Mountain region will "continue to exhibit strong demographic and economic growth," and the "comparatively low cost of living and [cost] of doing business is considered attractive to new residents and conducive to employment growth." Indeed, the Spokane metro region has added population and jobs faster than the USA average, although income growth is expected to grow at a slower rate. In more recent years, Spokane has been transitioning from a natural resource-based economy to a more high-tech and services orientation. Emerging Trends also advises on the types of development that are likely to be most desirable in the coming years from both a developer and investor perspective. While this is a national outlook, the guidance is relevant for most local markets.

Figure 2. Prospects for Major Property Types, 2020



The figure at left shows ULI's high-level summary of national investment and development prospects for 2020. Industrial and housing top the list, with significantly weaker development prospects for office, hotels, and retail. Industrial and distribution uses have become increasingly popular investments in recent years, largely due to the rapid rise of e-commerce.

Focus groups conducted by ULI for the Spokane/Coeur d'Alene region report that their metro could benefit from

[1] According the Urban Land Institute (ULI) in its annual "Emerging Trends in Real Estate" 2020 publication, survey respondents ranked Spokane in only 61st in overall prospects, with a similar lassitude among investors, in 79th place. This score is based on participants' opinions on the strength of the local economy, investor demand, capital availability, development and redevelopment opportunities, public/private investments, and the local development community.

increased infrastructure investment and that they continue to see rising interest from national and regional investors.

However, like most cities across the nation, Spokane is experiencing significant issues with a shortage of construction labor and higher construction costs, which is amplified locally by stagnant rent growth.

EXISTING CONDITIONS

This section presents demographic and employment conditions for the study area and surrounding region, as well as a high-level assessment of land supply conditions in the study area.

Demographics

As the table below shows, the study area contains almost six percent of Spokane County's total population and almost 14 percent of the City of Spokane's total population. Over the past two decades, the study area has seen modest population growth, closely following trends for the City of Spokane but slightly lower than Spokane County.

As noted previously, the characteristics of the east and west parts of the study area are distinctly different. This also extends to population trends. While the east side of the study area (east of the river) contains approximately three-fifths of the total study area population, it has seen limited growth over the past two decades—albeit a higher rate of growth since 2010. Meanwhile, the west of the study area increased by more than three percent annually between 2000 and 2010 and almost two percent since 2010—growth rates among the fastest in the county.

Table 1. Population Summary, 2000-2019

Population Summary	Study Area*	Spokane	Medical Lake	Cheney	Airway Heights	Spokane County
2000 Pop	26,789	198,140	4,060	9,226	5,259	417,939
2010 Pop	28,220	209,770	5,060	10,590	7,251	471,221
2019 Pop	30,921	227,620	5,368	11,443	9,338	528,652
2000-2010 CAGR**	0.5%	0.6%	2.2%	1.4%	3.3%	1.2%
2010-2019 CAGR	1.0%	0.9%	0.7%	0.9%	2.9%	1.3%
2000-2019 CAGR	0.8%	0.7%	1.5%	1.1%	3.1%	1.2%

Source: ESRI

**The Study Area dissects many block group boundaries, thus the numbers in the table do not total the sum of the west and east block groups.*

*** CAGR = Compound Annual Growth Rate*

The following table shows per capita income, median age, and educational attainment (percent of the population above 25 years old). On average, as of 2019, residents in the study area were among the highest earners, oldest, and most educated in the region.

With a median age of 42.7, the population of the study area is considerably older, on average, than any of these comparison geographies, which are generally between 35.4 to 39.2 years old. Cheney, the location of Eastern Washington University, is the exception at 23.9 years old.

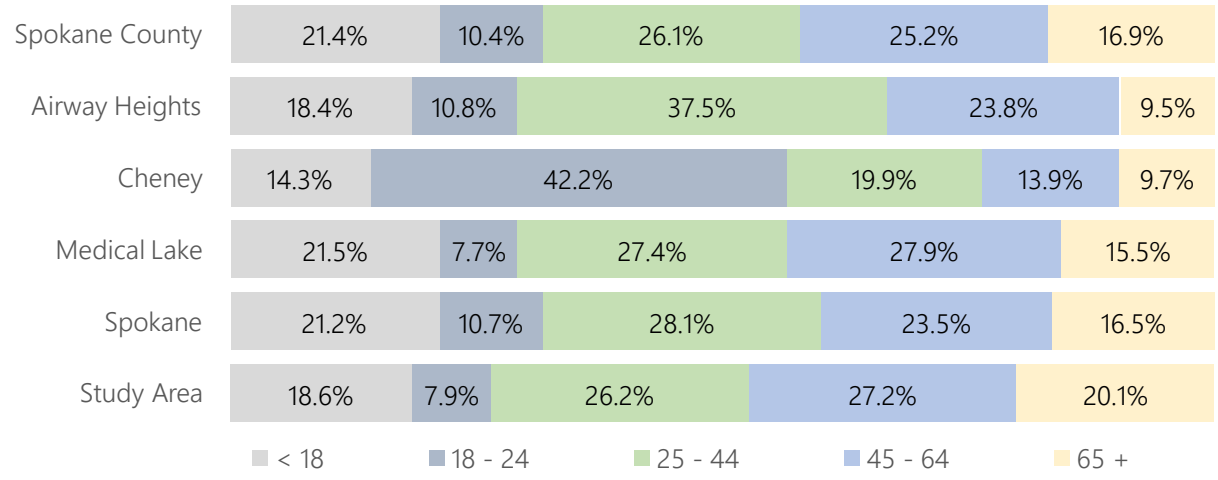
Table 2. Population Characteristics

	Study Area	Spokane	Medical Lake	Cheney	Airway Heights	Spokane County
Per Capita Income	$43,307	$28,749	$28,086	$21,941	$18,014	$30,841
Median Age	42.7	37.0	39.2	23.9	35.4	38.4
% Bachelor's Degree	49.3%	31.0%	28.3%	42.4%	10.4%	31.0%

Source: ESRI

The following chart shows the age distribution of the study area compared to surrounding cities in the region, as well as to Spokane County. As the previous table indicates, residents in the study area tend to be older, on average, than the surrounding region, with almost half aged 45 or over. Similarly, there is a lower proportion of the population aged 24 and younger.

Figure 3. Population Age Distribution, 2019



Source: ESRI

The following table shows select household characteristics for the study area and the surrounding region.

- The higher rate of homeownership coincides with the higher proportion of older, higher-income residents in the study area.
- Combined with the study area's older age profile, the lower proportion of households with children and higher proportion of one- and two-person households indicates a high proportion of households either without children or with older children that no longer live with their parents.
- Home values and median household incomes are also among the highest in the region, reflecting not only the newer construction (particularly on the west) but also the desirability of the South Hill neighborhood.

Table 3. Household Summary, 2019

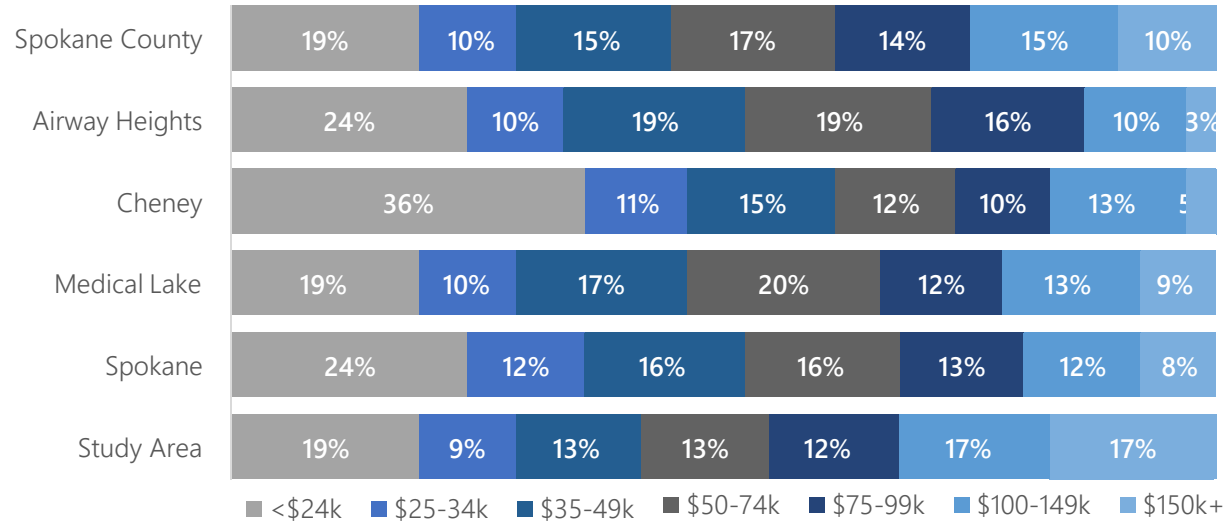
	Study Area	Spokane	Medical Lake	Cheney	Airway Heights	Spokane County
Total Households (2019)	14,221	94,642	1,885	4,254	2,950	208,981
Renter-Occ. Households	40.5%	43.3%	33.3%	65.6%	48.2%	36.3%
% Family Households*	52.4%	56.3%	68.5%	42.8%	59.4%	63.2%
% Households w/ Children*	23.4%	28.9%	37.7%	21.7%	32.2%	30.9%
% 1/2-person Households*	73.6%	66.8%	59.4%	65.5%	63.8%	63.5%
Avg. Household Size	2.13	2.33	2.76	2.31	2.37	2.46
Med. Household Income	$64,124	$47,943	$53,297	$37,688	$47,381	$56,227
Med. Home Value	$339,681	$210,170	$277,638	$212,529	$191,709	$253,278

Source: ESRI
** 2010 data (from US Census)*

As the following figure shows, more than one-third of households in the study earn $100,000 or more annually, a significantly greater proportion than any other comparison area. On the lower end, the study area is consistent with Spokane County (and Medical Lake) for the proportion of households earning less than $24,000 annually and has the least percentage of households earning between $25,000 and $49,999 annually.

While these numbers reflect *current* trends, they do not reflect future housing *needs*. In fact, there may be a greater need for housing units that accommodate the needs of lower-income residents and/or renters. While this market analysis and development forecast will present housing demand based on current trends, it will not describe specific needs.

Figure 4. Household Income Distribution, 2019

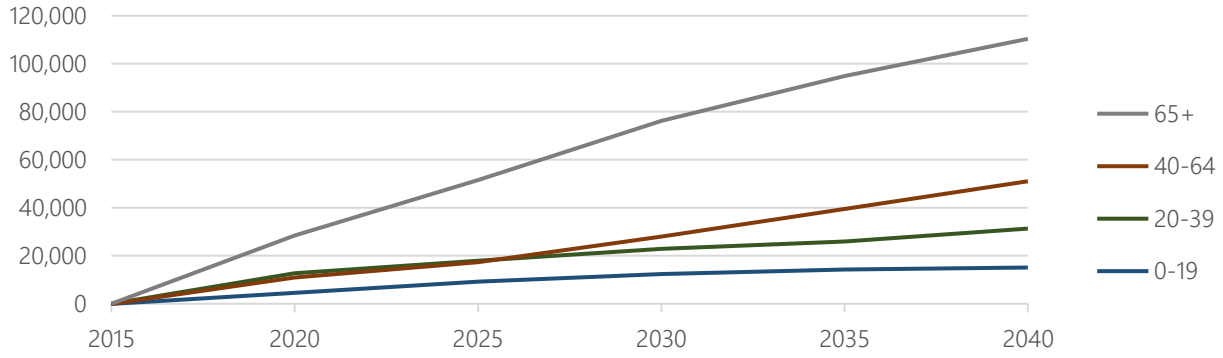


Source: ESRI

Population and Age Projections

The following chart demonstrates that the overwhelming majority of population growth is projected to occur in the senior age groups (65+) over the next 20 years.

Figure 5. Spokane County Net Population Growth Projections by Age Group (Cumulative), 2015-2040

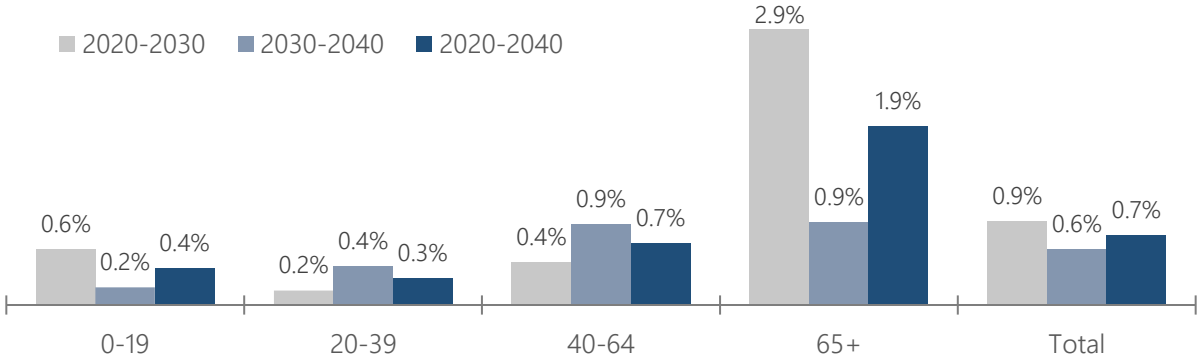


Source: WAOFM, 2017 GMA Projections of the Total Resident Population for Growth Management

Generally, Spokane County is projected to experience a slightly higher rate of annual growth between 2020 and 2030 at 0.9 percent than between 2030 and 2040 at 0.6 percent. The annual rate of growth among seniors is projected to be triple the average annual rate over the next decade.

Housing implications potentially include a greater need for "move-down" single-family residential as empty-nesters no longer require as much space after their children leave home, as well as senior multifamily housing (assisted living facilities and market-rate/age-restricted apartments).

Figure 6. Spokane County Projected Population Growth Rates by Age, 2020-2040



Source: WAOFM, 2017 GMA Projections of the Total Resident Population for Growth Management

Employment

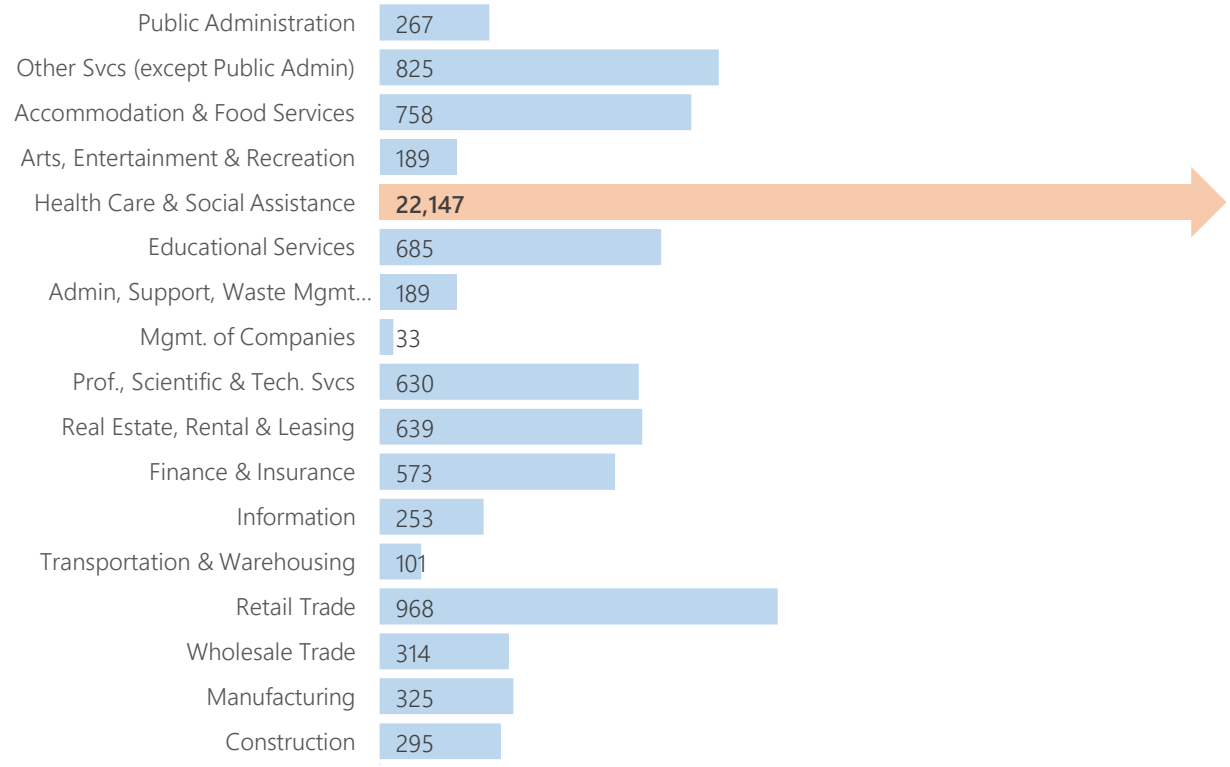
This section provides an overview of employment and commute patterns in the study area.

As the following chart shows, healthcare is the dominant industry, comprising approximately three-quarters of all jobs. Typically, this high concentration of jobs in one area reflects one or more major employers or

institutions. In this case, almost all of Spokane's major healthcare providers are located in the northeast of the study area.

Outside of the healthcare industry, office-using industries (primarily information, finance and insurance, and professional services), account for about 7.3 percent of jobs, while industrial industries (primarily manufacturing, wholesale, transportation and warehousing, and utilities) account for about 4.2 percent. Retail jobs, including arts, recreation, entertainment, accommodation, and food services, account for about 6.6 percent.

Figure 7. Study Area Employment Profile, 2019 (est.)



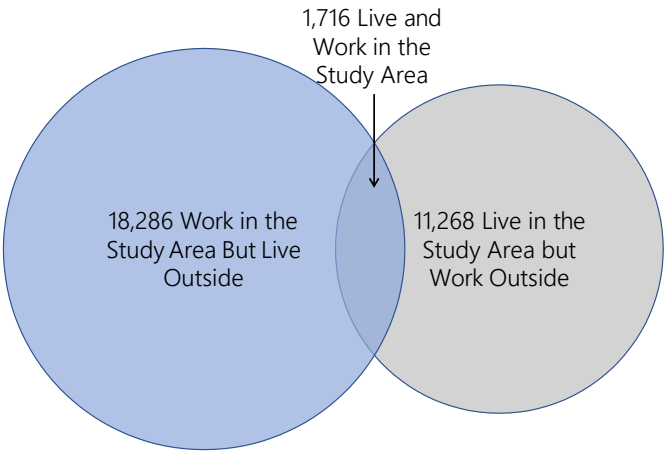
Source: ESRI

Commute Patterns

The figure below shows the number of employees that worked, lived, or both worked and lived in the study area, as of 2017.

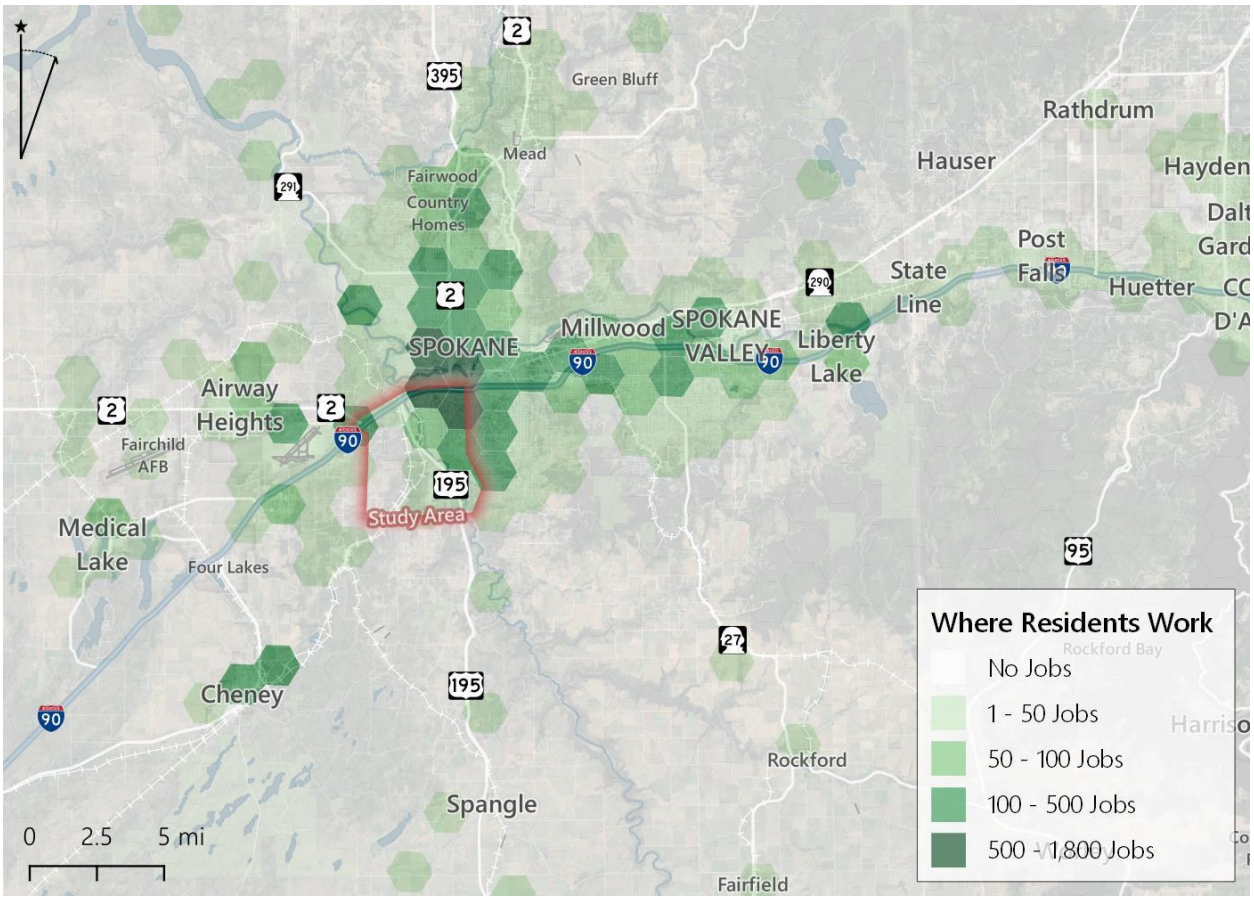
While there is a balanced distribution of jobs outside of the healthcare industry, the vast majority of the people that live in the study area do not also work in the study area. Just 1,716 people both live and work in the study area—about 13 percent of employed residents.

Figure 8. Employment Inflow/Outflow, 2017



As demonstrated in the map at left, study area residents work throughout the region and typically travel in all directions for work. Downtown Spokane is the employment epicenter for study area residents. To the south, there is a small concentration of residents employed in Cheney, likely education-related. To the west, Airway Heights, Medical Lake, and Fairchild Air Force Base are employment hubs, the majority of which is likely industrial-related. Elsewhere, the jobs are more sparsely populated, but generally following major transportation corridors.

Figure 9. Where Study Area Residents Work, 2015



Source: LEHD, LCG

Employment Projections

Spokane County is projected to experience 1.3 percent annual employment growth through 2027. The healthcare industry is projected to account for more than one-quarter of new Spokane County jobs between 2017 and 2027 as the population ages and demand for healthcare facilities increases.

Recent employment growth trends for the study area between 2012 and 2017 have largely followed those projected for Spokane County between 2017 and 2027. In the study area, almost all new employment growth between 2012 and 2017 was in the healthcare and social assistance industry, a trend which is expected to largely continue going forwards.

Some employment diversification can be expected, especially as household growth ramps up and generates demand for services such as grocery stores, restaurants, medical clinics. Recent study area growth and countywide projections also suggest the study area could see moderate growth in office-using industries, including professional services, management of companies, and real estate, rental, and leasing. With this said, employment is generally limited in most industries aside from healthcare and social assistance, so while projected annual growth rates are moderate, the total numbers will remain low within the timeframe of this study.

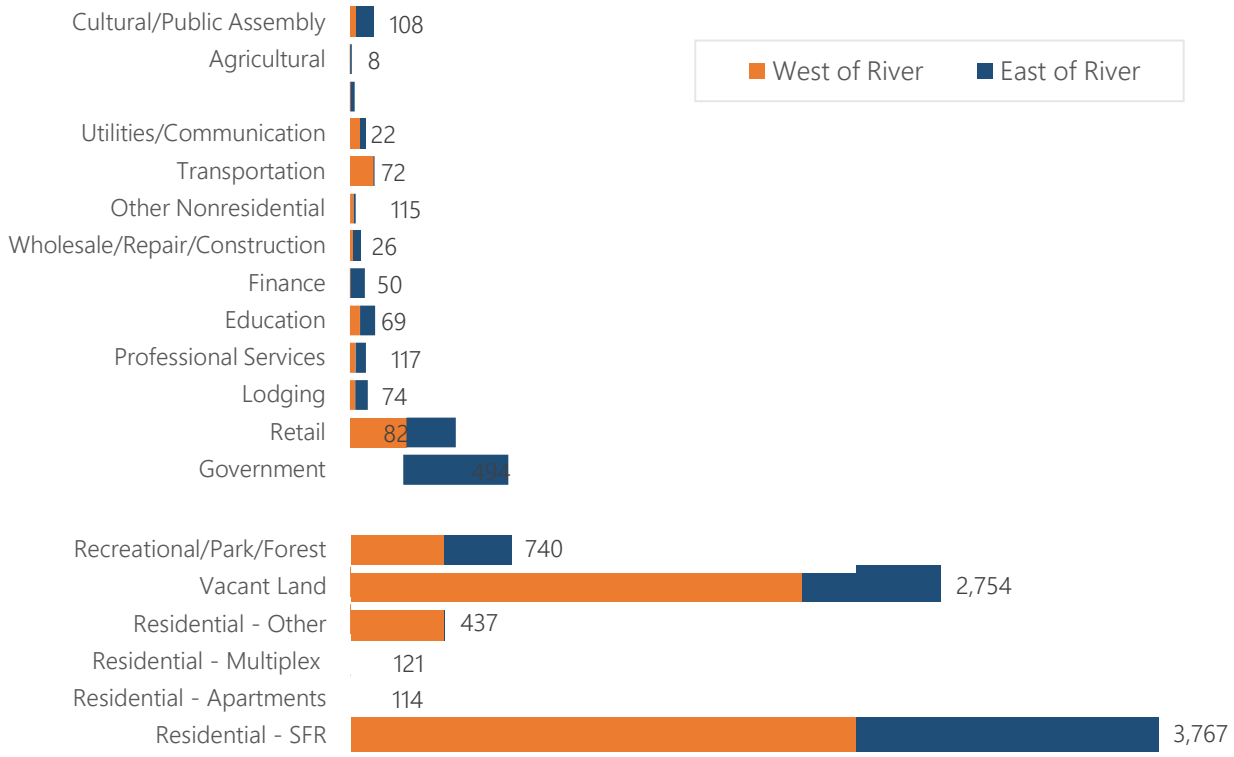
REAL ESTATE MARKET

This section provides information about the regional real estate market and the implications for the prospects of various land uses in the study area.

Market Summary

Land Development Trends. Single-family uses account for 72 percent of all parcels in the study area. Vacant land—largely zoned for residential uses—accounts for a further 14 percent. In terms of acreage, as the following figure shows, single-family uses account for 41 percent of all land, while vacant land accounts for 30 percent. Vacant land is far more prevalent on the west side of the study area (i.e. west of the river and US 195).

Figure 10. Study Area Land Use by Acreage (March 2020)



Source: Spokane County Assessor (taxlot code)

For these and other reasons, the vast majority of new residential development is expected to occur to the west of US 195, in keeping with the recent population trends (described in the prior section) that have seen significantly faster growth on the west side versus the east side over the past two decades.

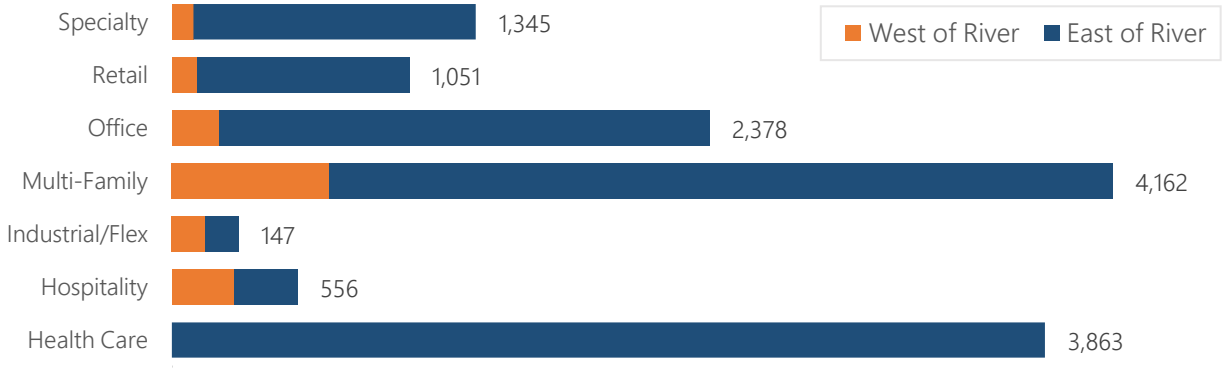
Non-residential uses, on the other hand, are likely to continue clustering primarily in the northeastern portion of the study area, closest to downtown and the highest densities of jobs and households.

On the west, very little non-residential development is expected for many reasons, including the current lack of residential density, the presence of existing retailers adequately serving the needs of current households, and the access and transportation challenges of the area. With that said, as residential growth ramps up, commercial uses tend to follow.

Building Area. As the following figure shows, most of the built building square footage in the study area is on the east side, reflecting the established neighborhoods and higher-density land uses.

This figure, however, excludes single-family residential uses, which would otherwise be the dominant land use (as demonstrated above). Indeed, at a conservative estimate of 1,200 square feet of building space per single-family dwelling unit, single-family residential would account for 11 million square feet, easily eclipsing any other land use.

Figure 11. Study Area Development by Total Square Feet and Location*

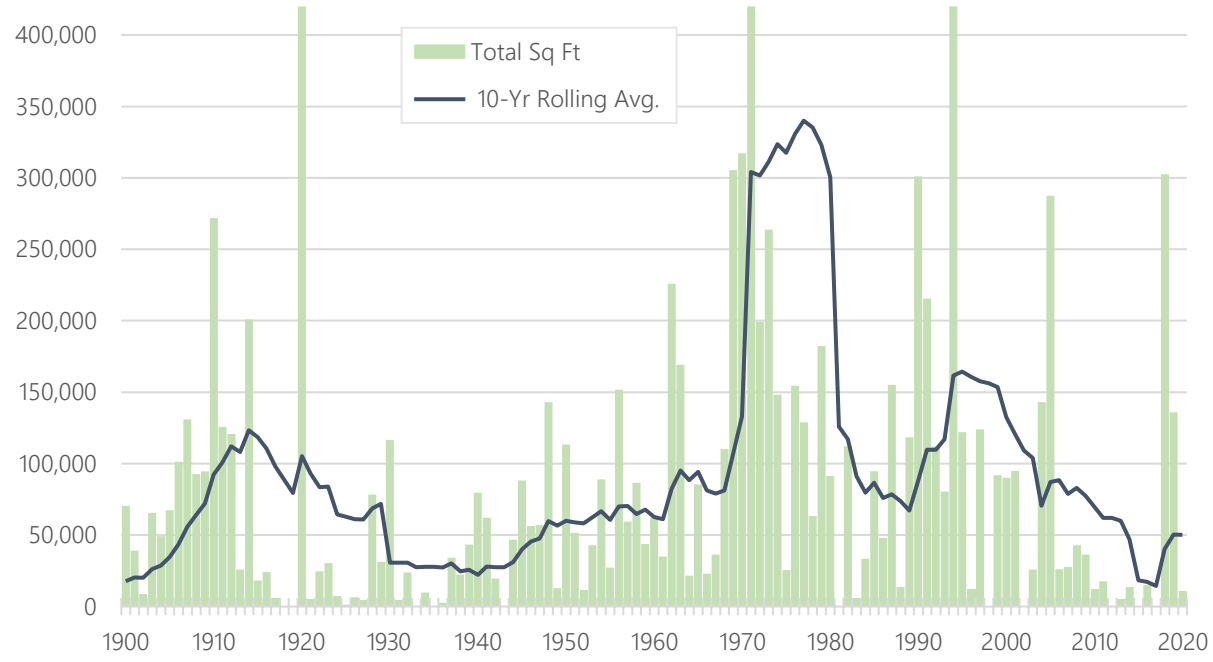


Source: Costar

** Not including single-family residential or institutional/governmental uses*

Development Over Time. The following figure shows this same information by square feet, land use, and year built (since 1990). Since the 1970s, average annual construction (in total square feet) has generally on the decline. The late 1980s and early 1990s saw a slight increase, only for construction starts to flatline in the late 2000s and early 2010s—reflecting the far-reaching impact of the Great Recession on real estate.

Figure 12. Study Area Development by Total Square Feet and Year Built*

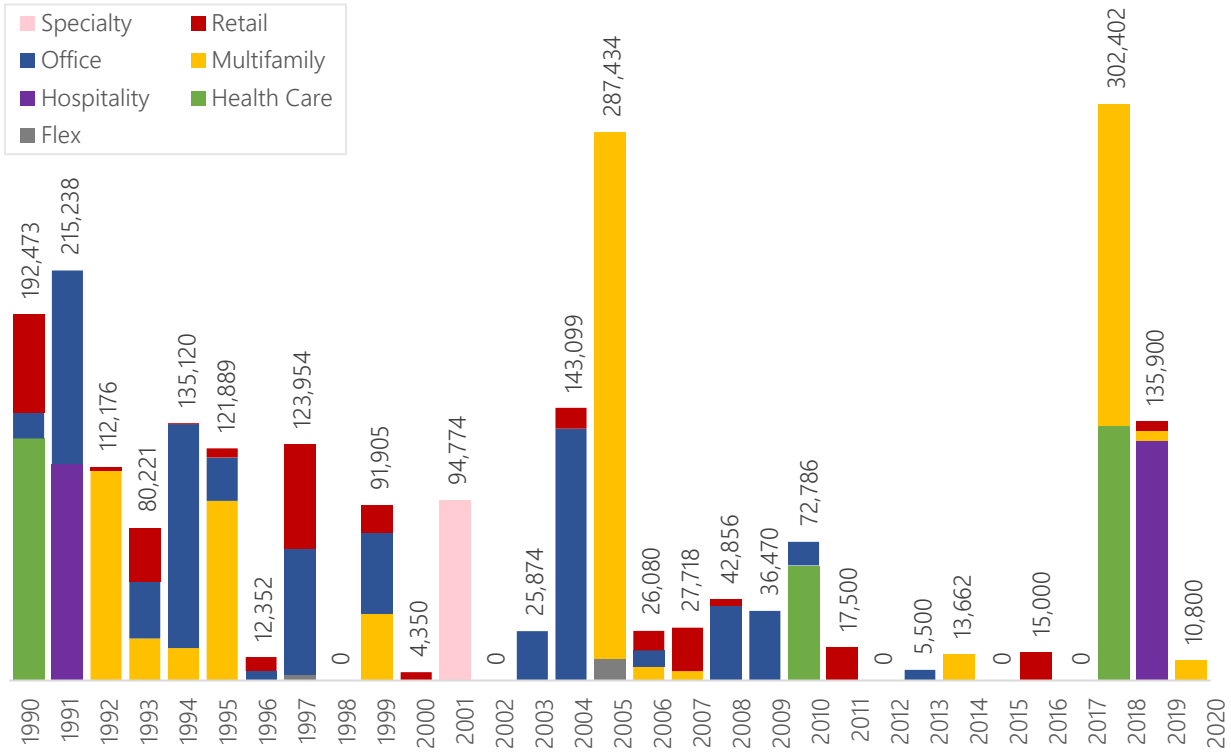


Source: Costar
** Not including single-family residential or institutional/governmental uses*

Development Over Time by Land Use. Similarly, the following figure shows this same information by land use since 1990. The 1990s saw relatively consistent but gradually declining development across a variety of land uses. Generally, the study area has seen relatively little new development since this time. Over the past

decade, only recently in 2018 and 2019 have construction trends picked back up, largely driven by significant multifamily residential and lodging construction.

Figure 13. Study Area Development by Total Square Feet, Land Use, and Year Built*



Source: Costar
** Not including single-family residential or institutional/governmental uses*

Market Sectors

Single-Family Residential

Spokane Regional Market. The Spokane housing market is viewed as affordable when compared to Seattle and Portland.

It was also ranked fourth out of 300 cities in a national Realtor.com survey of the hottest markets, trailing Midland, Texas; Chico, California; and Colorado Springs, Colorado. The survey, released in March, measures listing views per property and the average amount of time a home is on the market. With such a hot market, it is not uncommon for sellers to receive multiple offers on homes, especially in the $300,000-or-less price range.

Redfin, a comprehensive real estate brokerage that tracks national home listings and sales, similarly considers the Spokane Housing Market among the "most competitive" with a Redfin Compete Score[2] of 92 out of 100.

[2] The Redfin Compete Score rates how competitive an area is on a scale of 0 to 100, where 100 is the most competitive.

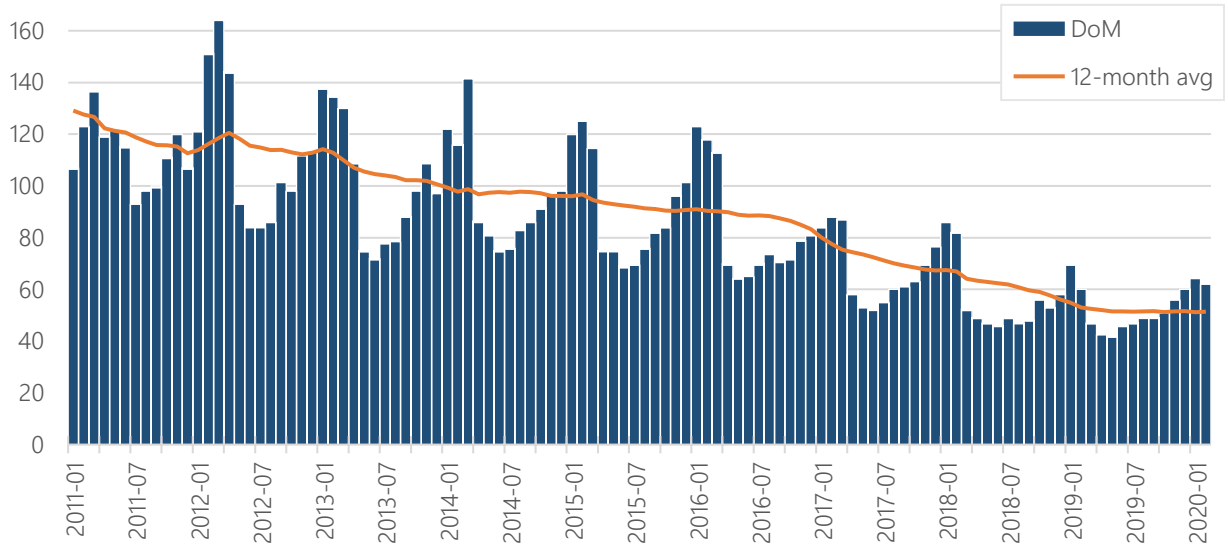
Specifically, Redfin data shows that most homes get multiple offers, often with waived contingencies; homes sell for around list price and go pending in around seven days; and "Hot Homes"[3] can sell for about three percent above list price and go pending in around four days.

In terms of data, there are two key indicators of market strength in the for-sale housing market:

1. The ratio of the sale price to list price and
2. Days on market.

For the **sale-to-list price ratio**, a ratio of 1.0 indicates that homes are being sold for the original list price, on average. If this ratio is anywhere near or even above 1.0, the housing market is considered very tight and a seller's market. At 1.0, this rings true for Spokane County. The average number of **days on the market** from list date to sale (closing) date has been gradually decreasing over the past decade and is currently at a 10-year low.

Figure 14. Study Area Single-family Sales Trends,



Source: Redfin

With the sale-to-list price ratio increasing and the days on market decreasing, there is strong demand for new for-sale housing. Such high demand will usually drive up home prices, however, threatening the affordability of the market. Through March 2020, sales on single-family homes, including condos, were up 19.4 percent while the median price was up 18.1 percent to $290,000 according to the Spokane Association of Realtor's market snapshot.

Supply continues to lag behind demand in the Spokane Market, with just a 1.1-month supply of homes on the market. A healthy market generally ranges between four and six months of supply. Below four months is considered a sellers' market, and above six is considered a buyers' market. As a result of these supply and demand pressures, the average cost of a house is expected to increase by about five to six percent in 2020

[3] A home that is expected to be among the most competitive homes on the market, according to a proprietary Redfin algorithm.

compared with 2019. Similarly, the affordability of single-family homes for low-income families will continue to be a challenge in 2020.

Local market. Single-family homes in the study area are mostly in the "South Hill" neighborhood, an established neighborhood in the east of the study area. As the area is largely built out, opportunities for large-scale single-family development have diminished and larger subdivisions, such as Eagle Ridge, have more recently begun to take shape in the west.

New homes and current listings are both significantly higher than the median sale price over the past year, as demonstrated below.

- The median sale price over the past year was $339,250
- Among new homes only, the median sale price was $642,500
- The median listing price was $514,900

Single-family sale activity has generally concentrated in the more affordable price ranges between $200,000 and $500,000, although the average days on the market have lagged the Spokane market. The fastest-selling homes, on average, have been in the $500,000 to $700,000 range, most of which were newly constructed.

New home sales, which totaled 79 over the past year and accounted for approximately 13 percent of all sales, provide a useful indication of construction trends and demand for single-family products. The fastest-selling homes, per Redfin data in the table below, over the past year, were priced between $500,000 and $600,000. Home listings in this price range also account for 41 percent of all current listings, with seven active listings (equating to 1.3 months of inventory).

Table 4. Study Area Single Family Sales Trends, Past 12 Months

	ALL SALES		NEW HOME SALES		ACTIVE LISTINGS	
Price Range (000s)	Avg DoM	# Sales	Avg DoM	# Sales	# Listings	Months of Inventory
<$200	211	38		0	0	0.0
$200 - $300	214	122		0	1	0.1
$300 - $400	213	212		0	1	0.1
$400 - $500	212	112		0	5	0.5
$500 - $600	189	63	168	29	7	1.3
$600 - $700	193	31	193	31	2	0.8
$700+	229	18	229	18	1	0.7
Average/Total	210	596	193	79	17	0.3

Source: Redfin, LCG

Generally, there is a highly constrained supply of for-sale residential products in the study area with only 0.3 months of inventory on the market, and LCG is bullish about demand going forward.

Multifamily Residential

Spokane Regional Market. The multifamily market in the Greater Spokane area is now considered robust after a slow start following the Great Recession. The multifamily market has picked up steam in recent years,

with an overall average apartment vacancy rate at historic low levels. Though investment activity slowed in 2019, buyers are taking increasing notice of the Spokane multifamily sector's strength. Price appreciation is robust and cap rates have remained fairly steady due to equally strong rent growth.

Despite these positive indicators, however, a looming downturn could prove difficult. The tight residential market—and more apparent housing shortages in some submarkets, such as West Plains[4]—will likely help the Spokane market maintain a reasonable level of resiliency. Investment from both public and private parties is also necessary to increase the amount of shovel-ready land to allow developers to respond to housing needs and catalyze further residential development.

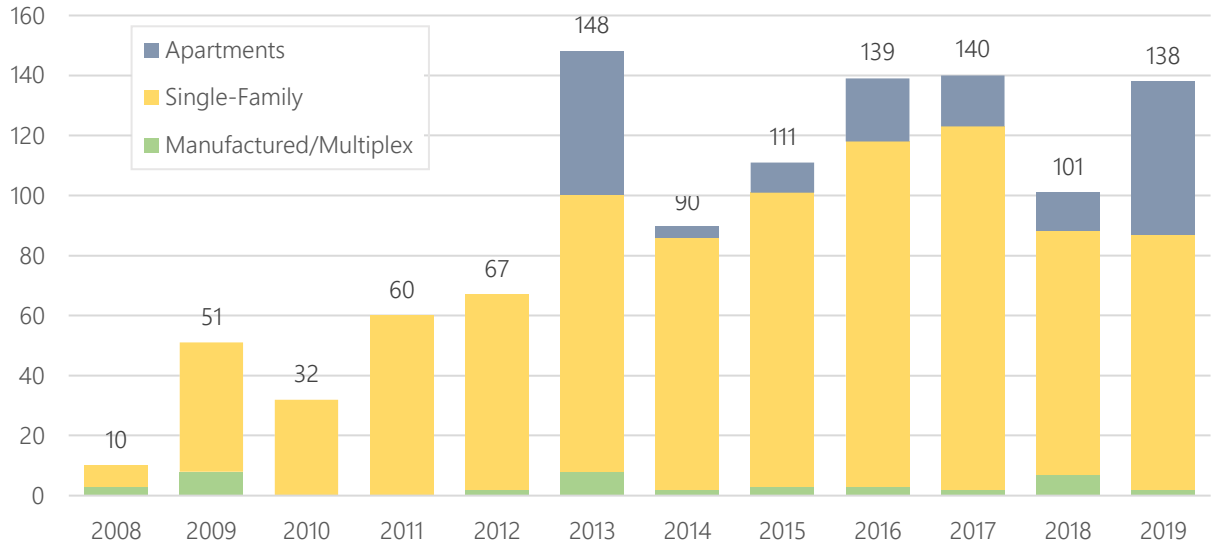
Other key information pertaining to the multifamily market is provided below.

- Despite nearly 1,000 new units coming online in 2018, there was a significant slowdown in deliveries in 2019, resulting in a tight market.
- Average rental rates have been climbing as occupancy rates increase. The overall average apartment vacancy rate has sustained historic low levels throughout the past few years. In submarkets where the rate increased, this was largely because they were the most affected by new construction being absorbed into those areas.
- The Cheney submarket has seen the most rapid increase of new apartment units in the Spokane region.
- The multifamily market is expected to remain strong through the next real estate cycle, even in the event of an economic downturn. Lower-than-average vacancy rates will continue to drive rental rates upwards.
- Apartment trends likely to influence both new construction and acquisition/rehab projects in the future include continued development of mixed-use properties, a reduction in average unit size, an increase in available tenant services, additional affordable housing units, and offerings of tenant customization within individual apartment units.
- **Senior Housing.** The Urban Land Institute (ULI) is bullish about senior housing prospects, with strong investor returns, portfolio diversification, and rising liquidity continuing to drive demand. Challenges include recent supply growth (which puts downward pressure on demand) and ongoing labor shortages.

Local Market. While multifamily apartments have accounted for almost one-quarter of all residential building permits in the study over the past five years, this equates to an average of just 22 units per year. Generally, however, building permit activity in the area has been increasing year-over-year since the Great Recession of 2008-2010.

[4] With rapidly increasing employment opportunities over the next two years, a housing shortage on the West Plains is predicted. Specifically, the completion of the Amazon fulfillment center and Fairchild Air Force Base's employment increase of about 1,000 new jobs by 2020.

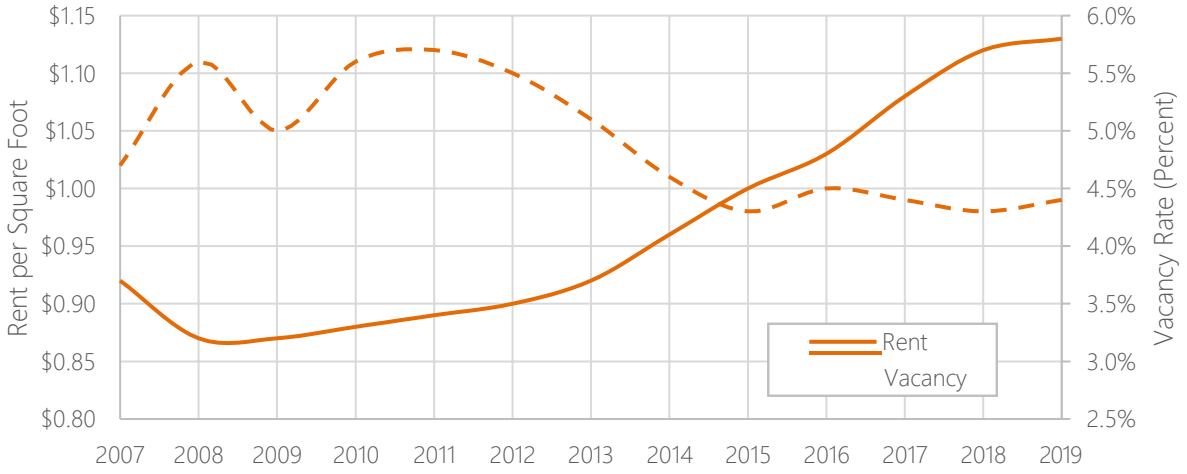
Figure 15. Residential Building Permit Trends, Study Area, 2008-2019



Source: City of Spokane

Vacancy rates in the study area have remained relatively steady over the five years, settling around 4.5 percent. Typically, a vacancy rate under 5.0 percent indicates a tight market with demand eclipses supply. Meanwhile, rental rates have climbed 30 percent since 2009, reflecting both the pent-up demand for multifamily products and the increasing number of new apartments constructed in the area.

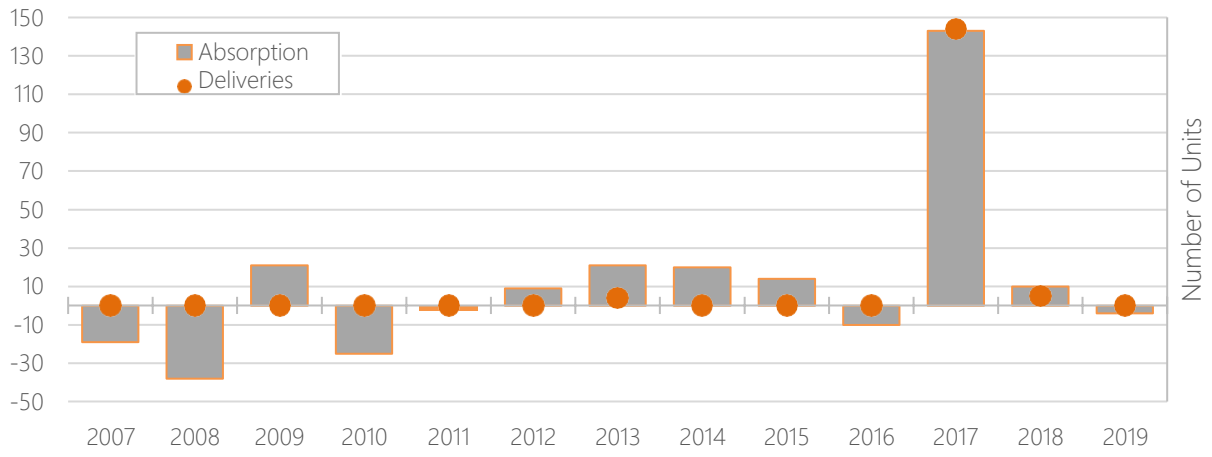
Figure 16. Multifamily Rent and Vacancy Trends, Study Area



Source: Costar

Indeed, deliveries of new apartment units in the study area have been highly limited, except for 2017 that saw 143 units delivered to the market. High demand for multifamily products is demonstrated by the fact that 2017 also saw 144 units absorbed.

Figure 17. Multifamily Absorption and Delivery Trends, Study Area



Source: Costar

Office

Spokane Regional Market. The Spokane office market shows signs of improving demand, albeit with mixed indicators. Deliveries during the current cycle have largely been build-to-suit development (in other words, development for a specific, predetermined user or landowner), without much speculative construction. Though pipeline activity remains limited, the vacancy has fluctuated. Moderate rent growth is well above the historical average, with the highest-end spaces seeing the strongest performance.

Investment in Spokane has increased substantially, and price appreciation has been moderate over the past few years. Sales volume in 2019 finished well above the historical average, with several sizable deals moving the needle earlier in the year.

There is optimism surrounding the future of Spokane's office market, with the only barrier being a lack of large space. Many options are available for companies needing 4,000 square feet and less, but large floor plates (more than 15,000 square feet) are limited, likely because of a lack of construction.

While there is an unprecedented regional and national interest in the Spokane market, it remains vulnerable to significant market disruptions and a potential incoming downturn.

Spokane's rent growth has been driven mostly by tenants filling up high-end office space, according to CoStar's Spokane market report. New construction has been limited, which has helped drive up office rents. Most new office buildings have been built specifically for the companies filling space.

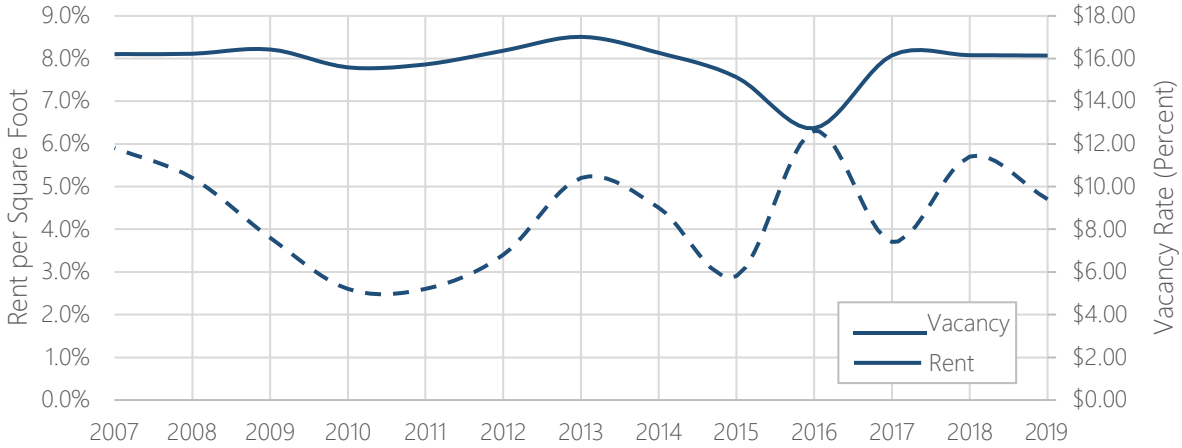
Medical-related office space is set to continue growing, however. Nationally, healthcare innovation is spurring medical office transformation while investment demand is bolstered by the demographic outlook. The aging population, an increased number of people with medical insurance, and cost-reduction strategies by insurance companies that favor outpatient care have converged to bolster medical office space demand. In conjunction with a limited development pipeline, these factors point to continued momentum for purpose-built medical office space. Further, in comparison to other, more volatile sectors, the moderating pace of development sustains compressed vacancy rates, and low-interest rates power investor appetite.

Ultimately, even with the small pullback in 2018, Spokane's medical office market is and will continue to be very healthy.

Local Market. Office development in the study area is largely confined to the South Hill office market—one of the smallest submarkets in Spokane—to the east of US 195. With that said, South Hill remains more a bedroom community office market consisting of smaller local tenants. While medical office space does well on the South Hill, the office market has always seemed to lag.

Indeed, as the following chart shows, office rents in the area have remained flat, likely due to the lack of new construction in the area and the fact that healthcare, as the dominant industry, does not usually conform to typical market dynamics (such as rent). Vacancy rate trends, which have fluctuated in recent years, also provide little reason to believe that the area will become a hotbed for future office development.

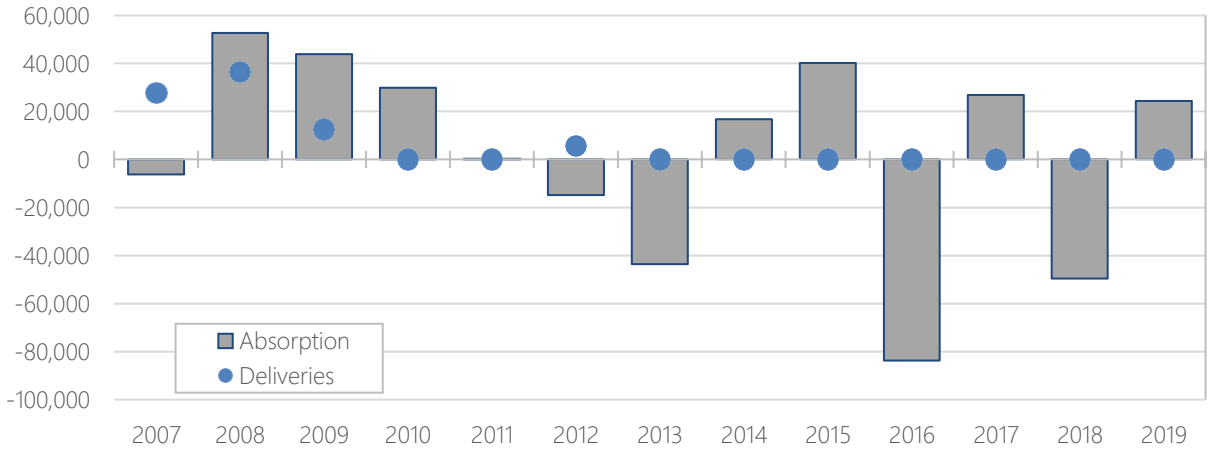
Figure 18. Office Rent and Vacancy Trends, Study Area



Source: Costar

In keeping with the statement above, office deliveries in the study area have been low or non-existent. Absorption has fluctuated from negative to positive each year for the past five years, demonstrating the area's propensity to easily feel the effects of a couple of larger offices' leases or vacancies.

Figure 19. Office Absorption and Delivery Trends, Study Area



Source: Costar

Local Medical Office. With several regionally significant healthcare organizations in the study area, medical-oriented office space is likely to continue to grow in both demand and building space.

On the west, specifically, new office space is also likely to take the form of dentists, clinics, veterinary offices, and banks, albeit to a limited extent. This westside development is likely to cluster around existing centers.

Retail

Spokane Regional Market. Real estate indicators show mixed support for the Spokane retail sector. Recent store closures had led to an uptick in the vacancy rate, but positive net absorption in recent quarters has allowed vacancies to tighten.

Local retailers in Spokane (compared to retailers in other large Northwest markets) continue to enjoy a stable economic environment and a growing population, although the pandemic and a looming economic downtown threaten the strength of the retail market.

Spokane is attractive to national retailers seeking to get an early foothold in an emerging but vibrant retail market. Duluth Trading Company, Nike, Dick's Sporting Goods, and others entered the market during 2018. A limited pipeline, with less than one percent of total inventory underway, should help limit the impacts of an economic downturn.

Rental rates remain below the prerecession peak, and rent growth is consistently lower than the national average. Despite low rent growth, investors continue to pour money into the Spokane retail market. Sales volume in 2019 finished at nearly double the historical annual average. Price growth is moderate and cap rates are well above the national index.

Retail is currently undergoing a seismic transition in the age of e-commerce, which has been well-documented in recent years. Beyond ecommerce, a new class of tenants has gone from strength-to-strength in brick-and-mortar retail. These tenants include online brands ("clicks-to-bricks"), experiential and entertainment uses, food and beverage, fitness, health, and wellness, coworking, and shared office space.

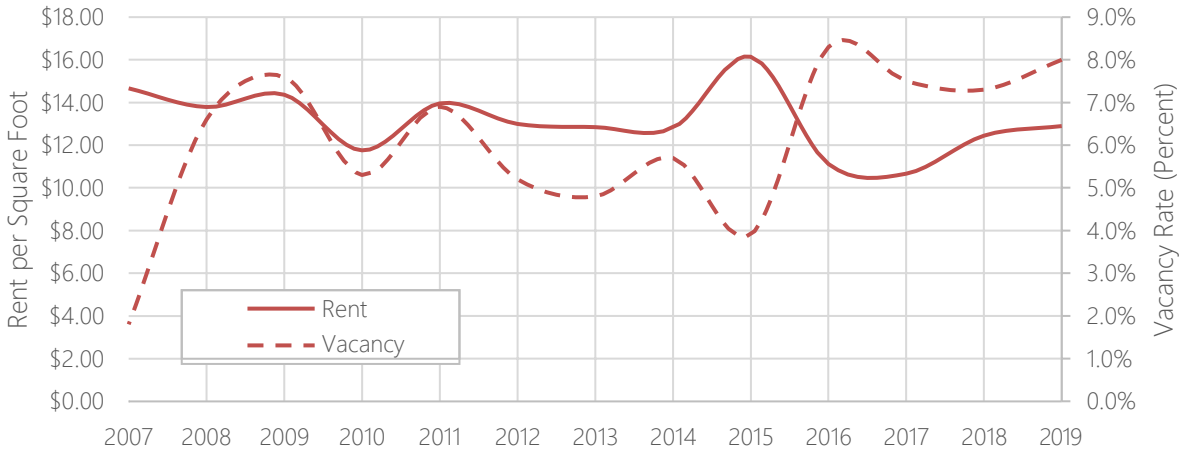
Local Market. The South Hill retail market continues to represent the lowest retail vacancy rate in the market, although this does not reflect strong retail prospects. The vacant Hastings Records and upcoming Shopko spaces present an opportunity for large new box tenants to enter the South Hill market.

West of US 195, standing retail inventory is limited and growth opportunities are not expected in the near-term until there is significant household growth. At such time that rooftop density supports new retail development, it is likely to be limited to neighborhood and/or community-supportive retail, such as:

- Foodservice (restaurants, cafes, bars)
- Grocery stores
- Landscaping
- Convenience stores
- Fitness, health, and wellness
- Finance and banks

Rent growth has been flat or negative in recent years as vacancy rates have been relatively high, which is problematic for new retail prospects.

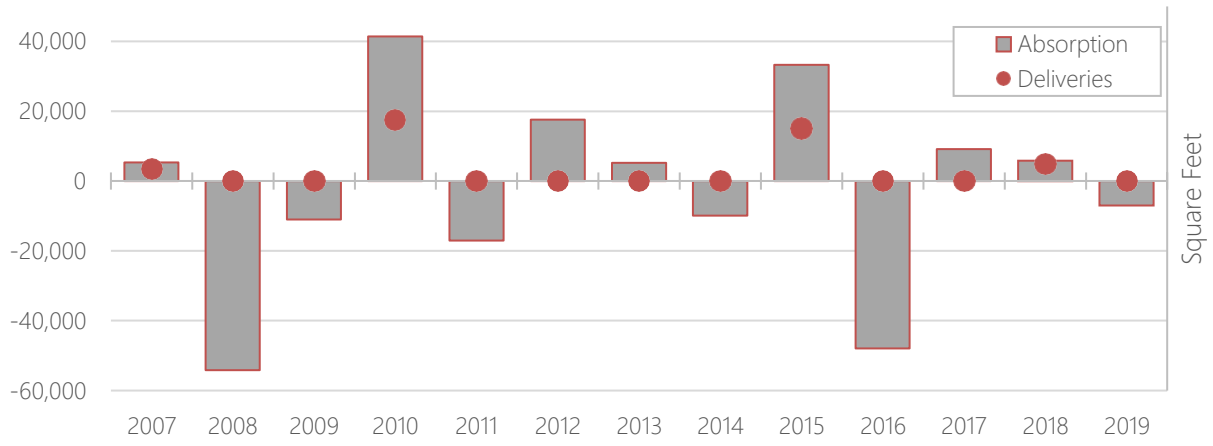
Figure 20. Retail Rent and Vacancy Trends, Study Area



Source: Costar

Retail deliveries are highly limited, recently topping out at 15,000 square feet in 2015. Retail Absorption, as with the office sector, has been limited and fluctuating year-over-year.

Figure 21. Retail Absorption and Delivery Trends, Study Area



Source: Costar

Ultimately, rent, vacancy, construction, and absorption data for the past decade give little cause for optimism regarding retail prospects in the study area. Larger scale retail development prospects, particularly along interchanges, may improve as employment growth opportunities are realized in West Plains. Long-term prospects appear more positive given the existing sales leakage from the area, but probably only after substantial residential development.

Other Uses

Industrial. Spokane's industrial market remains locally dominated, aside from the recently built Amazon distribution facility. Despite a relatively busy delivery schedule, vacancies are well below the historical average, which has allowed landlords to maintain leverage. Rent growth is well above the historical average, but it has slowed from banner years recorded earlier in the cycle.

Sales volume is in line with the historical average and most deals involve small or middle-market players. Prices have increased substantially this cycle and cap rates have compressed too, with notable moderation in recent quarters.

Given the residential land use designations in the City's comprehensive plan, industrial development is likely going to be highly limited. Some users, such as landscaping or construction companies, may find the westside of the study area attractive because of cheaper land—especially in the County—and proximity to major transportation routes and the West Plains submarket.

Lodging. Lodging in the Spokane Market is generating cautious optimism among investors, both from a return-on-investment and a development perspective. That said, the impact of slowing economic growth and operational performance suggests that the industry is at an inflection point. In the very near-term, the implications from the Covid-19 pandemic are clearly bad for hotel prospects and have caused uncertainty about the near- and mid-term future. Aside from these immediate issues, a deceleration in top-line revenue growth, trade implications, rising labor costs, and political uncertainty further contribute to concerns among hotel investors.

Investors are likely to benefit from seeking opportunities that capitalize on shifting customer preferences and technological innovations and allow for differentiation in an increasingly challenging operating environment. These include brand proliferation as brands move closer to boutique offerings and present alternative models to the traditional hotel landscape and embracing digital transformation, both of which appear ever more important given the current situation.

DEVELOPMENT FORECAST

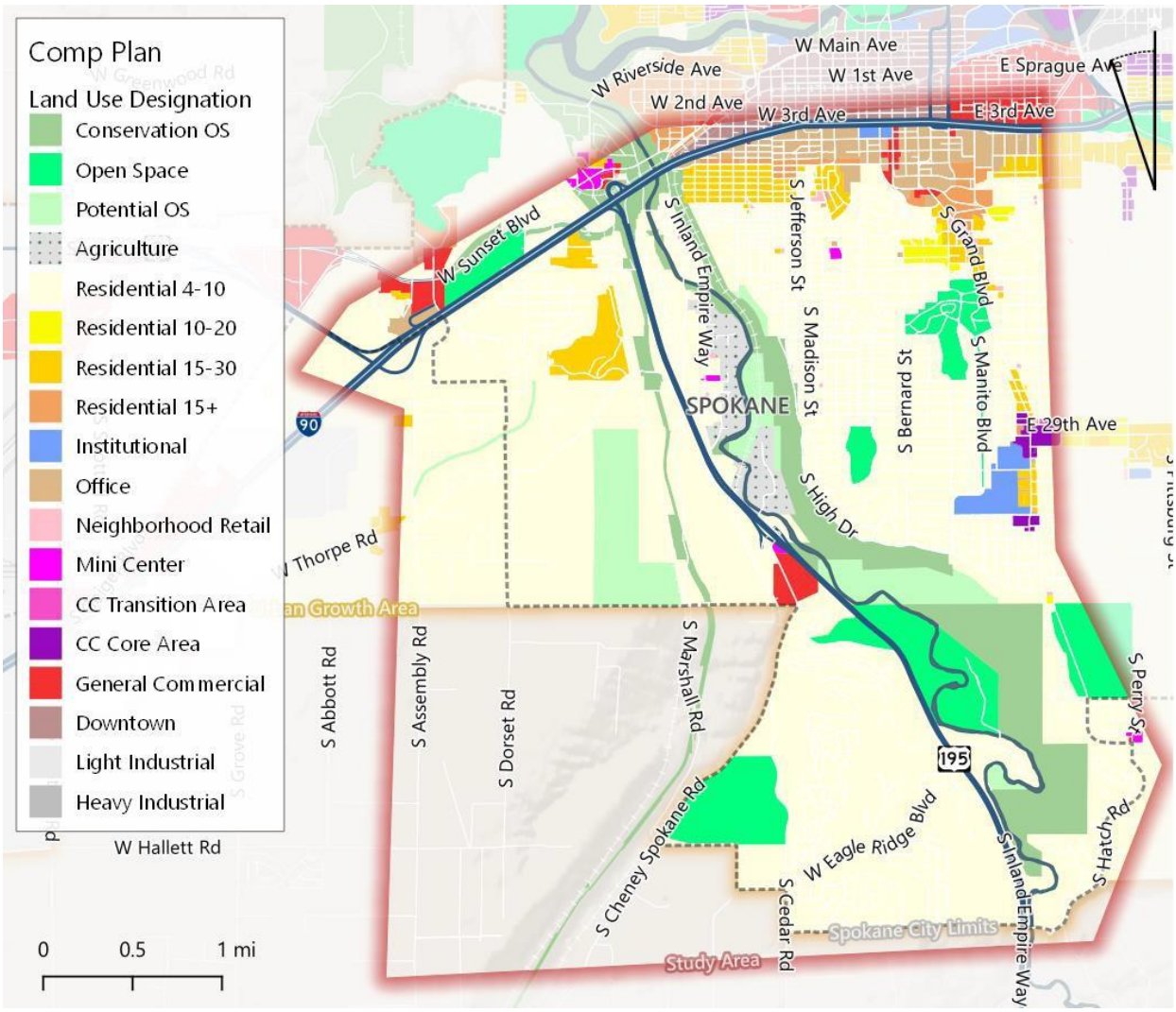
This section summarizes LCG's development forecast, which is an estimate of net new development by land use in the study area. The development forecast is based on the known development projects, land supply analysis, and general development trends in the area, among other elements. The forecast applies the findings from the market analysis to the study area at the parcel level, highlighting potential development opportunities on a site-by-site basis.

Regulatory Context

The City of Spokane's current Comprehensive Plan serves as the guiding regulatory framework upon which our development forecast is founded. The land use designations have been established through extensive processes that, while not permanent, should be considered the desired land uses in the area.

As the following map shows, most of the land use designations in the study area are residential. Most of the higher density residential designations in the study area surround downtown in the northeast, but approximately 100 acres of Residential 15-30 land is in the northwest of the study area (where there are significant tracts of undeveloped land). Large swaths of land—mostly following the creek to the east of US 195—are designated recreation or open space that is not likely to develop.

Figure 22. Comprehensive Plan Designations



Source: City of Spokane, LCG

Land Supply Analysis

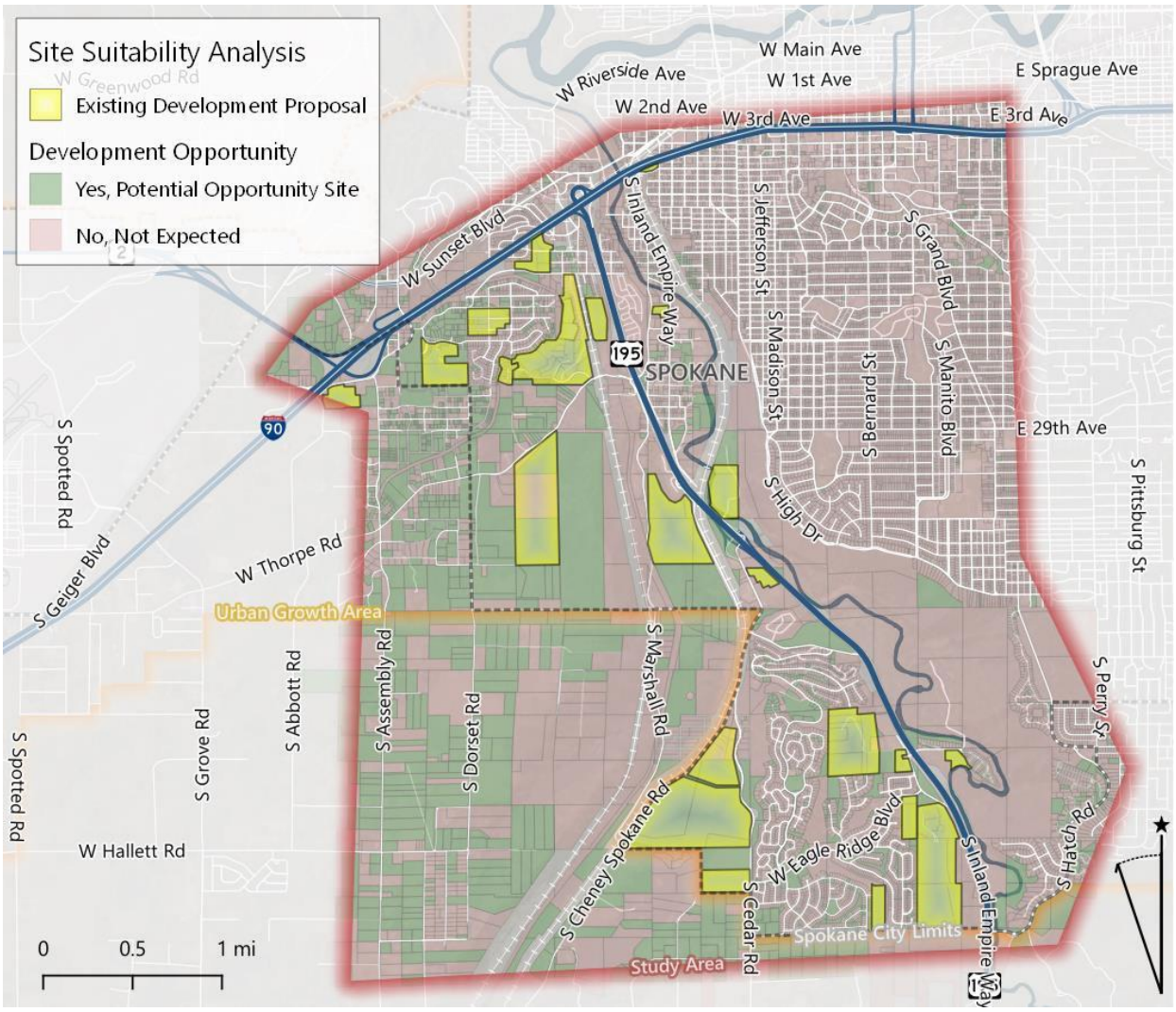
While this market analysis mostly focuses on demand, calculating a development program for the next two decades requires an understanding of how much land is currently available to develop.

Developable land includes land free of development impediments, such as steep slopes, wetlands, easements, right-of-way, and existing development. While parcels containing existing development may, in theory, be redeveloped, this market is unlikely to support or warrant the higher cost of redevelopment. As such, the land supply analysis summarized below focuses only on vacant or highly underutilized land.

The following map shows the "developable" parcels in the study area. This is an approximation and should not be considered a 100 percent accurate depiction of the study area.[5]

Existing development proposals are also shown, based on information provided by public agencies and private property owners and developers. These proposals are at varying stages of planning, from preliminary efforts to acquire and consolidate sell for sale or development, to fully permitted projects. The planning stage, site and access conditions, market feasibility, phasing (especially for larger projects), and market cycles were all considered for assessing each development proposal's prospects and construction and absorption timeline.

Figure 23. Development Opportunities and Existing Development Proposals



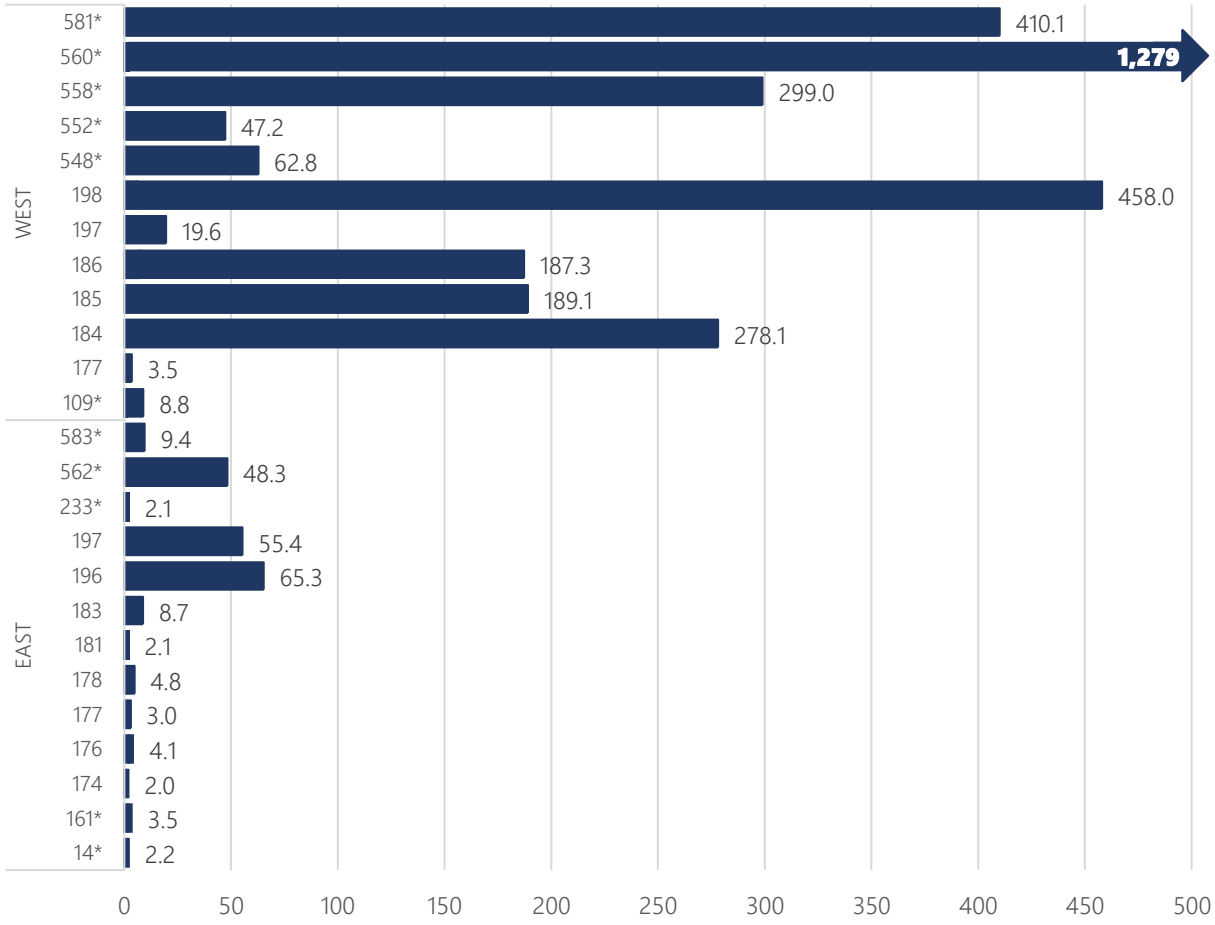
Source: City of Spokane, LCG

[5] Some parcels with certain impediments, such as steep slope or existing buildings, for example, may see new development if financially feasible. Given the existing market, however, this is unlikely.

The following chart presents these "opportunity sites" (including those sites for which there are existing development proposals) in total acreage by TAZ. Opportunities were considered either residential or non-residential uses (i.e. employment uses, such as commercial, retail, office, industrial). Any TAZ number with an asterisk (*) indicates *partial* inclusion in the study area. This is an important distinction for the development forecast that follows, as it includes only the development that is likely to get built in the portion of each TAZ within the study area.

The majority of development opportunity sites are located west of US 195 and are largely residential (based on both the existing comprehensive plan land use designations and likely future development as described in the previous section).

Figure 24. Development Opportunities



Source: LCG
Notes: TAZs with estimated opportunity sites that total less than 2.0 acres are omitted from the chart; an asterisk (*) indicates a TAZ boundary that partially falls outside of the project study area.

Market Demand

This subsection describes residential, retail, and office and industrial demand. Demand is considered market-based and can fluctuate based on a wide variety of factors, especially over a 20-year timeframe. It is therefore important to consider market demand from an *absorption* perspective.

Residential Demand

The following chart shows estimated new demand in the residential market area for multifamily and single-family residential units by maximum monthly rent and home price brackets. These brackets are simply estimates based on projected household growth by income. The market area comprises the main study area and the area to the south and southwest, generally defined by US 195 and I-90, but not including Spangle or Cheney. Generally, this extended area is undeveloped Spokane County land.

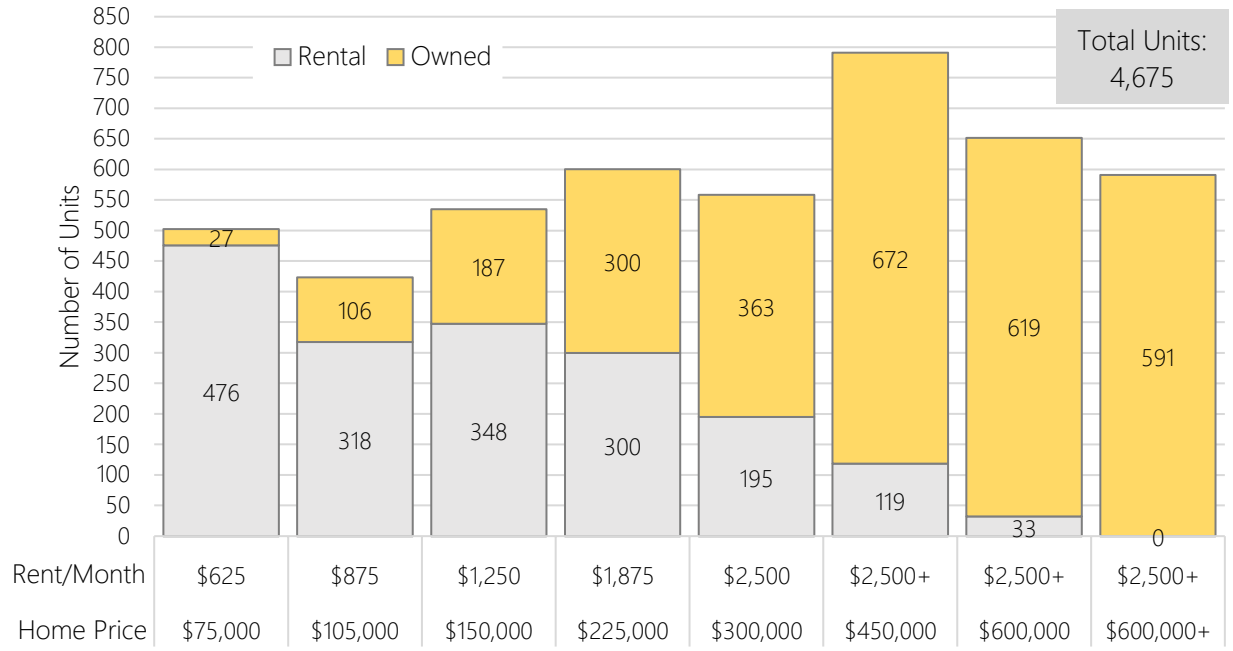
Given LCG's knowledge of development projects, opportunity sites, growth areas, and the market in general, new household growth is anticipated to be approximately 38 percent rental, largely made up of apartments and multiplexes. We expect rental housing to account for only a small proportion of single-family development, and vice versa.

At 1.1 percent average annual growth over 20 years, we project market-area demand for about 4,675 new households between 2020 and 2040, of which approximately 3,700, or 80 percent—in keeping with current trends—are expected within the study area. This is potentially aggressive, given that 2010 to 2020 saw only growth of about 1,300 households (single-family and multifamily combined total). This projection, therefore, assumes a significant uptick in residential construction activity.

LCG believes this is a reasonable assumption, given Spokane's increasing interest from national investors, the rapidly dwindling alternatives for large-scale residential development elsewhere in the Spokane market, and positive socioeconomic trends.

It is important to note, however, that this projection does not reflect full build-out in the study area. Instead, it is a reflection of LCG's expectations for construction and absorption between 2020 and 2040. Some areas are expected to see significant concentrations of new growth, while other areas are not expected to see growth until beyond the 2040 planning horizon. These details are shown in the Development Forecast Summary that follows.

Figure 25. 20-year Projected New Residential Demand Summary, Market Area



Source: LCG

Retail Demand

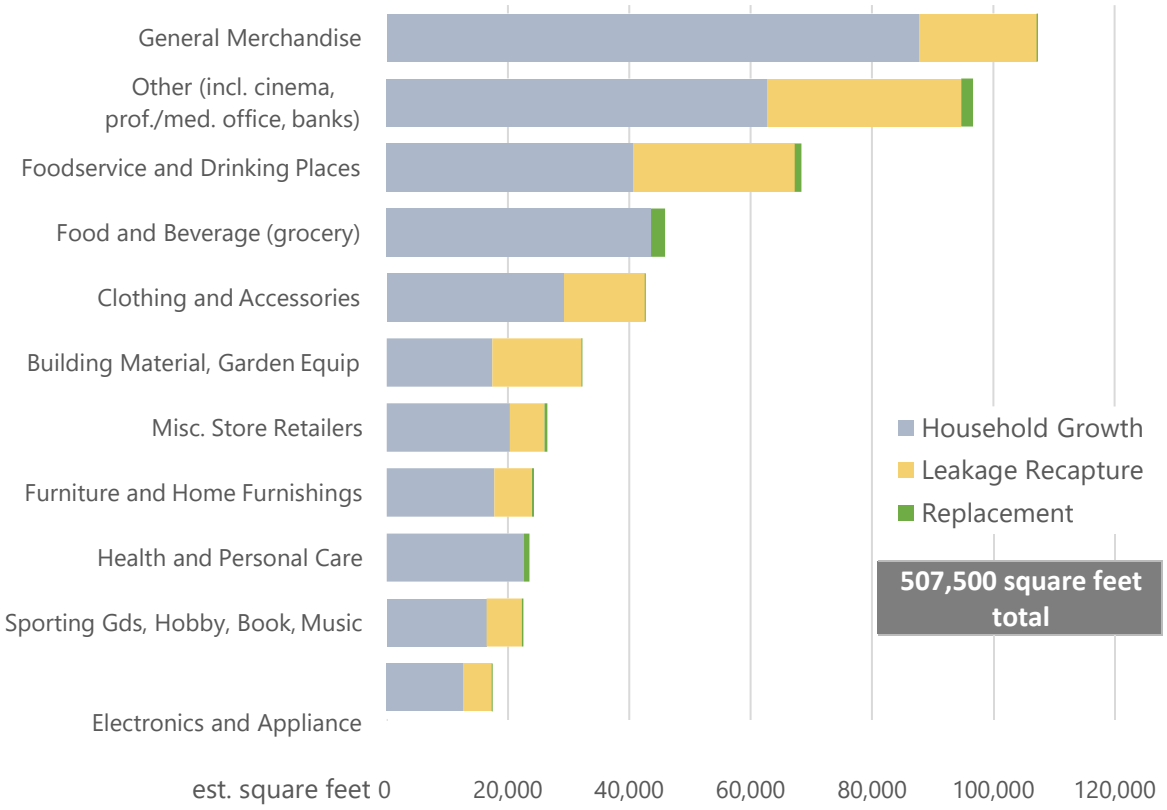
The following chart shows the projected demand for new retail development for the retail trade area. The retail trade area is defined as those households that would comprise about 75 percent of the customers. Because of the study area's location on the edge of the metro, the market area captures many of the communities to the south that would be expected to travel north to shop for goods and services.

We project demand for approximately 507,500 square feet of new retail space (including medical clinics, banks, etc.). We expect the study area to capture no more than 130,000 square feet of the total (25%), with the remaining consumer demand continuing to come in the form of leakage outside the study area (such as downtown and larger commercial centers, like those planned along US 2 near Airway Heights). Despite the lower capture rate, 130,000 square feet remains an aggressive target given that just 37,400 square feet of new retail delivered to the market in the study area in the past decade. That said, the projection is likely reasonable given that retail typically follows significant household growth. Non-retail commercial spaces, such as medical, finance, and real estate-related spaces, will be subject to similar market forces as retail.

Retailers likely to locate within the study area boundaries include grocery stores, 'other' stores, foodservice and drinking places (although limited), building material and garden equipment stores, and health and personal care. Attractive retail locations remain limited to high trafficked, visible, accessible areas where there is a nearby critical mass of households (existing or expected in the near future), such as near interchanges and major routes.

Last, it is important to remember that typical store sizes differ for each retail category. For example, general merchandisers are typically 40,000 to 100,000+ square feet, while restaurants are usually no more than 10,000 square feet. Job densities also vary drastically depending on the tenant.

Figure 26. 20-year Projected New Retail Trade Area Demand



Source: LCG

Office and Industrial Demand

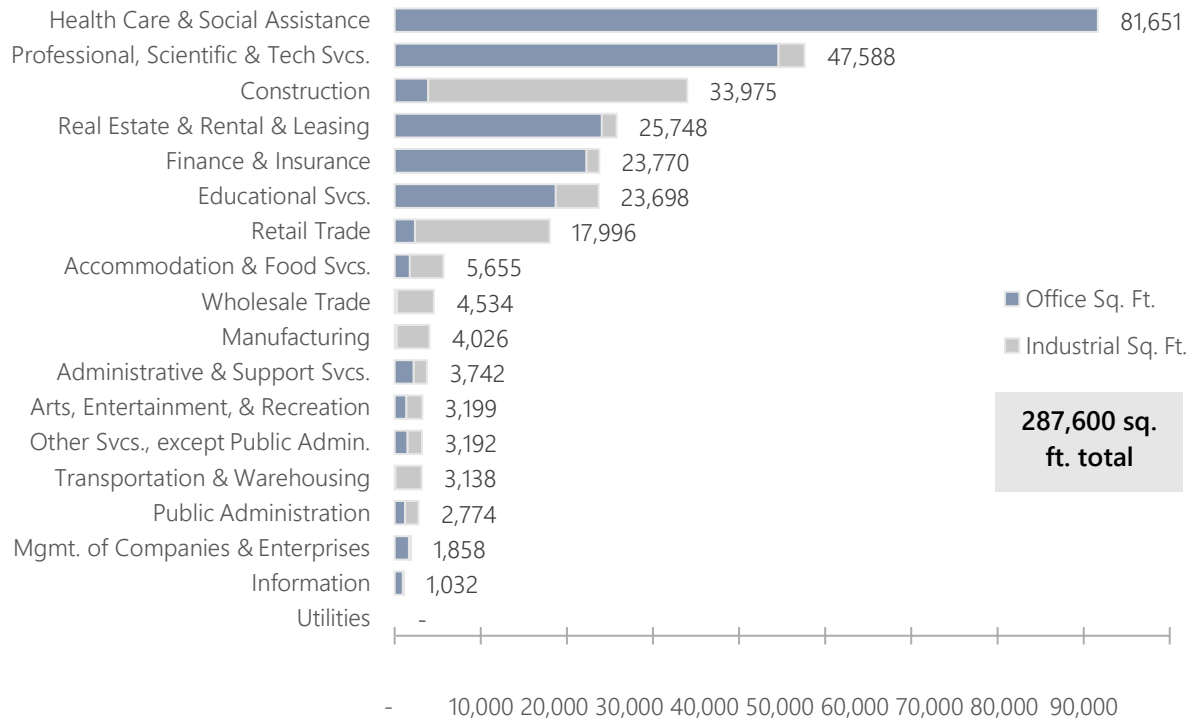
Projected employment growth in the study area is unlikely to drive demand for significant new office or industrial development. However, limited opportunities may arise in commercial centers adjacent to community-serving retailers or as part of mixed-use residential or mid-rise office buildings closer to downtown.

For office, the existing healthcare cluster (the dominant industry) is unlikely to see large expansions—which has driven employment growth in the area in the recent past—but instead see modest job gains. Elsewhere, office development will likely be driven by job gains in the business services, financial, and information-oriented industries.

Industrial opportunities are likely limited, yet the space needs for industrial users are significantly higher than office users, and therefore projected demand is typically similar or higher. Users are likely to locate in areas where cheaper land can be found, concentrate near existing industrial users and away from non-compatible uses (like residential), and/or along major transportation routes.

With this said, these projections represent LCG's approximation of new *speculative* construction. This is an important distinction because of the challenge in forecasting new build-to-suit construction. Speculative construction typically aligns with market trends, while owner-occupiers or build-to-suit users may choose to construct a new building regardless of market forces. In short, employment projections should be considered a loose approximation of future growth and may be conservative for the reasons listed above.

Figure 27. 20-year Projected New Employment Market Area Demand



Source: LCG

Other Uses

Hospitality will probably be a significant driver of employment growth, with a select few locations likely to see new development as regional job growth accelerates and the market improves. These locations are typically downtown, near interchanges, or places with easy access to the airport. Hotel market dynamics are unique to other uses, and new construction is therefore challenging to forecast. With this said, a conservative projection of new hotel construction is included in the following development forecast, based on regional trends and prospects.

Development Forecast Summary

The following table shows a summary of the location-specific employment projections for the next 20 years. These projections reflect a market-based approach to forecasting housing units and employment and consider market cycles, construction and absorption trends, the availability of developable land and utility provisions and other physical conditions, regulatory constraints (such as zoning), and financial feasibility. This forecast should, therefore, be considered a reflection of estimated absorption rather than full build-out.

Figure 28. Study Area Market Based Growth Projections, 2020-2040

	DWELLING UNITS		EMPLOYMENT (BLDG. SQUARE FEET)					
	Single family	Multi family	Retail	FIRES*	Hotel	Industry	Medical	Office
Units/Sq. Ft.	2,548	1,418	129,500	49,240	270,000	40,000	41,000	68,600
Emps/SF			300	180	600	400	250	160
Est. Jobs			432	271	493	100	164	423
Totals		**3,966 units**						**1,883 jobs**

Source: LCG
**Finance, Information, Real Estate Services*

A full breakdown of units and square feet of development is provided in the table below.

Figure 29. Study Area Market Based Growth Projections, 2020-2040

	DWELLING UNITS		EMPLOYMENT (BLDG. SQUARE FEET)					
TAZ No	Single family	Multi family	Retail	FIRES	Hotel	Industry	Medical	Office
*14				4,400				11,000
*15				2,000				6,000
*16				2,000				6,000
*17				3,440				8,600
*19		80		4,000				10,000
*105								
*106		20						
*107				8,000		10,000		10,000
*108			15,000					
*109	20		10,000		150,000	5,000		
*161		25	3,000	5,000		5,000		5,000
*162								
171		70		5,000				
172			10,000	5,000				
173		80					4,000	
174		50	5,000		90,000		10,000	
175			2,000					
176	20		2,500				20,000	
177	20							
178	20							
179	5		5,000					
181	4	4						
182		30						
183		100						
184	250	800						
185	579							

TAZ No	DWELLING UNITS		EMPLOYMENT (BLDG. SQUARE FEET)					
	Single family	Multi family	Retail	FIRES	Hotel	Industry	Medical	Office
186	213		60,000	5,000		20,000	5,000	
187	1							
188	2							
189	3							
190								
192		4						
193	7							
194	2		1,000					4,000
195	3							
196	62	32						
197	20	40						
198	925							
199		15		2,000			2,000	4,000
*200	2							
*206	7							
*212	3							
*213	1							
*214								
*221	1			2,000				3,000
*227	5							
*233		8						
*236								
*548	25	15	15,000		60,000			
*552								
*558	200	45						
*560	50		1,000	1,000				
*562								
*581	10							
*583								

Source: LCG

*Notes: (1) * Denotes a TAZ with partial inclusion in the study area; (2) Grey cells denote a TAZ with an insignificant portion within the study area, and therefore no development potential. These are presented simply to represent the full dataset.*

Attachment B. West Plains Land Use Development

FEHR PEERS

MEMORANDUM

Date: June 26, 2020

To: Bonnie Gow, *Washington State Department of Transportation*

From: Kara Hall and Don Samdahl

Subject: West Plains Sub Area Land Use & Trip Generation Methodology

SE18-0645

The Washington State Department of Transportation (WSDOT) is leading a study to evaluate the future needs of the transportation system in the West Plains. To understand future traffic volume based on land use growth in the area, WSDOT will use the regional travel demand model developed by Spokane Regional Transportation Council (SRTC).

As part of this study, WSDOT will update the future year land use in the travel demand model based on the land use inputs summarized below. This memorandum also documents the process for validating future trip generation rates based on land use inputs. This is an important step in confirming that the regional travel demand model is forecasting the appropriate amount of growth based on industry standard trip generation rates.

Trip Generation Rates

The expected PM peak hour vehicle trip generation estimates were developed using the number of employees expected, number of single-family dwelling units (SFDUs) and multi-family dwelling units (MFDUs) expected, and trip generation rates from the *Institute of Traffic Engineers (ITE) Trip Generation Manual, 10th Edition*. Trip rates per employee were used for retail, industrial, and commercial land uses, while trip rates per dwelling unit for SFDU and MFDU were used for residential land uses.

The study area includes a number of land uses that were identified as "Special Generators". These uses include Fairchild Air Force Base (FAFB), Spokane International Airport (SIA), and the Amazon Distribution Center. Trip generation estimates for these land uses were developed separately due

to limited land use information and expected differences from standard ITE trip generation rates. Special generators are described in detail below.

Market-Based Analysis

An independent market-based development forecast was completed to identify net new development estimates on vacant and under-utilized sites. The documentation and findings from that study are included as **Attachment A** to this memorandum**.** The market analysis forecasts growth expected to occur within the West Plains over the next 20-years and serves as the baseline for the 2040 land use inputs.

Special Generators

There were several locations within the study area where Special Generator land use estimates were needed. These occurred in two situations: (1) locations where limited information was available regarding future land use plans, and (2) where the identified land uses were not expected to generate trips consistent with rates documented in the ITE Trip Generation Manual. These areas and land uses were identified as Special Generators, for which land use estimates and trip generation rates were developed using the methodologies described below.

Fairchild Air Force Base

Land use and trip generation estimates for FAFB were developed using the best available information provided by Air Force representatives on the Technical Advisory Committee. For future land use and employee estimates, an existing baseline was established using the 2016 Fiscal Statement for FAFB.

This statement provides information on the number of Active Duty, National Guard, and Reserve members stationed at FAFB. Information on the number of civilians and total personal were also provided in this information.

Recent and planned growth information for FAFB was based on the best available information provided to the project team. Available information indicated that 200 additional Active Duty Airmen were recently stationed at FAFB and future growth plans include the addition of 600 more Active Duty Airmen.

To develop a conservative estimate of future growth, it was assumed that as additional Airmen were added the total personnel on base would also increase proportionally. As a result, ratios between

Active Duty Airmen and all other personal groups were assumed to remain constant with future growth.

To establish a current baseline, the 200 Active Duty Airmen were added to the 2016 personnel. All other personnel were increased proportionally to represent a 2018 baseline. To develop projected numbers to be utilized in the trip generation analysis, an additional 600 Airmen were then added to the baseline numbers with respective growth across all base personnel. Current and projected employment numbers for FAFB are summarized in **Attachment B**.

To develop a trip generation rate for FAFB traffic counts collected in 2018 at the US 2 and Mitchell Street, which serves as the primary access point for the base, along with the 2018 employment data were utilized to develop a trip per employee rate.

The current trip rate during the PM peak hour was found to be 0.10 trips per employee. As this land use is identified as a Special Generator and does not align with any of the land use categories within the travel demand model, this trip rate was used to determine the number of employees that should be added to the travel demand model to best replicate the expected trip generation from FAFB based on future growth. The final model land use inputs are included in the West Plains Trip Generation.xlsx included as **Attachment C** to this memorandum.

Amazon Distribution Center

Information for the Amazon Distribution Center is documented in the *Project Rose Traffic Impact Analysis* (May, 2018). As noted in the TIA completed for the project, the proposed distribution center will provide 2,560,000 square feet of warehousing and distribution. Amazon Distribution Centers tend to generate a much higher trip rate than typical warehousing uses. A trip generation study for similar fulfillment centers was completed as part of the TIA for Project Rose, which resulted in an expected trip generation for the Project Rose site of 1.25 trips/1,000 square feet (KSF) or 0.90 trips per employee.

The typical trip generation rate per employee for industrial uses is 0.49 trips per employee, approximately half of what was measured at a similar facility. While development associated with the Amazon Distribution Center was considered in the market analysis described above, to account for the higher trip generation expected from this site, the number of employees included in the land use inputs for the model were factored up. The number of trips expected from the Amazon Distribution Center, trip generation rates, and land use inputs are summarized in **Attachment C**.

Spokane International Airport

Two factors are expected to contribute to growth in the area controlled by Spokane International Airport. The first is continued growth in operations at Spokane International Airport, including the future addition of a third runway. The second factor is growth in development on land around the airport, which is expected to be developed by a mix of commercial and industrial uses. Development expected to occur over the next 20 years in the area surrounding the airport was considered in the market analysis described above; however, growth associated with airport operations was considered separately.

The best available metric to estimate growth associated with airport operations was determined to be the number of enplanements. The number of enplanements in 2015 was used to establish a baseline along with employment data. Using the number of enplanements and the number of employees, determined using On the Map Census data, a baseline number of employees per enplanement was established. Using the number of employees per enplanement and the forecasts for 2030 enplanements from the Spokane International Airport Master Plan a future number of employees was calculated. Calculations for the airport land use are summarized in **Attachment D**.

Traffic Forecasting Approach

This section describes how the results of the land use analysis and trip generation calculations described above are planned to be incorporated by WSDOT into the regional travel demand model for the West Planes area.

The first step in the future land use updates for the 2040 travel demand model is validating the trip generation step of the model within the study area.

To validate the trip generation for the primary land uses within the study area five dynamic tests will be performed to establish model trip generation rates. The five tests completed for a TAZ containing each of the land uses below include:

- Add 100 single family dwelling units
- Add 100 multifamily dwelling units
- Add 100 non-CDB retail employees
- Add 100 office employees
- Add 100 industrial employees

The PM peak hour trips generated before adding the test land uses will then be compared to the PM peak hour trips generated after adding the test land uses to verify the trip rates assumed in the travel demand model for each land use type. These rates will be compared to trip generation rates found in the current Institute of Transportation Engineers (ITE) manual and summarized as part of the effort described above.

Through this process a proposed multiplier will be identified for each of the land use types. This multiplier will then be applied to the appropriate land use types for each TAZ in the study area. Through an iterative process, the trips generated with the proposed multiplier will be compared to the expected generation. This process will need to be iterated until it is determined that the trips generated from the travel demand model and the expected trip generation rates are within an acceptable threshold (approximately +/- 10%).

Once the land use multipliers result in a trip generation that is within 10% of the expected trip generation, the factored land uses will be used to develop traffic forecasts for 2040.

LELAND CONSULTING GROUP

Market Analysis and Development Forecast

Date August 21, 2019

To Kara Hall, Don Samdahl
Fehr & Peers

From Sam Brookham, Chris Zahas
Leland Consulting Group

Subject Market Analysis and Development Forecast

Project West Plains Transportation Management Plan

INTRODUCTION AND PURPOSE

Project Overview

The US 2 West Plains Subarea Management Plan refines previous studies that have been completed in the West Plains area. Previous studies have indicated performance concerns mobility gaps (congestion) for the US 2 corridor in Airway Heights, as well as a need for a local parallel roadway network. This study addresses the mobility gaps along US 2 between the US 2 & I-90 interchange and Fairchild Air Force Base entrance. This study also looks at other possible parallel frontage road connections for 6th/12th and 18th/21st, to help alleviate traffic loading directly onto the US 2 corridor.

In recent years, land use developments in the West Plains area has been growing at a fast pace. There is a need to understand the land use growth and the impacts it will have on the transportation system, so we can plan accordingly. This transportation-focused study will help position the West Plains for continued growth, prioritize improvements and maximize return on investments, secure scarce funding, and plan for dedication of needed right-of-way.[1]

Economic Analysis

This economic analysis is aimed to help WSDOT better understand the future development potential of the study area for residential, commercial, and industrial uses by providing data relating to new jobs and residents to populate new traffic models based on realistic development trends in the area.

A market-based development forecast for the next 20 years summarizes future conditions by identifying net new development on vacant and underutilized sites. While the analysis is largely undertaken at the parcel-level, the development forecast is aggregated into TAZ shapefiles to populate traffic models.

The forecast is informed by a market analysis, which includes an assessment of current and future demographic conditions, land use conditions, real estate dynamics, and West Plains strengths and weakness. The analysis

[1] From WSDOT Project Home Page, URL

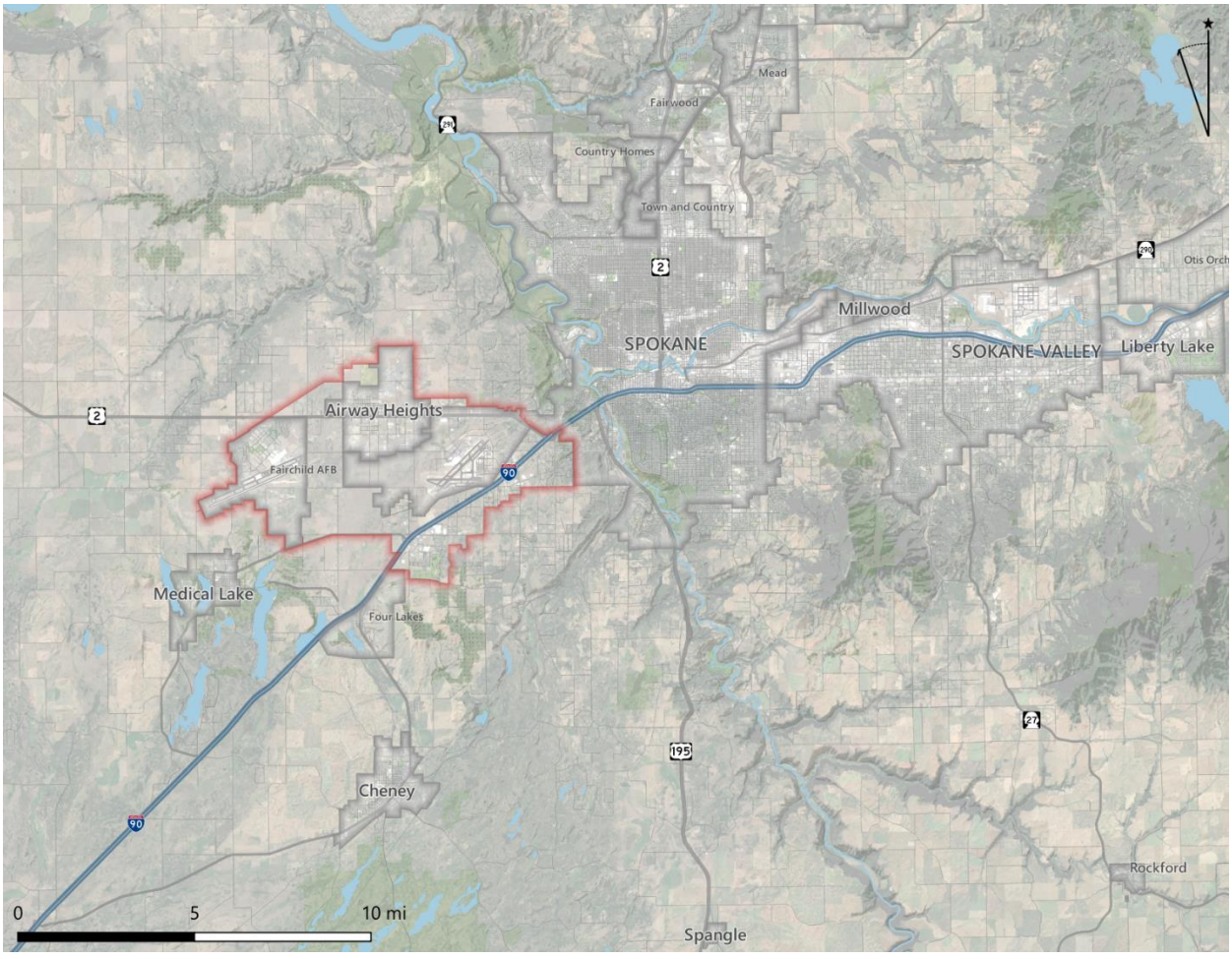
culminates with the characterization of long-term growth potential and expected development types for each expected land use in the study area.

Related to many, if not all, components of this market research are a series of stakeholder interviews. Stakeholder interviews are critical in building a basic understanding of development trends, the area's strengths and weaknesses, expected development projects, as well as how the area might change as a direct result of infrastructure investment. This memorandum includes a summary of these interviews.

West Plains Study Area

West Plains is located on the western edge of the Spokane metro region in Spokane County, Washington, centered around Highway 2 and Interstate 90. Fairchild Air Force Base, the City of Airway Heights, the City of Spokane, the Kalispel Tribe, the Spokane Tribe, Spokane County, and Spokane International Airport are all prominent stakeholders. With few cities or town to the west, and only the cities of Medical Lake and Cheney nearby to the south, West Plains has a substantial trade area which is unique to the rest of the Spokane metro region.

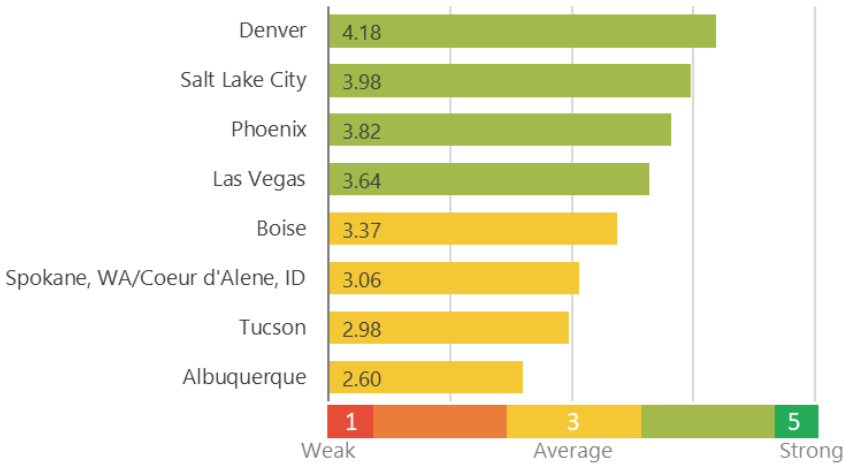
Figure 1. West Plains Study Area and Regional Context



Source: TIGER, Spokane County, State of Washington, Google (imagery), Leland Consulting Group

REGIONAL CONTEXT

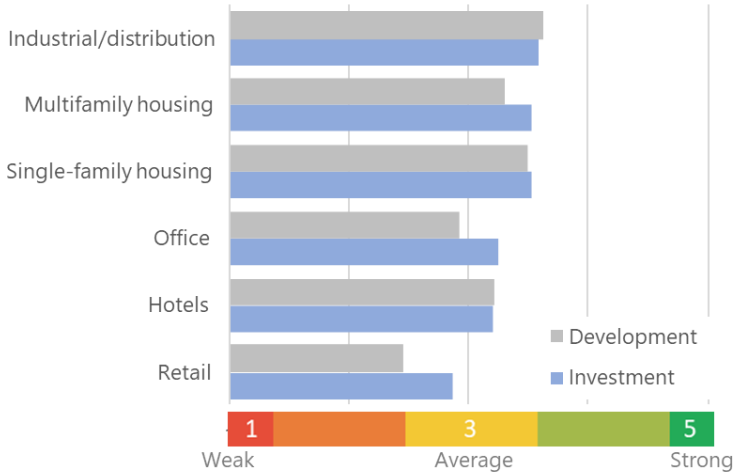
In recent years, the Spokane metropolitan regional market has not been considered a hotbed of investment. Indeed, Spokane ranked 64th out of the 79 markets identified by the Urban Land Institute (ULI) in its annual "Emerging Trends in Real Estate" publication. This score is based on participants' opinions on the strength of the local economy, investor demand, capital availability, development and redevelopment opportunities, public/private investments, and the local development community.



Generally, however, ULI maintains that the Mountain region will "continue to exhibit strong demographic and economic growth," and the "comparatively low cost of living and [cost] of doing business is considered attractive to new residents and conducive to employment growth." Indeed, the Spokane metro region has added population and jobs faster than the USA average, although income growth is expected to grow at a slower rate.

Emerging Trends also advises on the types of development that are likely to be most desirable in the coming years from both a developer and investor perspective. While this is a national outlook, the guidance is relevant for most local markets, including West Plains and the greater Spokane region.

The figure below shows ULI's high-level summary of national investment and development prospects for 2019. Industrial and housing top the list, with office, hotels, and retails falling somewhat far behind. Industrial and distribution uses have become increasingly popular investments in recent years, largely due to the rapid rise of ecommerce.



Focus groups conducted by ULI for the Spokane/Coeur d'Alene region report that their metro could benefit from increased infrastructure investment, and that they continue to see rising interest from national and regional investors.

However, like most cities across the nation, Spokane is experiencing significant issues with a shortage of construction labor and higher construction costs, which is amplified locally by stagnant rent growth.

EXISTING CONDITIONS ANALYSIS

This section presents demographic and employment conditions for the study area and surrounding region, as well as high-level assessment of land supply conditions in the study area.

Demographic Summary

The data provided in this section pertains to West Plains, Spokane County, and the State of Washington. Also included is the "subregion," referring to the area generally defined by the West Plains study area, Medical Lake, Cheney, Four Lakes, and Cheney Spokane Road—roughly a 7.5-mile radius around the 902/I-90 interchange. This subregion represents the residential market area, reflecting the area that shares similar characteristics with the West Plains study area and from which most competitive development will originate.

The following table shows population trends over the past 18 years. The West Plains study area has seen higher-than-average growth compared to the wider region, county, and state. It is important to note that although the data shows a 2.2 percent compound annual growth rate in West Plains' population from 2010 to 2019, the last year saw almost 4.8 percent growth, highlighting the rapid increase in the rate of growth in very recent years. West Plains' existing employment focus is highly apparent, as the only area showing more workers than residents for "daytime population."

Also significant is the proportion of the population in group quarters (17.5 percent), reflecting the presence of the Airway Heights Correctional Facility.

Table 1. Population Summary, 2000-2019

Population	West Plains	Subregion	Spokane Co.	Washington
2000 Total	12,418	33,815	417,939	5,894,121
2010 Total	14,344	40,313	471,221	6,724,540
2019 Total	17,415	46,033	515,061	7,608,571
00-19 CAGR	1.90%	1.73%	1.17%	1.43%
10-19 CAGR	2.18%	1.67%	1.12%	1.56%
2019 Daytime Pop	22,749	47,883	524,440	7,526,959
Workers	13,892	23,648	238,181	3,701,657
Residents	8,857	24,235	286,259	3,825,302
% In Group Quarters ('19)	17.5%	11.5%	2.9%	2.0%

Source: ESRI

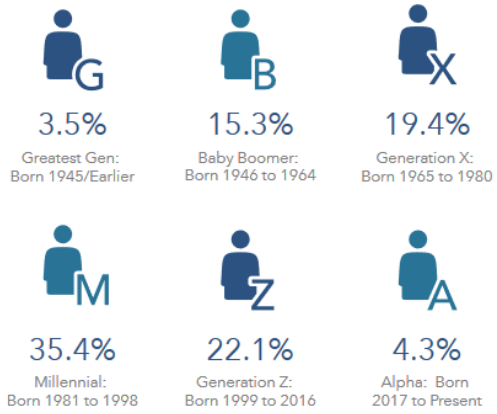
The following table shows age distribution and the percent of the population aged 25 and over that have a bachelor's degree or higher. This part of the Spokane metro region is significantly younger than the rest, with an average age of only 32.1 versus 38.1 for the county. Most significantly, well in excess of half the population is under 35 years old. A smaller proportion of seniors (aged 65 and over) is potentially indicative of the area's employment-heavy focus and isolation from the rest of the Spokane metro, where a greater array of transit options, amenities, services, and housing is more accessible.

Table 2. Population Age Distribution and Education, 2019

	West Plains	Subregion	Spokane Co	Washington
Median Age	32.3	32.1	38.1	38.6
% Under 18	21.8%	19.6%	21.3%	21.3%
% 18-34	33.3%	34.8%	24.5%	23.5%
% 35-64	35.6%	33.6%	37.9%	39.1%
% 65+	9.3%	12.0%	16.3%	16.1%
% with bachelor's degree	19.8%	28.6%	31.1%	36.0%

Source: ESRI

The following graphic provides a more detailed breakdown of the West Plains population by generation. Different generations typically share similar lifestyle preferences and trends. This is particularly true for housing, recreation, and amenities. People belonging to the Millennial and Boomer generations typically place the highest demand for multifamily housing and affordable, smaller single-family homes (including townhomes and small single-family structures). Generation Xers, of which West Plains has a significant population, typically drives demand for larger "move-up" single-family homes. Generation Z—largely the children of older Millennials and Gen Xers—are likely to either move out of the area for college or enter the local workforce. Gen Z preferences remain open-ended, but it is likely that they will continue to drive demand for multifamily and, more selectively, student housing.



According to data from the Washington Office of Financial Management, Spokane County is projected to experience major population growth in Baby Boomer and Millennial generations over the next 10 years.

The stakeholder interviews conducted for this analysis—summarized in more detail later in the report—highlighted substantial projected growth for the Cheney School District. This data would appear to support that notion, with Alpha's (the newest, youngest generation) already totaling more than four percent of the total population, despite only being born in the last two to three years.

The following table shows a range of housing characteristics, hightling the high proportion of rental housing in West Plains, despite the fact that the area has not historically been a hotbed of apartment construction. Indeed, the fact that West Plains also has the highest average household size of other comparison areas appears to reflect the single-family nature of the housing market. Along with the previous data showing West Plains' significantly younger population, this appears to suggest young families living in rented single-family homes, perhaps driven by the presence of larger institutions like Fairchild Air Force Base.

Table 3. Household Summary, 2019

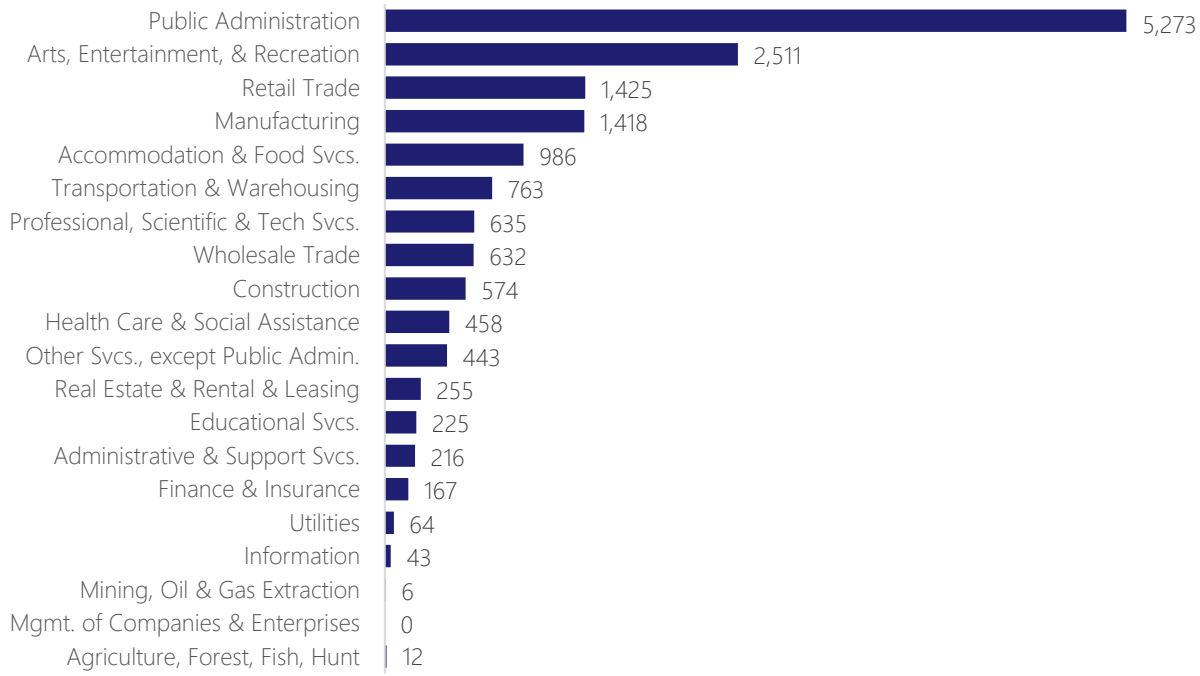
	West Plains	Subregion	Spokane Co	Washington
Avg. Household Size	2.60	2.52	2.48	2.54
1- & 2-Person HHs	57.3%	61.1%	63.5%	61.7%
Med. HH Income	$52,684	$53,338	$56,511	$73,627
Med. Home Val.	$220,970	$250,158	$225,078	$370,055
% Renter Occupied	49%	45%	37%	36%

Source: ESRI

Employment Summary

This section provides an overview of employment and commute patterns in West Plains. The following chart provides a high-level summary of West Plains employment profile.

Figure 2. West Plains Employment Profile, 2018 (est.)



Source: ESRI

The graph shows "public administration" accounting for about one-third of all jobs in West Plains. Public administration encompasses the many public or semi-public agencies or jobs in West Plains, such as the Airway Heights Corrections Facility, Fairchild Air Force Base (military) and Spokane International Airport (notably, security).

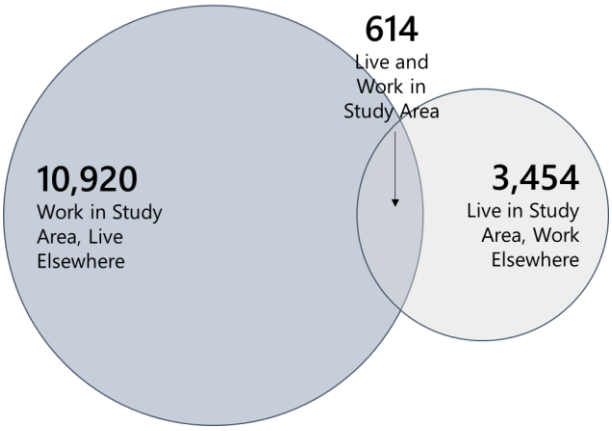
Entertainment and recreation jobs are also very prominent, largely because of the Spokane Tribe Casino and the Northern Quest Resort and Casino. Both these institutions are expected to expand in the near future, so jobs in the art, entertainment, and recreation industry are likely to continue to feature prominently. Similarly, retail

trade and accommodation and food services are both prominent industries and expected to grow as the Tribes develop their land, more housing units are built in the area, and tourism emerges as a prominent sector.

Most significantly, however, manufacturing, transportation and warehousing, professional, scientific, and technical services, and wholesale trade—which collectively account for almost one-fifth of all jobs—are expected to grow at a faster rate the rest of the region. West Plains presents a significant competitive advantage for manufacturing and transportation and warehousing, in particular, both regionally and further afield, and will drive industrial development in the area. Employment growth in the professional, scientific, and technical services industry will drive office demand but the industry is smaller and unlikely to achieve the same rate of growth as more prominent office locations in the Spokane metro, such as downtown Spokane. The Pacific Northwest Tech Park may be one of the few places that well-suited office tenants may locate.

Commute Patterns

Figure 3. Employment Inflow/Outflow, 2015



The figure at left shows—using 2015 data (the latest available)—the number of employees that worked, lived, or both worked and lived in West Plains. Despite a larger geographical area, very few people lived *and* worked in the area in 2015.[2]

The data also shows a significantly higher number of employees than employed residents, demonstrating West Plains' status as a strong employment hub in the region.

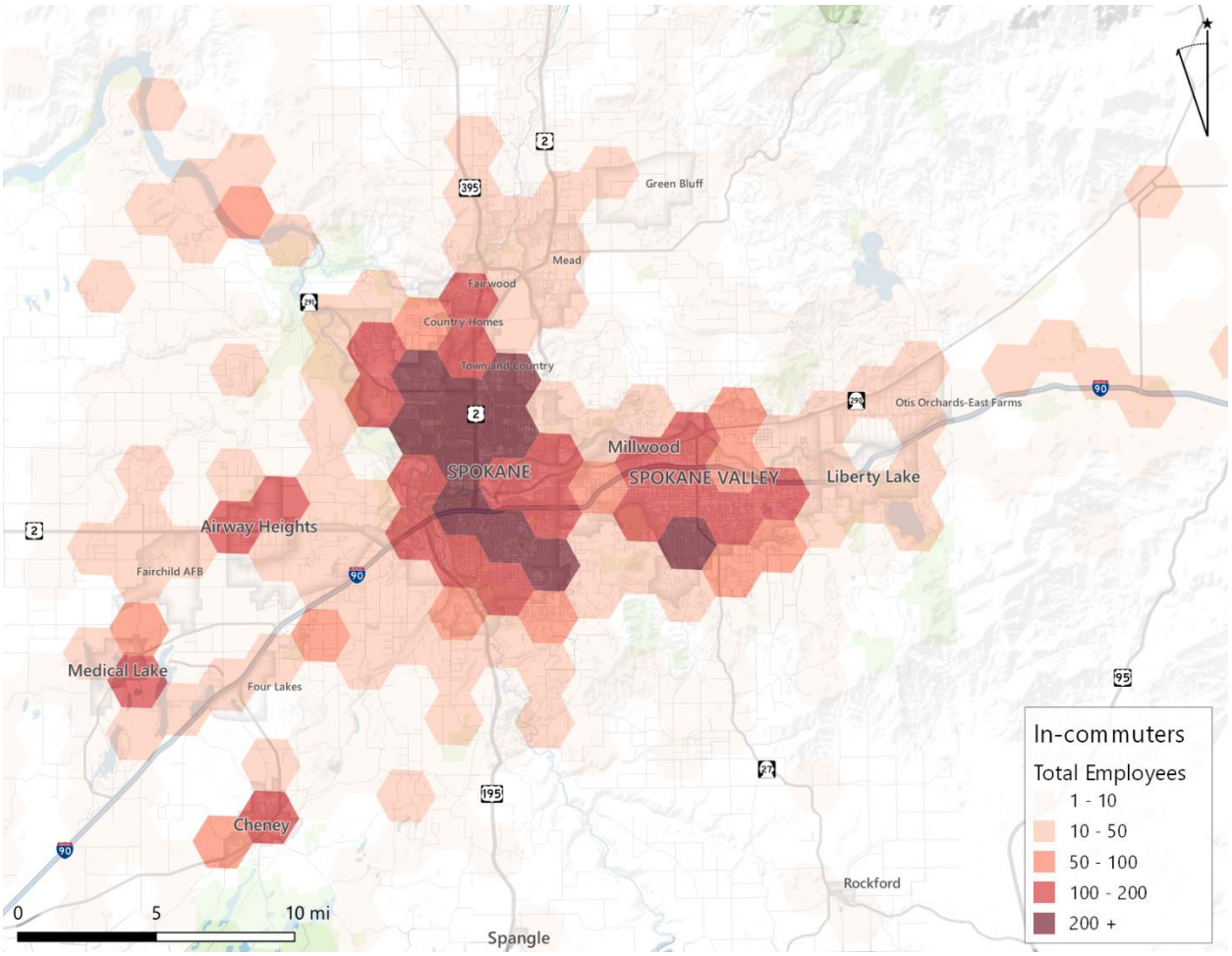
Source: LEHD

The past three years has seen significant growth in both residential and employment-based construction, so some of these numbers may have changed. Anecdotally, it is also understood that quality of life, housing quality, and housing availability have all improved in recent years. However, there is likely still an opportunity to provide additional housing that meets the needs and desires of those working in West Plains.

To reinforce this point, the following map shows the home location of people working West Plains. Most people that commute *into* the region for work live further east in Spokane and Spokane Valley. West Plains is unlikely to attract people to live in the area purely based on commute time as the transportation network provides quick cross-metro travel times. Instead, West Plains is challenged with creating a place that offers an attractive mix of housing, recreational and commercial amenities, and high-quality schools[3], among other elements.

[2] Typically, the larger the area, the higher the percentage of employed persons and work and live in the area.
[3] The Cheney School District, which encompasses West Plains and is not seen as attractive relative to other school districts in the Spokane metro region, is considered a barrier to major growth.

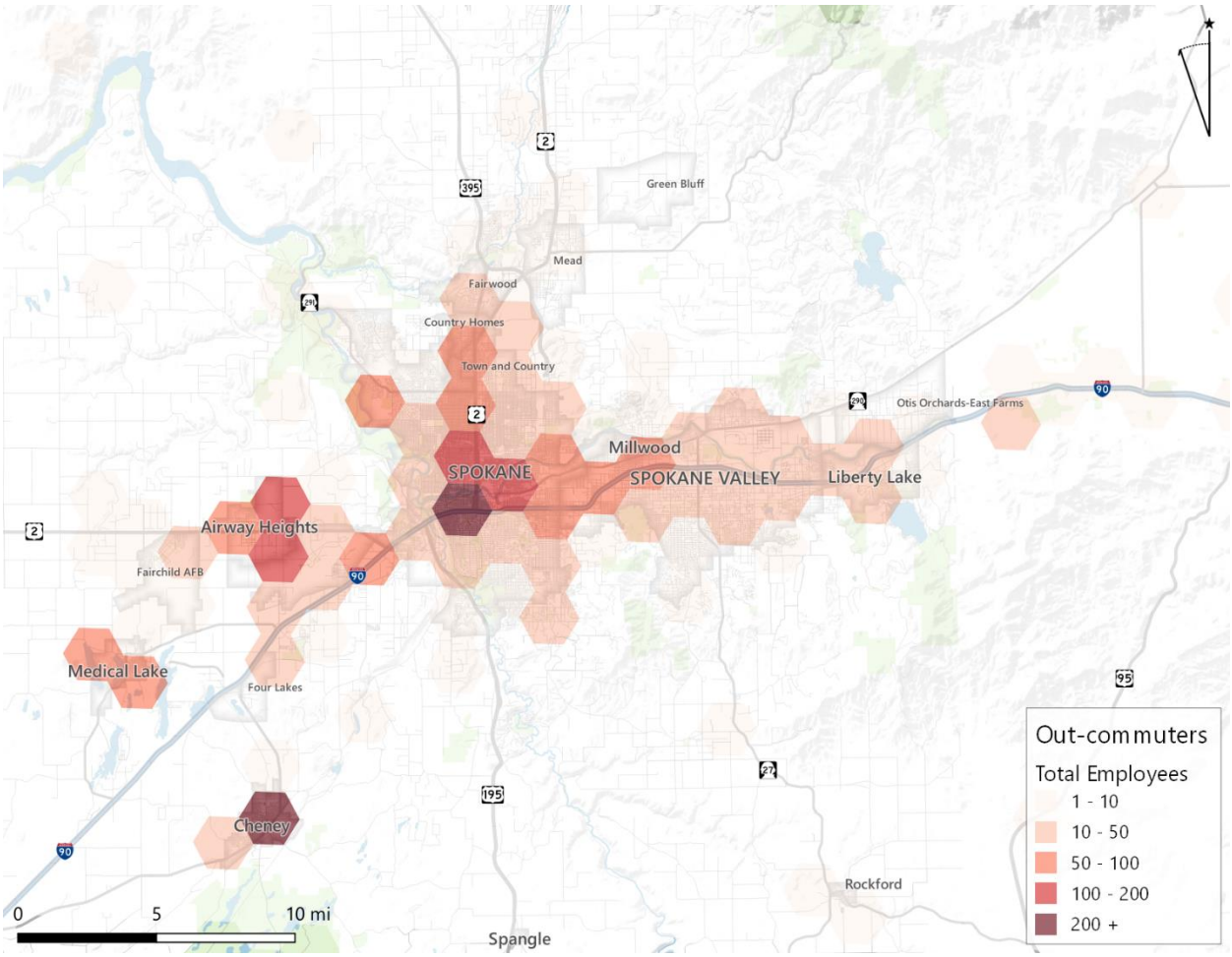
Figure 4. Where West Plains Workers Live, 2015



Source: LEHD, Leland Consulting Group

The following map shows the employment location of people living West Plains. The highest concentrations of workers are in Cheney—likely driven by Eastern Washington University, and downtown Spokane—the main office cluster in the metro. West Plain residents also work throughout the rest of the metro, in employment corridors centered around I-90 and US-2. West Plains appears to be a relatively attractive place to live for those working in these areas.

Figure 5. Where West Plains Residents Work, 2015



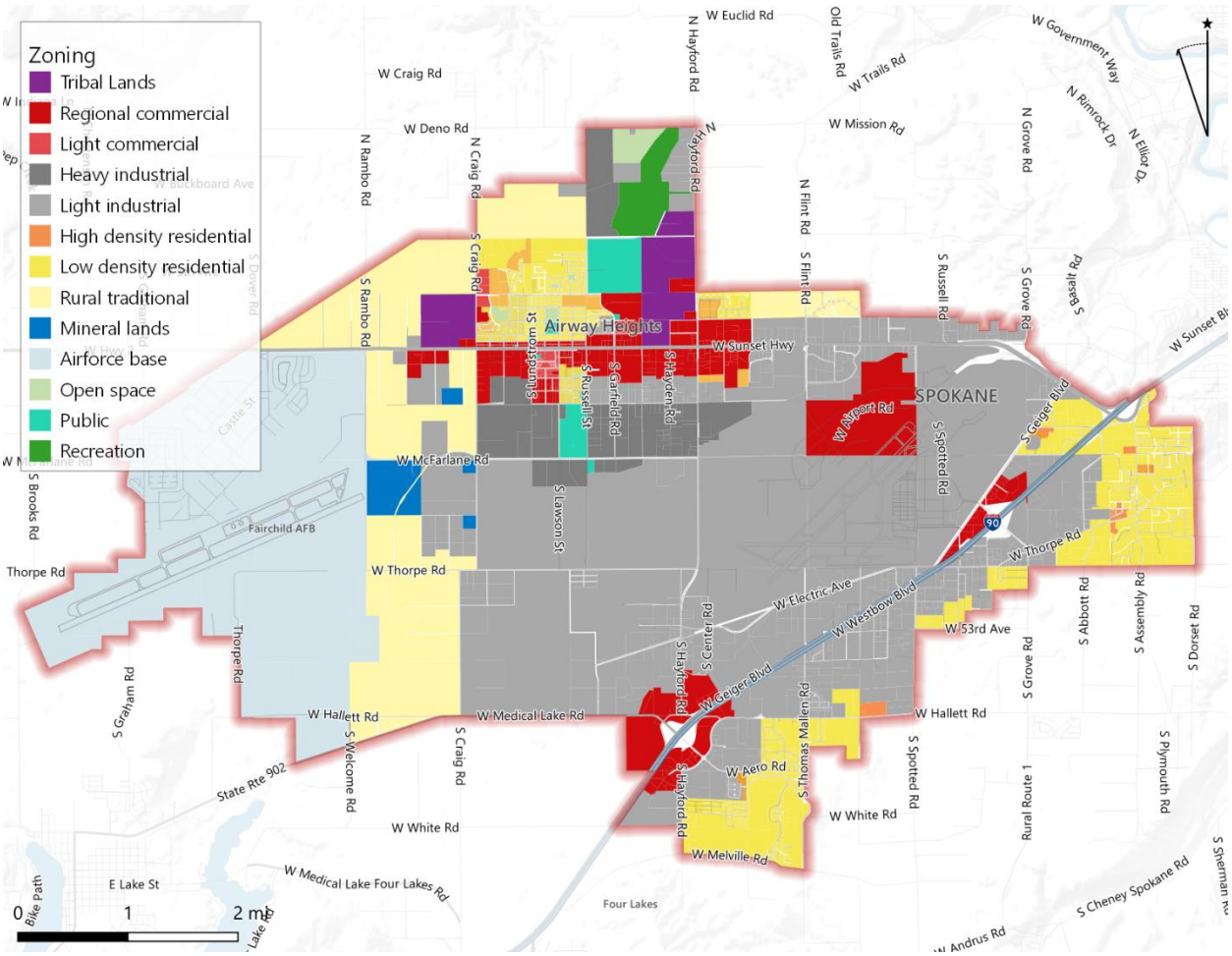
Source: LEHD, Leland Consulting Group

Land Conditions

Cataloging the amount of developable land is critical to a land development Land supply is a critical component of a land development forecast. To this end, land utilization, zoning, and ownership are all important factors.

The following information portrays the aggregated zoning for the entire West Plains study area. These zones were considered when forecasting future development. Light industrial zoned land is the dominant zoning type, largely due to the presence of the airport, which also owns a substantial portion of the land in central West Plains.

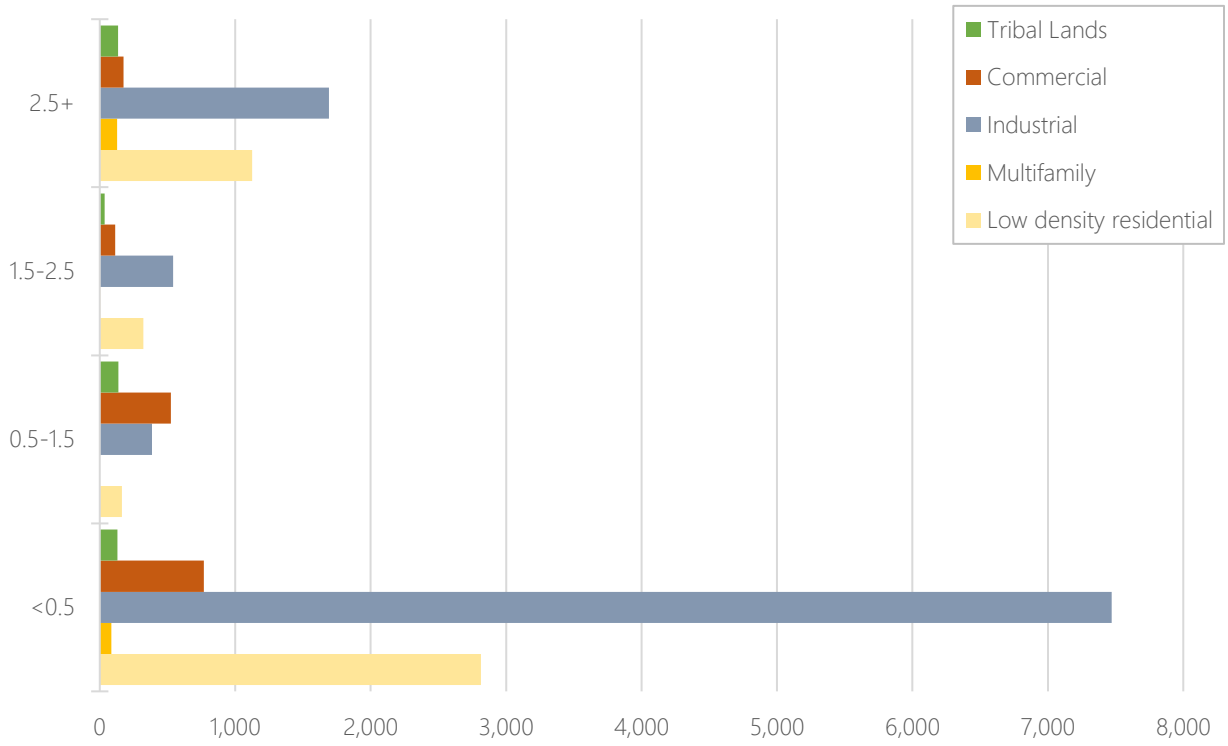
Figure 6. Zoning (Aggregated)



Source: City of Airway Heights, City of Spokane, Spokane County, Leland Consulting Group

The sheer amount of industrial zoned land relative to other zoning is clearly seen in the following graphic, which shows total acreage in West Plains broken down by land utilization and aggregated zoning type. West Plains has an extraordinary amount of highly underutilized land, much of it is zoned for low density residential or industrial uses. That said, much of this land is also found in unincorporated county land where development is likely to be low density and land may lack significant infrastructure. There is significantly less shovel-ready land in West Plains.

Figure 7. Acreage by Land Utilization and Zoning



Source: City of Airway Heights, City of Spokane, Spokane County, Leland Consulting Group

STAKEHOLDER INTERVIEW SUMMARY

Stakeholder interviews are an integral component of the analysis, as they help to ground truth preliminary market findings, identify trends that would not otherwise be seen in more traditional data sources, and highlight the area's nuanced strengths and weaknesses. Stakeholder interviews are especially critical in areas with multiple jurisdictions, significant landowners, and other organizations, such as the West Plains. For example, plans for development on Tribe-owned land or on Spokane International Airport property are likely to register with traditional, market-driven sources of real estate data.

The interviews involved a number of public representatives, namely from Spokane International Airport, the Spokane Tribe, the Kalispel Tribe, Airway Heights, City of Spokane, Spokane Transit Authority (STA), West Plains Public Development Authority (PDA), and West Plains Chamber. Additionally, a significant landowner and two commercial and industrial brokers were interviewed to gain an understanding of markets trends from the perspective of the private sector.

Findings from the interviews, including strengths, challenges, opportunities, and development trends, are summarized as follow. These findings will be carried through the remainder of the memorandum and—where applicable—elaborated. As much of the interview content focused on not-yet-public information, the findings are typically presented as key takeaways and major themes.

Strengths

- **Substantial Growth.** There has been a recent uptick in growth—particularly with regard to industrial and residential land uses. The rate of growth is expected among stakeholders to continue ramp up.
- **Good Access.** West Plains benefits from access to major transportation networks, rail, and the airport, which is attractive to industrial users, in particular.
- **Industrial Land Supply.** The West Plains area is one of the few places in the entire region where an industrial user can find large tracts (e.g. 15 acres) of industrial-zoned land that can be served by adequate infrastructure.
- **Strengthening Housing Market.** Rapidly increasing housing prices and declining vacancies reflect the growing strength of the housing market. Despite the recent uptick in growth, the rate of construction is still not keeping pace with demand. New units are therefore almost immediately absorbed by the market.
- **Significant Aerospace Cluster.** The region has one of the strongest aerospace manufacturing industry clusters in the nation, with around 240 aerospace-related manufacturing businesses and approximately 8,000 jobs. Significant growth could occur within the next few decades, especially if a large user is successfully attracted to airport land.
- **Strong Workforce.** The area boasts a young, educated workforce and strong workforce development programs in partnership with educational and other institutions throughout the region.
- Affordable Housing Market. Housing is cheaper than the rest of the Spokane metro region, although housing prices are increasing. Housing construction cannot keep up with demand, particularly with regard to workforce housing.

Challenges

- Highway 2 is considered "at capacity," with the performance of many key intersections expected to worsen as the rate of growth in the area continues. Potentially troublesome pinch points include Hwy 2 & Hayford, Hwy 2 & Craig.
- **FAA Restrictions.** While Spokane International Airport owns a significant portion of the land in West Plains, it is unlikely to attract small- to medium-sized private developers. Due to FAA regulations, the airport has little choice but to ground lease land to developers. If the airport desires to sell any land, they must go through an extensive, time-consuming process with the FAA. This is likely to deter near- and mid-term development while other, less complicated land is still available in the area. Larger companies—particular aerospace-related—are less likely to be deterred.
- **Restrictive Overlay Zone.** The airport overlay zone impacts allowed development and building types and extends into the surrounding areas where development might otherwise be possible. The zone largely impacts land within the City of Spokane and in unincorporated Spokane County.
- **Adequate Infrastructure** to support high-intensity users is lacking in many places. Additional infrastructure investment—which is understood to be planned—would greatly increase development prospects by providing shovel-ready land and heighten development feasibility for all users, particularly with regard to land to the south of US 2 (in and near Airway Heights).
- **Wetlands** present a barrier to development in some places that must be mitigated prior to new development.
- **Fairchild Air Force Base** may prefer to remain isolated from adjacent development. As such, prospective developers looking to locate projects near the base face challenges on the basis of encroachment.

- **Image Issue.** West Plains and the greater Spokane region does not typically attract significant national interest, but the area is beginning to "get on the map" due to a number of new large businesses and an extensive marketing effort. This also extends to substandard perceptions about the school district and quality of life, irrespective of actualities.
- **Regional Competition.** Post Falls and Spokane Valley may also prove difficult to compete against for industrial development. However, West Plains possesses unique competitive advantages with the airport, tribal land development plans, Fairchild AFB, and the new Amazon facility.
- **Lack of Households for Retail.** West Plains has about 35 square feet of retail space per capita, significantly higher than the 15 to 20 square feet that is typically considered "equilibrium." While the West Plains trade area extends significantly beyond its boundaries to the southwest (i.e. the area containing the consumer base that existing retail serves), retailers are today placing increasingly more importance on activity densities and income levels. While prospective retail tenants in the past have struggled to see a significant market in West Plains for new development—citing feasibility concerns in addition to a saturated market—significant household growth and mid-wage job growth is expected to improve retail prospects.

Opportunities

- **Residential Demand.** Demand for residential uses typically follow large job generators, such as Amazon, Kenworth Trucking, Caterpillar, casino growth, etc. These types of uses are especially driving demand for workforce housing. Residential development is allowed in the County area south of I-90 despite a designation as light industrial in the Spokane comprehensive plan, resulting in several new subdivisions and other residential projects. This is likely to continue until the existing developable residential land has built out. Rezoning certain areas or removing regulatory and physical barriers to development would likely result in further residential development within the next few decades.
- **Fairchild Air Force Base Growth.** Fairchild has been selected to receive 12 additional KC-135 refueling aircraft, which will begin arriving in 2020. Fairchild is said to be planning to reactivate its 97th Air Refueling Squadron, as well as an unnamed maintenance unit, to handle the Stratotankers. About 1,000 additional airmen and family members combined are expected to move to the Spokane region, potentially having a profound positive impact on demand for housing and commercial amenities in West Plains. Beyond this known near-term growth, there is the potential for further employment growth.
- **Industrial Growth.** Manufacturing, transportation, and distribution are likely to drive industrial development, but these users are not necessarily expected to require access to the airport. Instead, transportation infrastructure and clustering nearby mutualistically beneficial users is of greater importance.
- **New Transload Facility.** The new transload facility and rail spur presents a tremendous opportunity for major industrial development and employment generation. The facility is expected to support the expansion of existing industries and improve the prospects of attracting major companies to the area.
- **Opportunity Zone.** Much of West Plains is considered an Opportunity Zone—a tax incentive program that is likely to increase development in the area. However, Spokane also has several Opportunity Zones in prime development locations, so this may prove less significant.
- **Plentiful Land Supply.** There is plentiful vacant land that is ripe for new development—depending on the provision of adequate infrastructure and the successful navigation of the regulatory restrictions that apply to some of the land (e.g. FAA regulations, flight overlay zones, etc.).
- **The I-90 corridor** is a desirable place to develop for industrial and commercial users, and benefits from City of Spokane infrastructure (versus Airway Heights, where there is less infrastructure capacity for these users).

- **Strong Transit System.** STA is adding new routes to accommodate residential and employment growth in the area. New transit routes help connect the area, especially people living in Cheney and Medical Lake to jobs in and around Airway Heights. STA anticipates these new routes, as well as a planned BRT route in 2040 along US-2, to induce growth.
- **New Infrastructure Investment.** The PDA is undertaking a regional stormwater study and aim to invest in critical stormwater infrastructure to support new investment in the next two to three years. This will be a coordinated effort focused on implementing other infrastructure elements, largely made possible by a recent grant.

Development Trends

- **Tribal Land.** There is significant development interest in both Tribe areas, with both Tribes expressing a desire for development. Immediate plans include casino/event space expansions. Additional development is expected to be market-driven, with a range of land uses on the table, including housing, retail, entertainment, and hotel.
- **Amazon.** The new Amazon facility is expected to drive significant interest for associated distribution, logistics, and other industrial uses in the near-term.
- **Phasing.** Highway 2 and I-90 corridors are likely to approach build-out in the next 20 to 30 years, particularly with regard to residential land. The area east of Airway Heights along US-2 may see build out achieved even sooner. Industrial development surrounding Macfarlane Road and the new transload facility is anticipated in the near-term, but only with new investments in infrastructure.
- **Airport Development.** Spokane International Airport and the PDA are targeting large aerospace manufacturing companies for its land to the west of the airport. A third runway is planned in this area which will absorb a significant chunk of the land, particularly once the land at either end is subsequently classified non-developable due to aircraft takeoff/landing zones. The additional runway is still considered a long-term project and construction may occur beyond the 2040 planning horizon of this project.

  This land is a key component in the airport's efforts to attract Boeing or other relating suppliers as Boeing targets 2025 for its new midsize aircraft (NMA). Spokane is thought to be competing with North Carolina for the opportunity to home Boeing. If successful, around 300 acres of aeronautical land will be developed, potentially generating around 5,000 new jobs.

- Spokane International Airport also owns the land east of Spotted Road (roughly bounded by the US-2 and Geiger Blvd.)—about 590 acres of vacant space that has had some infrastructure investment. However, despite investments in roads more than 15 years ago the area has remained vacant with little development interest. This is unlikely to change, although there is a planned interchange and new road that may improve access and, subsequently, prospects.
- **Hotel Growth.** Additional hotel development is expected in the I-90 corridor and near the airport.
- **Limited Office Market.** While the office market is considered limited, new development is likely to occur north of the airport. The PDA is looking into an innovation park, which will include research and development (R&D) to partner with the extensive number of local educational institutions in the area.
- **Increasing Rate of Development.** Development over the past few decades has been highly constrained. However, the rate of development over the past two to three years has been unprecedented and is likely to continue as long as the economy remains strong. Continuing growth largely depends on infrastructure

availability and capacity, the success of the PDA to attract a large aerospace-related user, and the lifting of regulatory barriers to development.

- **Multifamily Development.** Several large apartment projects have been recently constructed or are in the near-term pipeline. Historically challenging market conditions and long-lasting impacts from the recession potentially resulted in a highly constrained housing market with pent-up demand. As absorption slows and the market right-sizes, there may be a glut of multifamily units in the next five years, but the housing market is likely to remain strong.

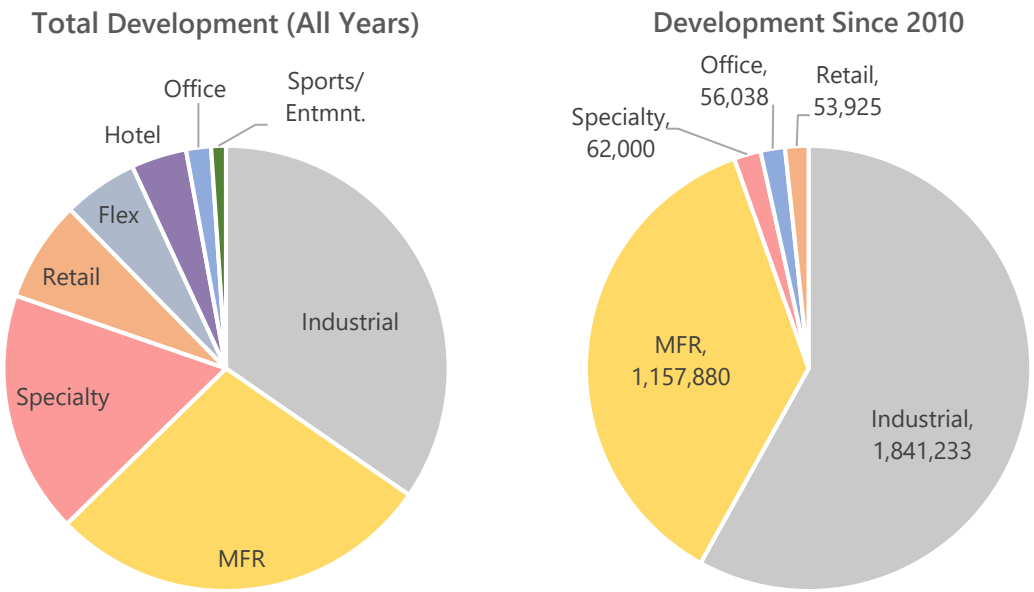
MARKET ANALYSIS

Real Estate Market Summary

With regard to non-institutional or non-single-family residential land uses, the West Plains study area is primarily made up of industrial and multifamily land uses, with a relatively small amount of retail, flex, office, and other developments, as shown in Figure 8, below. These are usually more equally proportioned, and the retail sector is typically one of the largest in terms of square footage. For West Plains, it would appear that these other real estate sectors are lagging behind industrial and residential development.

Since 2010, this trend has only intensified, with multifamily development increasing the pre-2010 inventory by about 50 percent and the industrial market also showing significant growth (not including under construction or planned developments, such as Amazon and Kenworth Trucking). As an earlier section highlight national development and investment prospects, this closely follows national trends that suggest strong support for industrial and residential development.

Figure 8. West Plains Development by Total Square Feet and Year Built



Source: Costar

These trends go some way in underlining West Plains' industrial character. The lack of retail is a curious phenomenon: in contrasting form to much of the retail sector throughout the rest of the United States, it would appear that continued residential and employment growth in West Plains would only underpin the need and demand for significant retail construction going forward. As such, as we move into the demand forecast later in this report, land use projections indicate significantly higher rates of retail development over the next 20 year.

Market Sectors

This section includes a summary of current market trends at both the Spokane metro region (market) and West Plains (submarket) levels.

Residential Market

Multifamily Residential. Spokane's multifamily sector continues to benefit from strong fundamentals. Vacancy remained tight in 2018, even as over 900 new units came online. Though annual rent growth has moderated, rents are growing more quickly in Spokane than nationally. Buyers are taking increasing notice of the Spokane multifamily sector's strength: multifamily sales volume more than doubled in 2018, and investment benefits from numerous transactions.

Market data pertaining to the West Spokane County Submarket is as follows.

- The local multifamily market appears more constrained than the metro market, with very low vacancies (3.1 percent) and historically low deliveries (average of 45 units per year over the past 10 years).
- Average rents are relatively consistent with those throughout the Spokane metro region, with high rent growth likely reflecting the addition of several new projects.
- Th rate of multifamily construction has increased recently, with 232 units delivered over the past year—seven percent of the total inventory and the first deliveries since 2015. This growth is clearly in line with demand, with the market showing almost instant absorption.
- Average rents remain around $815 per unit, on average, but new construction been upwards of $900 to $1,000—in line with averages in the rest of the Spokane market. New multifamily construction on the Kalispel Tribal land, for example, is looking to rent for even more (between $1,000 and $1,500 for one-, two-, and three-bedroom units), which would easily be a historical high for the submarket. Generally, however, rent growth remains slower than the wider market, at 3.27 percent versus 5.21 percent for the submarket and market, respectively.
- Anecdotally, it is understood that significant demand exists for apartments, with several developers poised to develop if the opportunity arises. However, significant barriers exist, such as the airport overlay zone, the glut of light industrial zoning, and a lack of quality infrastructure in places.

Area	12 Month Deliveries	12 Month Absorption	Vacancy Rate (%)	Average Rent	12 Month Rent Growth
Metro	542 units	561 units	5.0%	$1.08 PSF	5.4%
Submarket	232 units	212 units	3.1%	$1.03 PSF	4.2%

Source: Costar

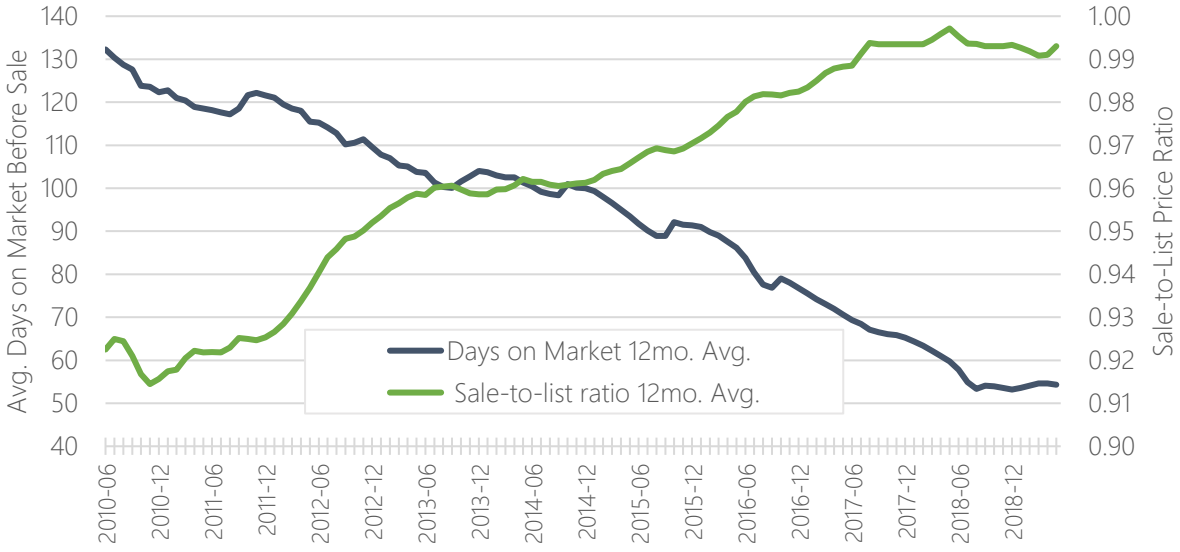
Single-family Residential. The West Plains residential market has been—at least historically—predominantly single-family oriented. Development activity has increased in Airway Heights and in Spokane County south of I-90, with many new single-family subdivisions coming online.

The Spokane housing market is viewed as affordable when compared to Seattle and Portland. It was also ranked fourth out of 300 cities in a national Realtor.com survey of the hottest markets, trailing Midland, Texas; Chico, California; and Colorado Springs, Colorado. The survey, released in March, measures listing views per property and the average amount of time a home is on the market. With such a hot market, it is not uncommon for sellers to receive multiple offers on homes, especially in the $300,000-or-less price range. However, high demand will usually drive up home prices. In the Spokane market, home prices rose more than 11 percent over the past year.

Two key indicators of market strength in the for-sale housing market are the average number of days on the market from list date to sale (closing) date, as well as the ratio of sale price to list price. These trends are presented below in Figure 9.

- For **days on market**, decreasing numbers indicate a strengthening market. Spokane County has continued to experience a decreasing average since the Great Recession.
- For **sale-to-list ratio**, a ratio of 1.0 indicates that homes are being sold for the original list price, on average. If this ratio is anywhere near or even above 1.0, the housing market is considered very tight and a seller's market. At 0.99, this rings true for Spokane County, and demand for new housing is strong.

Figure 9. Spokane County For-Sale Market Trends



Source: Zillow Market Research

The strength of the Spokane metro market has certainly spilled over into West Plains, with data indicating a very tight market. Indeed, current home listings account for less than three months of standing inventory, and new homes (built in the past five years) account for one-third of these sales. Strong demand exists for all housing types, but particularly for homes priced under $300,000, with only 1.7 months of standing inventory.

Additional information pertaining to the West Plains single-family housing market is as follows.

- Over the past five years, about 60 new homes have been built and purchased annually. A similar rate of construction and absorption over the next 21 years would see up to 1,300 new single-family homes built. However, the rate of construction has been increasing with each passing year, increasing to around 90 homes over the past year (an increase of 50 percent). While this trend is unlikely to see exponential increases through the study's horizon year of 2040, West Plains may see at least a tripling of this annual development rate (around 200 units per year). Indeed, with more than 3,000 known residential units (both single-family multifamily) in the pipeline, this is highly likely.
- With this said, land supply may soon be an issue. While there are several locations that could accommodate additional residential uses, particularly south of I-90 in unincorporated county land, much of this land is within the airfield overlay zone for Spokane International Airport and/or zoned for light industrial, limiting alternative land uses in these areas. Alleviating these regulatory barriers may be one strategy to accommodate additional residential growth. However, if not possible, residential growth immediate east of the West Plains study area boundary has seen moderate residential development activity. This could extend west into the West Plains area, but a lack of infrastructure and fragmented land ownership, among other reasons, is likely to cause this development to occur beyond the 2040 planning horizon for this study.

Home Price	Closed Sales	Percent of Total	Absorption (Units Sold per Month)	Active Listings	Months of Inventory
Under $200k	17	7%	1.4	1	0.7
$200k to $300k	197	81%	16.4	28	1.7
$300k to $400k	24	10%	2.0	22	11.0
$400k to $500k	4	2%	0.3	2	6.0
Total	242		20	53	2.6

Source: Redfin, Leland Consulting Group

Retail Market

Market indicators show mixed support for the Spokane retail sector. Low vacancies have tightened over the cycle, with absorption typically outpacing new deliveries. Spokane has also weathered a number of store closures, and all three of the metro's Shopko locations are set to close in the first half of 2019. However, rent growth is consistently low, and rental rates remain below the prerecession peak. Though 2018 saw the largest new retail delivery since the recession, a Costco build-to-suit, inventory has increased by only 1 percent this cycle.

Market data pertaining to the West Spokane County Submarket retail sector is as follows.

- With 1.1 million square feet of standing inventory in West Plains—equating to approximately 63 square foot per resident—the retail sector is currently only a local market (in other words, it fails to draw customers from outside its trade area).
- While only approximately 54,000 square foot of new retail development has been built since 2010, the next few years will see some significant deliveries, including the North 40 outfitters, a handful of new gas stations

and convenience stores, Dutch Bros coffee, and continued development interest in the Cross Pointe commercial center. Further, not-yet-planned retail development is also likely in the near-term.

- Very low vacancies suggest a constrained market, but with zero to negative absorption and a volatile national market, there is reason to be guarded about the strength of Spokane's retail sector.
- Retail rents are consistent with averages for the metro, with marginally faster annual rent growth. New strip center retail is expected to rent for around $22 to $24 per square foot—significantly higher than current averages.
- The retail sector is struggling nationally, with retailers challenged to compete with the rapidly growing ecommerce sector. West Plains stands to benefit from high-traffic routes and good visibility along both the US-2 and I-90 corridors, potentially mitigating some of the negative impacts that ecommerce has had on traditional brick-and-mortar retail. The lack of existing retail development in these corridors means that new development is not constrained by the increasingly unpopular land use patterns that auto-oriented retailers and big box retail centers have created across the United States. Instead, West Plains has the opportunity to shape its commercial centers in a way that remains popular: as accessible, interesting, unique places that cater to a diverse array of needs.

Area	12 Month Deliveries	12 Month Absorption	Vacancy Rate (%)	Average Rent	12 Month Rent Growth
Metro	196k sf	-383k sf	5.1%	$13.35	0.5%
Submarket	0k sf	14.1k sf	3.0%	$13.34	0.9%

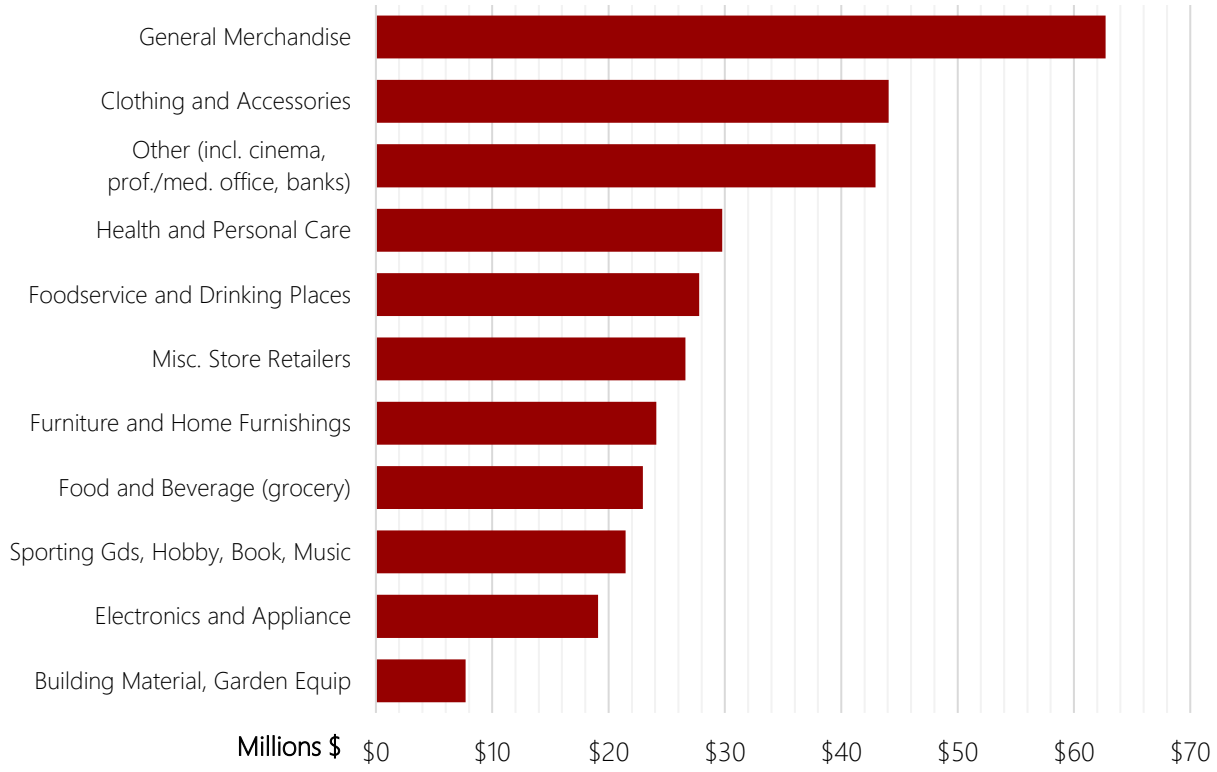
Source: Costar

National retail tenants are unlikely to have expressed significant interest in West Plains due to the lack of residential rooftops, lower household incomes, and stagnant growth. This has arguably resulted in an under-retailed environment with the majority of West Plains residents doing their shopping in the City of Spokane—the closest retail center.

This has perhaps contributed to significant spending leakage across *all* retail categories, as shown in the following chart. Leakage occur when household spending is not captured within the defined trade area. When local demand for a specific product is not being met within a trade area, consumers are going elsewhere to shop, creating retail leakage.

Opportunities appear to abound to recapture a substantial portion of existing leakage within West Plains in the form of new retail development. Recapturing all or even half of leakage is highly unlikely. Instead, community-serving retailers, such as restaurants, grocery stores, and health stores are likely to make significant inroads in recapturing existing leakage.

Figure 10. Spending Leakage by Retail Category



Industrial Market

The new Amazon distribution center aside, Spokane's industrial sector remains a local market despite exhibiting very strong fundamentals. Rent growth has posted substantial gains for years, and vacancies are well below the historical average. However, construction has been limited. Inventory has increased by only 3.7 percent since 2010, with absorption steadily outpacing new supply. The Spokane metro's moderate sales volume is in line with the historical average. Many properties trade hands each year, though at low prices, and typically both buyers and sellers are based within the region.

With this said, economic development and other marketing efforts have intensified in recent years to broaden the reach of Spokane's economy and attract and expand companies to the region. Indeed, the metro region currently boasts the fifth largest aerospace manufacturing cluster in the United States and the industrial market stands to gain a significant impetus if these economic development efforts are successful in attracting related industries.

Market data pertaining to the West Spokane County Submarket (West Plains) is as follows.

- Absorption has fallen in West Plains over the past 12 months, although the last 10 years has averaged around 110,000 square feet of positive net absorption. This is largely due to significant new vacancies in 2018, resulting in a vacancy rate spike. Vacancies have otherwise been very low over the past decade.
- Rent growth remains high—a positive sign for new development—although industrial development typically follows buy/sell trends than rental trends.

- Upcoming projects include the 2,560,000 square foot Amazon facility, Kenworth Trucking (80,000 sq. ft.), and a number of proposed projects in and around the Pacific Northwest Tech Park along US-2 that have not been finalized.
- Despite the lack of deliveries in in the last year, approximately 1.2 million square feet of new industrial space was built (not including flex) since 2010—accounting for more than one-quarter of existing inventory. The recent construction surge indicates an emerging industrial market in the West Plains that appears set to continue.

Area	12 Month Deliveries	12 Month Absorption	Vacancy Rate (%)	Average Rent	12 Month Rent Growth
Metro	266k sf	-81.3k sq. ft.	2.7%	$6.90	4.2%
Submarket	0k sf	-83.6k sq. ft.	6.1%	$6.78	4.5%

Source: Costar

Office Market

The Spokane office market presents mixed indicators. Though pipeline activity remains limited, vacancy rates have fluctuated significantly. Deliveries during the current cycle have largely been build-to-suits, and more recent speculative projects are experiencing lease-up challenges. However, though rent growth remains fairly low, it remains stronger than both the historical average and the three preceding years. Additionally, investment in Spokane is increasing. Sales volume in 2018 was near the cycle peak, seeing the largest office trade of the post-recession era. That said, the office market appears limited to downtown, with even higher vacancies, lower rent growth, limited construction, and negative absorption in the north county submarket.

Market data pertaining to the West Spokane County Submarket is as follows.

- With only 536,000 square feet, West Plains' office sector is considered local. New construction has been very limited, although new medical-related offices have recently been in the pipeline.
- Vacancies have fluctuated significantly despite the lack of new construction, providing signs that the market would support new development.
- Rent growth among the existing inventory has been stagnant, with rents averaging around $17 per square foot (gross).
- With regard to absorption, the West Plains submarket has actually performed better than the wider region, helping to lower vacancies. A prolonged period of positive absorption may help attract office developers to the area.
- Despite weaker office market fundamentals (such as slower rent growth, relatively stagnant construction activity, and moderate average rents), office development is likely to ramp up, albeit as a secondary land use (to industrial, retail, and residential uses) and only in select locations. New development is likely to locate primarily around Flint Road near existing and planned office development. Continued infrastructure investment and successful economic development efforts are likely to support additional office growth. Further, residential growth will heighten the need for medical offices, such as clinics and dentists, and support specialized office developments, such as coworking spaces, business incubators, and small-scale speculative office space.

Office Market Trends, Spokane Metro Region, 2019 Q2

Area	12 Month Deliveries	12 Month Absorption	Vacancy Rate (%)	Average Rent	12 Month Rent Growth
Metro	6.3k sf	493k sq. ft.	8.2%	$17.27 PSF	2.8%
Submarket	0k sf	74.7k sf	5.7%	$17.14 PSF	2.6%

Source: Costar

Demand Forecasts

Demand forecasts for retail, residential, office and industrial development over the next 20 years are shown in the following pages. Both the retail and residential forecasts utilize projected annual household growth rates. Given the lack of geographically specific projected growth rates for West Plains, LCG has triangulated multiple data sources—including existing county-wide projections and historical growth rates—to come up with a 2.6 percent annual growth rate in an attempt to minimize the potential margin of error.

Methodology

Retail Demand Forecast

The retail demand model provides estimated demand by square feet per retail category for the primary trade area, which extends west in a semi-circle 35-miles from near the US-2 and I-90 interchange, in an area encompassing Davenport, Harrington, Sprague, and Spangle. The primary trade area represents the area from which most retail spending will be derived.

LCG's demand model is built from consumer spending reports that show existing household demand and spending for every retail category. Projected annual growth rates are then applied to existing demand, leakage recapture potential is assessed, and an assumption is made about the level of redevelopment or replacement of standing inventory due to obsolescence.

The resulting demand model shows the total estimated square feet of *new* retail development that can be expected over the next 20 years in the primary trade area.

Residential Demand Forecast

The residential demand model provides the estimated number of single-family and multifamily housing units expected in the residential market area over the next 20 years. The residential market area is generally defined by the West Plains study area, Medical Lake, Cheney, Four Lakes, and Cheney Spokane Road—roughly a 7.5-mile radius around the 902/I-90 interchange. This subregion represents the residential market area, reflecting the area that shares similar characteristics with the West Plains study area and from which most competitive development will originate.

The residential model similarly utilizes triangulated growth rate projections to build off the existing housing inventory. The models apply these growth rates to the existing number of households by income to provide a breakdown of total demand by future income level. Assessing tenure trends (i.e. rent versus own) distinguishes the number of rental apartments to owned single-family homes and townhomes.

Office and Industrial Demand Forecast

The employment demand model provides the estimated amount of industrial and office development by new square feet in West Plains over over the next 20 years. Given the lack of competing employment lands elsewhere in the region (namely to the south and west of the West Plains study area) and the unique market characteristics of the West Plains, the West Plains boundary serves as the primary employment market area.

To calculate demand for employment uses, we apply annual growth rates to current employment data. Growth rates are triangulated for each industry based on published projected growth rates for the region, expected growth from new projects in the pipeline, and historical trends. Applying industry standards to these job totals, such as space needs and the percentage of workers in either office or industrial space, then provides total estimated building square footage.

Retail Demand

Total retail demand for the primary trade area over the next 21 years is shown in the following figure. This shows the total retail square footage expected to be supported by existing and future households and visitors.

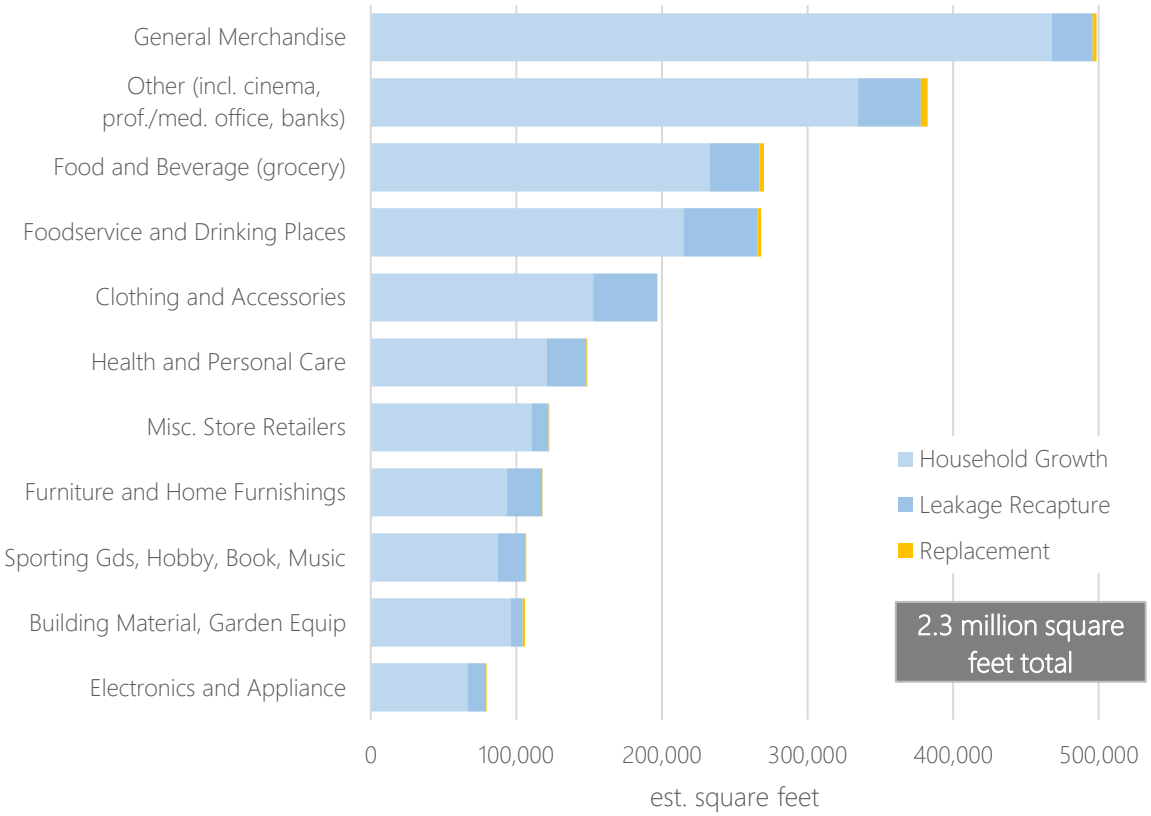
The chart shows three sources of demand for the development of new retail space:

- Household growth, i.e., from new households moving into the market area;
- Leakage recapture, i.e., by "recapturing" some of the retail spending that households are making outside of the market area; and
- Replacement, reflecting the fact that existing space becomes obsolete over time. This is a small share of overall demand.

Retail demand for the entire primary trade area accounts for 2.3 million square feet over the next 21 years. With the model utilizing a 2.6 percent annual household growth rate, it is reasonable to think that additional demand may arise with other demand drivers, such as significant employment generation and tourism efforts.

Given the lack of other competing areas of retail throughout the primary trade area, West Plains can expect to capture the vast majority of total retail demand. Recent development trends show West Plains capturing upward of 75 percent of new retail demand in the trade area. Using this same metric, West Plains might capture 1.7 million square feet of retail within its boundaries, depending on available land, infrastructure capacity, and continued residential and employment growth.

Figure 11. Retail Demand, Primary Trade Area, 2019-2040



Residential Demand

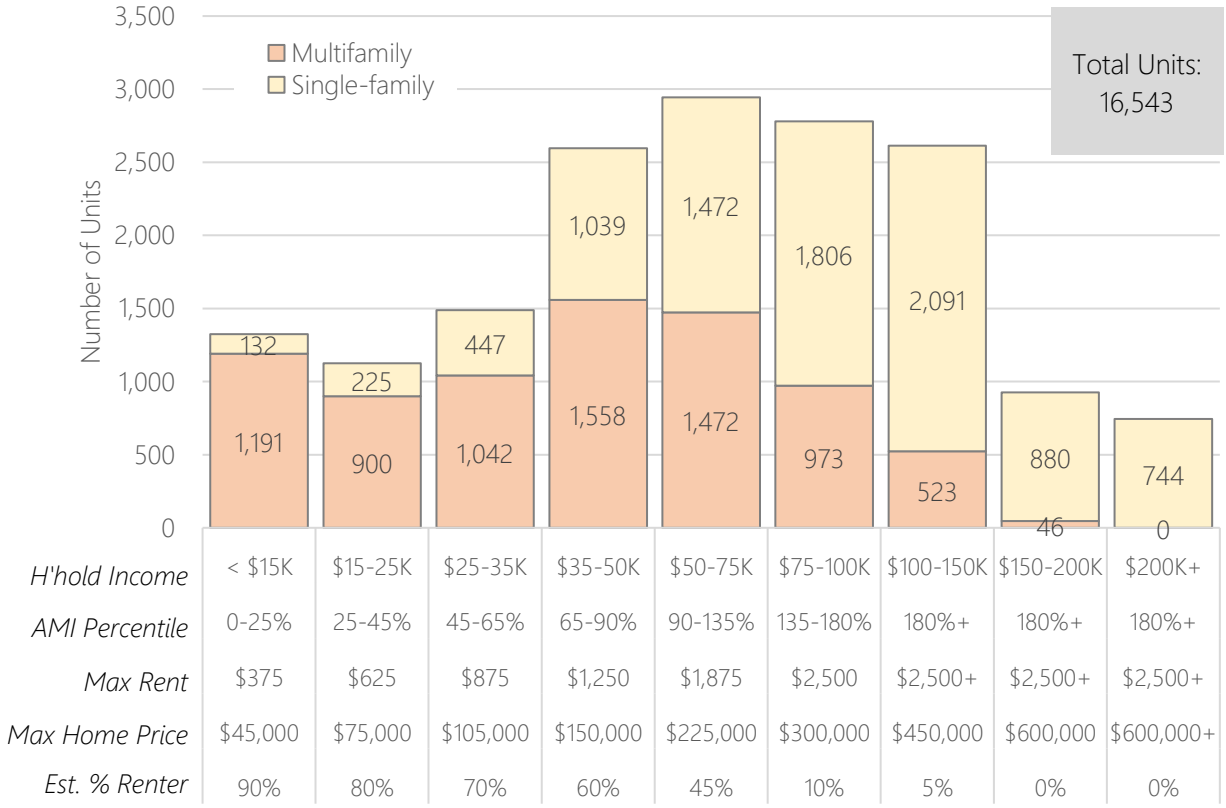
The following chart shows total market area demand for multifamily and single-family housing units. In total, we project demand for 16,500 new residential units in the market area—an area containing Medical Lake, Cheney, and extending west about 7.5 miles from the 902/I-90 interchange.

As West Plains is unlikely to capture 100 percent of total market area demand, a capture rate needs to be established based on historical trends and anticipated future trends. Medical Lake, Cheney, and the surrounding unincorporated county land will continue to grow and capture a significant portion of demand. However, West Plains is well-poised to capture denser housing typologies, such as apartments and townhomes, as well as a smaller share of single-family homes. Indeed, a look at recent trends suggest that this is highly likely, particularly as subdivisions are completed and land becomes scarcer.

Between 2000 and 2019, West Plains was responsible for about 35 percent of new growth in the residential market area, up from 25 percent between 2000 and 2010, suggesting an increasing preference for residential development in West Plains.

As such, while we anticipate a similar rate of growth to continue in West Plains, we expect the area to be able to capture about 30 percent of total market area demand, equating to about 5,000 units. A conservative estimate of attainable capture, with 10 percent of single-family detached, 25 percent of single-family attached, and 40 percent of rental apartments would equate to 3,940 total units.

Figure 12. Residential Demand, Residential Market Area, New Units, 2019-2040



Office and Industrial Demand

Primary drivers of demand are likely to remain industrial-oriented, particularly with Amazon's new facility creating additional interest for associated warehousing and distribution. Aerospace manufacturing growth at and around Spokane International Airport will support manufacturing growth and, to a lesser extent, research and development. Successful economic development efforts may provide even more impetus to this industry. Also, while not necessarily market-driven, the continued growth of "public administration" jobs will continue to support both office and industrial development, particularly at Fairchild and the airport.

New estimated demand for office and industrial development over the next 21 years is as follows.

270,000 sq. ft. 6,340,000 million sq. ft.

Flex space, which can often bridge the gap between office and industrial, depending on total market demand, currently accounts for about 15 percent of office, industrial, and flex space in West Plains. At a similar rate, flex development would account for an additional 1.0 million square feet. However, flex is particularly challenging to forecast, so we would simply expect that any potential market gaps in the future would be plugged by new flex space.

DEVELOPMENT PROGRAM

This section describes total predicted new development, based on known projects, land supply analysis, planning documents, and general development trends in the area, among other elements. The development forecast applies the findings from the market analysis to the West Plains study area at the parcel level, highlighting potential development opportunities on a site-by-site basis.

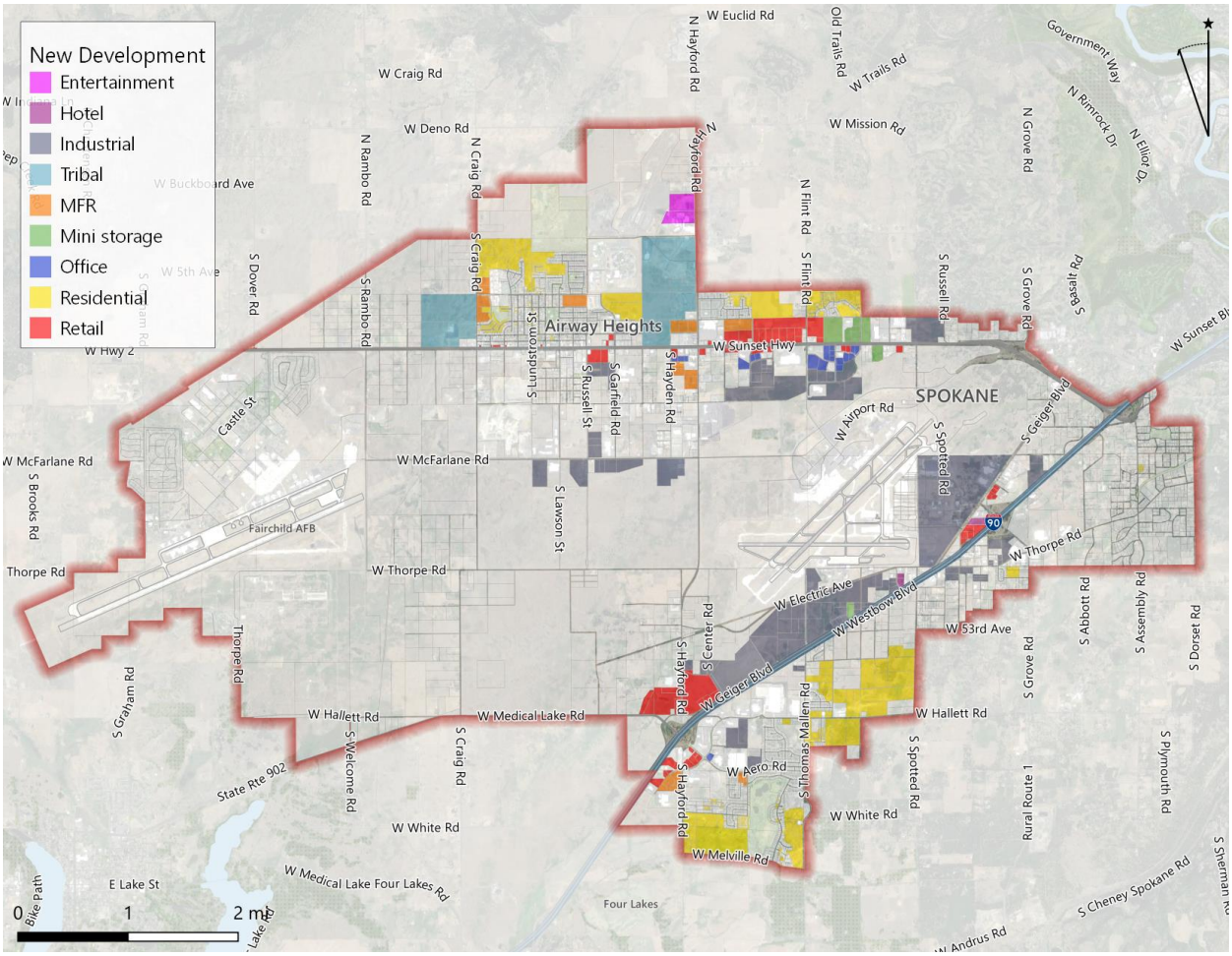
Generally, the Hwy 2 (City of Spokane segment) and I-90 corridors are likely to see the most development activity based on current development trends, existing infrastructure capacity, and a number of planned projects providing impetus to the market. Key takeaways, including phasing notes, additional rationale, and other findings relating to each development type are discussed below.

- For **industrial**, development to the south of the airport is likely to follow in Amazon's footsteps. New infrastructure investments and access to high quality transportation networks make this area particularly attractive to transportation, distribution, and warehousing companies. The new Geiger Rail Spur and planned transload facility will also improve prospects for industrial users, like manufacturers, for the area surrounding McFarlane Road, although much of this land is owned by the airport. The remaining areas likely to see additional industrial development are the Pacific Northwest Tech Park, the area south of Triumph, and the airport business. These areas are served by existing infrastructure and transportation networks and development interest have recently peaked.
- **Development of airport-owned land** is challenging to forecast for a number of reasons. There is a concerted effort to attract large companies to the area that are tied to the aerospace industry, but these rarely follow regular market dynamics. We understand that talks are underway with a number of companies but may not necessarily result in new development projects. Another complication for airport-owned land are the FAA regulations that restrict the sale of the land for private development, which is to be considered a barrier to development. If the PDA and airport's economic development efforts are successful in attracting a number of large companies to the area, full build-out numbers are more likely to apply (development would likely impact TAZ 460, 546, and potentially 551). The aforementioned transload facility will likely increase the appeal of this land to these companies.
- For **residential**, development activity is largely expected in Airway Heights, on Kalispel Tribal land, and south of I-90. Single-family residential will continue to be highly sought after, particular homes in the $200,000 to $300,000 range that give West Plains a competitive advantage over its neighboring area. Continued residential construction of lots in the County south of I-90 and outside the overlay zone is expected, adding significant residential activity to the area and supporting retail demand. Substantial residential activity is also planned for the Kalispel Tribal land, which will capitalize on the high demand for multifamily units. Airway Heights' residential areas to the north of Hwy 2 will likely continue to see residential construction until full build-out is achieved, likely before the 2040 planning horizon. At which point, increasing the availability of buildable residential land through rezoning or annexation may be needed; the strength of the housing market is likely to support almost all additional development.
- For **retail**, there are a few areas identified for significant retail development, largely based on available land, suitable zoning, visibility and access. These include eastern Airway Heights and further along US-2 (near the proposed North 40 outfitters), as well as surrounding each of the I-90 interchanges. Retail is currently challenging on industrially zoned land in the City of Spokane and Spokane County within the airport overlay zone. Commercial developments and expansions of existing property (potentially including retail, hotel, and other entertainment uses) are also expected on both Kalispel and Spokane Tribal Lands.

- The **office** market is limited and is unlikely to see the same uptick in development activity as residential and industrial. Some data points to a handful of small- and medium-sized office projects on or near existing business parks to the north and east of the airport. The development forecast summary table, below, presents about 90,000 additional square feet of office space than the demand forecast in the previous section identified. This is to be considered a "buffer" that would largely be accommodated by flex development, although flex space is likely to assume a larger market share than 90,000 square feet over the next 20 years.
- **Significant infrastructure investment** is required to increase the development capacity of the West Plains, particularly in order to attract high-intensity industrial users. Water remains an issue to be addressed, especially in Airway Heights, and improvements to the transportation network have highlighted as necessary for the area's continued development. With an understanding that there are plans for major infrastructure, this investment would greatly increase development prospects by helping to prepare shovel-ready land and heighten development feasibility for all users, particularly with regard to land to the south of Hwy 2 (in and near Airway Heights).

These site-specific development projections are presented in the following map.

Figure 13. Anticipated New Development, 2019-2040



Source: Leland Consulting Group

Development Forecast Summary

In order to populate traffic models, these site-specific development projections are packaged into areas called traffic analysis zones (TAZ). Development projections for each land use in each TAZ are presented in the following table. Basic metrics (such as average square feet per employee for each land use and people per household) are provided to show estimated job generation and population growth. For industrial job generation, we assume a lower density to reflect the propensity of new industrial to be largely tied to logistics, warehousing, and distribution. Additional manufacturing jobs—particularly aerospace-related—would be expected to be higher density. Several additional notes are provided below the table.

Table 4. Market-based Development Forecast, 2019-2040

TAZ Number	Housing Units	Industrial	Office	Retail	Hotel	Storage	Other/ Misc.[4]
459	1,098			25,744			
460		500,000[a]					
461							150,000
462	567	118,021					
463				120,000	100,000		120,000
464	241	475,060	31,494	105,851			
546	249						
547	78	201,705		120,160		368,015	
549							
550	204	769,416	285,274	387,629		64,040	
551		3,520,215[b]		407,460	63,824	38,021	
552		298,916		113,555	104,361		
553	791	177,829	12,000	146,362			
556				295,206			
558	8						
559	897	201,979					
579	147						
Total Dev't.	**4,274**	**6,263,141**	**328,768** [e]	**1,721,967**	**268,185**	**470,076**	**270,000**
Est. Employees[5]		8,563[c]	939	2,870	107	19	450
Est. Pop (2.60/HH)	11,112	**Total Est. Employment:** 12,949[d]					

Source: Leland Consulting Group

[4] "Other/Misc." here refers to non-specific commercial uses associated with the potential development on Tribal Lands, which may include hotel(s), entertainment uses, retail, etc.

[5] These employment projections are calculated using a combination of direct employment inputs for planned and under construction projects with known project details and estimated forecasts for projected development using average industry standards for square footage per job (the rationale for which is provided on the following page).

[a] Mullen Technologies Inc. planned development for 500,000 square foot manufacturing plant adjacent to the planned Transload Facility employing around 800 people (625 sq. ft. per employee). An additional 800,000 (1.3 total) square feet and 2,200 jobs (3,000 total) may be possible with a potential lithium battery R&D and production facility (potential expansion, not planned). Only the first, known phase of development is included in this analysis.

[b] Includes known 2.6m sq. ft. Amazon facility, set to employ between 1,500 and 1,800 employees, with seasonal influxes up to 2,300 (model uses an average of 2,000 employees—an equivalent of 1,300 sq. ft. per employee).

[c] Job density calculations are used for speculative development only. That is, for large planned and under construction projects—such as Kenworth Trucking, Amazon, Mullen Technologies, etc.—this job data is added directly to the model, rather than as an employment density calculation. That said, it is expected that, cumulatively, new development will largely follow industry standards.

[d] This employment forecast is significantly higher than most employment projections sources indicate. That is because these projections are typically based on historical averages and high-level trends. This analysis, on the other hand, blends market research and analysis with a detailed understanding of the development pipeline, highlighting several substantial projects that do not abide by typical market dynamics (for example, a market analysis cannot provide guidance on whether a development as large as Amazon will occur because there are far more important elements at play, nor can it indicate significant growth in government institutions, such as Fairchild Air Force Base).

e Assumes additional development beyond the office demand presented in the previous section due to demand for flex space.

Employment Density

Existing employment at a specific site can be known with certainty. But often, industry averages serve as a starting point for communities planning future land use. Several institutions have research on the average square feet typically utilized by employees for different land uses. These include the Building Owners and Managers Association (BOMA), the U.S. Energy Information Administration (EIA), commercial brokers, and local governments that have conducted surveys of commercial buildings to identify space utilization averages for specific building types or industries. The variability of the data is typically broad, so a certain level of customization is required depending on anticipated land uses. For example, big box retail and warehouse industrial or high tech industrial data centers will have fewer employees per square foot than food-service retail and manufacturing industrial. Total employment generation for known development projects in the region also help ground truth some of these density assumptions.

The following table provides an explanation of the rationale behind the employment density used in the development forecast.

Table 5. Typical Space Utilization Per Job

Land Use	Sq. Ft./ Emp	Rationale
Industrial	1,000	EIA recommends 1,500 square feet (sf) for warehouse, using 2012 data, while Energy Star estimates 1,700 sf. Building Owners and Managers Association (BOMA) recommends 469 sf per employee for industrial (primarily manufacturing). Snohomish County's 2007 employment density study estimated 1,000 for wholesale, transportation, and utilities (WTU), and 500 for manufacturing. With industrial development expected to largely mostly WTU and warehousing, we expect a marginally higher-than-average employment density metric of 900 to 1,100 sf.
Office	350	EIA recommends 600 sf per office job, and 550 for medical offices. However, EIA uses 2012 data and new research (C&W, URL) indicates office space utilization trending towards 180 sf. BOMA, as of 2018, also recommends 288 sf per worker for private sector office buildings. Several other planning agencies have documented 250 sf for traditional office, 350 for R&D or flex, and 400 for medical office. For the West Plains area, where office space is likely to be limited to land uses that require more space, such as flex buildings, medical offices, and secondary office buildings (i.e. in support of other industries, like construction), employment density is likely marginally lower than the BOMA and broker numbers, which would apply mostly to established urban office locations.
Retail	600	Retail development can be either food service establishments strip/big box retail, or others, each of which have different employment densities. Regional planning entities have these ranging from 200 sf for food service, to 600 or more for traditional mercantile retail, and 1,000 for a supermarket. EIA estimates are high, at 920 sf for traditional retail and 567 for food service but reflect the range of metrics presented by different entities. Retail in West Plains is likely to be predominantly traditional mercantile, so an upper range of 600 is reasonable.
Hotel	2,500	EIA's estimates for hotel employment density is approximately 2,500 sf. While the data is from 2012, there have been few changes in the manner in which hotels operate over the past decade, so it is reasonable to assume this information still rings true. More recent data provided by Energy Star also uses a ratio of 0.32 workers per 1,000 sf, the equivalent of about one employee per 2,500 sf (URL).
Self-Storage	25,000	Self-storage typically only employs a full-time attendant and one or two others due to its hands-off and often automated nature. This is reflected in the fact that it is one of the lowest employment generators across all land uses.
Other/ Misc.	600	For properties that do not necessarily fit within the above categories, such as entertainment uses associated with the casino and/or others, are likely to follow a similar trend to retail.

Source: Leland Consulting Group

B. FAFB Build Out Land Use				
2016 Fiscal Statement		**Ratios**	**Current**	**Projected**
Active Duty	2828	-	3028	3628
Washington Air National Guard	947	0.33	1014	1215
Army Nation Guard/Army Reserve	685	0.24	733	879
Total Military	**4,460**	**1.58**	**4,775**	**5,722**
General Schedule	611	0.22	654	784
Federal Wage System	94	0.03	101	121
Defense Commisary Agency	58	0.02	62	74
Non-Appropriated Fund Civilians	221	0.08	237	284
Contract Civilians	363	0.13	389	466
AAFES Civilians	103	0.04	110	132
Branch Banks/Credit Union Civilians	10	0.00	11	13
Other Civilian Vendors	15	0.01	16	19
Total Civilians	**1,475**	**0.52**	**1,579**	**1,892**
Total Dependants	**5,935**	**2.10**	**6,355**	**7,614**
Total Personal	**11,870**	**4.20**	**12,709**	**15,228**

Current Estimates = 2016 Economic Impact Statement + 200 Airmen added recently.
Projected Estimates = Current + 600 Airmen planned to be added.

D. Spokane International Airport Operations Projected Growth

2015 Census Data		Enplanements		
Employment Sector	Jobs	2015 Enplanements	2030 Enplanements	2030 Projected Employees
Manufacturing	6	3.30E-06	-	10
Retail Trade	31	1.70E-05	-	53
Transportation and Warehousing	431	2.37E-04	-	739
Information	14	7.69E-06	-	24
Real Estate Rental and Leasing	96	5.27E-05	-	165
Professional Scientific and Technical Ser	20	1.10E-05	-	34
Admin & Support	78	4.29E-05	-	134
Educational Services	66	3.63E-05	-	113
Accommodation and Food Services	165	9.07E-05	-	283
Total	**907**	**1,820,148**	**3,119,876**	**1,555**

Attachment C. Model Land Use Allocations

Table C-1. Land Use Allocations by Jurisdiction

Study Area/ Jurisdiction	SRTC Model Growth		Market Analysis Growth		Δ From STRC Model			
	Households	Employment	Households	Employment	Households	Employment	% Households	% Employment
US 195	**4,891**	**4,491**	**3,445**	**1,853**	**-1,446**	**-2,638**	**-30%**	**-59%**
Spokane	4,188	3,637	3,165	1,732	-1023	-1,905	-24%	-52%
Spokane County	703	854	280	121	-423	-733	-60%	-86%
West Plains	**3,644**	**8,043**	**4,533**	**11,981**	**889**	**3,938**	**24%**	**49%**
Spokane	119	2,293	16	5,412	-103	3,119	-87%	136%
Spokane County	1,085	3,680	2,147	5,328	1,062	1,648	98%	45%
Airway Heights	2,440	2,070	2,370	1,242	-70	-828	-3%	-40%

Table C-2. US 195 Study Area Land Use Validation

TAZ	ITE Trips	Model Trips (with Land Use Multiplier)	Difference (ITE-Land Use Multiplier)	% Difference
14	544	407	137	25%
15	986	743	242	25%
16	365	277	88	24%
17	1,208	878	330	27%
19	1,838	1,318	521	28%
105	327	337	-10	-3%
106	603	576	27	4%
107	688	736	-48	-7%
108	290	258	32	11%
109	2,486	1,516	969	39%
161	2,801	2,543	258	9%
162	2,428	2,486	-58	-2%
171	481	476	5	1%
172	514	487	27	5%
173	1,278	1,507	-229	-18%
174	787	727	60	8%
175	547	567	-20	-4%
176	420	542	-121	-29%
177	469	486	-17	-4%
178	636	629	7	1%
179	868	874	-6	-1%
181	334	366	-32	-10%
182	503	510	-6	-1%
183	550	566	-16	-3%
184	912	1,027	-116	-13%

185	638	807	-168	-26%
186	1,306	1,377	-70	-5%
187	537	554	-17	-3%
188	681	823	-143	-21%
189	347	399	-52	-15%
190	1,975	2,875	-900	-46%
192	488	579	-91	-19%
193	801	938	-138	-17%
194	726	659	67	9%
195	423	487	-64	-15%
196	120	152	-32	-27%
197	394	457	-63	-16%
198	2,282	2,380	-98	-4%
199	1,043	1,065	-23	-2%
200	497	528	-31	-6%
206	383	437	-53	-14%
212	471	544	-73	-16%
213	476	510	-34	-7%
214	282	340	-58	-21%
221	1,166	1,175	-9	-1%
227	350	382	-32	-9%
233	364	416	-51	-14%
236	460	533	-74	-16%
548	1,349	1,020	329	24%
560	882	971	-89	-10%
562	542	615	-72	-13%
581	716	778	-63	-9%
583	639	705	-67	-10%
Totals	**43,200**	**43,342**	**-142**	**0%**

Table C-3. West Plains Land Use Validation

TAZ	ITE Trips	Model Trips (with Land Use Multipliers)	% Difference
459	3,047	2,878	6%
460	116	152	-31%
461	3,149	2,532	20%
462	1,581	1,627	-3%
463	934	902	3%
464	1,776	1,792	-1%
546	390	514	-32%
547	666	801	-20%
549	3,075	2,371	23%
550	3,166	3,169	0%
551	4,877	5,209	-7%
552	2,339	2,157	8%
553	2,666	2,616	2%
556	603	670	-11%
558	1,402	1,682	-20%
559	1,622	1,637	-1%
579	774	874	-13%
Totals	**32,181**	**31,582**	**2%**

Attachment D. Model Outputs & Forecast Volume

Table D-1. Model Outputs & Growth Rate

	Roadway Segment	Existing (2020)								Model Growth				Annual Growth Rate				2040 Roadway Segment Volume			
		AM Peak Hour				PM Peak Hour				AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		NB	SB	EB	WB	NB	SB	EB	WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB
1	Northbound US 195 south of Hatch Road	582	-	-	-	389	-	-	0	246	0	129	0	1%	0%	1%	0%	830	-	520	-
	Southbound US 195 south of Hatch Road	-	348	-	-	-	591	-	0	0	149	0	243	0%	2%	0%	2%	-	500	-	830
2	S Meadow Lane Road west of US 195	-	-	247	95	-	-	142	327	851	207	462	688	7%	5%	7%	6%	1,150	320	630	1,140
3	Cheney-Spokane Road between US 195 and W Qualchan Drive	728	196	-	-	272	476	-	0	129	-4	83	149	1%	0%	1%	1%	1,140	280	360	750
4	Marshall Road south of Thorpe Road	2	-	-	-	6	2	-	0	0	0	0	0	0%	0%	0%	0%	10	-	10	10
5	Thorpe Road east of US 195	-	-	55	61	-	-	82	79	21	179	147	95	1%	4.4%	3%	2%	120	270	290	220
6	W 16th Avenue between US 195 and S Lindeke Street	244	152	-	-	207	151	-	0	-49	303	231	83	-2%	4%	3%	2%	310	500	470	230
7	Westbound I-90 west of Grove Road interchange	-	-	-	1,626	-	-	-	1,767	0	386	0	353	0%	1%	0%	1%	-	2,380	-	2,120
	Eastbound I-90 west of Grove Road interchange	-	-	2,021	-	-	-	2,534	0	486	0	642	0	1%	0%	1%	0%	2,510	-	3,800	-
8	Eastbound US 2 west of I-90	-	-	1,386	-	-	-	2,332	0	157	0	950	0	0%	0%	2%	0%	1,540	-	3,830	-
	Westbound US 2 west of I-90	-	-	-	1,736	-	-	-	1,806	0	1023	0	296	0%	2%	0%	1%	-	2,760	-	2,100
9	S Lindeke Street south of W Sunset Boulevard	306	78	-	-	153	191	-	0	491	21	293	348	4%	1%	5%	4%	850	100	450	540
10	Northbound US 195 south of I-90	1,635	-	-	-	707	-	-	0	1101	0	455	0	3%	0%	2%	0%	3,370	-	1,340	-
	Southbound US 195 south of I-90	-	518	-	-		1,638	-	0	0	354	0	910	0%	2%	0%	2%	0	870	0	3,040
11	Inland Empire Way just north of Thorpe Road	233	27	-	-	106	58	-	0	230	125	182	410	2%	6%	2%	6%	670	160	450	540
12	S Cedar Street between 16th Avenue and 17th Avenue	613	373	-	-	456	604	-	0	208	6	134	124	1%	0%	1%	1%	820	480	660	890
13	Hatch Road between Hangman Valley Road and E 57th Avenue	312	339	-	-	438	362	-	0	348	297	274	321	3%	2%	2%	2%	660	830	710	770
14	Eastbound I-90 east of Division Street Ramps	-	-	5,504	-	-	-	6,166	0	648	0	774	0	1%	0%	1%	0%	6,150	-	6,940	-
	Westbound I-90 east of Division Street Ramps	-	-	-	5,734	-	-	-	5,972	0	1104	0	861	0%	1%	0%	1%	-	6,840	-	6830
15	W Qualchan Drive	31	208	-	-	107	61	-	0	-1	132	(17)	119	0%	3%	-100%	5%	40	440	180	180
16[1]	Eastbound I-90 west of Study Area	-	-	-	-	-	-	-	-	517	750	573	556	2%	5%	3%	3%	1,200	1,160	1,240	1,140
	Westbound I-90 west of Study Area	-	-	-	-	-	-	-	-	246	0	129	0	1%	0%	1%	0%	830	-	520	-

[1] Segment is not a study facility, model data was extracted to understand growth expected to occur on I-90 west of the US 195 and West Plains study areas

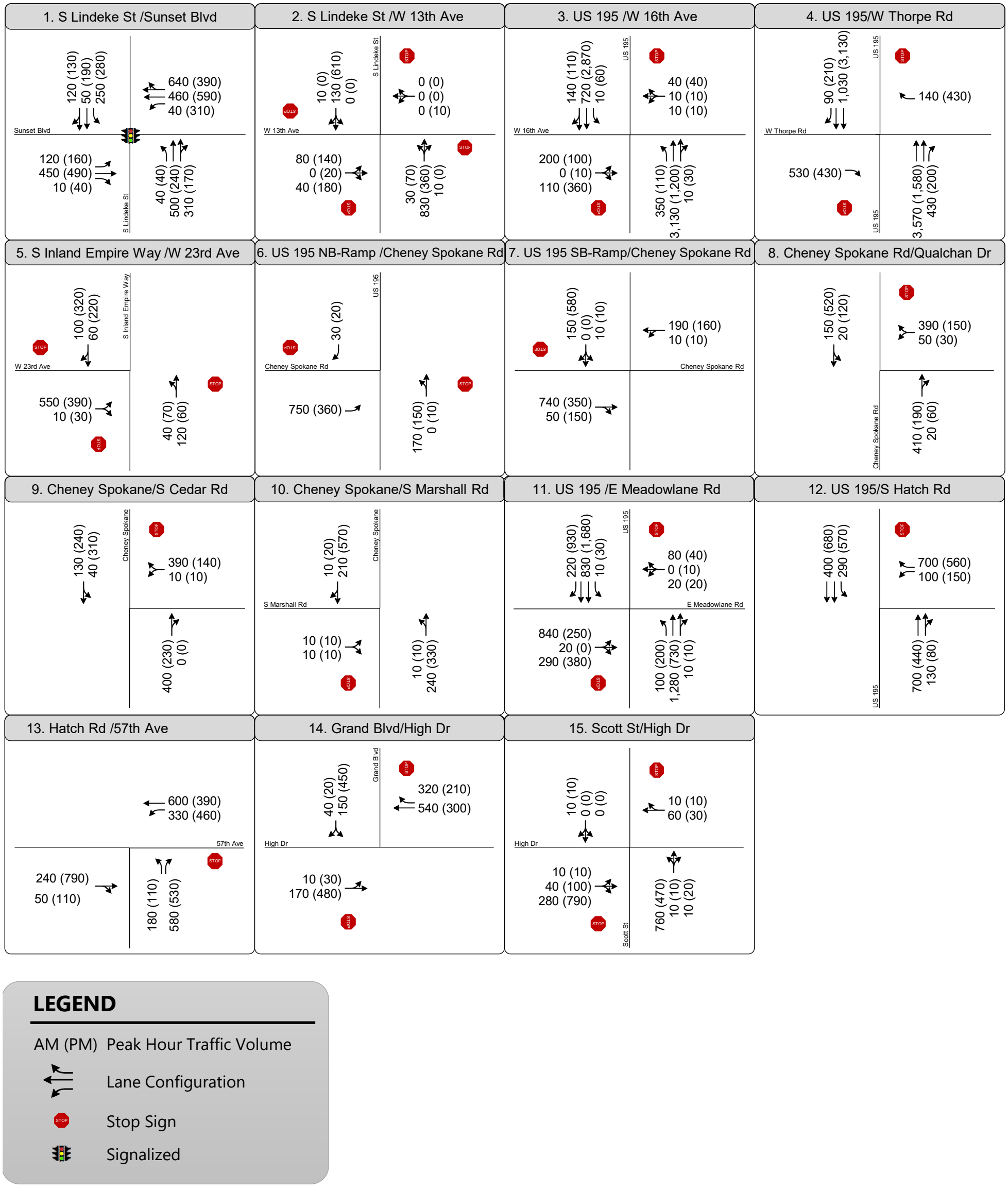


Figure D-1

Peak Hour Traffic Volumes
Baseline Conditions (2040)

Attachment E. LOS Calculations

HCS7 Freeway Facilities Report

Project Information

Analyst	Fehr & Peers	Date	February 2021
Agency		Analysis Year	2040
Jurisdiction	WSDOT Eastern Region	Time Period Analyzed	AM Peak Hour
Project Description	US 195/I-90	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	0	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	1.95		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	I-90 Mainline west of US 195 Interchange	2590	3
2	Diverge	Diverge	US 195 Diverge	1500	3
3	Basic	Basic	I-90 between US 195 Ramps	1240	3
4	Merge	Merge	US 195 Merge	1500	3
5	Diverge	Diverge	Maple Street Diverge	700	3
6	Basic	Basic	I-90 Mainline west of Maple Street	2740	3

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	1.00	0.909	5050	7050	0.72	63.9	26.3	D

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	1.00	1.00	0.909	0.952	5050	315	7050	2000	0.72	0.16	58.7	54.5	28.7	30.8	D

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	1.00	0.909	4719	7050	0.67	64.3	24.3	C

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	1.00	1.00	0.909	0.952	6641	1922	7050	2000	0.94	0.96	51.3	48.4	43.2	39.3	E

Segment 5: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	1.00	1.00	0.909	0.980	6733	1327	7050	4000	0.96	0.33	56.7	52.4	39.6	29.0	D

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	1.00	0.909	5303	6996	0.76	61.9	28.6	D

Facility Time Period Results

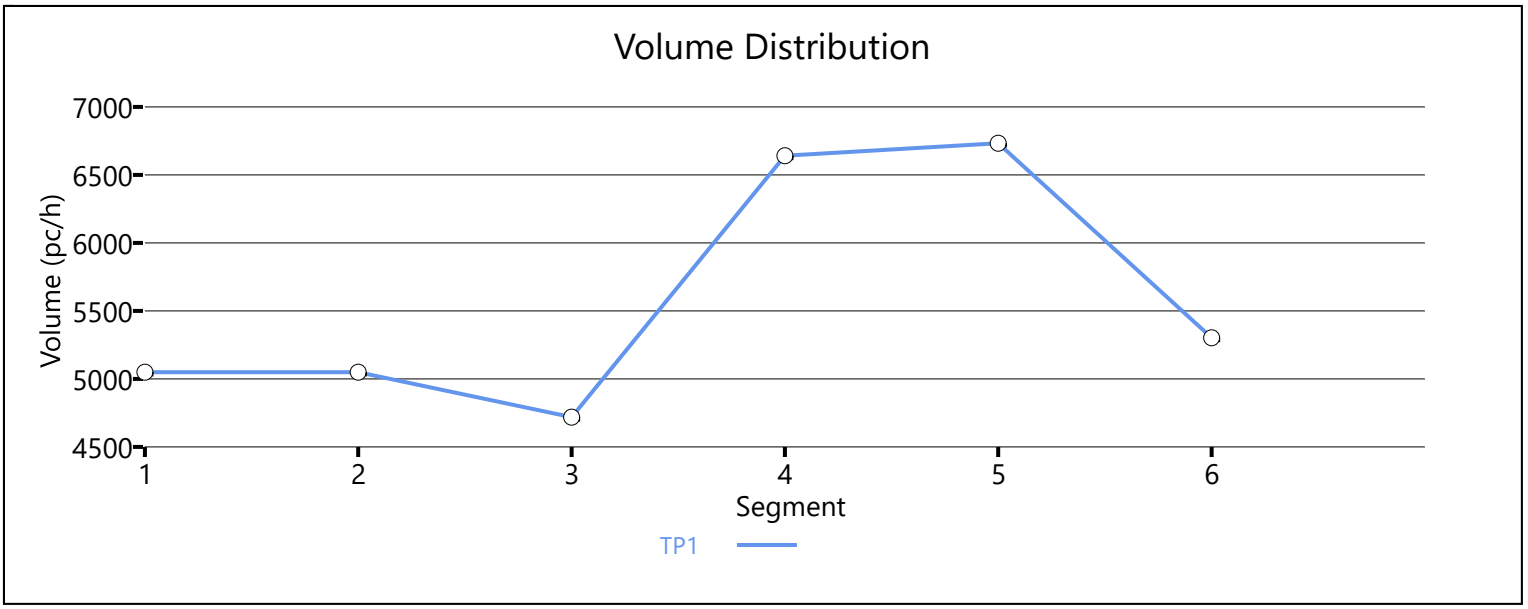
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	59.5	30.4	27.6	2.00	D

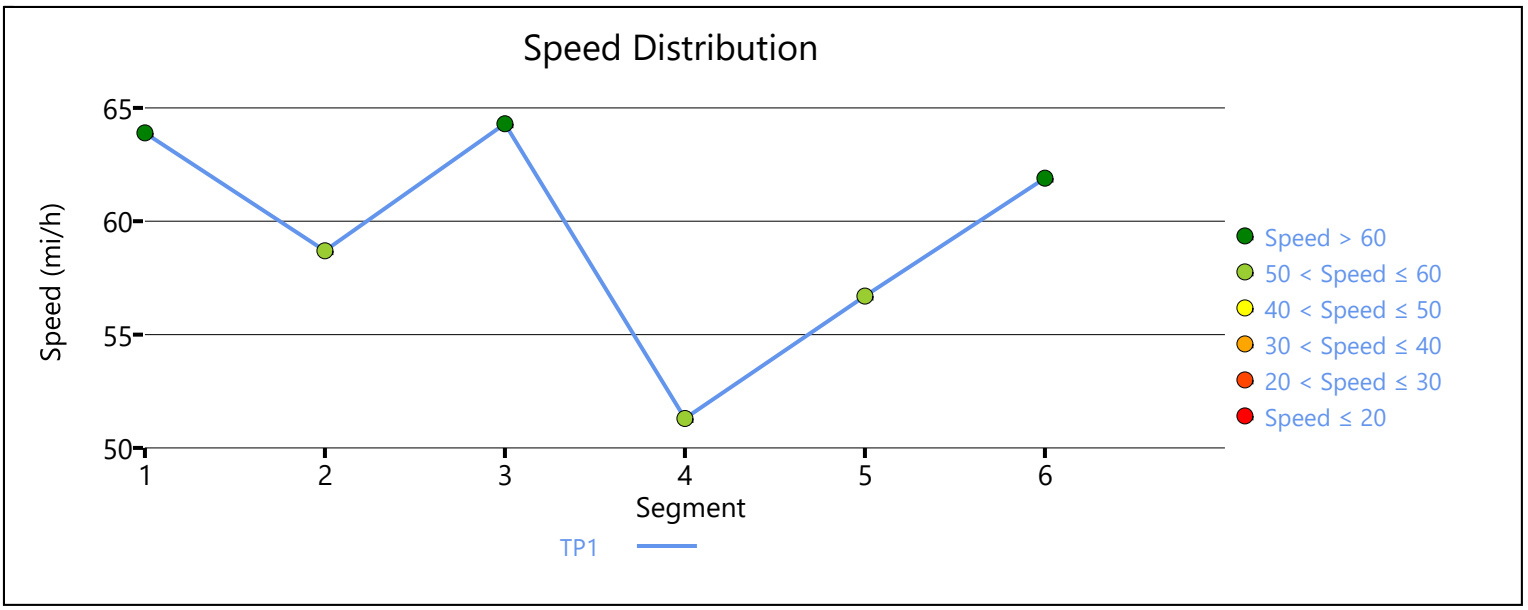
Facility Overall Results

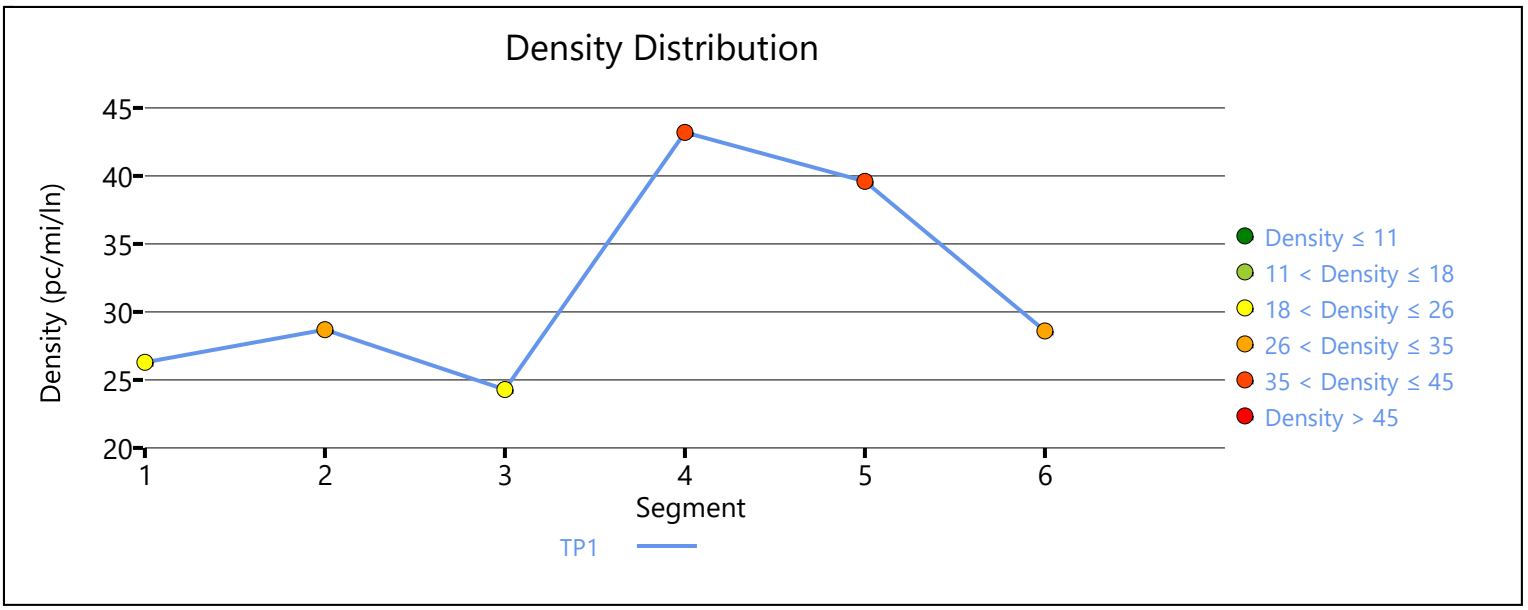
Space Mean Speed, mi/h	59.5	Density, veh/mi/ln	27.6
Average Travel Time, min	2.00	Density, pc/mi/ln	30.4

Messages

Comments







HCS7 Freeway Facilities Report

Project Information

Analyst	Fehr & Peers	Date	February 2021
Agency		Analysis Year	2040
Jurisdiction	WSDOT Eastern Region	Time Period Analyzed	PM Peak Hour
Project Description	US 195/I-90	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	0	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	1.95		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	I-90 Mainline west of US 195 Interchange	2590	3
2	Diverge	Diverge	US 195 Diverge	1500	3
3	Basic	Basic	I-90 between US 195 Ramps	1240	3
4	Merge	Merge	US 195 Merge	1500	3
5	Diverge	Diverge	Maple Street Diverge	700	3
6	Basic	Basic	I-90 east of Maple Street Diverge	2740	3

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	1.00	0.917	7050	7050	1.06	52.2	45.0	F

Segment 2: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	1.00	1.00	0.917	0.952	7050	798	7050	2000	1.06	0.40	57.3	53.5	41.0	40.3	F

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	1.00	0.917	6252	7050	0.94	58.4	35.7	E

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	1.00	1.00	0.917	0.952	7050	798	7050	2000	1.06	0.40	52.5	50.4	44.8	38.1	F

Segment 5: Diverge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	1.00	1.00	0.917	0.980	7050	1510	7050	4000	1.06	0.38	56.2	52.0	41.8	31.8	F

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	1.00	0.917	5540	6996	0.84	61.0	30.3	D

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	55.8	39.1	35.9	2.10	F

Facility Overall Results

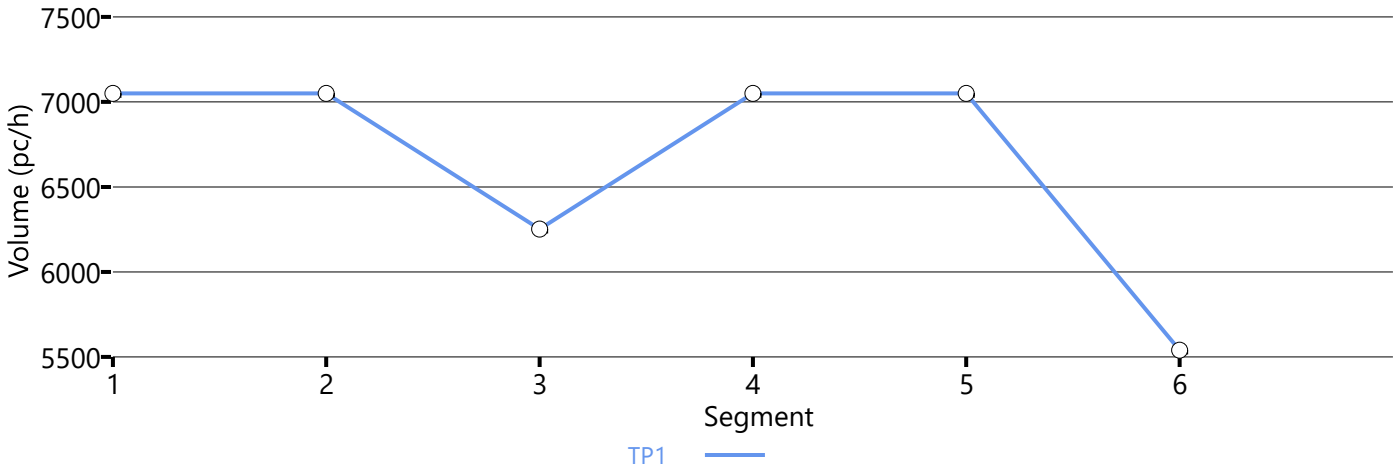
Space Mean Speed, mi/h	55.8	Density, veh/mi/ln	35.9
Average Travel Time, min	2.10	Density, pc/mi/ln	39.1

Messages

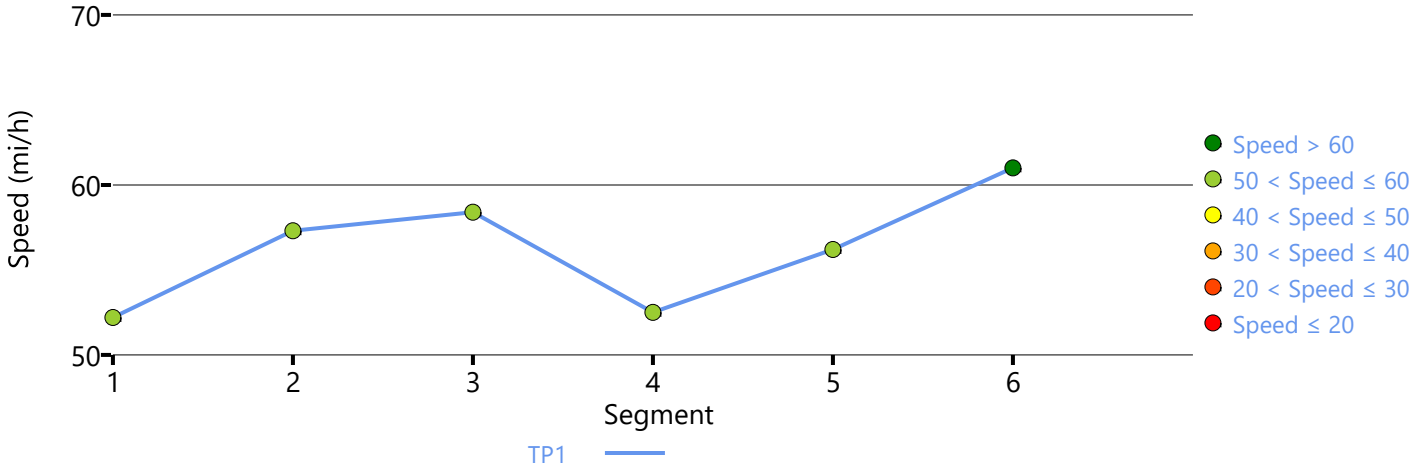
WARNING 1	Oversaturated conditions currently exist in boundary segment 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 2	Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.

Comments

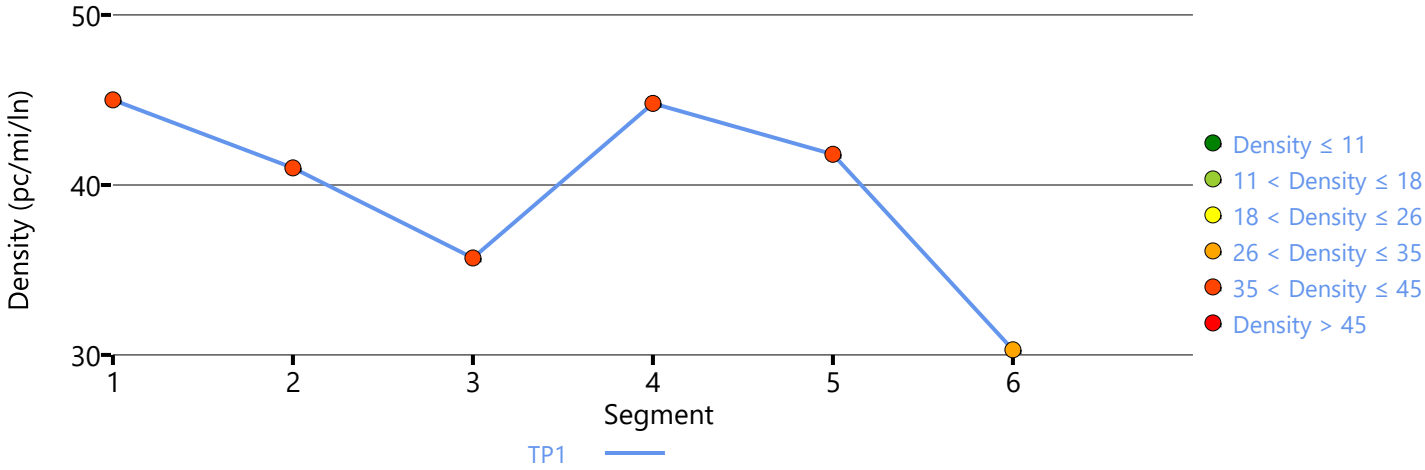
Volume Distribution

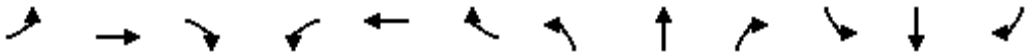


Speed Distribution



Density Distribution





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	450	10	40	460	640	40	500	310	250	50	120
Future Volume (veh/h)	120	450	10	40	460	640	40	500	310	250	50	120
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	143	536	12	48	548	762	48	595	369	298	60	143
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	1	1	1
Cap, veh/h	163	662	561	97	563	502	511	825	512	209	701	626
Arrive On Green	0.09	0.35	0.35	0.05	0.32	0.31	0.39	0.39	0.38	0.39	0.39	0.38
Sat Flow, veh/h	1781	1870	1585	1781	1777	1585	1179	2106	1306	587	1791	1598
Grp Volume(v), veh/h	143	536	12	48	548	762	48	502	462	298	60	143
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	1777	1585	1179	1777	1635	587	1791	1598
Q Serve(g_s), s	4.8	15.6	0.3	1.6	18.3	19.0	1.7	14.4	14.4	9.1	1.3	3.6
Cycle Q Clear(g_c), s	4.8	15.6	0.3	1.6	18.3	19.0	5.3	14.4	14.4	23.5	1.3	3.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.80	1.00		1.00
Lane Grp Cap(c), veh/h	163	662	561	97	563	502	511	696	640	209	701	626
V/C Ratio(X)	0.88	0.81	0.02	0.50	0.97	1.52	0.09	0.72	0.72	1.43	0.09	0.23
Avail Cap(c_a), veh/h	163	662	561	163	563	502	511	696	640	209	701	626
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.9	17.5	12.6	27.6	20.3	20.8	14.0	15.5	15.7	28.1	11.5	12.4
Incr Delay (d2), s/veh	37.5	7.4	0.0	3.9	31.3	243.2	0.4	6.4	6.9	217.8	0.2	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	7.3	0.1	0.7	11.6	40.2	0.5	6.3	6.0	15.5	0.5	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	64.4	25.0	12.6	31.5	51.5	264.0	14.4	21.8	22.6	245.9	11.7	13.2
LnGrp LOS	E	C	B	C	D	F	B	C	C	F	B	B
Approach Vol, veh/h		691			1358			1012			501	
Approach Delay, s/veh		32.9			170.0			21.8			151.4	
Approach LOS		C			F			C			F	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		27.5	7.3	25.2		27.5	9.5	23.0				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		23.0	5.0	18.5		23.0	5.0	18.5				
Max Q Clear Time (g_c+I1), s		16.4	3.6	17.6		25.5	6.8	21.0				
Green Ext Time (p_c), s		3.4	0.0	0.3		0.0	0.0	0.0				

Intersection Summary												
HCM 6th Ctrl Delay			98.7									
HCM 6th LOS			F									

Intersection	
Intersection Delay, s/veh	10.7
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	80	0	40	0	0	0	30	830	10	0	130	10
Future Vol, veh/h	80	0	40	0	0	0	30	830	10	0	130	10
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	9	9	9	0	0	0	1	1	1	3	3	3
Mvmt Flow	91	0	45	0	0	0	34	943	11	0	148	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	11.7	0	140.5	10.2
HCM LOS	B	-	F	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	3%	67%	0%	0%
Vol Thru, %	95%	0%	100%	93%
Vol Right, %	1%	33%	0%	7%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	870	120	0	140
LT Vol	30	80	0	0
Through Vol	830	0	0	130
RT Vol	10	40	0	10
Lane Flow Rate	989	136	0	159
Geometry Grp	1	1	1	1
Degree of Util (X)	1.252	0.233	0	0.231
Departure Headway (Hd)	4.559	6.687	7.017	5.534
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	801	540	0	652
Service Time	2.592	4.687	5.017	3.534
HCM Lane V/C Ratio	1.235	0.252	0	0.244
HCM Control Delay	140.5	11.7	10	10.2
HCM Lane LOS	F	B	N	B
HCM 95th-tile Q	35.2	0.9	0	0.9

Intersection	
Int Delay, s/veh	50.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	200	0	110	10	10	40	350	3130	10	10	720	140
Future Vol, veh/h	200	0	110	10	10	40	350	3130	10	10	720	140
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	230	-	-	250	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	1	1	1	6	6	6	1	1	1	10	10	10
Mvmt Flow	233	0	128	12	12	47	407	3640	12	12	837	163

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	3583	5409	500	4903	5484	1826	1000	0	0	3652	0	0
Stage 1	943	943	-	4460	4460	-	-	-	-	-	-	-
Stage 2	2640	4466	-	443	1024	-	-	-	-	-	-	-
Critical Hdwy	7.52	6.52	6.92	7.62	6.62	7.02	4.12	-	-	4.3	-	-
Critical Hdwy Stg 1	6.52	5.52	-	6.62	5.62	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.52	5.52	-	6.62	5.62	-	-	-	-	-	-	-
Follow-up Hdwy	3.51	4.01	3.31	3.56	4.06	3.36	2.21	-	-	2.3	-	-
Pot Cap-1 Maneuver	~ 2	0	519	0	0	63	694	-	-	52	-	-
Stage 1	284	342	-	~ 1	~ 4	-	-	-	-	-	-	-
Stage 2	~ 24	5	-	553	302	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	0	0	519	0	0	63	694	-	-	52	-	-
Mov Cap-2 Maneuver	~ -13	~ -9	-	0	~ 2	-	-	-	-	-	-	-
Stage 1	~ 118	263	-	0	~ 2	-	-	-	-	-	-	-
Stage 2	-	2	-	321	232	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s		$ 3848.6	1.7	1.1
HCM LOS	-	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	694	-	-	+	9	52	-	-
HCM Lane V/C Ratio	0.586	-	-	-	7.752	0.224	-	-
HCM Control Delay (s)	17.3	-	-	$	3848.6	93.1	-	-
HCM Lane LOS	C	-	-	-	F	F	-	-
HCM 95th %tile Q(veh)	3.8	-	-	-	10.2	0.8	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	72.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↱			↱		↑↑	↱		↑↑	↱
Traffic Vol, veh/h	0	0	530	0	0	140	0	3570	430	0	1030	90
Future Vol, veh/h	0	0	530	0	0	140	0	3570	430	0	1030	90
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	82	82	82	82	82	82	82	82	82
Heavy Vehicles, %	2	2	2	7	7	7	1	1	1	9	9	9
Mvmt Flow	0	0	646	0	0	171	0	4354	524	0	1256	110

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	628	-	-	2177	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	7.04	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	3.37	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	~ 426	0	0	~ 35	0	-	-	0	-	-
Stage 1	0	0	-	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	0	-	0	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	-	~ 426	-	-	~ 35	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	268.8	$ 1974	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	426	35	-	-
HCM Lane V/C Ratio	-	-	1.517	4.878	-	-
HCM Control Delay (s)	-	-	268.8	$ 1974	-	-
HCM Lane LOS	-	-	F	F	-	-
HCM 95th %tile Q(veh)	-	-	34.6	20.1	-	-

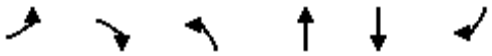
Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	117.3
Intersection LOS	F

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	550	10	40	120	60	100
Future Vol, veh/h	550	10	40	120	60	100
Peak Hour Factor	0.66	0.66	0.66	0.66	0.66	0.66
Heavy Vehicles, %	0	0	15	15	12	12
Mvmt Flow	833	15	61	182	91	152
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	175.5	16.1	14.7
HCM LOS	F	C	B

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	25%	98%	0%
Vol Thru, %	75%	0%	38%
Vol Right, %	0%	2%	62%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	160	560	160
LT Vol	40	550	0
Through Vol	120	0	60
RT Vol	0	10	100
Lane Flow Rate	242	848	242
Geometry Grp	1	1	1
Degree of Util (X)	0.44	1.326	0.411
Departure Headway (Hd)	7.405	5.627	6.954
Convergence, Y/N	Yes	Yes	Yes
Cap	490	653	521
Service Time	5.405	3.627	4.954
HCM Lane V/C Ratio	0.494	1.299	0.464
HCM Control Delay	16.1	175.5	14.7
HCM Lane LOS	C	F	B
HCM 95th-tile Q	2.2	35.1	2



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	750	0	170	0	0	30
Future Volume (Veh/h)	750	0	170	0	0	30
Sign Control	Free			Stop	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	789	0	179	0	0	32
Pedestrians	20					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	2					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		1630	1578	1578	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		1630	1578	1578	20
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	52		0	100	100	97
cM capacity (veh/h)	1630		49	57	56	1038

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	789	179	32
Volume Left	789	179	0
Volume Right	0	0	32
cSH	1630	49	1038
Volume to Capacity	0.48	3.69	0.03
Queue Length 95th (ft)	69	Err	2
Control Delay (s)	9.3	Err	8.6
Lane LOS	A	F	A
Approach Delay (s)	9.3	Err	8.6
Approach LOS		F	A

Intersection Summary			
Average Delay	1797.4		
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	740	50	10	190	0	0	0	0	10	0	150
Future Vol, veh/h	0	740	50	10	190	0	0	0	0	10	0	150
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	78	78	78	78	78	78	78	78	78
Heavy Vehicles, %	1	1	1	0	0	0	0	0	0	7	7	7
Mvmt Flow	0	949	64	13	244	0	0	0	0	13	0	192

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	1013	0	0	1251	1283	244
Stage 1	-	-	-	-	-	-	270	270	-
Stage 2	-	-	-	-	-	-	981	1013	-
Critical Hdwy	-	-	-	4.1	-	-	6.47	6.57	6.27
Critical Hdwy Stg 1	-	-	-	-	-	-	5.47	5.57	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.47	5.57	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.563	4.063	3.363
Pot Cap-1 Maneuver	0	-	-	692	-	0	186	161	783
Stage 1	0	-	-	-	-	0	764	677	-
Stage 2	0	-	-	-	-	0	356	310	-
Platoon blocked, %		-	-		-				
Mov Cap-1 Maneuver	-	-	-	692	-	-	182	0	783
Mov Cap-2 Maneuver	-	-	-	-	-	-	182	0	-
Stage 1	-	-	-	-	-	-	764	0	-
Stage 2	-	-	-	-	-	-	348	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0.5	13.1
HCM LOS			B

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	-	-	692	-	649
HCM Lane V/C Ratio	-	-	0.019	-	0.316
HCM Control Delay (s)	-	-	10.3	0	13.1
HCM Lane LOS	-	-	B	A	B
HCM 95th %tile Q(veh)	-	-	0.1	-	1.4

Intersection	
Int Delay, s/veh	63.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	50	390	410	20	20	150
Future Vol, veh/h	50	390	410	20	20	150
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	73	73	73	73	73	73
Heavy Vehicles, %	1	1	1	1	3	3
Mvmt Flow	68	534	562	27	27	205

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	835	576	0	0	589	0
Stage 1	576	-	-	-	-	-
Stage 2	259	-	-	-	-	-
Critical Hdwy	6.41	6.21	-	-	4.13	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	-	-	2.227	-
Pot Cap-1 Maneuver	339	~ 519	-	-	981	-
Stage 1	564	-	-	-	-	-
Stage 2	787	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	328	~ 519	-	-	981	-
Mov Cap-2 Maneuver	328	-	-	-	-	-
Stage 1	564	-	-	-	-	-
Stage 2	763	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	149.4	0	1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	487	981	-
HCM Lane V/C Ratio	-	-	1.238	0.028	-
HCM Control Delay (s)	-	-	149.4	8.8	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	23.9	0.1	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	31.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	390	400	0	40	130
Future Vol, veh/h	10	390	400	0	40	130
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	73	73	73	73	73	73
Heavy Vehicles, %	0	0	2	2	3	3
Mvmt Flow	14	534	548	0	55	178

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	836	548	0	0	548	0
Stage 1	548	-	-	-	-	-
Stage 2	288	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	340	540	-	-	1016	-
Stage 1	583	-	-	-	-	-
Stage 2	766	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	320	540	-	-	1016	-
Mov Cap-2 Maneuver	320	-	-	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	720	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	75.5	0	2.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	531	1016	-
HCM Lane V/C Ratio	-	-	1.032	0.054	-
HCM Control Delay (s)	-	-	75.5	8.7	0
HCM Lane LOS	-	-	F	A	A
HCM 95th %tile Q(veh)	-	-	15.4	0.2	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	10	10	240	210	10
Future Vol, veh/h	10	10	10	240	210	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	87	87	87	87	87	87
Heavy Vehicles, %	2	33	2	2	2	2
Mvmt Flow	11	11	11	276	241	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	545	247	252	0	-	0
Stage 1	247	-	-	-	-	-
Stage 2	298	-	-	-	-	-
Critical Hdwy	6.42	6.53	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.597	2.218	-	-	-
Pot Cap-1 Maneuver	499	722	1313	-	-	-
Stage 1	794	-	-	-	-	-
Stage 2	753	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	494	722	1313	-	-	-
Mov Cap-2 Maneuver	494	-	-	-	-	-
Stage 1	786	-	-	-	-	-
Stage 2	753	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.4	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1313	-	587	-	-
HCM Lane V/C Ratio	0.009	-	0.039	-	-
HCM Control Delay (s)	7.8	0	11.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1557.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	840	20	290	20	0	80	100	1280	10	10	830	220
Future Vol, veh/h	840	20	290	20	0	80	100	1280	10	10	830	220
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-	300	-	500
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	0	0	0	1	1	1	9	9	9
Mvmt Flow	977	23	337	23	0	93	116	1488	12	12	965	256

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1965	2721	483	2244	2971	750	1221	0	0	1500	0	0
Stage 1	989	989	-	1726	1726	-	-	-	-	-	-	-
Stage 2	976	1732	-	518	1245	-	-	-	-	-	-	-
Critical Hdwy	7.56	6.56	6.96	7.5	6.5	6.9	4.12	-	-	4.28	-	-
Critical Hdwy Stg 1	6.56	5.56	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.56	5.56	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.53	4.03	3.33	3.5	4	3.3	2.21	-	-	2.29	-	-
Pot Cap-1 Maneuver	~ 37	~ 20	527	24	14	358	572	-	-	410	-	-
Stage 1	~ 263	321	-	94	145	-	-	-	-	-	-	-
Stage 2	~ 268	139	-	514	248	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 23	~ 15	527	~ 5	11	358	572	-	-	410	-	-
Mov Cap-2 Maneuver	~ 89	73	-	30	60	-	-	-	-	-	-	-
Stage 1	~ 210	312	-	75	116	-	-	-	-	-	-	-
Stage 2	~ 158	111	-	166	241	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, $	4994.7	168.6	0.9	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	572	-	-	112	112	410	-	-
HCM Lane V/C Ratio	0.203	-	-	11.939	1.038	0.028	-	-
HCM Control Delay (s)	12.9	-	-	$ 4994.7	168.6	14	-	-
HCM Lane LOS	B	-	-	F	F	B	-	-
HCM 95th %tile Q(veh)	0.8	-	-	156.4	6.9	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	88.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	100	700	700	130	290	400
Future Vol, veh/h	100	700	700	130	290	400
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	-	-	300	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	1	1	2	2	9	9
Mvmt Flow	116	814	814	151	337	465

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1797	483	0	0	965	0
Stage 1	890	-	-	-	-	-
Stage 2	907	-	-	-	-	-
Critical Hdwy	6.82	6.92	-	-	4.28	-
Critical Hdwy Stg 1	5.82	-	-	-	-	-
Critical Hdwy Stg 2	5.82	-	-	-	-	-
Follow-up Hdwy	3.51	3.31	-	-	2.29	-
Pot Cap-1 Maneuver	~ 72	~ 532	-	-	668	-
Stage 1	364	-	-	-	-	-
Stage 2	357	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 36	~ 532	-	-	668	-
Mov Cap-2 Maneuver	123	-	-	-	-	-
Stage 1	364	-	-	-	-	-
Stage 2	177	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	251.6	0	6.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	123	532	668	-
HCM Lane V/C Ratio	-	-	0.945	1.53	0.505	-
HCM Control Delay (s)	-	-	134.2	268.4	15.8	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	6.2	42.4	2.9	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

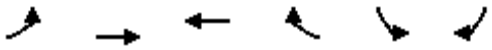
Intersection	
Int Delay, s/veh	15.8

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Traffic Vol, veh/h	240	50	330	600	0	580
Future Vol, veh/h	240	50	330	600	0	580
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	282	59	388	706	0	682

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	341	0	-	312
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.12	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.218	-	-	3.318
Pot Cap-1 Maneuver	-	-	1218	-	0	728
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	-	0	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1218	-	-	728
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NE
HCM Control Delay, s	0	3.3	43.6
HCM LOS			E

Minor Lane/Major Mvmt	NELn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	728	-	-	1218	-
HCM Lane V/C Ratio	0.937	-	-	0.319	-
HCM Control Delay (s)	43.6	-	-	9.3	-
HCM Lane LOS	E	-	-	A	-
HCM 95th %tile Q(veh)	13.4	-	-	1.4	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	170	540	0	150	40
Future Volume (Veh/h)	10	170	540	0	150	40
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	12	210	667	0	185	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	728	394	419	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	728	394	419	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	0	56	0	100	89	
cM capacity (veh/h)	0	481	466	1088	1617	

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	222	667	234
Volume Left	12	0	185
Volume Right	0	0	49
cSH	0	466	1617
Volume to Capacity	Err	1.43	0.11
Queue Length 95th (ft)	Err	818	10
Control Delay (s)	Err	229.1	6.1
Lane LOS	F	F	A
Approach Delay (s)	Err	229.1	6.1
Approach LOS	F	F	

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	84.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↑			↕			↕	
Traffic Vol, veh/h	10	40	280	0	60	10	760	10	10	0	0	10
Future Vol, veh/h	10	40	280	0	60	10	760	10	10	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Free	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	0	0	0	1	1	1	0	0	0
Mvmt Flow	12	49	346	0	74	12	938	12	12	0	0	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1943	1906	-	-	1906	18	12	0	0	24	0	0
Stage 1	6	6	-	-	1894	-	-	-	-	-	-	-
Stage 2	1937	1900	-	-	12	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	-	-	6.5	6.2	4.11	-	-	4.1	-	-
Critical Hdwy Stg 1	6.12	5.52	-	-	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	-	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	-	-	4	3.3	2.209	-	-	2.2	-	-
Pot Cap-1 Maneuver	49	69	0	0	~ 69	1066	1613	-	-	1604	-	-
Stage 1	1016	891	0	0	119	-	-	-	-	-	-	-
Stage 2	85	117	0	0	890	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	~ 28	-	-	~ 28	1066	1613	-	-	1604	-	-
Mov Cap-2 Maneuver	-	~ 28	-	-	~ 28	-	-	-	-	-	-	-
Stage 1	417	891	-	-	~ 49	-	-	-	-	-	-	-
Stage 2	-	~ 48	-	-	890	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s		$ 989.4	10	0
HCM LOS	-	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1613	-	-	-	33	1604	-	-
HCM Lane V/C Ratio	0.582	-	-	-	2.619	-	-	-
HCM Control Delay (s)	10.3	0	-	-	$ 989.4	0	-	-
HCM Lane LOS	B	A	-	-	F	A	-	-
HCM 95th %tile Q(veh)	4	-	-	-	9.9	0	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Traffic Vol, veh/h	0	0	70	0	3640	1050	0
Future Vol, veh/h	0	0	70	0	3640	1050	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	None
Storage Length	-	0	-	600	-	-	-
Veh in Median Storage, #	0	-	-	-	0	0	-
Grade, %	0	-	-	-	0	0	-
Peak Hour Factor	82	82	82	82	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	0	0	85	0	4439	1280	0

Major/Minor	Minor2		Major1		Major2		
Conflicting Flow All	-	640	1280	-	0	-	0
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-
Critical Hdwy	-	6.94	6.44	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	2.52	-	-	-	-
Pot Cap-1 Maneuver	0	418	219	0	-	-	0
Stage 1	0	-	-	0	-	-	0
Stage 2	0	-	-	0	-	-	0
Platoon blocked, %					-	-	
Mov Cap-1 Maneuver	-	418	219	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBU	NBT	EBLn1	SBT
Capacity (veh/h)	219	-	-	-
HCM Lane V/C Ratio	0.39	-	-	-
HCM Control Delay (s)	31.6	-	0	-
HCM Lane LOS	D	-	A	-
HCM 95th %tile Q(veh)	1.7	-	-	-

Intersection	
Int Delay, s/veh	9.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	290	50	0	600	170	0
Future Vol, veh/h	290	50	0	600	170	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	1	1	2	2
Mvmt Flow	341	59	0	706	200	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	1077	-
Stage 1	-	-	-	-	371	-
Stage 2	-	-	-	-	706	-
Critical Hdwy	-	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	-
Pot Cap-1 Maneuver	-	-	0	-	242	0
Stage 1	-	-	0	-	698	0
Stage 2	-	-	0	-	489	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	242	-
Mov Cap-2 Maneuver	-	-	-	-	242	-
Stage 1	-	-	-	-	698	-
Stage 2	-	-	-	-	489	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	64.8
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	242	-	-	-
HCM Lane V/C Ratio	0.826	-	-	-
HCM Control Delay (s)	64.8	-	-	-
HCM Lane LOS	F	-	-	-
HCM 95th %tile Q(veh)	6.4	-	-	-

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	340	10	0	0	190
Future Vol, veh/h	0	340	10	0	0	190
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	81	81	81	81	81	81
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	420	12	0	0	235

Major/Minor	Minor2	Major2		
Conflicting Flow All	235	-	-	-
Stage 1	235	-	-	-
Stage 2	0	-	-	-
Critical Hdwy	6.52	-	-	-
Critical Hdwy Stg 1	5.52	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	4.018	-	-	-
Pot Cap-1 Maneuver	666	0	0	-
Stage 1	710	0	0	-
Stage 2	-	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	0	-	-	-
Mov Cap-2 Maneuver	0	-	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-

Approach	NB	SB
HCM Control Delay, s		0
HCM LOS	-	

Minor Lane/Major Mvmt	NBLn1	SBT
Capacity (veh/h)	-	-
HCM Lane V/C Ratio	-	-
HCM Control Delay (s)	-	-
HCM Lane LOS	-	-
HCM 95th %tile Q(veh)	-	-

Intersection	
Int Delay, s/veh	4785.1

Movement	WBL	WBR	NBT	NBR	SBU	SBL	SBT
Lane Configurations							
Traffic Vol, veh/h	0	0	3790	0	210	0	1350
Future Vol, veh/h	0	0	3790	0	210	0	1350
Conflicting Peds, #/hr	0	0	0	0	286	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	-	None
Storage Length	-	0	-	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	-	0
Grade, %	0	-	0	-	-	-	0
Peak Hour Factor	82	82	82	82	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	0	0	4622	0	256	0	1646

Major/Minor	Minor1		Major1		Major2		
Conflicting Flow All	-	2311	0	-	4622	-	-
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	6.44	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.52	-	-
Pot Cap-1 Maneuver	0	30	-	0	~ 1	0	-
Stage 1	0	-	-	0	-	0	-
Stage 2	0	-	-	0	-	0	-
Platoon blocked, %			-				-
Mov Cap-1 Maneuver	-	30	-	-	~ 1	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	$ 16410.4
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBU	SBT
Capacity (veh/h)	-	-	~ 1	-
HCM Lane V/C Ratio	-	256.098		-
HCM Control Delay (s)	-	$ 1021905.9		-
HCM Lane LOS	-	A	F	-
HCM 95th %tile Q(veh)	-	-	34.7	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

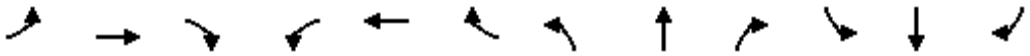
Intersection	
Int Delay, s/veh	20.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	380	0	170	580	0	50
Future Vol, veh/h	380	0	170	580	0	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	447	0	200	682	0	59

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	600	-	0	0	-	-
Stage 1	541	-	-	-	-	-
Stage 2	59	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	-	-
Pot Cap-1 Maneuver	464	0	-	-	0	-
Stage 1	583	0	-	-	0	-
Stage 2	964	0	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	464	-	-	-	-	-
Mov Cap-2 Maneuver	464	-	-	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	964	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	63.1	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	464	-
HCM Lane V/C Ratio	-	-	0.963	-
HCM Control Delay (s)	-	-	63.1	-
HCM Lane LOS	-	-	F	-
HCM 95th %tile Q(veh)	-	-	11.9	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	490	40	310	590	390	40	240	170	280	190	130
Future Volume (veh/h)	160	490	40	310	590	390	40	240	170	280	190	130
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1885	1885	1885
Adj Flow Rate, veh/h	170	521	43	330	628	415	43	255	181	298	202	138
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	1	1	1
Cap, veh/h	204	601	509	221	678	448	467	913	625	416	941	612
Arrive On Green	0.11	0.32	0.32	0.12	0.33	0.33	0.45	0.45	0.45	0.45	0.45	0.45
Sat Flow, veh/h	1781	1870	1585	1781	2050	1354	1040	2018	1381	960	2079	1353
Grp Volume(v), veh/h	170	521	43	330	544	499	43	223	213	298	173	167
Grp Sat Flow(s),veh/h/ln	1781	1870	1585	1781	1777	1627	1040	1777	1622	960	1791	1642
Q Serve(g_s), s	11.0	30.8	2.2	14.6	34.8	34.8	3.1	9.3	9.8	33.4	6.9	7.3
Cycle Q Clear(g_c), s	11.0	30.8	2.2	14.6	34.8	34.8	10.4	9.3	9.8	43.1	6.9	7.3
Prop In Lane	1.00		1.00	1.00		0.83	1.00		0.85	1.00		0.82
Lane Grp Cap(c), veh/h	204	601	509	221	588	538	467	804	734	416	810	743
V/C Ratio(X)	0.83	0.87	0.08	1.49	0.93	0.93	0.09	0.28	0.29	0.72	0.21	0.23
Avail Cap(c_a), veh/h	227	639	542	221	601	551	467	804	734	416	810	743
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	50.9	37.5	27.8	51.5	38.0	38.2	22.8	20.2	20.4	33.9	19.5	19.8
Incr Delay (d2), s/veh	20.6	11.6	0.1	243.8	20.3	21.8	0.4	0.9	1.0	10.1	0.6	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	15.8	0.9	21.5	18.2	16.9	0.8	4.0	3.9	8.8	3.0	3.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	71.6	49.1	27.9	295.3	58.3	60.0	23.2	21.0	21.4	44.0	20.1	20.5
LnGrp LOS	E	D	C	F	E	E	C	C	C	D	C	C
Approach Vol, veh/h		734			1373			479			638	
Approach Delay, s/veh		53.1			115.9			21.4			31.4	
Approach LOS		D			F			C			C	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		57.2	18.6	41.8		57.2	17.5	42.9				
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5				
Max Green Setting (Gmax), s		52.7	14.1	39.7		52.7	14.5	39.3				
Max Q Clear Time (g_c+I1), s		12.4	16.6	32.8		45.1	13.0	36.8				
Green Ext Time (p_c), s		3.2	0.0	2.0		2.2	0.1	1.6				

Intersection Summary	
HCM 6th Ctrl Delay	70.8
HCM 6th LOS	E

Intersection	
Intersection Delay, s/veh	72.3
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	140	20	180	10	0	0	70	360	0	0	610	0
Future Vol, veh/h	140	20	180	10	0	0	70	360	0	0	610	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	9	9	9	0	0	0	1	1	1	3	3	3
Mvmt Flow	156	22	200	11	0	0	78	400	0	0	678	0
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	25.9	12.6	37.2	123.8
HCM LOS	D	B	E	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	16%	41%	100%	0%
Vol Thru, %	84%	6%	0%	100%
Vol Right, %	0%	53%	0%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	430	340	10	610
LT Vol	70	140	10	0
Through Vol	360	20	0	610
RT Vol	0	180	0	0
Lane Flow Rate	478	378	11	678
Geometry Grp	1	1	1	1
Degree of Util (X)	0.851	0.71	0.027	1.188
Departure Headway (Hd)	6.776	7.186	9.317	6.311
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	540	506	387	576
Service Time	4.776	5.186	7.317	4.382
HCM Lane V/C Ratio	0.885	0.747	0.028	1.177
HCM Control Delay	37.2	25.9	12.6	123.8
HCM Lane LOS	E	D	B	F
HCM 95th-tile Q	9	5.6	0.1	23.8

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	100	10	360	10	10	40	110	1200	30	60	2870	110
Future Vol, veh/h	100	10	360	10	10	40	110	1200	30	60	2870	110
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	230	-	-	250	-	-
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	6	6	6	1	1	1	10	10	10
Mvmt Flow	106	11	383	11	11	43	117	1277	32	64	3053	117

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	4118	4783	1585	3187	4825	655	3170	0	0	1309	0	0
Stage 1	3240	3240	-	1527	1527	-	-	-	-	-	-	-
Stage 2	878	1543	-	1660	3298	-	-	-	-	-	-	-
Critical Hdwy	7.52	6.52	6.92	7.62	6.62	7.02	4.12	-	-	4.3	-	-
Critical Hdwy Stg 1	6.52	5.52	-	6.62	5.62	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.52	5.52	-	6.62	5.62	-	-	-	-	-	-	-
Follow-up Hdwy	3.51	4.01	3.31	3.56	4.06	3.36	2.21	-	-	2.3	-	-
Pot Cap-1 Maneuver	~ 1	~ 1	~ 98	~ 4	~ 1	399	~ 98	-	-	484	-	-
Stage 1	~ 10	23	-	118	171	-	-	-	-	-	-	-
Stage 2	311	176	-	97	20	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	0	~ 98	-	0	399	~ 98	-	-	484	-	-
Mov Cap-2 Maneuver	~ 11	27		~ -6355	0	-	-	-	-	-	-	-
Stage 1	~ 10	20	-	118	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	17	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s			19.1	0.3
HCM LOS	-	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	~ 98	-	-	-	-	484	-	-
HCM Lane V/C Ratio	1.194	-	-	-	-	0.132	-	-
HCM Control Delay (s)	232.5	-	-	-	-	13.6	-	-
HCM Lane LOS	F	-	-	-	-	B	-	-
HCM 95th %tile Q(veh)	7.9	-	-	-	-	0.5	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	152.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations			↱			↱		↑↑	↱		↑↑	↱
Traffic Vol, veh/h	0	0	430	0	0	430	0	1580	200	0	3130	210
Future Vol, veh/h	0	0	430	0	0	430	0	1580	200	0	3130	210
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	7	7	7	1	1	1	9	9	9
Mvmt Flow	0	0	448	0	0	448	0	1646	208	0	3260	219

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	-	-	1630	-	-	823	-	0	0	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.94	-	-	7.04	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.32	-	-	3.37	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	~ 91	0	0	~ 306	0	-	-	0	-	-
Stage 1	0	0	-	0	0	-	0	-	-	0	-	-
Stage 2	0	0	-	0	0	-	0	-	-	0	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	-	~ 91	-	-	~ 306	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, $	1857.9	257.6	0	0
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	SBT	SBR
Capacity (veh/h)	-	-	91	306	-	-
HCM Lane V/C Ratio	-	-	4.922	1.464	-	-
HCM Control Delay (s)	-	-	$ 1857.9	257.6	-	-
HCM Lane LOS	-	-	F	F	-	-
HCM 95th %tile Q(veh)	-	-	48.1	24.6	-	-

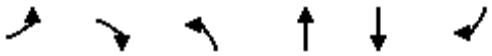
Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Intersection Delay, s/veh	38.3
Intersection LOS	E

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	390	30	70	60	220	320
Future Vol, veh/h	390	30	70	60	220	320
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	0	0	15	15	12	12
Mvmt Flow	443	34	80	68	250	364
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	31.9	12.8	49.5
HCM LOS	D	B	E

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	54%	93%	0%
Vol Thru, %	46%	0%	41%
Vol Right, %	0%	7%	59%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	130	420	540
LT Vol	70	390	0
Through Vol	60	0	220
RT Vol	0	30	320
Lane Flow Rate	148	477	614
Geometry Grp	1	1	1
Degree of Util (X)	0.288	0.822	0.957
Departure Headway (Hd)	7.027	6.2	5.615
Convergence, Y/N	Yes	Yes	Yes
Cap	514	577	638
Service Time	5.027	4.289	3.708
HCM Lane V/C Ratio	0.288	0.827	0.962
HCM Control Delay	12.8	31.9	49.5
HCM Lane LOS	B	D	E
HCM 95th-tile Q	1.2	8.4	13.4



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	360	0	150	10	0	20
Future Volume (Veh/h)	360	0	150	10	0	20
Sign Control	Free			Stop	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	379	0	158	11	0	21
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		779	758	758	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		779	758	758	0
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	77		38	96	100	98
cM capacity (veh/h)	1630		254	260	258	1085

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	379	169	21
Volume Left	379	158	0
Volume Right	0	0	21
cSH	1630	254	1085
Volume to Capacity	0.23	0.66	0.02
Queue Length 95th (ft)	23	106	1
Control Delay (s)	7.9	43.3	8.4
Lane LOS	A	E	A
Approach Delay (s)	7.9	43.3	8.4
Approach LOS		E	A

Intersection Summary			
Average Delay	18.4		
Intersection Capacity Utilization	35.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	9.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	350	150	10	160	0	0	0	0	10	0	580
Future Vol, veh/h	0	350	150	10	160	0	0	0	0	10	0	580
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	16974	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	1	1	1	0	0	0	0	0	0	7	7	7
Mvmt Flow	0	376	161	11	172	0	0	0	0	11	0	624

Major/Minor	Major1			Major2			Minor2		
Conflicting Flow All	-	0	0	537	0	0	651	731	172
Stage 1	-	-	-	-	-	-	194	194	-
Stage 2	-	-	-	-	-	-	457	537	-
Critical Hdwy	-	-	-	4.1	-	-	6.47	6.57	6.27
Critical Hdwy Stg 1	-	-	-	-	-	-	5.47	5.57	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.47	5.57	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.563	4.063	3.363
Pot Cap-1 Maneuver	0	-	-	1041	-	0	425	343	859
Stage 1	0	-	-	-	-	0	827	731	-
Stage 2	0	-	-	-	-	0	627	515	-
Platoon blocked, %		-	-		-				
Mov Cap-1 Maneuver	-	-	-	1041	-	-	420	0	859
Mov Cap-2 Maneuver	-	-	-	-	-	-	420	0	-
Stage 1	-	-	-	-	-	-	827	0	-
Stage 2	-	-	-	-	-	-	619	0	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0.5	21
HCM LOS			C

Minor Lane/Major Mvmt	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	-	-	1041	-	844
HCM Lane V/C Ratio	-	-	0.01	-	0.752
HCM Control Delay (s)	-	-	8.5	0	21
HCM Lane LOS	-	-	A	A	C
HCM 95th %tile Q(veh)	-	-	0	-	7.1

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	30	150	190	60	120	520
Future Vol, veh/h	30	150	190	60	120	520
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	99	99	99	99	99	99
Heavy Vehicles, %	1	1	1	1	3	3
Mvmt Flow	30	152	192	61	121	525

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	990	223	0	0	253	0
Stage 1	223	-	-	-	-	-
Stage 2	767	-	-	-	-	-
Critical Hdwy	6.41	6.21	-	-	4.13	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	-	-	2.227	-
Pot Cap-1 Maneuver	274	819	-	-	1306	-
Stage 1	816	-	-	-	-	-
Stage 2	460	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	238	819	-	-	1306	-
Mov Cap-2 Maneuver	238	-	-	-	-	-
Stage 1	816	-	-	-	-	-
Stage 2	400	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	14	0	1.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	582	1306	-
HCM Lane V/C Ratio	-	-	0.312	0.093	-
HCM Control Delay (s)	-	-	14	8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.3	0.3	-

Intersection	
Int Delay, s/veh	4.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	140	230	0	310	240
Future Vol, veh/h	10	140	230	0	310	240
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	0	0	2	2	3	3
Mvmt Flow	10	143	235	0	316	245

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1112	235	0	0	235	0
Stage 1	235	-	-	-	-	-
Stage 2	877	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.13	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.227	-
Pot Cap-1 Maneuver	233	809	-	-	1326	-
Stage 1	809	-	-	-	-	-
Stage 2	410	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	169	809	-	-	1326	-
Mov Cap-2 Maneuver	169	-	-	-	-	-
Stage 1	809	-	-	-	-	-
Stage 2	297	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.3	0	4.8
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	646	1326	-
HCM Lane V/C Ratio	-	-	0.237	0.239	-
HCM Control Delay (s)	-	-	12.3	8.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.9	0.9	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	10	10	330	570	20
Future Vol, veh/h	10	10	10	330	570	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	2	33	2	2	2	2
Mvmt Flow	11	11	11	351	606	21

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	990	617	627	0	-	0
Stage 1	617	-	-	-	-	-
Stage 2	373	-	-	-	-	-
Critical Hdwy	6.42	6.53	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.597	2.218	-	-	-
Pot Cap-1 Maneuver	273	438	955	-	-	-
Stage 1	538	-	-	-	-	-
Stage 2	696	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	269	438	955	-	-	-
Mov Cap-2 Maneuver	269	-	-	-	-	-
Stage 1	530	-	-	-	-	-
Stage 2	696	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.5	0.3	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	955	-	333	-	-
HCM Lane V/C Ratio	0.011	-	0.064	-	-
HCM Control Delay (s)	8.8	0	16.5	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	13.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	250	0	380	20	10	40	200	730	10	30	1680	930
Future Vol, veh/h	250	0	380	20	10	40	200	730	10	30	1680	930
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-	300	-	500
Veh in Median Storage, #	-	1	-	-	1	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	3	3	3	0	0	0	1	1	1	9	9	9
Mvmt Flow	263	0	400	21	11	42	211	768	11	32	1768	979

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2644	3033	884	2144	4007	390	2747	0	0	779	0	0
Stage 1	1832	1832	-	1196	1196	-	-	-	-	-	-	-
Stage 2	812	1201	-	948	2811	-	-	-	-	-	-	-
Critical Hdwy	7.56	6.56	6.96	7.5	6.5	6.9	4.12	-	-	4.28	-	-
Critical Hdwy Stg 1	6.56	5.56	-	6.5	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.56	5.56	-	6.5	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.53	4.03	3.33	3.5	4	3.3	2.21	-	-	2.29	-	-
Pot Cap-1 Maneuver	~ 11	12	~ 287	28	~ 3	614	~ 145	-	-	790	-	-
Stage 1	~ 78	124	-	201	262	-	-	-	-	-	-	-
Stage 2	337	254	-	284	40	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	-	0	~ 287	-	0	614	~ 145	-	-	790	-	-
Mov Cap-2 Maneuver	~ -50	~ -40	-	4322	0	-	-	-	-	-	-	-
Stage 1	~ 78	119	-	201	0	-	-	-	-	-	-	-
Stage 2	-	0	-	-	38	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s			62.7	0.1
HCM LOS	-	-		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	~ 145	-	-	-	-	790	-	-
HCM Lane V/C Ratio	1.452	-	-	-	-	0.04	-	-
HCM Control Delay (s)	294.5	-	-	-	-	9.7	-	-
HCM Lane LOS	F	-	-	-	-	A	-	-
HCM 95th %tile Q(veh)	13.9	-	-	-	-	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	63.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	150	560	440	80	570	680
Future Vol, veh/h	150	560	440	80	570	680
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	-	-	300	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	1	1	2	2	9	9
Mvmt Flow	155	577	454	82	588	701

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2022	268	0	0	536	0
Stage 1	495	-	-	-	-	-
Stage 2	1527	-	-	-	-	-
Critical Hdwy	6.82	6.92	-	-	4.28	-
Critical Hdwy Stg 1	5.82	-	-	-	-	-
Critical Hdwy Stg 2	5.82	-	-	-	-	-
Follow-up Hdwy	3.51	3.31	-	-	2.29	-
Pot Cap-1 Maneuver	~ 51	733	-	-	981	-
Stage 1	581	-	-	-	-	-
Stage 2	167	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 20	733	-	-	981	-
Mov Cap-2 Maneuver	~ 58	-	-	-	-	-
Stage 1	581	-	-	-	-	-
Stage 2	~ 67	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	211.5	0	6.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	58	733	981	-
HCM Lane V/C Ratio	-	-	2.666	0.788	0.599	-
HCM Control Delay (s)	-	-	$ 905.7	25.6	14	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	15.8	7.9	4.1	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	76.9

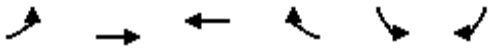
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	790	0	460	390	0	530
Future Vol, veh/h	790	0	460	390	0	530
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	849	0	495	419	0	570

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	-	849	0	-	849
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.12	-	-	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.218	-	-	3.318
Pot Cap-1 Maneuver	-	0	789	-	0	~ 361
Stage 1	-	0	-	-	0	-
Stage 2	-	0	-	-	0	-
Platoon blocked, %	-			-		
Mov Cap-1 Maneuver	-	-	789	-	-	~ 361
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	9.2	$ 300.2
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	WBL	WBT
Capacity (veh/h)	361	-	789	-
HCM Lane V/C Ratio	1.579	-	0.627	-
HCM Control Delay (s)	$ 300.2	-	16.9	-
HCM Lane LOS	F	-	C	-
HCM 95th %tile Q(veh)	32.7	-	4.5	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	30	480	300	0	450	20
Future Volume (Veh/h)	30	480	300	0	450	20
Sign Control		Stop	Stop		Free	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	33	533	333	0	500	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1178	1011	1022	0	0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1178	1011	1022	0	0	
tC, single (s)	7.1	6.5	6.5	6.2	4.1	
tC, 2 stage (s)						
tF (s)	3.5	4.0	4.0	3.3	2.2	
p0 queue free %	0	0	0	100	69	
cM capacity (veh/h)	0	166	164	1088	1617	

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	566	333	522
Volume Left	33	0	500
Volume Right	0	0	22
cSH	0	164	1617
Volume to Capacity	Err	2.04	0.31
Queue Length 95th (ft)	Err	649	33
Control Delay (s)	Err	532.6	8.0
Lane LOS	F	F	A
Approach Delay (s)	Err	532.6	8.0
Approach LOS	F	F	

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	100	790	10	30	10	470	10	20	0	0	10
Future Vol, veh/h	10	100	790	10	30	10	470	10	20	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Free	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	0	0	0	1	1	1	0	0	0
Mvmt Flow	11	108	849	11	32	11	505	11	22	0	0	11

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1060	1049	-	1092	1043	22	11	0	0	33	0	0
Stage 1	6	6	-	1032	1032	-	-	-	-	-	-	-
Stage 2	1054	1043	-	60	11	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	-	7.1	6.5	6.2	4.11	-	-	4.1	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	-	3.5	4	3.3	2.209	-	-	2.2	-	-
Pot Cap-1 Maneuver	202	227	0	194	231	1061	1615	-	-	1592	-	-
Stage 1	1016	891	0	284	313	-	-	-	-	-	-	-
Stage 2	273	306	0	957	890	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	128	155	-	67	157	1061	1615	-	-	1592	-	-
Mov Cap-2 Maneuver	128	155	-	67	157	-	-	-	-	-	-	-
Stage 1	692	891	-	193	213	-	-	-	-	-	-	-
Stage 2	156	208	-	842	890	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s		28	7.7	0
HCM LOS	-	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1615	-	-	-	199	1592	-	-
HCM Lane V/C Ratio	0.313	-	-	-	0.216	-	-	-
HCM Control Delay (s)	8.2	0	-	-	28	0	-	-
HCM Lane LOS	A	A	-	-	D	A	-	-
HCM 95th %tile Q(veh)	1.4	-	-	-	0.8	0	-	-

Intersection	
Int Delay, s/veh	23.5

Movement	EBL	EBR	NBU	NBL	NBT	SBT	SBR
Lane Configurations							
Traffic Vol, veh/h	0	0	70	0	1660	2710	0
Future Vol, veh/h	0	0	70	0	1660	2710	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	None
Storage Length	-	0	-	600	-	-	-
Veh in Median Storage, #	0	-	-	-	0	0	-
Grade, %	0	-	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	0	0	73	0	1729	2823	0

Major/Minor	Minor2		Major1		Major2		
Conflicting Flow All	-	1412	2823	-	0	-	0
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-
Critical Hdwy	-	6.94	6.44	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	2.52	-	-	-	-
Pot Cap-1 Maneuver	0	127	~ 21	0	-	-	0
Stage 1	0	-	-	0	-	-	0
Stage 2	0	-	-	0	-	-	0
Platoon blocked, %					-	-	
Mov Cap-1 Maneuver	-	127	~ 21	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	0	60.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBU	NBT	EBLn1	SBT
Capacity (veh/h)	~ 21	-	-	-
HCM Lane V/C Ratio	3.472	-	-	-
HCM Control Delay (s)	$ 1492.5	-	0	-
HCM Lane LOS	F	-	A	-
HCM 95th %tile Q(veh)	9.4	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	4.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	790	120	0	390	100	0
Future Vol, veh/h	790	120	0	390	100	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	1	1	2	2
Mvmt Flow	849	129	0	419	108	0

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	1333	-
Stage 1	-	-	-	-	914	-
Stage 2	-	-	-	-	419	-
Critical Hdwy	-	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	-
Pot Cap-1 Maneuver	-	-	0	-	170	0
Stage 1	-	-	0	-	391	0
Stage 2	-	-	0	-	664	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	170	-
Mov Cap-2 Maneuver	-	-	-	-	170	-
Stage 1	-	-	-	-	391	-
Stage 2	-	-	-	-	664	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	56.9
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	170	-	-	-
HCM Lane V/C Ratio	0.633	-	-	-
HCM Control Delay (s)	56.9	-	-	-
HCM Lane LOS	F	-	-	-
HCM 95th %tile Q(veh)	3.5	-	-	-

Intersection	
Int Delay, s/veh	0

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	210	30	0	0	470
Future Vol, veh/h	0	210	30	0	0	470
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	233	33	0	0	522

Major/Minor	Minor2	Major2		
Conflicting Flow All	522	-	-	-
Stage 1	522	-	-	-
Stage 2	0	-	-	-
Critical Hdwy	6.52	-	-	-
Critical Hdwy Stg 1	5.52	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	4.018	-	-	-
Pot Cap-1 Maneuver	459	0	0	-
Stage 1	531	0	0	-
Stage 2	-	0	0	-
Platoon blocked, %				-
Mov Cap-1 Maneuver	0	-	-	-
Mov Cap-2 Maneuver	0	-	-	-
Stage 1	0	-	-	-
Stage 2	0	-	-	-

Approach	NB	SB
HCM Control Delay, s		0
HCM LOS	-	

Minor Lane/Major Mvmt	NBLn1	SBT
Capacity (veh/h)	-	-
HCM Lane V/C Ratio	-	-
HCM Control Delay (s)	-	-
HCM Lane LOS	-	-
HCM 95th %tile Q(veh)	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	WBL	WBR	NBT	NBR	SBU	SBL	SBT
Lane Configurations							
Traffic Vol, veh/h	0	0	1190	0	160	0	2890
Future Vol, veh/h	0	0	1190	0	160	0	2890
Conflicting Peds, #/hr	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	-	None
Storage Length	-	0	-	-	-	600	-
Veh in Median Storage, #	0	-	0	-	-	-	0
Grade, %	0	-	0	-	-	-	0
Peak Hour Factor	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2
Mvmt Flow	0	0	1240	0	167	0	3010

Major/Minor	Minor1		Major1		Major2		
Conflicting Flow All	-	620	0	-	1240	-	-
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	6.44	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.52	-	-
Pot Cap-1 Maneuver	0	431	-	0	233	0	-
Stage 1	0	-	-	0	-	0	-
Stage 2	0	-	-	0	-	0	-
Platoon blocked, %			-				-
Mov Cap-1 Maneuver	-	431	-	-	233	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	0	0	2.7
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	WBLn1	SBU	SBT
Capacity (veh/h)	-	-	233	-
HCM Lane V/C Ratio	-	-	0.715	-
HCM Control Delay (s)	-	0	51.7	-
HCM Lane LOS	-	A	F	-
HCM 95th %tile Q(veh)	-	-	4.8	-

Intersection	
Int Delay, s/veh	22.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	460	0	100	530	0	120
Future Vol, veh/h	460	0	100	530	0	120
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	495	0	108	570	0	129

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	522	-	0	0	-	-
Stage 1	393	-	-	-	-	-
Stage 2	129	-	-	-	-	-
Critical Hdwy	6.42	-	-	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	-	-	-	-	-
Pot Cap-1 Maneuver	515	0	-	-	0	-
Stage 1	682	0	-	-	0	-
Stage 2	897	0	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	515	-	-	-	-	-
Mov Cap-2 Maneuver	515	-	-	-	-	-
Stage 1	682	-	-	-	-	-
Stage 2	897	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	58.8	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBT
Capacity (veh/h)	-	-	515	-
HCM Lane V/C Ratio	-	-	0.96	-
HCM Control Delay (s)	-	-	58.8	-
HCM Lane LOS	-	-	F	-
HCM 95th %tile Q(veh)	-	-	12.4	-