



February, 2013



Stapleton Road South Extension U.S. 24 to Judge Orr Road Transportation Impact Study



Prepared For:

El Paso County
Public Services Department
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Colorado Springs, CO 80922

Prepared By:

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HDR

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
1.0 INTRODUCTION.....	10
1.1 Stapleton Road Access Control Plan	12
1.2 U.S. 24 Access Control Plan	12
1.3 Permitted U.S. 24 Access.....	12
2.0 EXISTING AND FORECAST TRAFFIC VOLUMES.....	17
2.1 Traffic Volume Counts	17
2.1.1 ADT Traffic Volume Counts.....	17
2.1.2 Peak Hour Intersection Turn Movement Counts (TMC)	17
2.1.3 Existing Traffic Volumes Adjusted and Balanced	17
2.2 PPACG Travel Model Application.....	17
2.2.1 Adjustment of PPACG Travel Model Output	18
2.2.2 Raw Model Assignment “Smoothing” Process	21
2.3 Balancing Turning Movements	21
2.4 Development Traffic	23
2.4.1 Study Area Entitlement Development	23
2.4.2 Stapleton Road Corridor Development	24
3.0 TRAFFIC OPERATIONS ANALYSIS.....	26
3.1 Traffic Operations Analysis Methodology	26
3.2 Baseline Traffic Operations Analysis	28
3.2.1 Existing Conditions Baseline	28
3.2.2 Future No Build Conditions Baseline.....	30
3.3 Future Build Traffic Analysis	32
3.3.1 Level of Service Analysis	32
3.3.2 Signal Progression Analysis	41
APPENDIX A – Automatic Traffic Recorder/ADT Count Data	
APPENDIX B – Turning Movement Count Data	
APPENDIX C – Traffic Operations Model Output/Results	
APPENDIX D – Queue Length Model Output/Results	
APPENDIX E – Signal Progression Analysis Results	

Executive Summary

This report documents traffic analysis that was conducted to update analysis completed for the September 2003 Stapleton Road Extension Corridor Study, and to support obtaining an access permit for access to the south/east side of U.S. 24 and construction of an interim 2-lane connection between that intersection and the existing intersection of Judge Orr Road and Curtis Road. Updated analysis was conducted for two baseline analysis scenarios, two interim future (2018, 2023) “build” scenarios, and an ultimate future (2035) “build” scenario, as shown in **Table ES.1**, below.

Table ES.1 Stapleton Road Extension Analysis Scenarios	
Analysis Phase	Analysis Scenario
Travel Demand/Traffic Forecasts	2010 Modeled Base Year Traffic Volumes Modeled Background Traffic Volumes Interim 5-Year Future (2018) Build Site Traffic Volumes/Distribution – includes “short term” site-generated traffic volumes for US 24 Stapleton Parcels and 4-Way Ranch developments; with traffic distributed off-site in accordance with distribution provided by the associated traffic impact study reports. Interim 10-Year Future (2023) Build Site Traffic Volumes/Distribution – includes “short term” site-generated traffic volumes for US 24 Stapleton Parcels and 4-Way Ranch developments increased using a 5-year growth factor; with traffic distributed off-site in accordance with distribution provided by the associated traffic impact study reports. Ultimate Future (2035) Build Site Traffic Volumes/Distribution – includes 2030 build-out of US 24 Stapleton Parcels and 4-Way Ranch development site-generated traffic volumes (Phases 1, 2, 3, & 4); with traffic distributed off-site in proportion to route background traffic shares.
Baseline Traffic Operations Analysis	2012 Baseline Existing Condition Scenario – 2012 balanced AM Peak Hour and PM Peak Hour traffic volumes with existing study area roadway network 2035 Baseline Future No Build Condition Scenario – 2035 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes with existing study area roadway network
Future Build Traffic Operations Analysis	2018 Interim Future Build Scenario – 2018 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes plus “short term” interim future build site traffic volumes and distribution with a 2-lane Stapleton Road South extension 2023 Interim Future Build Scenario – 2023 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes plus interim future build site traffic volumes/distribution, with a 2-lane Stapleton Road extension and East Frontage Road (located south of US 24) extension between Judge Orr Road and Woodmen Road 2035 Ultimate Future Build Scenario – 2035 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes plus build-out site traffic volumes and distribution, with a 2-lane Stapleton Road extension, full East Frontage Road (located south of US 24), and 4-lane widening of US 24 through the larger project study corridor.

Baseline Analysis

Baseline traffic operations analysis was conducted for 2012 existing conditions and for 2035 future conditions, with no roadway network upgrades. The analysis was conducted using Synchro/SimTraffic software. Traffic operations were evaluated for morning and evening peak hour periods.

2012 Existing Conditions Analysis

Traffic operations analysis for 2012 existing conditions shows that most study area intersections currently operate at a level of service (LOS) of C or better during both the morning and evening peak hour periods.

Exceptions to this are the cross-street minor approaches at Rio Lane, Bluegill Road (north and south), and Cotton Tail Trail as shown in **Table ES.2**.

Table ES.2 2012 Existing Conditions Traffic Operations¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]²	LOS/ Delay (Critical Movement) [sec/veh]²
Woodmen Road & U.S. 24	B /11.3	A /9.4
Rio Lane & U.S. 24	C /22.5 (NB)	D /29.9 (NB)
South Bluegill Road & U.S. 24	D /25.6 (NB)	D /31.1 (NB)
Cotton Tail Trail & U.S. 24	C /24.6 (NB)	D /29.0 (NB)
North Bluegill Road & U.S. 24	D /25.8 (NB)	D /30.3 (NB)
Judge Orr Road & U.S. 24	B /10.0	A /9.0
Judge Orr Road & Curtis Road	A /9.6 (NB)	A /9.0 (NB)
Falcon Big R & U.S. 24	C /15.3 (NB)	C /17.0 (NB)
Stapleton Road & U.S. 24	B /12.1 (SB LT)	B /12.0 (SB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

No Build (2035) Scenario Analysis

Traffic operations analysis for 2035 future conditions with no roadway network upgrades shows that, with no improvements to the existing study area roadway network, almost all U.S. 24 stop-controlled intersections located within the study area will experience minor approach failure for 2035 background traffic volumes as shown in **Table ES.3**. The only exception to this is the Stapleton Road T-intersection, and the assumed background traffic does not include site-generated development traffic that would increase the load on this intersection. The effects of phased development build-out on the US 24/ Stapleton Road intersection are evaluated as part of future conditions build analysis for five-year, ten-year and full build-out scenarios. All existing signalized intersections will continue to operate at levels of service of C or better, even under forecast 2035 traffic.

Table ES.3 2035 Future No Build Traffic Operations¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]²	LOS/ Delay (Critical Movement) [sec/veh]²
Woodmen Road & U.S. 24	C /20.8	C /20.3
Rio Lane & U.S. 24	F /103.4 (NB)	F /460.2 (NB)
South Bluegill Drive & U.S. 24	F /103.7 (NB)	F /86.6 (NB)
Cotton Tail Trail & U.S. 24	F /79.5 (NB)	F /82.0 (NB)
North Bluegill Drive & U.S. 24	F /485.4 (NB)	F /138.2 (NB)
Judge Orr Road & U.S. 24	C /32.9	B /17.7
Judge Orr Road & Curtis Road	B /10.4 (NB)	A /9.7 (NB)
Falcon Big R & U.S. 24	E /37.0 (NB)	E /35.2 (NB)
Stapleton Road & U.S. 24	D /27.3 (SB LT)	C /22.7 (SB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Future Build Analysis

Two interim build scenarios (2018, 2023) and an ultimate build scenario (2035) for the Stapleton Road Extension were evaluated for the Stapleton Road South Extension. Each of the “build” scenarios includes background traffic and phased site-generated development traffic for two development projects: the US 24 Stapleton Parcels and 4-Way Ranch. The impacts of a third recent (2013) development project, Waterbury, are also discussed. The locations of these developments, not specifically accounted for by the PPACG travel model or CDOT US 24 traffic growth factors, are as shown by **Figure ES.1**, below. Background traffic volumes forecasts were developed using the PPACG travel model, and are consistent with CDOT growth factors for the US 24 corridor.

Figure ES.1 Stapleton Road Corridor Proposed Development Parcel Locations



Evaluated build scenarios demonstrated the need to signalize the U.S. 24/Stapleton Road intersection once access to the south of U.S. 24 is opened and initial development of the US 24 Stapleton Parcels and 4-Way are underway.

Five-Year (2018) Interim Build Scenario Analysis

Traffic analysis results for the five-year interim build scenario (2018) are presented in **Table ES.4**. Required improvements for the five-year interim build scenario (2018) to achieve acceptable traffic operations (LOS C or better) include: signalization of the Stapleton Road/U.S. 24 and Stapleton Road/West Frontage Road

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2013

intersections. Queue length analysis for the five-year interim build scenario (2018), as shown in **Table ES.5** (see **Appendix D** for full analysis), shows that short to moderate stacking distances are required for interim build conditions. The forecast 2018 background traffic, together with five-year site-generated development traffic, also dictated the need to upgrade of the Judge Orr Road/Bluegill Road North intersection and to construct the East Frontage Road (south of US 24) between Judge Orr Road and Woodmen Road.

Table ES.4 Five-Year (2018) Interim Build Traffic Operations¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]²	LOS/ Delay (Critical Movement) [sec/veh]²
Woodmen Road & U.S. 24	B /15.5	B /19.8
Judge Orr Road & U.S. 24	B /15.3	B /12.5
Stapleton Road & U.S. 24	B /13.9	B /17.9
Stapleton Road/West U.S. 24 Frontage Road	A /8.8	B /14.9
Stapleton Road/East U.S. 24 Frontage Road	B /10.3 (EB LT)	A /8.5 (EB/WB)
Judge Orr Road & Stapleton Road/Curtis Road	B /14.2 (WB LT)	B /11.7 (WB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Table ES.5 Five-Year (2018) Interim Build Signalized Intersection Queue Lengths								
Intersection	AM Peak Hour Queue Length (feet)¹							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	34	-- ²	-- ²	58	-- ²	-- ²	148	53
Judge Orr Road & U.S. 24	m9 ³	-- ²	5	-- ²	124 ⁴	-- ²	14	-- ²
Stapleton Road & U.S. 24	158 ⁴	24	17	26	59	-- ²	97	49
Intersection	PM Peak Hour Queue Length (feet)							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	49	-- ²	-- ²	43	-- ²	-- ²	381 ⁴	32
Judge Orr Road & U.S. 24	M56 ³	-- ²	9	-- ²	62	-- ²	40	-- ²
Stapleton Road & U.S. 24	169	10	6	25	75	-- ²	m149 ³	54

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement. 3. Queue for this movement is metered by an upstream signal. 4. 95th percentile volume exceeds capacity, queue may be longer.

Ten-Year (2023) Interim Build Scenario Analysis

Traffic analysis results for the ten-year interim scenario are presented in **Table ES.6**. Improvements that are required to attain acceptable traffic operations (LOS C or better) for the ten-year interim build scenario (2023) include construction of the East Frontage Road (south of US 24) from Rio Lane to the Woodmen Road intersection. Neither widening of US 24 to 4 lanes, nor signalization of the Stapleton Road/East Frontage Road intersection (south of US 24) are needed for this scenario. Queue length analysis for the ten-year interim build scenario (2023), as shown in **Table ES.7** (see **Appendix D** for full analysis), shows increased stacking distances are required to accommodate forecast 2023 traffic.

Table ES.6 Ten-Year (2023) Interim Build Traffic Operations ¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh] ²	LOS/ Delay (Critical Movement) [sec/veh] ²
Woodmen Road & U.S. 24	B/14.5	C/21.3
Judge Orr Road & U.S. 24	B/19.4	B/14.0
Stapleton Road & U.S. 24	B/15.5	B/19.0
Stapleton Road/West U.S. 24 Frontage Road	A/9.7	B/14.4
Stapleton Road/East U.S. 24 Frontage Road	B/11.2 (EB LT)	B/11.2 (EB LT)
Judge Orr Road & Stapleton Road/Curtis Road	C/15.3 (ER Thru/RT)	B/12.4 (EB Thru/RT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Table ES.7 Ten-Year (2023) Interim Build Signalized Intersection Queue Lengths								
Intersection	AM Peak Hour Queue Length (feet) ⁵							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	40	-- ²	-- ²	m11 ⁴	-- ²	-- ²	167	79
Judge Orr Road & U.S. 24	m26 ³	-- ²	7	-- ²	138 ⁴	-- ²	10	146
Stapleton Road & U.S. 24	200 ⁴	22	7	27	58	17	85	40
Intersection	PM Peak Hour Queue Length (feet)							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	78 ⁴	-- ²	-- ²	54	-- ²	-- ²	418 ⁴	32
Judge Orr Road & U.S. 24	78	-- ²	7	-- ²	68	-- ²	31	53
Stapleton Road & U.S. 24	214 ⁴	13	19	31	45	12	120	54

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement. 3. Queue for this movement is metered by an upstream signal. 4. 95th percentile volume exceeds capacity, queue may be longer. 5. Full analysis can be found in Appendix D

Ultimate (2035) Build Scenario Analysis

Traffic analysis results for the ultimate build scenario (2035) are presented in **Table ES.6**. In order to achieve acceptable traffic operations (LOS C or better) for the ultimate build condition, the Stapleton Road/East Frontage Road intersection (south of US 24) must be signalized and US 24 must be widened to 4 lanes, two through lanes in each direction, through the larger project study corridor between Woodmen Road and Stapleton Road. Queue length analysis for the interim build scenario, as shown in **Table ES.7** (see Appendix D for full analysis), shows that longer stacking distances, and/or double turn bays in some cases, will be required to accommodate 2035 ultimate traffic flows.

Table ES.6 2035 Ultimate Build Traffic Operations		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay [sec/veh] ¹ (Critical Movement)	LOS/ Delay [sec/veh] ¹ (Critical Movement)
Woodmen Road & U.S. 24	B/19.7	C/34.3
Judge Orr Road/Bluegill Road & U.S. 24	C/22.4	C/27.4
Stapleton Road & U.S. 24	C/29.5	C/30.2
Stapleton Road/West U.S. 24 Frontage Road	B/18.5	B/13.2
Stapleton Road/East U.S. 24 Frontage Road	A/7.9	A/7.7
Judge Orr Road & Stapleton Road/Curtis Road	C/20.3 (WB LT)	C/19.7 (EB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Table ES.7 2035 Ultimate Build Signalized Intersection Queue Lengths								
Intersection	AM Peak Hour Queue Length (feet)¹							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	82 ³	15	9	79	16	-- ²	330 ³	0
Judge Orr/Bluegill & U.S. 24	91 ³	-- ²	m6 ⁴	-- ²	49	-- ²	12	-- ²
Stapleton Road & U.S. 24	59 ³	m57 ⁴	71	60	69	25	144 ³	102
Intersection	PM Peak Hour Queue Length (feet)							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	125 ³	17	10	73	28	-- ²	600 ⁴	0
Judge Orr Road & U.S. 24	230 ³	-- ²	m41 ⁴	-- ²	121	-- ²	96	-- ²
Stapleton Road & U.S. 24	198	m1 ⁴	259 ³	32	160 ³	17	m66 ⁴	76

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement or queue does not exist due to free-flow condition. 3. Queue exceeds capacity and may be longer. 4. Queue is metered by an upstream signal.

Signal Progression Analysis

Passer II-90 was used to assess signal progression efficiency for the U.S. 24 study corridor for signalization of the Stapleton Road intersection together with the Woodmen Road and Judge Orr Road intersections. The results of that analysis, as summarized below in **Table ES.8**, show that US Highway 24 progression efficiencies ranging from 27% to 40% can be achieved for the proposed signalized intersection configuration with 2035 traffic volumes. These results place the progression in “good” to “great” signal progression efficiency rating categories.

Table ES.8 2035 Build Signal Progression		
U.S. 24 Corridor Signal Progression³		
Peak Hour Period	Signal Progression Efficiency	
	Efficiency ¹	Attainability ²
AM Peak Hour	0.37	0.77
PM Peak Hour	0.27	1.00
Notes: 1) Efficiency: 0.00 - 0.12 - "POOR PROGRESSION" 0.13 - 0.24 - "FAIR PROGRESSION" 0.25 - 0.36 - "GOOD PROGRESSION" 0.37 - 1.00 - "GREAT PROGRESSION" 2) Attainability: 1.00 - 0.99 - "INCREASE MIN THRU PHASE" 0.99 - 0.70 - "FINE-TUNING NEEDED" 0.69 - 0.00 - "MAJOR CHANGES NEEDED" 3) The State of Colorado Access Control Code design criteria call for a minimum 40% (.40) progression efficiency. The progression efficiency result for the proposed Stapleton Road/U.S. 24 signal is 0.37 for the AM peak hour and 27% (.27) for the PM peak hour. These results place the progression in “good” to “great” signal progression efficiency rating categories.		

Signal progression analysis was also conducted for the 2003 Stapleton Road Corridor Study as a means to compare alternative access concepts and to illustrate a full range of possible approaches to providing access and a local road network. The analysis results for the selected alternative, included in both the Stapleton Road Access Control Plan and the U.S. 24 Access Control Plan, are shown in **Table ES.9**, below. The selected alternative includes frontage roads elements, on both sides of U.S. 24, and employs Stapleton Road "shadow" signals coordinated with U.S. 24 signals at Judge Orr Road/ Blue Gill Road and Stapleton Road. The State Access Code requires that 35% signal progression efficiency be achieved when implementing access spacing at intervals less than specified by the Access Code. On County facilities, 30% progression efficiency is required for "shadow signal" installations. Signal progression efficiency measures the degree to which a motorist is able to pass through downstream signals on green, without having to stop. Fatal flaws feasibility signal progression analysis assumed "worst-case" development intensity adjacent to US 24/ Stapleton Road.

Table ES.9 Stapleton Road – Curtis Road Corridor Signal Progression Analysis

Access Concept Description	AM Peak Hour			PM Peak Hour		
	Distance to Frontage Roads	Efficiency	Cycle Length	Distance to Frontage Roads	Efficiency	Cycle Length
Local access to the north and south of US 24 is provided via frontage roads. On the south, the frontage road extends between Judge Orr and Stapleton Roads. "Shadow" signals control access to Judge Orr and Stapleton Roads from the frontage roads. On the north, the frontage road does not extend south to Judge Orr Road.	300/300 feet	35%	60	300/300 feet	27%	60
	350/350 feet	35%	60	350/350 feet	26%	60
	400/400 feet	35%	60	400/400 feet	25%	60
	450/450 feet	35%	60	450/450 feet	25%	60
	500/500 feet	35%	60	500/500 feet	25%	60
	550/550 feet	35%	60	550/550 feet	25%	60
	600/600 feet	35%	60			

US 24 Mainline Widening

Future build traffic operations analysis for the 2035 planning horizon demonstrated a need to widen US 24 through the study corridor, between Woodmen Road and Stapleton Road, to 4 lanes, two in each direction. By 2035, peak hour lane volumes approach 1200 vehicles per hour, and the combination of high through volume and high cross street volumes at major intersections outstrips the capacity of the existing 2-lane facility. A 2-lane cross section with frontage roads was shown to provide adequate traffic operations for the evaluated interim 2018 and 2023 build scenarios.

Summary of Traffic Analysis Findings

Table ES.10, below, summarizes required improvements identified by 2018, 2023 and 2035 future build scenario traffic operations analysis. The findings showed a need to

Table ES.10 Recommended US 24 Corridor Improvement Phasing

Analysis Scenario	Improvements Needed
Short Term Improvements	- Construct 2-lane Stapleton Road extension south to Curtis Road/Judge Orr Road intersection - Construct US 24 mainline auxiliary lanes as required for the south side access to US 24 - Construct short segment of East Frontage Road (south of US 24); Falcon Big R to maintain direct access to US 24
2018 Future Build Scenario	- Reconfigure Judge Orr Road/North Bluegill Road intersection - Signalize the US 24/Stapleton Road intersection; construct associated US 24 mainline auxiliary lane upgrades for the signalized condition - Signalize the West Frontage Road (north of US 24)/Stapleton Road intersection
2023 Future Build Scenario	Construct East Frontage Road (south of US 24) between Rio Lane and Woodmen Road
2035 Future Build Scenario	- Widen US 24 to 4 through lanes, 2 in each direction, within the study corridor (Woodmen Road to Stapleton Road) - Signalize the East Frontage Road/Stapleton Road intersection (south of US 24)

1.0 Introduction

In April 2003, El Paso County adopted a preferred alignment and access management plan for the extension of Stapleton Road east and south from Meridian Road to the existing Curtis Road/Judge Orr intersection. Together, the selected major arterial alignment and supporting frontage road/collector roadway network will provide an efficient major roadway facility and convenient access to business and residential property, while minimizing adverse impacts. It is envisioned that the Stapleton Road – Curtis Road corridor will ultimately be linked to Briargate Parkway to the west, creating a major arterial beltway facility with connectivity to the Interstate 25 corridor.

Since adoption of the Stapleton Road Access Management Plan in December 2003, construction of the preferred Stapleton Road Extension alignment, as shown in **Figure 1.1**, has been completed between Meridian Road and U.S. 24. An ultimate 4-lane cross section is envisioned as shown by **Figure 1.2**. An interim, 2-lane cross section, between Meridian Road and Eastonville Road, was completed in 2003 as a part of the Woodmen Hills development. In 2010, a second Stapleton Road Extension segment, between Eastonville Road and U.S. 24, was completed to support development of the 4-Way Ranch property. To allow development of the 4-Way Ranch property, access to the north/west side of U.S. 24 the (State Highway 24G, milepost 323.28) for the 4-Way Ranch property was also permitted on May 17, 2010. (State Highway Access Permit No. 210010). The access permit required that “initial” improvements be completed within one year of permit issue, and that specific additional improvements be completed coincident with two identified stages of phased build-out of the 4-Way Ranch property (see **Section 1.5** – Permitted U.S. 24 Access).

Figure 1.1 Study Location Map

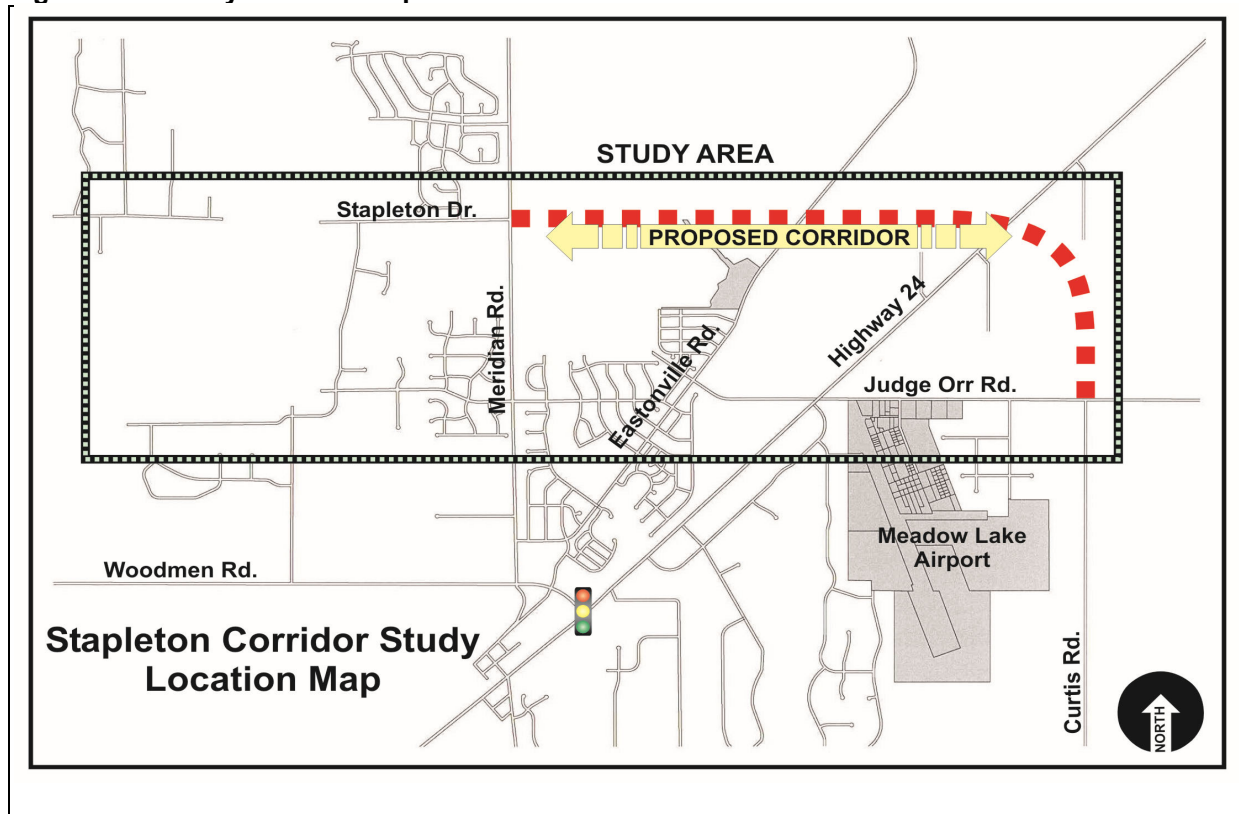
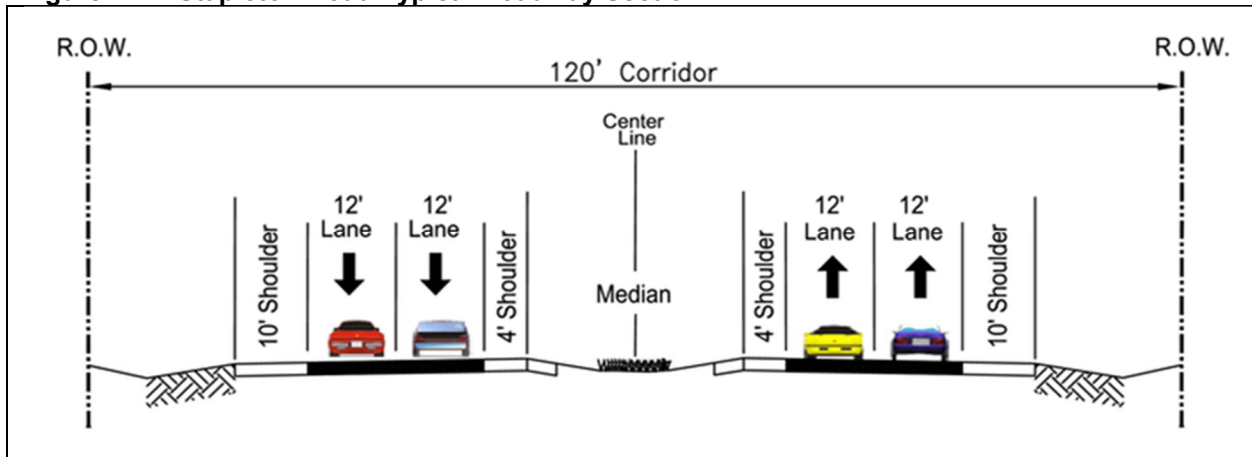


Figure 2.2 Stapleton Road Typical Roadway Section


This report documents traffic analysis that was conducted to update analysis completed for the September 2003 Stapleton Road Extension Corridor Study, and to support obtaining an access permit for access to the south/east side of U.S. 24 and construction of an interim 2-lane connection between that intersection and the existing intersection of Judge Orr Road and Curtis Road. Updated analysis was conducted for two baseline analysis scenarios and three future “build” scenarios as shown in **Table 1.1**.

Table 1.1 Stapleton Road Extension Analysis Scenarios	
Analysis Phase	Analysis Scenario
Travel Demand/Traffic Forecasts	2010 Modeled Base Year Traffic Volumes Modeled Background Traffic Volumes Interim 5-Year Future (2018) Build Site Traffic Volumes/Distribution – includes “short term” site-generated traffic volumes for US 24 Stapleton Parcels and 4-Way Ranch developments; with traffic distributed off-site in accordance with distribution provided by the associated traffic impact study reports. Interim 10-Year Future (2023) Build Site Traffic Volumes/Distribution – includes “short term” site-generated traffic volumes for US 24 Stapleton Parcels and 4-Way Ranch developments increased using a 5-year growth factor; with traffic distributed off-site in accordance with distribution provided by the associated traffic impact study reports. Ultimate Future (2035) Build Site Traffic Volumes/Distribution – includes 2030 build-out of US 24 Stapleton Parcels and 4-Way Ranch development site-generated traffic volumes (Phases 1, 2, 3, & 4); with traffic distributed off-site in proportion to route background traffic shares.
Baseline Traffic Operations Analysis	2012 Baseline Existing Condition Scenario – 2012 balanced AM Peak Hour and PM Peak Hour traffic volumes with existing study area roadway network 2035 Baseline Future No Build Condition Scenario – 2035 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes with existing study area roadway network
Future Build Traffic Operations Analysis	2018 Interim Future Build Scenario – 2018 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes plus “short term” interim future build site traffic volumes and distribution with a 2-lane Stapleton Road South extension 2023 Interim Future Build Scenario – 2023 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes plus interim future build site traffic volumes/distribution, with a 2-lane Stapleton Road extension and East Frontage Road (located south of US 24) extension between Judge Orr Road and Woodmen Road 2035 Ultimate Future Build Scenario – 2035 adjusted/balanced background AM Peak Hour and PM Peak Hour traffic volumes plus build-out site traffic volumes and distribution, with a 2-lane Stapleton Road extension, full East Frontage Road (located south of US 24), and 4-lane widening of US 24 through the larger project study corridor.

1.1 Stapleton Road Access Control Plan

The Stapleton Road Access Control Plan, adopted in December 2003, provides the necessary framework to protect both the functionality and future capacity of the new roadway. As shown in **Figure 1.3**, reasonable access to all property adjacent to the proposed roadway and all property and private driveways is maintained via U.S. 24 frontage roads and a collector roadway network.

1.2 U.S. 24 Access Control Plan

Like the Stapleton Road Access Control Plan, the U.S. 24 Access Control Plan, adopted in January 2005, restricts access to U.S. 24 and uses frontage roads to provide reasonable access to all property and private driveways. As shown in **Figure 1.4**, **Figure 1.5** and **Figure 1.6**, full access is maintained only at Woodmen Road, Judge Orr Road-Bluegill Road, and Stapleton Road signalized intersections. Other existing accesses are either downgraded to right-in/right-out operation or closed and redirected to frontage road connections.

1.3 Permitted U.S. 24 Access

A permit for Stapleton Road access to the west/north side of U.S. 24 was issued in May 2010. Requirements and timing for phased access allowed by the permit are as shown in **Table 1.1**. A separate access permit is required to access to the east/south side of U.S. 24 as required to complete extension of Stapleton Road to Curtis Road/Judge Orr Road.

Table 1.1 State Highway Access Permit No. 210010 Requirements	
Phase	Requirements
Initial Connection (without any on-site development)	- An abbreviated WB right turn deceleration lane on U.S. 24 approaching Stapleton (390' deceleration lane plus 195' taper). Abbreviated lane is approved for "Initial Connection" and Phases 1 and 2 only. - A WB right-turn lane acceleration lane on U.S. 24 from Stapleton Road (1380' acceleration lane plus 300' taper). - An EB left-turn lane deceleration lane on U.S. 24 approaching Stapleton Road (775' of effective deceleration lane plus 215' stacking plus 223' taper). - Overlay the entire width of U.S. 24 G within project limits.
Phases 1 & 2 (36.5 KSF Shopping Center, 5.8 KSF High Turnover Sit-Down Restaurant, 3 KSF Fast-Food Restaurant with Drive-Through Window, 10 VFP Gas Station with Convenience Store, 53.6 KSF Medical-Dental Office Building)	- Developer to escrow \$300,000 with El Paso County and install the signal when CDOT determines that a signal at U.S. 24/Stapleton Road is warranted. - Developer to <u>dedicate</u> ROW along U.S. 24 to accommodate dual EB left-turn, two EB through lanes (for receiving the SB dual left-turn from Stapleton), one WB thru lane, one right-turn deceleration lane, required shoulders on both sides of the roadway and necessary drainage facilities. In addition to this, the developer is required to <u>reserve</u> ROW for one additional WB through lane.
Phases 3 & 4 (additional 168 KSF Shopping Center, 6 KSF Fast Food Restaurant with Drive Through Window, 6 KSF High Turnover Sit-Down Restaurant, 35 KSF Industrial Park, 200-DU Residential Condo/Townhomes, 18 KSF Warehousing)	- The developer is required to <u>dedicate</u> ROW along U.S. 24 to accommodate dual EB left-turn, and one EB thru lane, one WB thru lane, one WB right-turn acceleration lane, required shoulders on both sides of the roadway and other necessary drainage facilities. In addition to this, the developer is required to <u>reserve</u> ROW for one additional EB thru lane and one WB thru lane. - Build the second EB left-turn lane on U.S. 24. - Build the second receiving lane on U.S. 24 for the SB left-turn movement. - Extend the box culvert. - Extend the WB right-turn deceleration lane on U.S. 24 (from the substandard lane built by Phase 1) to a length of 800' plus a 300' - Overlay the entire width of U.S. 24 G within the project limits.

Figure 3.3 Stapleton Road Extension Access Management Plan

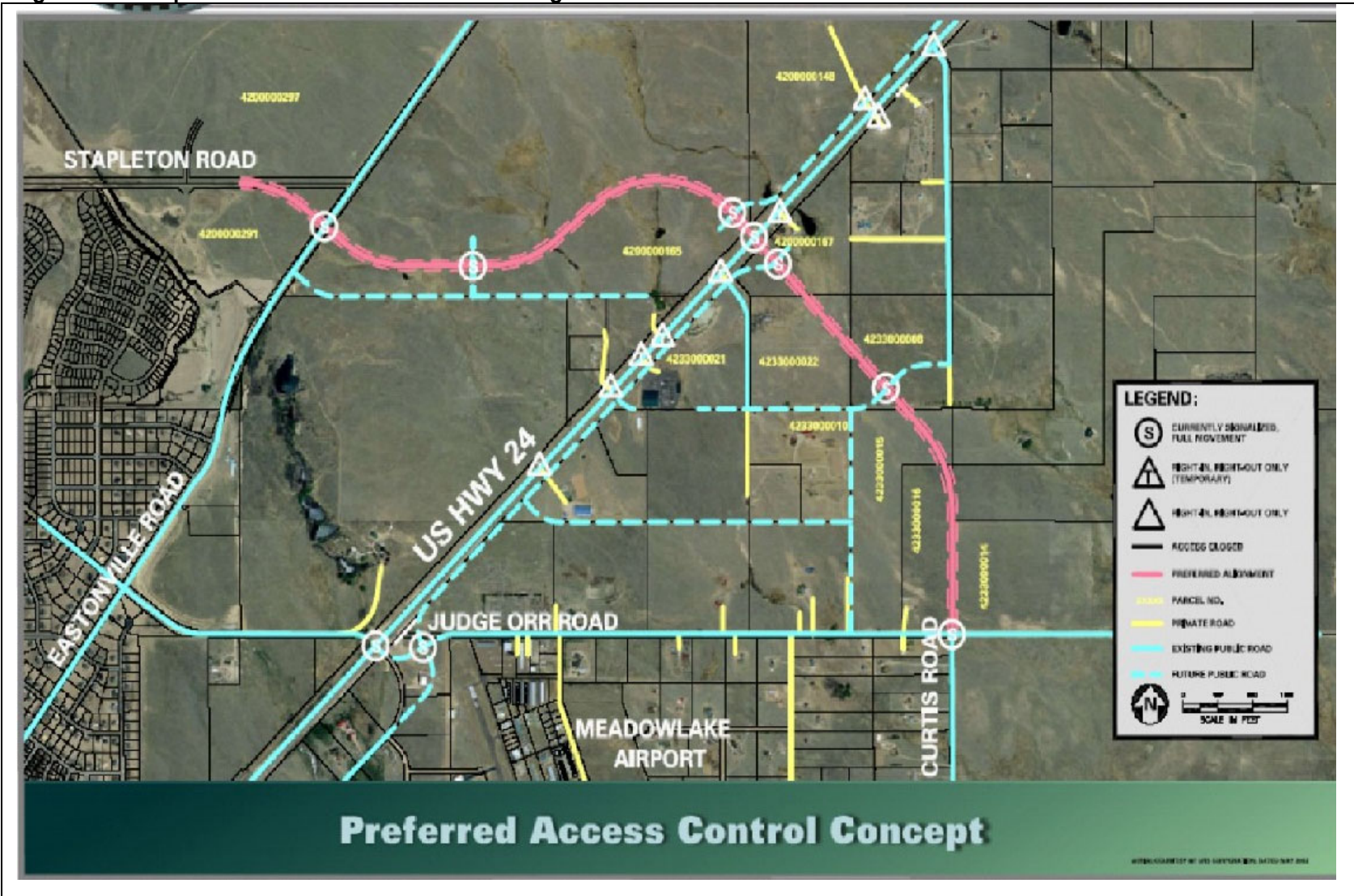


Figure 4.4 U.S. 24 Access Management Plan Maps – Falcon Highway to South Bluegill Road

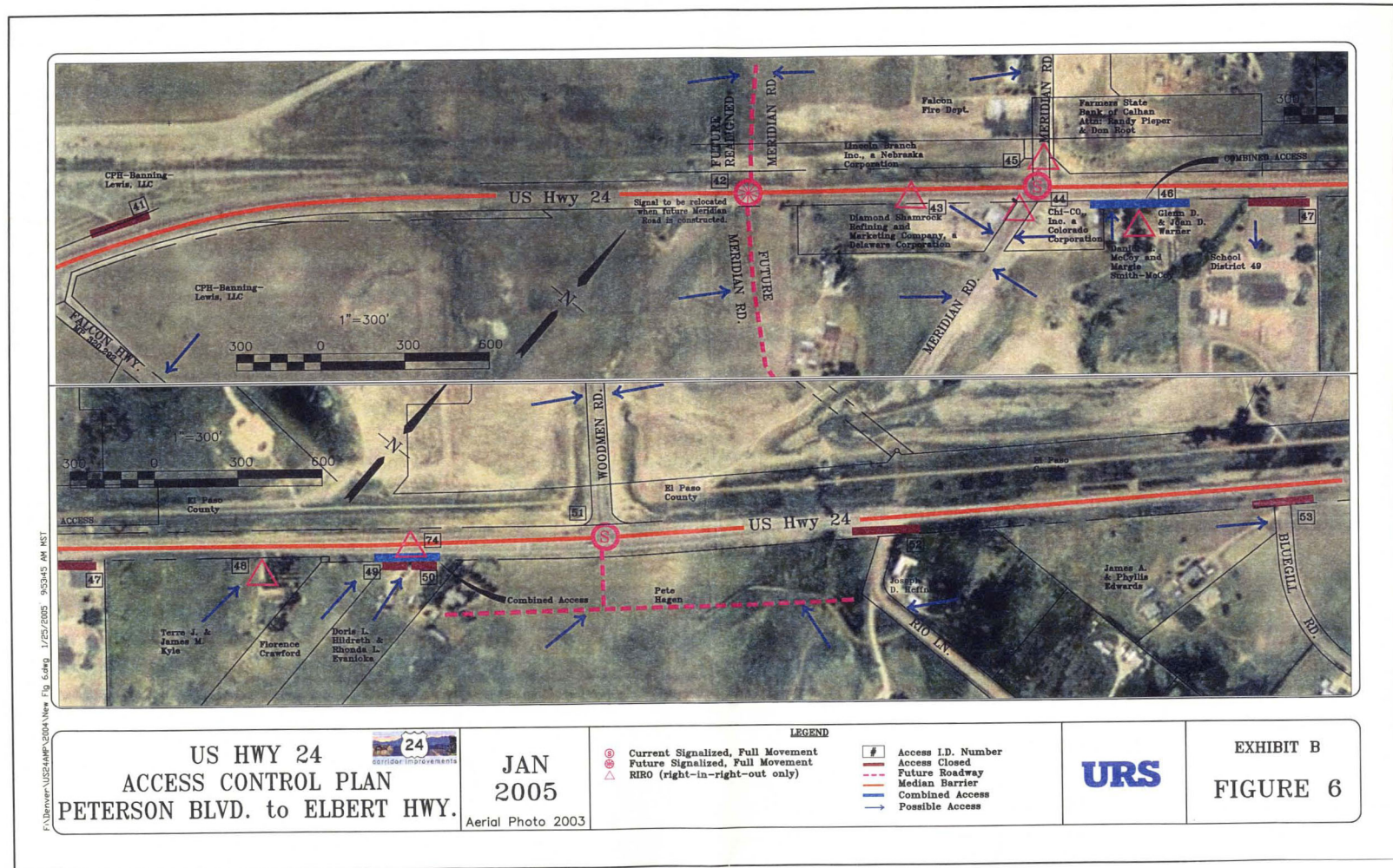


Figure 5.5 U.S. 24 Access Management Plan Maps – Judge Orr Road to Curtis Road

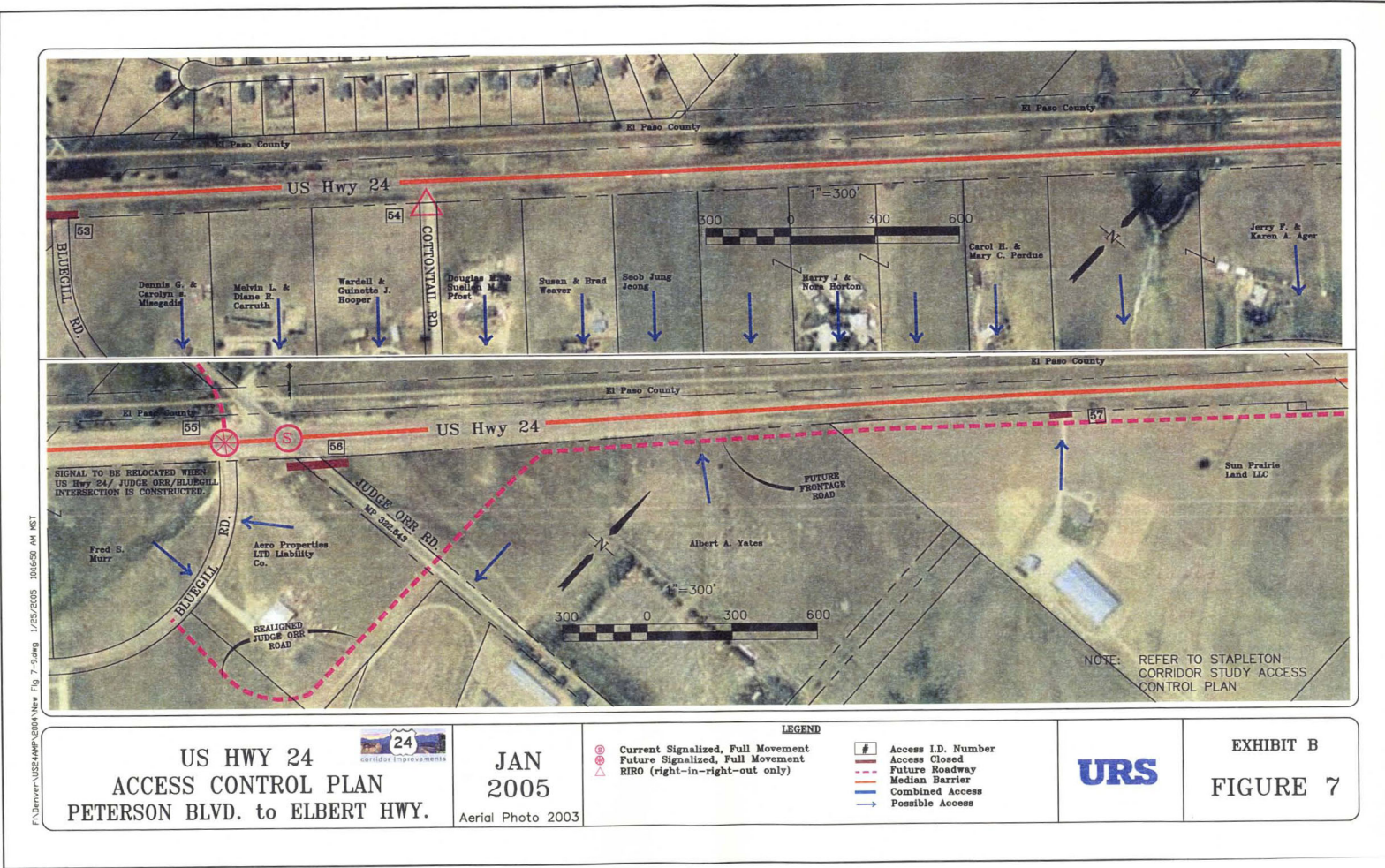
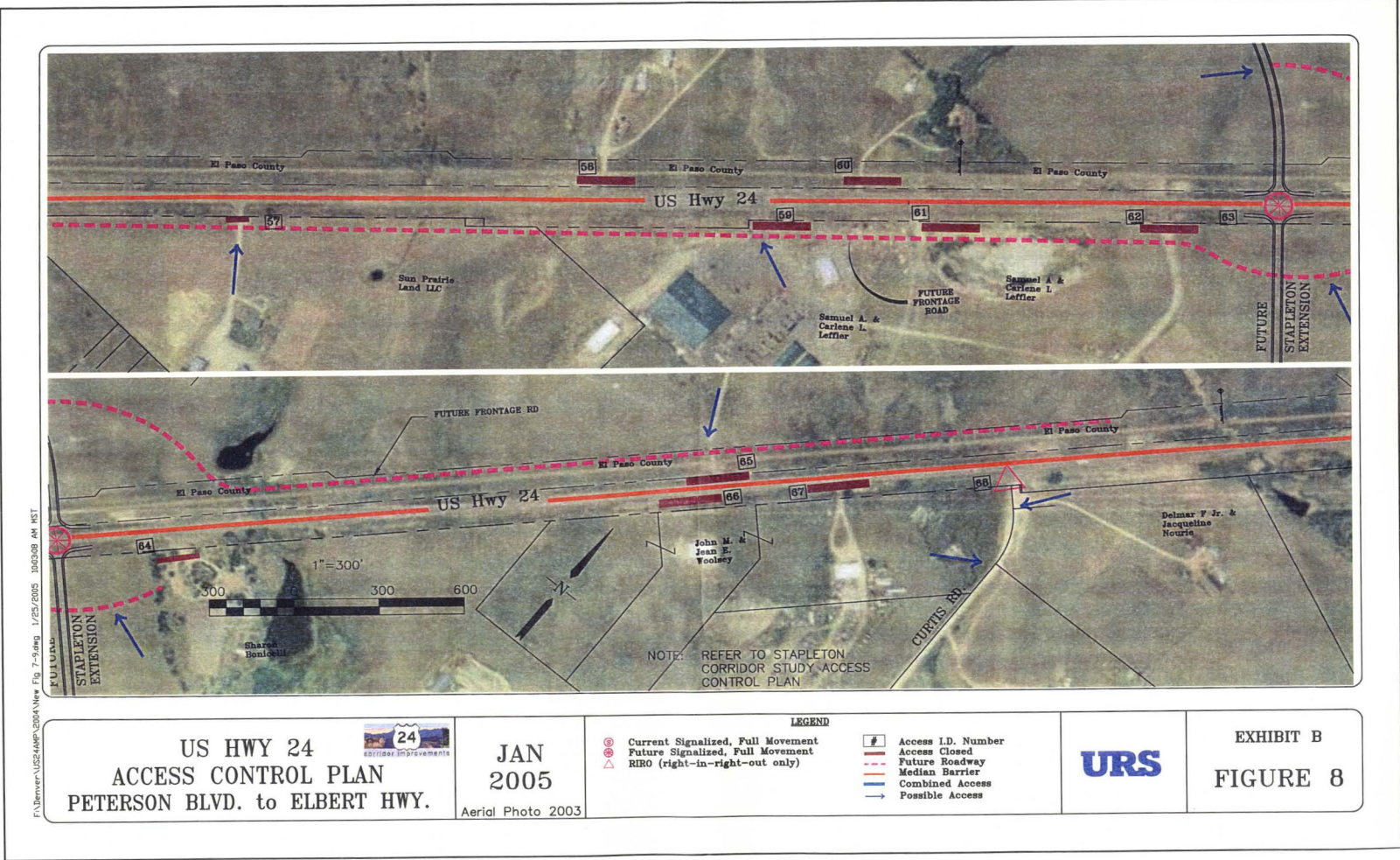


Figure 6.6 U.S. 24 Access Management Plan Maps – Falcon Highway to South Bluegill Road



2.0 Existing and Forecast Traffic Volumes

2.1 Traffic Volume Counts

2.1.1 ADT Traffic Volume Counts

Available 2010 Automatic Traffic Recorder (ATR) traffic volume counts were assembled to support travel demand model validation and “smoothing” of travel model raw assignment traffic volumes. The assembled data was obtained from sources including the Colorado Department of Transportation (CDOT), the Pikes Peak Area Council of Governments (PPACG), and recent corridor and traffic impact studies.) Short-term (24-hour and 48-hour) and continuous bidirectional, hourly counts and selected vehicle classification counts comprise the assembled data. Additional 24-hour counts were collected at three study area locations on hourly counts were also collected on December 18, 2012 at three study locations (Judge Orr Road east of U.S. 24, Curtis Road south of Judge Orr Road and Stapleton Road east of Eastonville Road). The new count data, collected at 15-minute increments, was used for Synchro model coding and to support signal warrant assessment for adjacent intersections.

2.1.2 Peak Hour Intersection Turn Movement Counts (TMC)

Available peak hour turn movement counts were collected for study area intersections. Primary sources for assembled data included recent corridor and traffic impact studies. Additional AM peak period (7:00 AM to 9:00 AM) and PM peak period (4:00 PM to 6:00 PM) turn movement counts were also collected at four study area intersections (U.S. 24/Woodmen Road, U.S. 24/Judge Orr Road, Curtis Road/Stapleton Road, and Stapleton Road/Eastonville Road) on December 18, 2012. The assembled TMC data was used, together with current and historic ADT count data and travel model assignment data, to support adjustment of raw travel model traffic assignments for estimation of peak hour turn movement volumes.

2.1.3 Existing Traffic Volumes Adjusted and Balanced

The traffic volume counts assembled for this study were assembled from various sources. Not all counts were collected on the same day and many intersections and roadway segments were not counted. As a result, the raw traffic volume data, from intersection to intersection and on corresponding links, may not balance, or add up correctly as is required for traffic modeling purposes. To meet model coding requirements, collected data was adjusted to represent average weekday peak hour conditions for all “key” study area intersections. Assembled ADT volumes were used to validate travel model assignments and to adjust the raw intersection TMCs collected in different years and on different days of the week. Adjusted ADT volumes were also used to estimate turning movements at the intersections that had not been counted. Estimated TMC volumes were used for modeling purposes only, not to assess signal warrant threshold attainment. . The resulting adjusted and estimated intersection turning movement volumes study area intersections and access points were then balanced so that traffic traveling from the upstream intersection(s) would be equal to the traffic arriving at the downstream intersection(s). Resulting 2012 existing condition peak hour turning movement volumes for the morning (AM) and evening (PM) peak hours are shown in **Figure 3.1 in Section 3 – Traffic Operations Analysis**.

2.2 PPACG Travel Model Application

To support analysis of future conditions (20218, 2023, and 2035), traffic flow forecasts were prepared for each of the future network scenarios. The Pikes Peak Area Council of Governments (PPACG) VISUM regional travel demand model was used as a basis for preparing of forecast background traffic volumes. Because the regional travel model was designed for system-wide analysis, coding within the Stapleton Road

study area was reviewed and enhanced to provide enhanced network detail, as well as more detailed supporting land use data. Both 2010 and 2035 runs were then completed using the enhanced subarea model to produced 2010 model base year and 2035 model forecast year traffic assignments. The raw traffic volume assignments produced by the model were then adjusted prior to using them for Stapleton Road Extension project-level analysis. Necessary adjustments were made using standard NCHRP 255 procedures supported by 2010 ground counts for the study area roadway network.

2.2.1 Adjustment of PPACG Travel Model Output

The following procedures were used to adjust/post-process PPACG travel model 2035 raw traffic assignment volumes for use in Stapleton Road Extension project-level traffic operations analysis:

1. *Traffic Volume Data was collected for the PPACG Model Base Year (2010)*

Recent ADT counts and turning movement counts for the AM and PM peak periods were assembled/ collected to estimate actual traffic volumes for the chosen PPACG model baseline year (2010). The baseline was established to evaluate an existing condition, without proposed roadway improvements or anticipated 4-Way Ranch site development traffic.

2. *PPACG 2010 Assignment Volumes were validated to Counted Traffic Volumes*

The assembled ADT counts were compared to the assigned volumes generated by a 2010 baseline run of the PPACG travel model (see **Figure 2.1**) in order to validate the corridor-level application of the regional model for the base year.

3. *An NCHRP 255-Based “Smoothing” Process to was applied to Model Outputs*

Using a process previously approved by PPACG (for project-level analysis for Highway 105, Meridian Road, Woodmen Road, Austin Bluffs Parkway, etc.), the baseline condition (2010) raw model assignment results were systematically “smoothed” to better replicate 2010 traffic volume ground count experience. Initially, the baseline condition model outputs were adjusted to achieve a better fit compared to the ground counts. The differences in year 2010 traffic counts as compared to the 2010 baseline model outputs were then applied to the forecast model outputs (see **Figure 2.2**) as part of the smoothing process.

4. *Resulting Volumes were Checked for Reasonableness*

As a validity check, resulting volumes (baseline year to forecast year) were compared to historic growth rates along the study corridor.

Figure 2.1 PPACG Travel Model 2010 ADT Traffic Assignment

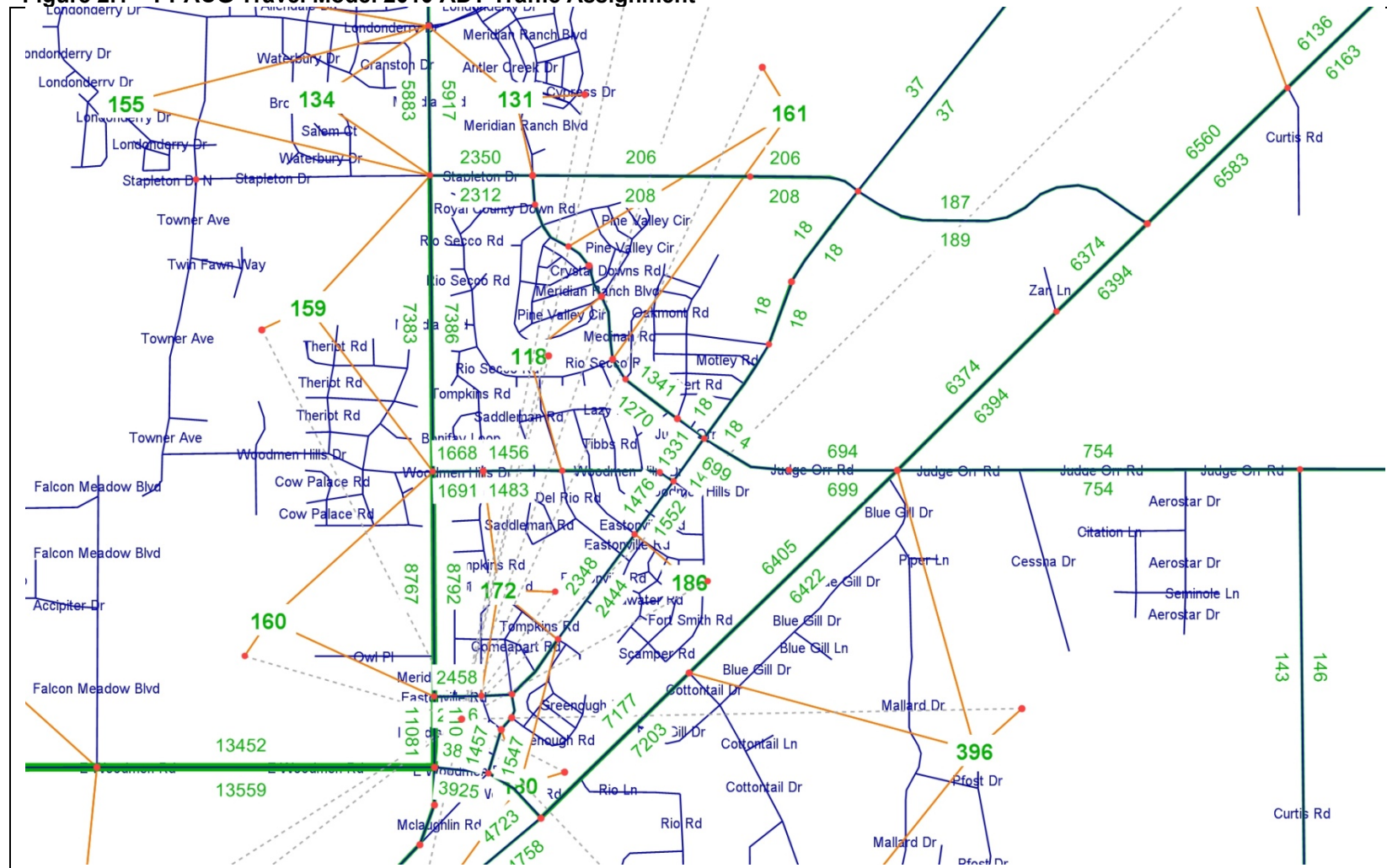
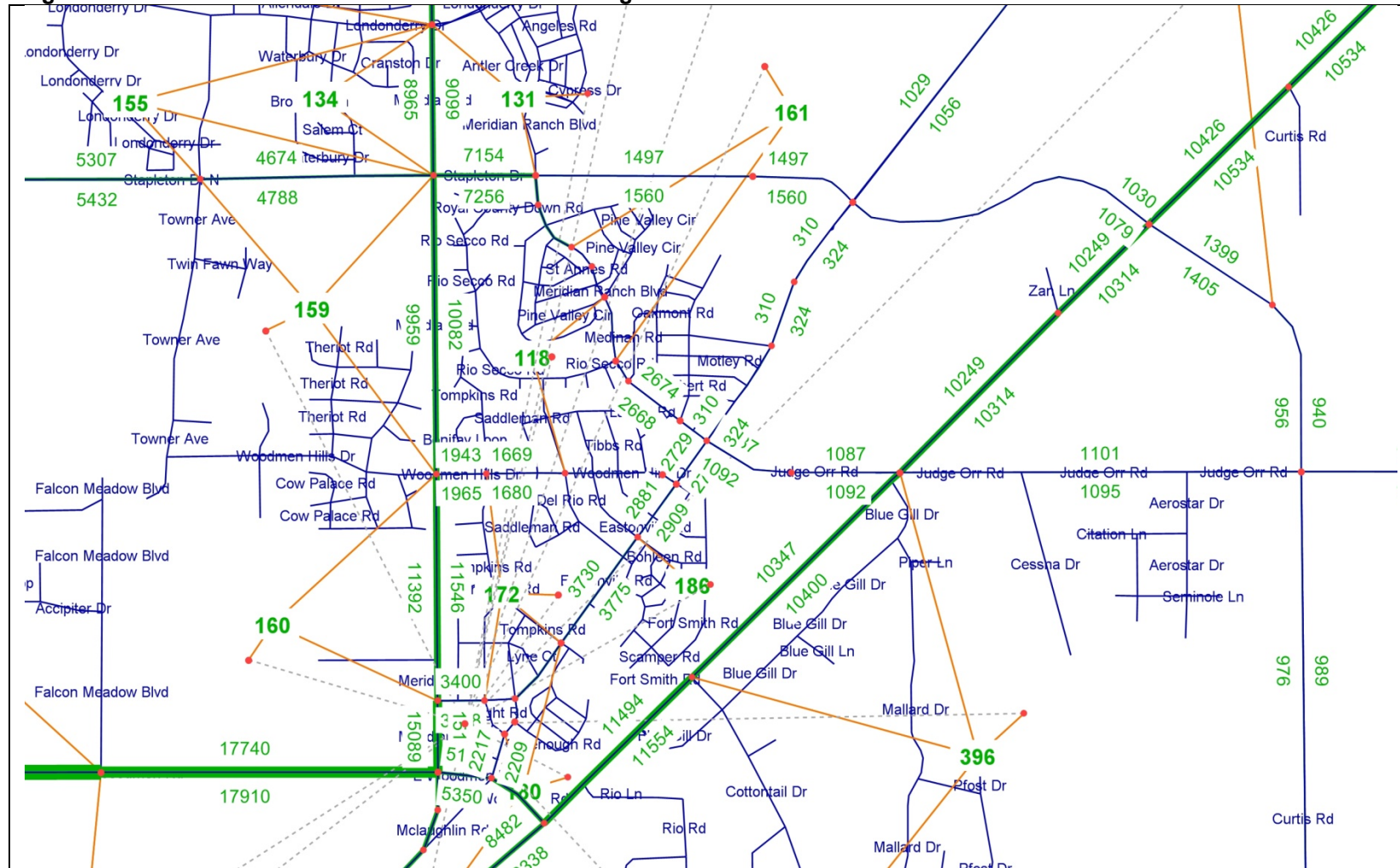


Figure 2.2 PPACG Travel Model 2035 ADT Traffic Assignment



2.2.2 Raw Model Assignment “Smoothing” Process

The “smoothing” process that was used, as described below, uses formulas based on industry standard procedures set for by the Transportation Research Board (TRB) NCHRP (National Cooperative Highway Research Program) Report 255. Each roadway link for which there was a traffic count was “smoothed” and reassigned a forecast volume. Average values were also calculated by segment to allow adjustment where count data was not available. The calculated future volume assigned to each link was based on the percentile difference (i.e. relative difference) between the traffic count and base year model assigned volume. If the percentile difference between the traffic count and the base year model assigned volume was greater than 15%, then the absolute difference was used. If the percentile difference between the traffic count and the base year model assigned volume is less than or equal to 15%, then the average of the relative difference and absolute difference was taken and applied (see example in **Table 2.1**).

The formulas for the smoothing process are as follows:

- If the percentile difference between the count and assigned volume is >15%, then the absolute difference is added to the assigned volume.

$$\text{Smoothed \#} = AV + ABS$$

$$AV = \text{assigned volume}; ABS = \text{absolute difference}$$

- If the percentile difference between the count and assigned volume is $\leq 15\%$, then the average of the relative difference and absolute difference is used.

$$\text{Smoothed \#} = ((AV * (1 + (\% / 100))) + (ABS + AV)) / 2$$

$$AV = \text{assigned volume}; ABS = \text{absolute difference};$$

$$\% = \text{percentile (relative) difference}$$

2.3 Balancing Turning Movements

Once adjusted intersection “approach” volumes had been developed, turn movement volumes were estimated (based on splits observed in available turning movement counts) and balanced for operations analysis. This was done using a custom spreadsheet calculation tool, but could also have been completed using any of a variety of available commercial and freeware applications. If initial input turning movement splits were not available, required splits were calculated using model assignment results.

Table 2.1 Regional Travel Model ADT Volume Assignment Adjustment Process

SEGMENT LOCATION	ADT DIRECTIONAL VOLUMES								Adjusted ADT Future Volume
	2005 Ground Count Volumes		PPACG Model	Difference		% Difference			
	Date	Adj. Count	2005	2035	2005 vs Count	% Difference	2005 vs Count	2035 vs 2005	
US HIGHWAY 24									
NB - South of Garrett Road	2007	8,300	11,700	22,330	-3,400	41%	70.94%	190.85%	25,730
SB - South of Garrett Road	2007	8,100	11,685	22,150	-3,585	44%	69.32%	189.56%	25,735
NB - South of Falcon Highway	2007	8,000	10,440	18,465	-2,440	31%	76.63%	176.87%	20,905
SB - South of Falcon Highway	2007	8,000	10,425	18,300	-2,425	30%	76.74%	175.54%	20,725
NB - South of Meridian Road	2007	7,000	8,770	16,640	-1,770	25%	79.82%	189.74%	18,410
SB - South of Meridian Road	2007	7,100	8,760	16,510	-1,660	23%	81.05%	188.47%	18,170
NB - South of Woodmen Road	2005	6,300	4,980	10,665	1,320	21%	126.51%	214.16%	11,985
SB - South of Woodmen Road	2005	6,300	4,985	10,595	1,315	21%	126.38%	212.54%	11,910
NB - South of Judge Orr Road	2007	6,200	6,885	18,015	-685	11%	90.05%	261.66%	12,450
SB - South of Judge Orr Road	2007	6,200	6,905	18,070	-705	11%	89.79%	261.69%	12,488
US HIGHWAY 24 AVERAGE		7,150	8,554	17,174	-1,404	25.89%	88.72%	206.11%	17,851
MC LAUGHLIN ROAD									
NB - South of Eastonville Road	2007	2,100	2,450	3,796	-350	17%	85.71%	154.94%	4,146
SB - South of Eastonville Road	2007	2,100	2,450	3,772	-350	17%	85.71%	153.96%	4,122
NB - South of Woodmen Road	2007	3,100	2,925	5,500	175	6%	105.98%	188.03%	4,388
SB - South of Woodmen Road	2007	3,100	2,925	5,500	175	6%	105.98%	188.03%	4,388
NB - North of Rolling Thunder/Old Meridian	2007	1,875	2,500	5,500	-625	33%	75.00%	220.00%	6,125
SB - North of Rolling Thunder/Old Meridian	2007	1,875	2,500	5,500	-625	33%	75.00%	220.00%	6,125
MC LAUGHLIN ROAD AVERAGE		2,358	2,625	4,928	-267	18.55%	88.90%	187.49%	4,882
FALCON HIGHWAY									
WB - East of US 24	2005	790	1,660	9,265	-870	110%	47.59%	558.13%	10,135
EB - East of US 24	2005	790	1,670	9,280	-880	111%	47.31%	555.69%	10,160
WB - East of Meridian Road	2005	3,160	3,685	3,830	-525	17%	85.75%	103.93%	4,355
EB - East of Meridian Road	2005	3,160	3,695	3,875	-535	17%	85.52%	104.87%	4,410
FALCON HIGHWAY AVERAGE		1,975	2,678	6,563	-703	63.77%	66.54%	330.66%	7,265
GARRETT ROAD									
WB - East of US 24	2006	1,290	1,220	6,560	70	5%	105.74%	537.70%	3,960
EB - East of US 24	2006	1,290	1,250	6,575	40	3%	103.20%	526.00%	3,953
WB - East of Meridian Road	2006	1,020	740	5,805	280	27%	137.84%	784.46%	6,085
EB - East of Meridian Road	2006	1,020	740	5,830	280	27%	137.84%	787.84%	6,110
GARRETT ROAD AVERAGE		1,155	988	6,193	168	15.86%	121.15%	659.00%	5,027
MERIDIAN ROAD									
NB - South of Stapleton Road	2005	5,500	7,700	13,525	-2,200	40%	71.43%	175.65%	15,725
SB - South of Stapleton Road	2005	5,500	7,750	13,300	-2,250	41%	70.97%	171.61%	15,550
NB - South of Eastonville Road	2005	6,550	9,550	17,640	-3,000	46%	68.59%	184.71%	20,640
SB - South of Eastonville Road	2005	6,550	9,600	17,450	-3,050	47%	68.23%	181.77%	20,500
NB - South of Woodmen Road	2005	3,000	5,865	5,500	-2,865	96%	51.15%	93.78%	8,365
SB - South of Woodmen Road	2005	3,000	5,845	5,500	-2,845	95%	51.33%	94.10%	8,345
NB - South of Rolling Thunder Road	2005	4,375	5,865	11,025	-1,490	34%	74.60%	187.98%	12,515
SB - South of Rolling Thunder Road	2005	4,375	5,845	10,910	-1,470	34%	74.85%	186.66%	12,380
NB - South of US 24	2005	3,400	2,600	6,200	800	24%	130.77%	238.46%	7,000
SB - South of US 24	2005	3,400	2,600	6,200	800	24%	130.77%	238.46%	7,000
NB - South of Swingline Road	2005	3,400	2,600	6,200	800	24%	130.77%	238.46%	7,000
SB - South of Swingline Road	2005	3,400	2,600	6,200	800	24%	130.77%	238.46%	7,000
MERIDIAN ROAD AVERAGE		4,371	5,702	9,971	-1,331	43.78%	87.85%	185.84%	11,835
OLD MERIDIAN/ ROLLING THUNDER ROADS									
NB - South of Falcon Highway	2005	800	485	610	315	39%	164.95%	125.77%	925
SB - South of Falcon Highway	2005	800	485	610	315	39%	164.95%	125.77%	925
		800	485	610	315	39.38%	164.95%	125.77%	925

2.4 Development Traffic

2.4.1 Study Area Entitlement Development

For many years, land within the Stapleton Road Extension project area has remained in active farmland, open space, or large lot rural residential uses and as public use land, with very limited retail, commercial, and industrial use. Over the past ten to fifteen years, increasing growth pressures have rapidly changed the landscape of the Stapleton Road Extension study area, and zoning has been introduced to more effectively assist in implementing planned land use in the area.

In 2003, the Stapleton Road Corridor Study identified seven approved development plans within the project area, as shown in **Table 2.2**, below. It was recognized that the build-out of these approved projects, encompassing over 6,700 acres of then undeveloped land, would produce significant impacts to Stapleton Road travelshed traffic volumes and distribution. Several other projects that had not yet advanced through the development plan stage, including the 4-Way Ranch development, were also identified. Many of the developments listed in **Table 2.2** have already been built out, and additional projects, including the 4-Way Ranch development proposal, have advanced through development plan approval.

Table 2.2 Approved Development in the Project Area

Development	Location	Number of Acres	Development Type	Build-out Year
Meridian Ranch	NE quadrant of Meridian and Stapleton roads	2,650	3,266 rural lots schools commercial industrial	2020
Bennett Ranch	SE quadrant of Meridian and Stapleton roads	540	873 single-family lots	2010
Falcon Highlands	West and adjacent to town center of Falcon	822	713 residential units school commercial industrial	2010
Falcon Vista	SE of Meridian Road and US24	50	45 residential lots	2010
Falcon Hills	West of Meridian Road and north of Stapleton Road	800	2,021 residential units schools commercial	2015
Woodmen Hills	NE quadrant of Woodmen and Meridian roads	1,220	1,600 residential units	2005
Elkhorn Estates	SE corner of Raygor and Stapleton roads	640	110 single-family lots	2010

Source: El Paso County Planning Department, 2003.

2.4.2 Stapleton Road Corridor Development

All of the approved development projects, as well as many of the concept-level development proposals that were identified by the Stapleton Road Corridor Study travel model, are accounted for by the current PPACG travel model. However, traffic generated by three recent proposed developments located along the Stapleton Road extension corridor are not specifically included in the PPACG 2035 travel model land use data base. Site-generated traffic for these developments, US 24 Stapleton Parcels, 4-Way Ranch and Waterbury, was incorporated into the analysis based on specific development proposal phasing plans.

2.4.2.1 4-Way Ranch Development

Phased peak hour volumes and distribution for 4-Way Ranch site-generated traffic were estimated based on the approved development plan as shown in **Table 2.3**, below. Institute of Transportation Engineers (ITE) trip generation rates were initially used to calculate site traffic for an interim condition (development Phases 1 & 2) and a build-out condition (development Phases 1, 2, 3, & 4). This calculated information was compared to available traffic study reports (2009, 2010) for the development and updated as indicated. Final estimated site-generated traffic for 2018, 2023 and 2035 was distributed to the study area roadway network in proportion to the distribution of background traffic to alternative off-site ingress and egress routes.

Table 2.3 4-Way Ranch Trip Generation Summary

Phase	Land Use	LU Code	Quantity	AM Rate	PM Rate	AM Peak Hour		PM Peak Hour	
						In	Out	In	Out
Phases 1 & 2	Shopping Center	820	36.5 K SF	1.03	3.75	23	15	66	71
	High Turnover Sit-down Restaurant	932	5.8 K SF	11.52	10.92	35	32	39	25
	Fast Food Restaurant with Drive Thru	934	3 K SF	53.11	10.92	18	17	20	13
	Gas Station with Convenience Store	945	10 VFP	10.06	13.38	50	50	67	67
	Medical Dental Office	720	53.6 K SF	2.48	3.72	105	28	54	146
Phase 1 & 2 Totals						294	203	279	358
Phases 3 & 4	Shopping Center	820	168 K SF	1.03	3.75	106	67	302	328
	Fast Food Restaurant with Drive Thru	934	6 K SF	53.11	34.64	163	156	108	100
	High Turnover Sit-down Restaurant	932	6 K SF	11.52	10.92	36	33	40	26
	Industrial Park	130	35 K SF	0.84	0.86	24	5	6	24
	Condo/Townhouses	230	220 DU	0.24	0.32	8	40	42	22
	Warehousing	150	18 K SF	0.45	0.47	7	1	2	6
Phase 3 & 4 Totals						342	304	501	505
Build-out Total						637	507	780	863

Sources: 1. State Highway Access Permit No. 210010, Located on Highway 24, Milepost 323.72 in El Paso County, p.1; 2. Trip Generation, Institute of Transportation Engineers (ITE), 9th Edition, 2012.

2.4.2.2 US 24 Stapleton Road Parcel

Phased peak hour volumes and distribution for the US 24 Stapleton Road Parcels development site-generated traffic was obtained from the final development traffic study (2005). Short term site-generated traffic was used for 2018 and was factored using a five-year growth factor (between the short term and 2030 traffic study site traffic estimates) for 2023. Traffic study site-generated traffic for 2030 was used for the 2035 planning horizon for this study.

2.4.2.3 Waterbury

A new development proposal for over 1000 residential units to be located along Eastonville Road, east of Stapleton Road was submitted to the County in late 2012, with an update already submitted in 2013. Site-generated traffic for this proposal, not yet approved by the County was not included in analysis for this study. Although primary access is to the west from Eastonville Road, this project would have impacts on Stapleton Road and US 24 traffic that were not accounted for under the north side US 24 access permit that was issued in 2010. Additional US 24 access improvements may be required for this development and/or timing for the committed developer improvements to the US 24 accesses may be revised and/or advanced as a result of this project.

3.0 Traffic Operations Analysis

3.1 Traffic Operations Analysis Methodology

Traffic operations performance was evaluated for two baseline scenarios (existing condition and future “no build” condition), and two future “build” scenarios using Synchro/SimTraffic software. In general, the use of this software involves the development of a Synchro network, adjustment of the model to reflect actual measured conditions to verify the accuracy of the model network, and use of the adjusted model to analyze future-year conditions under various scenarios. For the existing baseline condition, a Synchro model was developed by coding existing geometrics, traffic control conditions, and traffic volumes for each included network intersection. Specifically, this coded data included:

Per Intersection

- Number and type of approach lanes
- Widths of lanes
- Lengths of turn lanes (if applicable)
- Existing traffic volumes
- Existing signal timing parameters (if applicable)
- Percentage of heavy vehicles

Per Link (Roadway Segment)

- Link distances (intersection to intersection)
- Speed limits
- Widths of travel lanes

The analysis used Level of Service (LOS) as defined by the *Highway Capacity Manual 2010* (HCM 2010) to assess how well or how poorly study area intersections and roadway segments function under alternative traffic flow scenarios. The HCM 2010 utilizes measures including operating speed and delay to characterize roadway operations, and uses letter codes ranging from A (excellent, free flow) to F (failing, interrupted flow). Descriptions of conditions associated with each of the individual Levels of Service, by control and or facility type are summarized in **Table 2-1**, **Table 2-2**, and **Table 2-3**.

Once existing data was coded, Synchro/SimTraffic models were used to evaluate intersection level of service (LOS) performance for AM Peak Hour and PM Peak Hour baseline existing conditions. LOS provides a measure of how well an intersection or stretch of roadway functions, or operates, when a specific volume of traffic is present. Synchro traffic operations simulation software implements procedures consistent with those outlined in the nationally recognized Highway Capacity Manual (HCM) [Transportation Research Board, 2010 (HCM2010)].

The HCM utilizes measures, including operating speed and delay (in seconds per vehicle), to characterize roadway and/or intersection traffic operations, which are reported as LOS. Level of service is a qualitative measure of intersection functionality based on average delay experienced at an intersection. Level of service grades range from LOS A to LOS F, where LOS A indicates a free-flow condition with little to no delay, while LOS F is indicative of an unstable breakdown of flow with very high levels of delay. Separate grading scales are used for signalized versus unsignalized intersections. Signalized intersections are given an LOS grade based on overall functionality of the intersection, whereas unsignalized intersections are graded based

on the movement that suffers the most delay, otherwise known as the critical movement (i.e., a left-turning movement from a minor street onto a major street). **Error! Reference source not found., Table 3.2** and **Error! Reference source not found.** illustrate the various grades for unsignalized intersections, signalized intersections, and multilane highways, their corresponding delay per vehicle, and the definition of each Level of Service grade from A through F. The typical minimum acceptable level of service is LOS C, although many urbanized areas allow peak hour LOS D provided that peak hour volumes are not sustained during a significant portion of the day.

Table 3.1 LOS Criteria for Two-Way Stop Controlled Intersections

Level of Service	Expected Delay to Minor Street Traffic	Average Control Delay (sec/veh)
A	Little or no delay	0-10
B	Short traffic delays	>10-15
C	Average traffic delays	>15-25
D	Long traffic delays	>25-35
E	Very long traffic delays	>25-50
F	When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing that may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improving the intersection.	>50

Note: For two-way stop controlled (TWSC) intersections, level of service is determined by the control delay for each minor movement, LOS is not defined for the intersection as a whole. Source: HCM2010, Page 18.6.

Table 3.2 LOS Criteria for Signalized Intersections

Level of Service	Expected Delay to Minor Street Traffic	Average Control Delay (sec/veh)
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may contribute to low delay.	≤ 10
B	Good progression, short cycle lengths, or both. More vehicles stop than with LOS A.	>10 and ≥ 20
C	Fair progression, longer cycle lengths, or both. The number of vehicles stopping is significant, though many still pass through without stopping.	>20 and ≥ 35
D	Longer delays result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop.	>35 and ≥ 55
E	High delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.	>55 and ≥ 80
F	This level often occurs with over saturation when arrival flow rates exceed the capacity of the intersection. Poor progression and long cycle lengths may be major contributing factors to such delays.	>80

Source: HCM2010, Page 19-2.

Table 3.3 Level of Service Criteria for Multilane Highways

Free-Flow Speed	Criteria	A	B	C	D	E
60 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	40
	Average speed (mi/h)	60.0	60.0	59.4	56.7	55.0
	Maximum volume to capacity ratio (v/c)	0.30	0.49	0.70	0.90	1.00
	Maximum service flow rate (pc/h/ln)	660	1080	1550	1980	2200
55 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	41
	Average speed (mi/h)	55.0	55.0	54.9	52.9	51.2
	Maximum volume to capacity ratio (v/c)	0.29	0.47	0.68	0.88	1.00
	Maximum service flow rate (pc/h/ln)	600	990	1430	1850	2100
50 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	43
	Average speed (mi/h)	50.0	50.0	50.0	48.9	47.5
	Maximum volume to capacity ratio (v/c)	0.28	0.45	0.65	0.86	1.00
	Maximum service flow rate (pc/h/ln)	550	900	1300	1710	2000
45 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	45
	Average speed (mi/h)	45.0	45.0	45.0	44.4	42.2
	Maximum volume to capacity ratio (v/c)	0.26	0.43	0.62	0.82	1.00
	Maximum service flow rate (pc/h/ln)	490	810	1170	1550	1900

Source: HCM2010, Pages 14-22 – 14-25.

3.2 Baseline Traffic Operations Analysis

3.2.1 Existing Conditions Baseline

For the existing baseline condition, with the existing roadway network and traffic volumes, most study area intersections operate at a level of service of C or better during both the morning and evening peak hour periods. Exceptions to this are the cross street minor approaches at Rio Lane, Bluegill Road (north and south), and Cotton Tail Trail as shown in **Table 3.4**. At each of these locations, increasing traffic flows, as shown in **Figure 3.1**, reduce gaps in U.S. 24 traffic, creating increasing cross-street approach delay.

Table 3.4 2012 Existing Conditions Traffic Operations¹

Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh] ²	LOS/ Delay (Critical Movement) [sec/veh] ²
Woodmen Road & U.S. 24	B/11.3	A/9.4
Rio Lane & U.S. 24	C/22.5 (NB)	D/29.9 (NB)
South Bluegill Road & U.S. 24	D/25.6 (NB)	D/31.1 (NB)
Cotton Tail Trail & U.S. 24	C/24.6 (NB)	D/29.0 (NB)
North Bluegill Road & U.S. 24	D/25.8 (NB)	D/30.3 (NB)
Judge Orr Road & U.S. 24	B/10.0	A/9.0
Judge Orr Road & Curtis Road	A/9.6 (NB)	A/9.0 (NB)
Falcon Big R & U.S. 24	C/15.3 (NB)	C/17.0 (NB)
Stapleton Road & U.S. 24	B/12.1 (SB LT)	B/12.0 (SB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Figure 3.1 2012 Baseline Existing Condition Peak Hour Traffic Volumes



2012 Existing AM Peak Hour Volumes



2012 Existing PM Peak Hour Volumes

3.2.2 Future No Build Conditions Baseline

For the future no build baseline condition, with the existing roadway network and 2035 future background traffic volumes, the existing Woodmen Road and Judge Orr Road signalized intersections continue to operate at a level of service of C or better during both the morning and evening peak hour periods, as does the stop-controlled Judge Orr Road/Curtis Road intersection. With increased 2035 U.S. 24 traffic volumes, the Stapleton Road/U.S. 24 stop-controlled T-intersection drops to a D/C level of service for the future “no build” condition, as shown in **Table 3.5**. Cross-street minor approaches at Rio Lane, Bluegill Road (north and south), Cotton Tail Trail, and the Big R experience failure, with E/F levels of service. At each of these locations, increasing traffic flows on U.S. 24, as shown in **Figure 3.2**, reduce gaps in U.S. 24 traffic, creating significantly increased cross street delay.

Table 3.5 2035 Future No Build Traffic Operations¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]²	LOS/ Delay (Critical Movement) [sec/veh]²
Woodmen Road & U.S. 24	C/20.8	C/20.3
Rio Lane & U.S. 24	F/103.4 (NB)	F/460.2 (NB)
South Bluegill Drive & U.S. 24	F/103.7 (NB)	F/86.6 (NB)
Cotton Tail Trail & U.S. 24	F/79.5 (NB)	F/82.0 (NB)
North Bluegill Drive & U.S. 24	F/485.4 (NB)	F/138.2 (NB)
Judge Orr Road & U.S. 24	C/32.9	B/17.7
Judge Orr Road & Curtis Road	B/10.4 (NB)	A/9.7 (NB)
Falcon Big R & U.S. 24	E/37.0 (NB)	E/35.2 (NB)
Stapleton Road & U.S. 24	D/27.3 (SB LT)	C/22.7 (SB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Figure 3.2 2035 Baseline Future No Build Condition Peak Hour Traffic Volumes



2035 Future No Build AM Peak Hour Traffic Volumes



2035 Future No Build PM Peak Hour Traffic Volumes

3.3 Future Build Traffic Analysis

3.3.1 Level of Service Analysis

3.3.1.1 Interim Future Build Condition Analysis

Traffic operations were evaluated for two interim build scenarios, one five years in the future (2018), the other ten years in the future (2023).

Five-Year (2018) Interim Build Scenario Analysis

For the 2018 interim build condition, network traffic volumes include 2018 background traffic and “short term” 4-Way Ranch and US 24 Stapleton site-generated development traffic. The modeled roadway network includes a 2-lane Stapleton Road extension, between U.S. 24 and Curtis Road. A short, south side extension of the proposed frontage road connector between Stapleton Road and Judge Orr Road was also added to the modeled network, with access to US 24 for Falcon Big R complex maintained. The completed Stapleton Road/U.S. 24 intersection (with north side access, was signalized, as was the north side Stapleton Road frontage road intersection.

Model results for the interim future build condition show that the Woodmen Road and Judge Orr Road intersections (signalized) would continue to operate at a level of service (LOS) B, as would the Judge Orr Road/Curtis Road intersection (stop-controlled). The completed, full access Stapleton Road/U.S. 24 intersection would need to be signalized and would operate at a LOS B as a signalized intersection, as shown in **Table 3.6**. Combined site-generated and 2018 background traffic volumes for the five-year interim future build scenario are shown in **Figure 3.3**, below. Queue lengths for the 2018 interim build condition were also evaluated, as shown in **Table 3.7**, below, to support identification of required turn bay storage lengths. Full analysis results can be found in **Appendix D**.

Table 3.6 Five-Year (2018) Interim Build Traffic Operations¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]²	LOS/ Delay (Critical Movement) [sec/veh]²
Woodmen Road & U.S. 24	B /15.5	B /19.8
Judge Orr Road & U.S. 24	B /15.3	B /12.5
Stapleton Road & U.S. 24	B /13.9	B /17.9
Stapleton Road/West U.S. 24 Frontage Road	A /8.8	B /14.9
Stapleton Road/East U.S. 24 Frontage Road	B /10.3 (EB LT)	A /8.5 (EB/WB)
Judge Orr Road & Stapleton Road/Curtis Road	B /14.2 (WB LT)	B /11.7 (WB LT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Table 3.7 Five-Year (2018) Interim Build Signalized Intersection Queue Lengths								
Intersection	AM Peak Hour Queue Length (feet) ¹							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	34	-- ²	-- ²	58	-- ²	-- ²	148	53
Judge Orr Road & U.S. 24	m9 ³	-- ²	5	-- ²	124 ⁴	-- ²	14	-- ²
Stapleton Road & U.S. 24	158 ⁴	24	17	26	59	-- ²	97	49
Intersection	PM Peak Hour Queue Length (feet)							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	49	-- ²	-- ²	43	-- ²	-- ²	381 ⁴	32
Judge Orr Road & U.S. 24	M56 ³	-- ²	9	-- ²	62	-- ²	40	-- ²
Stapleton Road & U.S. 24	169	10	6	25	75	-- ²	m149 ³	54

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement. 3. Queue for this movement is metered by an upstream signal. 4. 95th percentile volume exceeds capacity, queue may be longer.

Figure 3.3 2 Five-Year (2018) Interim Build Condition Peak Hour Traffic Volumes



Five-Year (2018) Interim AM Peak Hour Traffic Volumes



Five-Year (2018) Interim PM Peak Hour Traffic Volumes

Ten-Year (2023) Interim Build Scenario Analysis

For the 2023 interim build condition, network traffic volumes include 2023 background traffic and “short term” 4-Way Ranch and US 24 Stapleton site-generated development traffic that has been factored up to 2023 levels using a five-year growth factor. The modeled roadway network includes Stapleton Road, between U.S. 24 and Curtis Road, as an interim, 2-lane roadway. The proposed south side frontage road connector, extended south to Judge Orr Road, has also added to the modeled network. As for the 2018 interim future build scenario, the Stapleton Road/U.S. 24 intersection was signalized, as was the north side Stapleton Road frontage road intersection. Additional network upgrades, include reconfiguration of the Judge Orr signalized intersection to Bluegill Road and construction of the south side frontage road between Rio Lane and Woodmen Road.

Model results for the interim future build condition show that the Woodmen Road and Judge Orr Road intersections (signalized) would continue to operate at a level of service of C or better, as would the Judge Orr Road/Curtis Road intersection (stop-controlled). The full access Stapleton Road/U.S. 24 intersection would operate at a LOS B as a signalized intersection, as shown in **Table 3.8**. Combined site-generated and 2023 background traffic volumes for the five-year interim future build scenario are shown in **Figure 3.4**, below. Queue lengths for the 2023 interim build condition were also evaluated to support identification of required turn bay storage lengths. Queue analysis findings are summarized in **Table 3.9**, below. Full analysis results can be found in **Appendix D**.

Table 3.8 Ten-Year (2023) Interim Build Traffic Operations¹		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]²	LOS/ Delay (Critical Movement) [sec/veh]²
Woodmen Road & U.S. 24	B /14.5	C /21.3
Judge Orr Road & U.S. 24	B /19.4	B /14.0
Stapleton Road & U.S. 24	B /15.5	B /19.0
Stapleton Road/West U.S. 24 Frontage Road	A /9.7	B /14.4
Stapleton Road/East U.S. 24 Frontage Road	B /11.2 (EB LT)	B /11.2 (EB LT)
Judge Orr Road & Stapleton Road/Curtis Road	C /15.3 (ER Thru/RT)	B /12.4 (EB Thru/RT)

Notes: 1. Full analysis results can be found in Appendix C. 2. Per HCM2010; Signalized intersection LOS is based on overall intersection delay; Stop-controlled intersection LOS is based on delay for critical movement.

Table 3.9 Ten-Year (2023) Interim Build Signalized Intersection Queue Lengths								
Intersection	AM Peak Hour Queue Length (feet) ⁵							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	40	-- ²	-- ²	m11 ⁴	-- ²	-- ²	167	79
Judge Orr Road & U.S. 24	m26 ³	-- ²	7	-- ²	138 ⁴	-- ²	10	146
Stapleton Road & U.S. 24	200 ⁴	22	7	27	58	17	85	40
Intersection	PM Peak Hour Queue Length (feet)							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	78 ⁴	-- ²	-- ²	54	-- ²	-- ²	418 ⁴	32
Judge Orr Road & U.S. 24	78	-- ²	7	-- ²	68	-- ²	31	53
Stapleton Road & U.S. 24	214 ⁴	13	19	31	45	12	120	54

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement. 3. Queue for this movement is metered by an upstream signal. 4. 95th percentile volume exceeds capacity, queue may be longer. 5. Full analysis can be found in Appendix D

Figure 3.4 Ten-Year (2023) Interim Build Condition Peak Hour Traffic Volumes



Ten-Year (2023) Interim AM Peak Hour Traffic Volumes



Ten-Year (2023) Interim PM Peak Hour Traffic Volumes

3.3.1.2 Ultimate Build Condition Analysis

For the ultimate future build condition, modeled traffic volumes include 2035 background traffic volumes and 2030 build-out of the US 24 Stapleton Road Parcels and 4-Way Ranch site traffic. The ultimate future build roadway network includes a 4-lane Stapleton Road connection between Meridian Road and The Curtis Road/Judge Orr intersection, the full proposed frontage road network, reconfiguration of the Judge Orr signalized intersection to Bluegill Road, construction of a fourth leg at Woodmen Road, with connection to Rio Lane, and signalization, upgrade of the signalized U.S. 24/Stapleton Road intersection, and widening of US 24 to four lanes, two in each direction, through the study corridor (Woodmen Road to Stapleton Road).

For the ultimate future build condition, the Woodmen Road and Judge Orr Road signalized intersections would operate at a level of service of C or better during both the morning and evening peak hour periods, as does the stop-controlled Judge Orr Road/Curtis Road intersection. The full access, four-leg Stapleton Road/U.S. 24 intersection would operate at a LOS B as a signalized intersection, as shown in **Table 3.8**, below. Combined 2035 site-generated and 2035 background traffic volumes for the ultimate future build scenario are shown in **Figure 3.5**, below.

Queue lengths were also evaluated to support identification of required turn bay storage lengths. Queue analysis findings are summarized in **Table 3.9**, below. Full analysis results can be found in **Appendix D**.

Table 3.8 Ultimate Build Traffic Operations		
Intersection	AM Peak Hour	PM Peak Hour
	LOS/ Delay (Critical Movement) [sec/veh]¹	LOS/ Delay (Critical Movement) [sec/veh]¹
Woodmen Road & U.S. 24	C /21.2	B /18.4
Judge Orr Road & U.S. 24	C /34.5	B /17.5
Stapleton Road & U.S. 24	B /18.7	C /23.0
Stapleton Road/West U.S. 24 Frontage Road	A /9.4	B /11.5
Stapleton Road/East U.S. 24 Frontage Road	B /13.4	B /10.4
Judge Orr Road & Curtis Road	C /19.8 (EB RT)	B /14.8 (EB LT)

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement. 3. Queue for this movement is metered by an upstream signal.

Table 3.9 2035 Ultimate Build Signalized Intersection Queue Lengths								
Intersection	AM Peak Hour Queue Length (feet) ¹							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	245 ³	32	-- ²	-- ²	160 ³	-- ²	-- ²	m8 ⁴
Judge Orr Road & U.S. 24	-- ²	-- ²	-- ²	-- ²	77 ³	-- ²	16	-- ²
Stapleton Road & U.S. 24	96	-- ²	63	-- ²	204 ³	17	25	29
Intersection	PM Peak Hour Queue Length (feet)							
	EBL	EBR	WBL	WBR	NBL	NBR	SBL	SBR
Woodmen Road & U.S. 24	395 ³	70	-- ²	-- ²	117 ³	-- ²	-- ²	38
Judge Orr Road & U.S. 24	-- ²	-- ²	-- ²	-- ²	m61 ³	-- ²	33	-- ²
Stapleton Road & U.S. 24	m125 ⁴	-- ²	150 ³	-- ²	174	21	40	31

Notes: 1. Modeled Synchro queue length 95th percentile (feet). 2. Turn bay does not exist for this movement or queue does not exist due to free-flow condition. 3. Queue exceeds capacity and may be longer. 4. Queue for this movement is metered by an upstream signal.

Figure 3.5 2035 Ultimate Future Build Condition Peak Hour Traffic Volumes



2035 Future Build AM Peak Hour Traffic Volumes



2035 Future Build PM Peak Hour Traffic Volumes

3.3.2 Signal Progression Analysis

3.3.2.1 U.S. 24 Corridor Signal Progression

The proposed Stapleton Road intersection would be located over a mile (6840 feet) east of the existing Judge Orr Road signalized intersection. The existing Woodmen Road signalized intersection is located 8590 feet to the west of the Judge Orr Road signalized intersection. The ultimate configuration, per the U.S. 24 Access Control Plan (2005), will shift the Judge Orr Road signal to the current location of the North Bluegill Drive intersection (west of the Judge Orr Road intersection). This will shift spacing among the three intersections by approximately 190 feet, to 8400 feet between the Woodmen Road and Judge Orr/Bluegill Drive signal and 7030 feet between the relocated Judge Orr/Bluegill Drive signal and the proposed Stapleton Road signal.

Passer II-90 was used to assess signal progression efficiency for the U.S. 24 Corridor for signalization of the Stapleton Road intersection together with the Woodmen Road and Judge Orr Road intersections. The results of that analysis, as summarized below in **Table 4.4**, show that US Highway 24 progression efficiencies ranging from 27% to 40% can be achieved for the proposed signalized intersection configuration with 2035 traffic volumes. These results place the progression in “good” to “great” signal progression efficiency rating categories.

Table 3.10 2035 Build Signal Progression		
U.S. 24 Corridor Signal Progression³		
Peak Hour Period	Signal Progression Efficiency	
	Efficiency ¹	Attainability ²
AM Peak Hour	0.37	0.77
PM Peak Hour	0.27	1.00
Notes: 1) Efficiency: 0.00 - 0.12 - "POOR PROGRESSION" 0.13 - 0.24 - "FAIR PROGRESSION" 0.25 - 0.36 - "GOOD PROGRESSION" 0.37 - 1.00 - "GREAT PROGRESSION" 2) Attainability: 1.00 - 0.99 - "INCREASE MIN THRU PHASE" 0.99 - 0.70 - "FINE-TUNING NEEDED" 0.69 - 0.00 - "MAJOR CHANGES NEEDED" 3) The State of Colorado Access Control Code design criteria call for a minimum 40% (.40) progression efficiency. The progression efficiency result for the proposed Stapleton Road/U.S. 24 signal is 0.37 for the AM peak hour and 27% (.27) for the PM peak hour. These results place the progression in “good” to “great” signal progression efficiency rating categories.		

3.3.2.2 Stapleton Road Corridor Signal Progression

Signal progression analysis was conducted for the 2003 Stapleton Road Corridor Study as a means to compare alternative access concepts and to illustrate a full range of possible approaches to providing access and a local road network. The analysis results for the selected alternative, included in both the Stapleton Road Access Control Plan and the U.S. 24 Access Control Plan, are shown in **Table 3.11**, below. The selected alternative includes frontage roads elements, on both sides of U.S. 24, and employs Stapleton Road

"shadow" signals coordinated with U.S. 24 signals at Judge Orr Road/ Blue Gill Road and Stapleton Road. The State Access Code requires that 35% signal progression efficiency be achieved when implementing access spacing at intervals less than specified by the Access Code. On County facilities, 30% progression efficiency is required for "shadow signal" installations. Signal progression efficiency measures the degree to which a motorist is able to pass through downstream signals on green, without having to stop. Fatal flaws feasibility signal progression analysis assumed "worst-case" development intensity adjacent to US 24/ Stapleton Road.

Table 3.11 Stapleton Road – Curtis Road Corridor Signal Progression Analysis						
Access Concept Description	AM Peak Hour			PM Peak Hour		
	Distance to Frontage Roads	Efficiency	Cycle Length	Distance to Frontage Roads	Efficiency	Cycle Length
Local access to the west and east of US 24 is provided via frontage roads. On the east, the frontage road extends between Judge Orr and Stapleton Roads. "Shadow" signals control access to Judge Orr and Stapleton Roads from the frontage roads. On the west, the frontage road does not extend south to Judge Orr Road.	300/300 feet	35%	60	300/300 feet	27%	60
	350/350 feet	35%	60	350/350 feet	26%	60
	400/400 feet	35%	60	400/400 feet	25%	60
	450/450 feet	35%	60	450/450 feet	25%	60
	500/500 feet	35%	60	500/500 feet	25%	60
	550/550 feet	35%	60	550/550 feet	25%	60
	600/600 feet	35%	60			

Appendix A:
Automatic Traffic Recorder/ADT Count Data

Volume			
Start Date: 12/18/2012			
Start Time: 12:00:00 AM			
Site Code: 5			
Station ID: 5			
Location 1: JUDGE ORR RD E/O US 24			
Date	Time	EB	WB
12/18/2012	12:00 AM	1	1
12/18/2012	12:15 AM	1	0
12/18/2012	12:30 AM	2	0
12/18/2012	12:45 AM	1	0
12/18/2012	01:00 AM	2	1
12/18/2012	01:15 AM	0	0
12/18/2012	01:30 AM	0	0
12/18/2012	01:45 AM	1	0
12/18/2012	02:00 AM	0	1
12/18/2012	02:15 AM	0	1
12/18/2012	02:30 AM	0	0
12/18/2012	02:45 AM	0	1
12/18/2012	03:00 AM	0	1
12/18/2012	03:15 AM	0	1
12/18/2012	03:30 AM	1	1
12/18/2012	03:45 AM	2	1
12/18/2012	04:00 AM	1	1
12/18/2012	04:15 AM	2	2
12/18/2012	04:30 AM	1	3
12/18/2012	04:45 AM	6	7
12/18/2012	05:00 AM	4	8
12/18/2012	05:15 AM	10	15
12/18/2012	05:30 AM	10	13
12/18/2012	05:45 AM	14	16
12/18/2012	06:00 AM	24	26
12/18/2012	06:15 AM	38	29
12/18/2012	06:30 AM	47	32
12/18/2012	06:45 AM	39	46
12/18/2012	07:00 AM	56	55
12/18/2012	07:15 AM	41	57
12/18/2012	07:30 AM	45	51
12/18/2012	07:45 AM	35	31
12/18/2012	08:00 AM	34	35
12/18/2012	08:15 AM	22	24
12/18/2012	08:30 AM	17	27
12/18/2012	08:45 AM	23	23
12/18/2012	09:00 AM	14	22
12/18/2012	09:15 AM	20	21
12/18/2012	09:30 AM	20	25
12/18/2012	09:45 AM	14	26
12/18/2012	10:00 AM	19	22
12/18/2012	10:15 AM	14	18
12/18/2012	10:30 AM	16	28
12/18/2012	10:45 AM	24	24
12/18/2012	11:00 AM	18	26
12/18/2012	11:15 AM	21	20
12/18/2012	11:30 AM	15	23
12/18/2012	11:45 AM	23	23

Volume			
Start Date: 12/18/2012			
Start Time: 12:00:00 AM			
Site Code: 5			
Station ID: 5			
Location 1: JUDGE ORR RD E/O US 24			
Date	Time	EB	WB
12/18/2012	12:00 PM	20	22
12/18/2012	12:15 PM	19	30
12/18/2012	12:30 PM	20	20
12/18/2012	12:45 PM	28	25
12/18/2012	01:00 PM	25	25
12/18/2012	01:15 PM	17	14
12/18/2012	01:30 PM	22	13
12/18/2012	01:45 PM	18	20
12/18/2012	02:00 PM	12	23
12/18/2012	02:15 PM	18	29
12/18/2012	02:30 PM	25	22
12/18/2012	02:45 PM	45	42
12/18/2012	03:00 PM	26	30
12/18/2012	03:15 PM	27	41
12/18/2012	03:30 PM	53	34
12/18/2012	03:45 PM	38	53
12/18/2012	04:00 PM	45	32
12/18/2012	04:15 PM	51	48
12/18/2012	04:30 PM	35	56
12/18/2012	04:45 PM	37	48
12/18/2012	05:00 PM	43	64
12/18/2012	05:15 PM	30	32
12/18/2012	05:30 PM	49	53
12/18/2012	05:45 PM	51	38
12/18/2012	06:00 PM	36	24
12/18/2012	06:15 PM	22	23
12/18/2012	06:30 PM	26	12
12/18/2012	06:45 PM	24	17
12/18/2012	07:00 PM	21	8
12/18/2012	07:15 PM	19	5
12/18/2012	07:30 PM	21	5
12/18/2012	07:45 PM	17	3
12/18/2012	08:00 PM	14	3
12/18/2012	08:15 PM	20	4
12/18/2012	08:30 PM	14	3
12/18/2012	08:45 PM	11	5
12/18/2012	09:00 PM	15	0
12/18/2012	09:15 PM	8	3
12/18/2012	09:30 PM	6	4
12/18/2012	09:45 PM	11	5
12/18/2012	10:00 PM	8	6
12/18/2012	10:15 PM	5	3
12/18/2012	10:30 PM	4	4
12/18/2012	10:45 PM	6	1
12/18/2012	11:00 PM	7	2
12/18/2012	11:15 PM	3	1
12/18/2012	11:30 PM	4	2
12/18/2012	11:45 PM	1	2

Volume				
Start Date: 12/18/2012				
Start Time: 12:00:00 AM				
Site Code: 6				
Station ID: 6				
Location 1: CURTIS RD S/O JUDGE ORR RD				
Date	Time	NB	SB	
12/18/2012	12:00 AM	0	0	
12/18/2012	12:15 AM	0	0	
12/18/2012	12:30 AM	0	0	
12/18/2012	12:45 AM	1	0	
12/18/2012	01:00 AM	0	1	
12/18/2012	01:15 AM	0	0	
12/18/2012	01:30 AM	0	0	
12/18/2012	01:45 AM	0	0	
12/18/2012	02:00 AM	1	0	
12/18/2012	02:15 AM	1	0	
12/18/2012	02:30 AM	0	0	
12/18/2012	02:45 AM	0	0	
12/18/2012	03:00 AM	0	1	
12/18/2012	03:15 AM	0	0	
12/18/2012	03:30 AM	1	0	
12/18/2012	03:45 AM	0	0	
12/18/2012	04:00 AM	0	2	
12/18/2012	04:15 AM	0	2	
12/18/2012	04:30 AM	1	0	
12/18/2012	04:45 AM	2	9	
12/18/2012	05:00 AM	0	6	
12/18/2012	05:15 AM	1	10	
12/18/2012	05:30 AM	0	10	
12/18/2012	05:45 AM	6	18	
12/18/2012	06:00 AM	8	23	
12/18/2012	06:15 AM	9	35	
12/18/2012	06:30 AM	6	44	
12/18/2012	06:45 AM	12	52	
12/18/2012	07:00 AM	27	46	
12/18/2012	07:15 AM	24	44	
12/18/2012	07:30 AM	18	57	
12/18/2012	07:45 AM	7	27	
12/18/2012	08:00 AM	7	28	
12/18/2012	08:15 AM	8	15	
12/18/2012	08:30 AM	9	16	
12/18/2012	08:45 AM	4	8	
12/18/2012	09:00 AM	8	11	
12/18/2012	09:15 AM	1	10	
12/18/2012	09:30 AM	7	4	
12/18/2012	09:45 AM	7	7	
12/18/2012	10:00 AM	3	5	
12/18/2012	10:15 AM	5	1	
12/18/2012	10:30 AM	6	6	
12/18/2012	10:45 AM	6	8	
12/18/2012	11:00 AM	9	7	
12/18/2012	11:15 AM	10	9	
12/18/2012	11:30 AM	7	8	
12/18/2012	11:45 AM	4	5	

Volume				
Start Date: 12/18/2012				
Start Time: 12:00:00 AM				
Site Code: 6				
Station ID: 6				
Location 1: CURTIS RD S/O JUDGE ORR RD				
Date	Time	NB	SB	
12/18/2012	12:00 PM	3	3	
12/18/2012	12:15 PM	13	6	
12/18/2012	12:30 PM	6	8	
12/18/2012	12:45 PM	9	7	
12/18/2012	01:00 PM	3	7	
12/18/2012	01:15 PM	5	5	
12/18/2012	01:30 PM	4	6	
12/18/2012	01:45 PM	10	6	
12/18/2012	02:00 PM	9	4	
12/18/2012	02:15 PM	10	3	
12/18/2012	02:30 PM	14	8	
12/18/2012	02:45 PM	21	11	
12/18/2012	03:00 PM	23	21	
12/18/2012	03:15 PM	29	14	
12/18/2012	03:30 PM	31	11	
12/18/2012	03:45 PM	38	9	
12/18/2012	04:00 PM	21	8	
12/18/2012	04:15 PM	37	13	
12/18/2012	04:30 PM	42	10	
12/18/2012	04:45 PM	43	12	
12/18/2012	05:00 PM	55	11	
12/18/2012	05:15 PM	27	13	
12/18/2012	05:30 PM	42	12	
12/18/2012	05:45 PM	23	8	
12/18/2012	06:00 PM	15	9	
12/18/2012	06:15 PM	13	3	
12/18/2012	06:30 PM	1	4	
12/18/2012	06:45 PM	8	6	
12/18/2012	07:00 PM	5	4	
12/18/2012	07:15 PM	3	1	
12/18/2012	07:30 PM	2	2	
12/18/2012	07:45 PM	2	2	
12/18/2012	08:00 PM	2	4	
12/18/2012	08:15 PM	1	4	
12/18/2012	08:30 PM	2	5	
12/18/2012	08:45 PM	3	2	
12/18/2012	09:00 PM	0	4	
12/18/2012	09:15 PM	3	3	
12/18/2012	09:30 PM	2	2	
12/18/2012	09:45 PM	2	0	
12/18/2012	10:00 PM	1	1	
12/18/2012	10:15 PM	4	0	
12/18/2012	10:30 PM	2	1	
12/18/2012	10:45 PM	0	1	
12/18/2012	11:00 PM	1	2	
12/18/2012	11:15 PM	0	0	
12/18/2012	11:30 PM	0	0	
12/18/2012	11:45 PM	1	0	

Volume				
Start Date: 12/18/2012				
Start Time: 12:00:00 AM				
Site Code: 7				
Station ID: 7				
Location 1: STAPLETON DR E/O EASTONVILLE RD				
Date	Time	EB	WB	
12/18/2012	12:00 AM	0	0	
12/18/2012	12:15 AM	0	0	
12/18/2012	12:30 AM	0	0	
12/18/2012	12:45 AM	0	0	
12/18/2012	01:00 AM	0	0	
12/18/2012	01:15 AM	0	0	
12/18/2012	01:30 AM	0	0	
12/18/2012	01:45 AM	0	0	
12/18/2012	02:00 AM	0	0	
12/18/2012	02:15 AM	0	0	
12/18/2012	02:30 AM	0	0	
12/18/2012	02:45 AM	0	0	
12/18/2012	03:00 AM	1	1	
12/18/2012	03:15 AM	0	0	
12/18/2012	03:30 AM	0	0	
12/18/2012	03:45 AM	0	0	
12/18/2012	04:00 AM	0	0	
12/18/2012	04:15 AM	1	0	
12/18/2012	04:30 AM	0	0	
12/18/2012	04:45 AM	1	0	
12/18/2012	05:00 AM	0	2	
12/18/2012	05:15 AM	0	1	
12/18/2012	05:30 AM	4	0	
12/18/2012	05:45 AM	1	1	
12/18/2012	06:00 AM	3	0	
12/18/2012	06:15 AM	5	1	
12/18/2012	06:30 AM	3	4	
12/18/2012	06:45 AM	6	11	
12/18/2012	07:00 AM	11	25	
12/18/2012	07:15 AM	10	49	
12/18/2012	07:30 AM	10	7	
12/18/2012	07:45 AM	2	6	
12/18/2012	08:00 AM	6	4	
12/18/2012	08:15 AM	4	6	
12/18/2012	08:30 AM	5	3	
12/18/2012	08:45 AM	2	1	
12/18/2012	09:00 AM	1	3	
12/18/2012	09:15 AM	5	5	
12/18/2012	09:30 AM	4	5	
12/18/2012	09:45 AM	4	4	
12/18/2012	10:00 AM	1	3	
12/18/2012	10:15 AM	2	1	
12/18/2012	10:30 AM	4	6	
12/18/2012	10:45 AM	6	4	
12/18/2012	11:00 AM	5	5	
12/18/2012	11:15 AM	7	6	
12/18/2012	11:30 AM	3	2	
12/18/2012	11:45 AM	2	4	

Volume				
Start Date: 12/18/2012				
Start Time: 12:00:00 AM				
Site Code: 7				
Station ID: 7				
Location 1: STAPLETON DR E/O EASTONVILLE RD				
Date	Time	EB	WB	
12/18/2012	12:00 PM	3	4	
12/18/2012	12:15 PM	4	5	
12/18/2012	12:30 PM	4	3	
12/18/2012	12:45 PM	3	5	
12/18/2012	01:00 PM	3	7	
12/18/2012	01:15 PM	0	6	
12/18/2012	01:30 PM	4	6	
12/18/2012	01:45 PM	4	5	
12/18/2012	02:00 PM	7	4	
12/18/2012	02:15 PM	7	8	
12/18/2012	02:30 PM	4	15	
12/18/2012	02:45 PM	13	11	
12/18/2012	03:00 PM	8	13	
12/18/2012	03:15 PM	10	12	
12/18/2012	03:30 PM	6	11	
12/18/2012	03:45 PM	9	10	
12/18/2012	04:00 PM	8	6	
12/18/2012	04:15 PM	11	10	
12/18/2012	04:30 PM	13	10	
12/18/2012	04:45 PM	7	10	
12/18/2012	05:00 PM	7	12	
12/18/2012	05:15 PM	8	10	
12/18/2012	05:30 PM	4	9	
12/18/2012	05:45 PM	9	9	
12/18/2012	06:00 PM	2	8	
12/18/2012	06:15 PM	5	3	
12/18/2012	06:30 PM	6	2	
12/18/2012	06:45 PM	2	4	
12/18/2012	07:00 PM	0	4	
12/18/2012	07:15 PM	5	2	
12/18/2012	07:30 PM	2	3	
12/18/2012	07:45 PM	5	3	
12/18/2012	08:00 PM	2	5	
12/18/2012	08:15 PM	3	0	
12/18/2012	08:30 PM	0	3	
12/18/2012	08:45 PM	3	0	
12/18/2012	09:00 PM	2	2	
12/18/2012	09:15 PM	2	1	
12/18/2012	09:30 PM	1	1	
12/18/2012	09:45 PM	0	2	
12/18/2012	10:00 PM	1	2	
12/18/2012	10:15 PM	1	0	
12/18/2012	10:30 PM	0	0	
12/18/2012	10:45 PM	0	1	
12/18/2012	11:00 PM	1	1	
12/18/2012	11:15 PM	0	0	
12/18/2012	11:30 PM	2	0	
12/18/2012	11:45 PM	0	0	

Appendix B: Turning Movement Count Data

File Name:	W:\NATHAN TMCSI\2012\STAPLETON EXT 12-2012\2 HOUR#1 US24&WOODMANAM.ppd															
Start Date:	12/18/2012															
Start Time:	7:00:00 AM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	US 24 Southbound				WOODMAN RD Westbound				US 24 Northbound				WOODMAN RD Eastbound			
Start Time	Right	Thru	Left	Other	Right	Thru	Left	Other	Right	Thru	Left	Other	Right	Thru	Left	Other
07:00 AM	99	128	0	0	0	0	0	0	0	28	45	0	89	0	43	0
07:15 AM	99	108	0	0	0	0	0	0	0	38	56	0	81	0	38	0
07:30 AM	87	107	0	0	0	0	0	0	0	33	58	0	66	0	52	0
07:45 AM	67	84	0	0	0	0	0	0	0	38	59	0	71	0	55	0
	352	427	0	0	0	0	0	0	0	137	218	0	307	0	188	0
08:00 AM	70	80	0	0	0	0	0	0	0	30	39	0	53	0	34	0
08:15 AM	68	68	0	0	0	0	0	0	0	23	51	0	70	0	34	0
08:30 AM	85	71	0	0	0	0	0	0	0	36	50	0	43	0	39	0
08:45 AM	64	61	0	0	0	0	0	0	0	24	22	0	43	0	45	0
	287	280	0	0	0	0	0	0	0	113	162	0	209	0	152	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#2 US24&JUDGEORRAM.ppd															
Start Date:	12/18/2012															
Start Time:	7:00:00 AM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	US 24 Southbound				JUDGE ORR RD Westbound				US 24 Northbound				JUDGE ORR RD Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
07:00 AM	6	111	2	0	16	9	32	0	6	38	14	0	41	49	4	0
07:15 AM	3	118	3	0	12	10	31	0	5	42	10	0	43	39	1	0
07:30 AM	1	106	3	0	4	13	22	0	12	51	13	0	45	29	1	0
07:45 AM	0	89	1	0	5	7	23	0	9	42	5	0	28	24	2	0
	10	424	9	0	37	39	108	0	32	173	42	0	157	141	8	0
08:00 AM	0	83	3	0	1	8	29	0	11	44	10	0	25	21	1	0
08:15 AM	2	98	2	0	2	3	15	0	9	28	5	0	19	11	2	0
08:30 AM	2	96	1	0	1	10	18	0	7	44	6	0	14	10	6	0
08:45 AM	3	72	0	0	0	2	20	0	15	49	5	0	17	6	3	0
	7	349	6	0	4	23	82	0	42	165	26	0	75	48	12	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#3 CURTIS&JUDGEORRAM.ppd															
Start Date:	12/18/2012															
Start Time:	7:00:00 AM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	CURTIS RD Southbound				JUDGE ORR RD Westbound				CURTIS RD Northbound				JUDGE ORR RD Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
07:00 AM	0	0	0	0	0	22	10	0	0	0	26	1	43	6	0	0
07:15 AM	0	0	0	0	0	32	8	0	0	0	24	0	38	6	0	0
07:30 AM	0	0	0	0	0	29	9	0	0	0	18	0	40	3	0	0
07:45 AM	0	0	0	0	0	26	5	0	0	0	7	0	25	7	0	0
	0	0	0	0	0	109	32	0	0	0	75	1	146	22	0	0
08:00 AM	0	0	0	0	0	20	4	0	2	0	5	1	20	9	0	0
08:15 AM	0	0	0	0	0	13	2	0	1	0	6	0	13	5	0	0
08:30 AM	0	0	0	0	0	15	2	0	0	0	10	0	10	3	0	0
08:45 AM	0	0	0	0	0	13	0	0	0	0	5	0	9	5	0	0
	0	0	0	0	0	61	8	0	3	0	26	1	52	22	0	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#4 EASTONVILLE&STAPLETONAM.ppd															
Start Date:	12/18/2012															
Start Time:	7:00:00 AM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	EASTONVILLE RD Southbound				STAPLETON DR Westbound				EASTONVILLE RD Northbound				STAPLETON DR Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
07:00 AM	63	62	6	0	30	5	0	0	0	175	1	0	3	1	65	0
07:15 AM	95	68	7	0	28	0	2	0	2	132	2	0	2	3	51	0
07:30 AM	30	26	4	0	3	5	0	0	1	7	7	0	2	4	5	0
07:45 AM	2	6	0	0	0	5	2	0	0	5	0	0	2	0	7	0
	190	162	17	0	61	15	4	0	3	319	10	0	9	8	128	0
08:00 AM	1	9	1	0	2	1	0	0	0	13	3	0	1	6	19	0
08:15 AM	3	10	2	0	1	4	0	0	1	7	1	0	1	2	11	0
08:30 AM	2	2	0	0	0	1	1	0	0	2	1	0	1	4	1	0
08:45 AM	0	3	0	0	0	1	0	0	0	8	1	0	0	1	1	0
	6	24	3	0	3	7	1	0	1	30	6	0	3	13	32	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#1 US24&WOODMANPM.ppd															
Start Date:	12/18/2012															
Start Time:	4:00:00 PM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	US 24 Southbound				WOODMAN RD Westbound				US 24 Northbound				WOODMAN RD Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
04:00 PM	75	61	0	0	0	0	0	0	0	72	73	0	44	0	115	0
04:15 PM	87	41	0	0	0	0	0	0	0	100	104	0	36	0	112	0
04:30 PM	86	53	0	0	0	0	0	0	0	92	79	0	40	0	111	0
04:45 PM	69	50	0	0	0	0	0	0	0	105	92	0	39	0	110	0
	317	205	0	0	0	0	0	0	0	369	348	0	159	0	448	0
05:00 PM	69	47	0	0	0	0	0	0	0	112	90	0	48	0	122	0
05:15 PM	55	54	0	0	0	0	0	0	0	101	78	0	50	0	120	0
05:30 PM	59	40	0	0	0	0	0	0	0	101	73	0	35	0	144	0
05:45 PM	53	30	0	0	0	0	0	0	0	91	64	0	30	0	111	0
	236	171	0	0	0	0	0	0	0	405	305	0	163	0	497	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#2 US24&JUDGEORRPM.ppd															
Start Date:	12/18/2012															
Start Time:	4:00:00 PM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	US 24 Southbound				JUDGE ORR RD Westbound				US 24 Northbound				JUDGE ORR RD Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
04:00 PM	1	87	7	0	4	12	16	0	29	113	23	0	11	8	11	0
04:15 PM	7	64	5	0	8	27	17	0	27	101	41	0	17	16	10	0
04:30 PM	2	89	9	0	5	24	25	0	24	93	27	0	14	6	7	0
04:45 PM	1	74	5	0	2	30	16	0	25	132	34	0	3	7	9	0
	11	314	26	0	19	93	74	0	105	439	125	0	45	37	37	0
05:00 PM	5	60	0	0	5	38	27	0	30	119	41	0	10	13	5	0
05:15 PM	4	64	1	0	2	17	15	0	21	120	27	0	20	8	9	0
05:30 PM	4	54	2	0	5	28	19	0	32	153	38	0	12	14	4	0
05:45 PM	1	43	3	0	1	17	14	0	40	136	30	0	8	10	9	0
	14	221	6	0	13	100	75	0	123	528	136	0	50	45	27	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#3 CURTIS&JUDGEORRPM.ppd															
Start Date:	12/18/2012															
Start Time:	4:00:00 PM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	CURTIS RD Southbound				JUDGE ORR RD Westbound				CURTIS RD Northbound				JUDGE ORR RD Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
04:00 PM	0	0	0	0	0	9	1	0	3	0	19	1	11	28	0	0
04:15 PM	0	0	0	0	0	15	2	0	7	0	31	0	8	32	0	0
04:30 PM	0	0	0	0	0	16	3	0	8	0	32	0	6	23	0	0
04:45 PM	0	0	0	0	0	7	2	0	6	0	43	0	9	25	0	0
	0	0	0	0	0	7	2	0	6	0	43	0	9	25	0	0
05:00 PM	0	0	0	0	0	13	0	0	8	0	42	1	11	36	0	0
05:15 PM	0	0	0	0	0	8	3	0	4	0	24	0	11	16	0	0
05:30 PM	0	0	0	0	0	13	2	0	5	0	35	0	9	33	0	0
05:45 PM	0	0	0	0	0	9	1	0	3	0	17	0	8	37	0	0
	0	0	0	0	0	9	1	0	3	0	17	0	8	37	0	0

File Name:	W:\NATHAN TMCS\2012\STAPLETON EXT 12-2012\2 HOUR\#4 EASTONVILLE&STAPLETONPM.ppd															
Start Date:	12/18/2012															
Start Time:	4:00:00 PM															
Site Code:	00000000															
Comment 1:	Default Comments															
Comment 2:	Change These in The Preferences Window															
Comment 3:	Select File/Preference in the Main Scree															
Comment 4:	Then Click the Comments Tab															
	EASTONVILLE RD Southbound				STAPLETON DR Westbound				EASTONVILLE RD Northbound				STAPLETON DR Eastbound			
Start Time	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other	Rght	Thru	Left	Other
04:00 PM	24	19	4	0	3	3	0	0	3	9	1	0	0	5	8	0
04:15 PM	9	9	2	0	3	7	1	0	2	12	1	0	1	8	11	0
04:30 PM	21	14	2	0	4	5	0	0	0	7	3	0	2	8	4	0
04:45 PM	14	18	0	0	3	5	1	0	2	13	4	0	0	3	12	0
05:00 PM	15	15	1	1	2	11	1	0	2	9	2	0	1	7	12	0
05:15 PM	19	29	1	0	5	3	0	0	1	17	3	0	1	3	21	0
05:30 PM	19	24	4	0	5	5	1	0	0	15	4	0	1	2	18	0
05:45 PM	12	11	2	0	4	1	1	0	1	18	2	0	1	3	17	0

Appendix C: Traffic Operations Model Output/Results

2012 Existing Conditions – AM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

2012 AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	305	190	220	135	345	420
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.42	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1518	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	332	207	239	147	375	457
RTOR Reduction (vph)	0	111	0	0	0	303
Lane Group Flow (vph)	332	96	239	147	375	154
Turn Type	Perm		Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	18.5	18.5	13.5	13.5	13.5	13.5
Effective Green, g (s)	18.5	18.5	13.5	13.5	13.5	13.5
Actuated g/C Ratio	0.46	0.46	0.34	0.34	0.34	0.34
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	819	732	512	629	629	534
v/s Ratio Prot	c0.19			0.08	c0.20	
v/s Ratio Perm		0.06	0.16			0.10
v/c Ratio	0.41	0.13	0.47	0.23	0.60	0.29
Uniform Delay, d1	7.1	6.2	10.4	9.5	11.0	9.7
Progression Factor	1.00	1.00	1.00	1.00	1.03	1.50
Incremental Delay, d2	1.5	0.4	0.7	0.2	1.4	0.3
Delay (s)	8.6	6.5	11.1	9.7	12.8	14.8
Level of Service	A	A	B	A	B	B
Approach Delay (s)	7.8			10.6	13.9	
Approach LOS	A			B	B	
Intersection Summary						
HCM Average Control Delay			11.3		HCM Level of Service	B
HCM Volume to Capacity ratio			0.49			
Actuated Cycle Length (s)			40.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			51.3%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

2012 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	10	140	175	120	40	35	40	315	35	10	415	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.98		1.00	0.98		1.00	0.99	
Flt Protected		1.00			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1725			1763		1770	1835		1770	1853	
Flt Permitted		0.99			0.53		0.43	1.00		0.51	1.00	
Satd. Flow (perm)		1706			969		808	1835		949	1853	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	152	190	130	43	38	43	342	38	11	451	16
RTOR Reduction (vph)	0	127	0	0	24	0	0	8	0	0	2	0
Lane Group Flow (vph)	0	226	0	0	187	0	43	372	0	11	465	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		10.9			10.9		21.1	21.1		21.1	21.1	
Effective Green, g (s)		10.9			10.9		21.1	21.1		21.1	21.1	
Actuated g/C Ratio		0.27			0.27		0.53	0.53		0.53	0.53	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		465			264		426	968		501	977	
v/s Ratio Prot								0.20			c0.25	
v/s Ratio Perm		0.13			c0.19		0.05			0.01		
v/c Ratio		0.49			0.71		0.10	0.38		0.02	0.48	
Uniform Delay, d1		12.2			13.1		4.7	5.6		4.5	6.0	
Progression Factor		1.00			1.00		0.59	0.65		1.00	1.00	
Incremental Delay, d2		0.8			8.4		0.5	1.1		0.1	1.7	
Delay (s)		13.0			21.5		3.2	4.7		4.6	7.6	
Level of Service		B			C		A	A		A	A	
Approach Delay (s)		13.0			21.5			4.6			7.5	
Approach LOS		B			C			A			A	
Intersection Summary												
HCM Average Control Delay			10.0				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			40.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			68.9%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: S Blue Gill Drive & US 24

2012 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	0	410	20	0	730
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	446	22	0	793
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1250	457			467	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1250	457			467	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	100			100	
cM capacity (veh/h)	191	604			1094	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	16	467	793			
Volume Left	16	0	0			
Volume Right	0	22	0			
cSH	191	1700	1094			
Volume to Capacity	0.09	0.27	0.00			
Queue Length 95th (ft)	7	0	0			
Control Delay (s)	25.6	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	25.6	0.0	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		0.3				
Intersection Capacity Utilization		48.4%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

8: Judge Orr Road & Curtis Road

2012 AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	5	85	10	45	85	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	92	11	49	92	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			98		122	52
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			98		122	52
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		89	100
cM capacity (veh/h)			1495		867	1016
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	98	60	92			
Volume Left	0	11	92			
Volume Right	92	0	0			
cSH	1700	1495	867			
Volume to Capacity	0.06	0.01	0.11			
Queue Length 95th (ft)	0	1	9			
Control Delay (s)	0.0	1.4	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	1.4	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			3.9			
Intersection Capacity Utilization			21.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

10: Cotton Tail Trail & US 24

2012 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	0	400	10	0	715
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	435	11	0	777
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1217	440			446	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1217	440			446	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	100			100	
cM capacity (veh/h)	200	617			1115	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	16	446	777			
Volume Left	16	0	0			
Volume Right	0	11	0			
cSH	200	1700	1115			
Volume to Capacity	0.08	0.26	0.00			
Queue Length 95th (ft)	7	0	0			
Control Delay (s)	24.6	0.0	0.0			
Lane LOS	C					
Approach Delay (s)	24.6	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		0.3				
Intersection Capacity Utilization		47.6%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

11: Stapleton Road & US 24

2012 AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	30	35	285	395	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	33	38	310	429	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	660	429	429			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	660	429	429			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	94	97			
cM capacity (veh/h)	383	574	1127			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	38	141	207	429	27	
Volume Left	5	38	0	0	0	
Volume Right	33	0	0	0	27	
cSH	670	1127	1700	1700	1700	
Volume to Capacity	0.06	0.03	0.12	0.25	0.02	
Queue Length 95th (ft)	5	3	0	0	0	
Control Delay (s)	12.1	2.5	0.0	0.0	0.0	
Lane LOS	B	A				
Approach Delay (s)	12.1	1.0		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay		1.0				
Intersection Capacity Utilization		43.0%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

14: Rio Lane & US 24

2012 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	10	420	20	0	745
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	11	457	22	0	810
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			986			
pX, platoon unblocked						
vC, conflicting volume	1277	467			478	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1277	467			478	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	98			100	
cM capacity (veh/h)	184	596			1084	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	33	478	810			
Volume Left	22	0	0			
Volume Right	11	22	0			
cSH	239	1700	1084			
Volume to Capacity	0.14	0.28	0.00			
Queue Length 95th (ft)	12	0	0			
Control Delay (s)	22.5	0.0	0.0			
Lane LOS	C					
Approach Delay (s)	22.5	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay		0.6				
Intersection Capacity Utilization		49.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

17: N Blue Gill Drive & US 24

2012 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	0	390	10	0	700
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	424	11	0	761
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						192
pX, platoon unblocked	0.84					
vC, conflicting volume	1190	429			435	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1132	429			435	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	100			100	
cM capacity (veh/h)	189	626			1125	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	16	435	761			
Volume Left	16	0	0			
Volume Right	0	11	0			
cSH	189	1700	1125			
Volume to Capacity	0.09	0.26	0.00			
Queue Length 95th (ft)	7	0	0			
Control Delay (s)	25.8	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	25.8	0.0	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		0.3				
Intersection Capacity Utilization		46.8%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

19: Falcon Big R & US 24

2012 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	0	355	5	0	435
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	386	5	0	473
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	861	389			391	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	861	389			391	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	326	660			1167	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	5	391	473			
Volume Left	5	0	0			
Volume Right	0	5	0			
cSH	326	1700	1167			
Volume to Capacity	0.02	0.23	0.00			
Queue Length 95th (ft)	1	0	0			
Control Delay (s)	16.2	0.0	0.0			
Lane LOS	C					
Approach Delay (s)	16.2	0.0	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			32.9%	ICU Level of Service	A	
Analysis Period (min)			15			

2012 Existing Conditions – PM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

2012 PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	450	160	475	645	205	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.62	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	2237	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	489	174	516	701	223	348
RTOR Reduction (vph)	0	104	0	0	0	209
Lane Group Flow (vph)	489	70	516	701	223	139
Turn Type	Perm		Perm			Perm
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	16.0	16.0	16.0	16.0	16.0	16.0
Effective Green, g (s)	16.0	16.0	16.0	16.0	16.0	16.0
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	708	633	895	745	745	633
v/s Ratio Prot	c0.28			c0.38	0.12	
v/s Ratio Perm		0.04	0.23			0.09
v/c Ratio	0.69	0.11	0.58	0.94	0.30	0.22
Uniform Delay, d1	9.9	7.5	9.4	11.5	8.2	7.9
Progression Factor	1.00	1.00	1.00	1.00	0.69	0.57
Incremental Delay, d2	5.5	0.4	0.9	19.9	0.2	0.2
Delay (s)	15.4	7.9	10.3	31.4	5.9	4.6
Level of Service	B	A	B	C	A	A
Approach Delay (s)	13.4			22.5	5.1	
Approach LOS	B			C	A	
Intersection Summary						
HCM Average Control Delay			16.0		HCM Level of Service	B
HCM Volume to Capacity ratio			0.82			
Actuated Cycle Length (s)			40.0		Sum of lost time (s)	8.0
Intersection Capacity Utilization			65.5%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

2012 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	35	45	75	95	20	125	530	105	25	350	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.95			0.99		1.00	0.98		1.00	1.00	
Flt Protected		0.99			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1800		1770	1817		1770	1855	
Flt Permitted		0.89			0.86		0.52	1.00		0.29	1.00	
Satd. Flow (perm)		1572			1577		959	1817		539	1855	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	38	49	82	103	22	136	576	114	27	380	11
RTOR Reduction (vph)	0	38	0	0	14	0	0	13	0	0	2	0
Lane Group Flow (vph)	0	87	0	0	193	0	136	677	0	27	389	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.9			8.9		23.1	23.1		23.1	23.1	
Effective Green, g (s)		8.9			8.9		23.1	23.1		23.1	23.1	
Actuated g/C Ratio		0.22			0.22		0.58	0.58		0.58	0.58	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		350			351		554	1049		311	1071	
v/s Ratio Prot							c0.37				0.21	
v/s Ratio Perm		0.06			c0.12		0.14			0.05		
v/c Ratio		0.25			0.55		0.25	0.65		0.09	0.36	
Uniform Delay, d1		12.8			13.8		4.2	5.7		3.8	4.5	
Progression Factor		1.00			1.00		0.89	0.84		1.00	1.00	
Incremental Delay, d2		0.4			1.8		0.6	1.6		0.5	1.0	
Delay (s)		13.2			15.5		4.3	6.4		4.3	5.5	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		13.2			15.5			6.1			5.4	
Approach LOS		B			B			A			A	
Intersection Summary												
HCM Average Control Delay		7.7					HCM Level of Service			A		
HCM Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		40.0					Sum of lost time (s)			8.0		
Intersection Capacity Utilization		62.8%					ICU Level of Service			B		
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: S Blue Gill Drive & US 24

2012 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	0	790	20	0	490
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	859	22	0	533
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1402	870			880	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1402	870			880	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	100			100	
cM capacity (veh/h)	154	351			768	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	16	880	533			
Volume Left	16	0	0			
Volume Right	0	22	0			
cSH	154	1700	768			
Volume to Capacity	0.11	0.52	0.00			
Queue Length 95th (ft)	9	0	0			
Control Delay (s)	31.1	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	31.1	0.0	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		0.4				
Intersection Capacity Utilization		52.8%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

8: Judge Orr Road & Curtis Road

2012 PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	25	10	5	10	45	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	11	5	11	49	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			38		54	33
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			38		54	33
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		95	99
cM capacity (veh/h)			1572		950	1041
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	38	16	54			
Volume Left	0	5	49			
Volume Right	11	0	5			
cSH	1700	1572	959			
Volume to Capacity	0.02	0.00	0.06			
Queue Length 95th (ft)	0	0	4			
Control Delay (s)	0.0	2.4	9.0			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.4	9.0			
Approach LOS			A			
Intersection Summary						
Average Delay		4.9				
Intersection Capacity Utilization		15.0%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Cotton Tail Trail & US 24

2012 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	0	775	15	0	480
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	842	16	0	522
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1372	851			859	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1372	851			859	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	100			100	
cM capacity (veh/h)	161	360			782	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	11	859	522			
Volume Left	11	0	0			
Volume Right	0	16	0			
cSH	161	1700	782			
Volume to Capacity	0.07	0.51	0.00			
Queue Length 95th (ft)	5	0	0			
Control Delay (s)	29.0	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	29.0	0.0	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		0.2				
Intersection Capacity Utilization		51.7%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

11: Stapleton Road & US 24

2012 PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	35	15	515	345	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	38	16	560	375	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	688	375	375			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	688	375	375			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	94	99			
cM capacity (veh/h)	375	623	1180			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	49	203	373	375	27	
Volume Left	11	16	0	0	0	
Volume Right	38	0	0	0	27	
cSH	800	1180	1700	1700	1700	
Volume to Capacity	0.06	0.01	0.22	0.22	0.02	
Queue Length 95th (ft)	5	1	0	0	0	
Control Delay (s)	12.0	0.8	0.0	0.0	0.0	
Lane LOS	B	A				
Approach Delay (s)	12.0	0.3		0.0		
Approach LOS	B					
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			35.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

14: Rio Lane & US 24

2012 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	10	800	20	0	505
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	11	870	22	0	549
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)			986			
pX, platoon unblocked	0.86	0.86			0.86	
vC, conflicting volume	1429	880			891	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1418	777			789	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	97			100	
cM capacity (veh/h)	129	340			711	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	33	891	549			
Volume Left	22	0	0			
Volume Right	11	22	0			
cSH	163	1700	711			
Volume to Capacity	0.20	0.52	0.00			
Queue Length 95th (ft)	18	0	0			
Control Delay (s)	32.5	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	32.5	0.0	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		0.7				
Intersection Capacity Utilization		53.3%		ICU Level of Service	A	
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

17: N Blue Gill Drive & US 24

2012 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	0	760	15	0	470
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	826	16	0	511
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						192
pX, platoon unblocked	0.89					
vC, conflicting volume	1345	834			842	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1327	834			842	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	100			100	
cM capacity (veh/h)	153	368			793	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	11	842	511			
Volume Left	11	0	0			
Volume Right	0	16	0			
cSH	153	1700	793			
Volume to Capacity	0.07	0.50	0.00			
Queue Length 95th (ft)	6	0	0			
Control Delay (s)	30.3	0.0	0.0			
Lane LOS	D					
Approach Delay (s)	30.3	0.0	0.0			
Approach LOS	D					
Intersection Summary						
Average Delay		0.2				
Intersection Capacity Utilization		50.9%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

21: Falcon Big R & US 24

2012 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	5	545	35	5	370
Sign Control	Stop		Free		Free	Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	5	592	38	5	402
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1005	592			630	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1005	592			630	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	99			99	
cM capacity (veh/h)	266	506			952	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	16	592	38	5	402	
Volume Left	11	0	0	5	0	
Volume Right	5	0	38	0	0	
cSH	316	1700	1700	952	1700	
Volume to Capacity	0.05	0.35	0.02	0.01	0.24	
Queue Length 95th (ft)	4	0	0	0	0	
Control Delay (s)	17.0	0.0	0.0	8.8	0.0	
Lane LOS	C			A		
Approach Delay (s)	17.0	0.0		0.1		
Approach LOS	C					
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			38.7%	ICU Level of Service		A
Analysis Period (min)			15			

2035 No Build Conditions – AM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	410	255	295	335	660	585
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.19	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	673	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	446	277	321	364	717	636
RTOR Reduction (vph)	0	116	0	0	0	324
Lane Group Flow (vph)	446	161	321	364	717	312
Turn Type	Perm		Perm	Perm		
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	17.5	17.5	24.5	24.5	24.5	24.5
Effective Green, g (s)	17.5	17.5	24.5	24.5	24.5	24.5
Actuated g/C Ratio	0.35	0.35	0.49	0.49	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	620	554	330	913	913	776
v/s Ratio Prot	c0.25			0.20	0.38	
v/s Ratio Perm		0.10	c0.48			0.20
v/c Ratio	0.72	0.29	0.97	0.40	0.79	0.40
Uniform Delay, d1	14.1	11.8	12.4	8.1	10.6	8.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.0	1.3	41.9	0.3	4.5	0.3
Delay (s)	21.2	13.1	54.4	8.4	15.1	8.4
Level of Service	C	B	D	A	B	A
Approach Delay (s)	18.1			29.9	11.9	
Approach LOS	B			C	B	
Intersection Summary						
HCM Average Control Delay			18.0	HCM Level of Service		B
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			50.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			75.9%	ICU Level of Service		D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	15	220	275	190	40	55	60	610	50	15	735	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.97		1.00	0.99		1.00	1.00	
Flt Protected		1.00			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1725			1755		1770	1842		1770	1854	
Flt Permitted		0.99			0.39		0.13	1.00		0.14	1.00	
Satd. Flow (perm)		1706			710		248	1842		264	1854	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	239	299	207	43	60	65	663	54	16	799	27
RTOR Reduction (vph)	0	64	0	0	13	0	0	4	0	0	2	0
Lane Group Flow (vph)	0	490	0	0	297	0	65	713	0	16	824	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		27.0			27.0		30.0	30.0		30.0	30.0	
Effective Green, g (s)		27.0			27.0		30.0	30.0		30.0	30.0	
Actuated g/C Ratio		0.42			0.42		0.46	0.46		0.46	0.46	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		709			295		114	850		122	856	
v/s Ratio Prot								0.39			c0.44	
v/s Ratio Perm		0.29			c0.42		0.26			0.06		
v/c Ratio		0.69			1.01		0.57	0.84		0.13	0.96	
Uniform Delay, d1		15.6			19.0		12.8	15.4		10.0	17.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.9			53.7		19.1	9.7		2.2	23.0	
Delay (s)		18.5			72.7		31.9	25.1		12.2	40.0	
Level of Service		B			E		C	C		B	D	
Approach Delay (s)		18.5			72.7			25.6			39.4	
Approach LOS		B			E			C			D	
Intersection Summary												
HCM Average Control Delay			34.6			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			102.1%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: S Blue Gill Drive & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	25	5	710	30	5	1195
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	5	772	33	5	1299
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2098	788			804	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2098	788			804	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	52	99			99	
cM capacity (veh/h)	57	391			820	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	33	804	1304			
Volume Left	27	0	5			
Volume Right	5	33	0			
cSH	66	1700	820			
Volume to Capacity	0.49	0.47	0.01			
Queue Length 95th (ft)	49	0	1			
Control Delay (s)	103.7	0.0	0.3			
Lane LOS	F		A			
Approach Delay (s)	103.7	0.0	0.3			
Approach LOS	F					
Intersection Summary						
Average Delay		1.8				
Intersection Capacity Utilization		76.9%		ICU Level of Service		D
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

8: Judge Orr Road & Curtis Road

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	10	115	10	65	140	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	125	11	71	152	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			136		166	73
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			136		166	73
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		81	100
cM capacity (veh/h)			1448		819	988
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	136	82	152			
Volume Left	0	11	152			
Volume Right	125	0	0			
cSH	1700	1448	819			
Volume to Capacity	0.08	0.01	0.19			
Queue Length 95th (ft)	0	1	17			
Control Delay (s)	0.0	1.1	10.4			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.1	10.4			
Approach LOS			B			
Intersection Summary						
Average Delay		4.5				
Intersection Capacity Utilization		26.3%	ICU Level of Service	A		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

10: Cotton Tail Trail & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	25	15	695	20	5	1175
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	16	755	22	5	1277
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2054	766			777	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2054	766			777	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	55	96			99	
cM capacity (veh/h)	60	403			839	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	43	777	1283			
Volume Left	27	0	5			
Volume Right	16	22	0			
cSH	89	1700	839			
Volume to Capacity	0.49	0.46	0.01			
Queue Length 95th (ft)	53	0	0			
Control Delay (s)	79.5	0.0	0.3			
Lane LOS	F		A			
Approach Delay (s)	79.5	0.0	0.3			
Approach LOS	F					
Intersection Summary						
Average Delay		1.8				
Intersection Capacity Utilization		75.8%		ICU Level of Service		D
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

11: Stapleton Road & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	65	155	120	510	595	120
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	168	130	554	647	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1185	647	647			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1185	647	647			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	55	59	86			
cM capacity (veh/h)	156	414	935			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	239	315	370	647	130	
Volume Left	71	130	0	0	0	
Volume Right	168	0	0	0	130	
cSH	530	935	1700	1700	1700	
Volume to Capacity	0.45	0.14	0.22	0.38	0.08	
Queue Length 95th (ft)	58	12	0	0	0	
Control Delay (s)	27.3	4.8	0.0	0.0	0.0	
Lane LOS	D	A				
Approach Delay (s)	27.3	2.2		0.0		
Approach LOS	D					
Intersection Summary						
Average Delay		4.7				
Intersection Capacity Utilization		62.5%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

14: Rio Lane & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	30	25	715	30	5	1215
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	27	777	33	5	1321
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)			986			
pX, platoon unblocked						
vC, conflicting volume	2125	793			810	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2125	793			810	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	40	93			99	
cM capacity (veh/h)	55	388			816	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	60	810	1326			
Volume Left	33	0	5			
Volume Right	27	33	0			
cSH	90	1700	816			
Volume to Capacity	0.67	0.48	0.01			
Queue Length 95th (ft)	81	0	1			
Control Delay (s)	103.4	0.0	0.3			
Lane LOS	F		A			
Approach Delay (s)	103.4	0.0	0.3			
Approach LOS	F					
Intersection Summary						
Average Delay		3.0				
Intersection Capacity Utilization		77.9%	ICU Level of Service	D		
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

17: Blue Gill Drive N & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	25	20	700	10	0	1155
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	22	761	11	0	1255
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						192
pX, platoon unblocked	0.56					
vC, conflicting volume	2022	766			772	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2430	766			772	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	95			100	
cM capacity (veh/h)	20	403			843	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	49	772	1255			
Volume Left	27	0	0			
Volume Right	22	11	0			
cSH	34	1700	843			
Volume to Capacity	1.43	0.45	0.00			
Queue Length 95th (ft)	133	0	0			
Control Delay (s)	485.4	0.0	0.0			
Lane LOS	F					
Approach Delay (s)	485.4	0.0	0.0			
Approach LOS	F					
Intersection Summary						
Average Delay		11.4				
Intersection Capacity Utilization		70.8%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

21: Falcon Big R & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	30	10	645	30	10	740
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	11	701	33	11	804
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1527	701			734	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1527	701			734	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	74	98			99	
cM capacity (veh/h)	128	439			871	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	43	701	33	11	804	
Volume Left	33	0	0	11	0	
Volume Right	11	0	33	0	0	
cSH	155	1700	1700	871	1700	
Volume to Capacity	0.28	0.41	0.02	0.01	0.47	
Queue Length 95th (ft)	27	0	0	1	0	
Control Delay (s)	37.0	0.0	0.0	9.2	0.0	
Lane LOS	E			A		
Approach Delay (s)	37.0	0.0		0.1		
Approach LOS	E					
Intersection Summary						
Average Delay			1.1			
Intersection Capacity Utilization			48.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

25: Stapleton Road & W Frontage Road

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Movement	WBL	WBR	WBR2	NBL	NBT	NBR	SBL	SBT	SBR	SEL2	SEL	SER
Lane Configurations												
Volume (veh/h)	95	95	50	40	20	60	60	20	40	50	100	95
Sign Control	Free				Stop				Stop			
Grade	0%				0%				0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	103	54	43	22	65	65	22	43	54	109	103
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	212			633	633	160	630	658	130	158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212			633	633	160	630	658	130	158		
tC, single (s)	4.1			7.1	6.5	6.2	7.1	6.5	6.2	4.1		
tC, 2 stage (s)												
tF (s)	2.2			3.5	4.0	3.3	3.5	4.0	3.3	2.2		
p0 queue free %	92			87	94	93	80	94	95	96		
cM capacity (veh/h)	1358			326	353	885	318	342	919	1422		
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SE 1	SE 2				
Volume Total	103	158	43	87	65	65	54	212				
Volume Left	103	0	43	0	65	0	54	0				
Volume Right	0	54	0	65	0	43	0	103				
cSH	1358	1700	326	643	318	588	1422	1700				
Volume to Capacity	0.08	0.09	0.13	0.14	0.20	0.11	0.04	0.12				
Queue Length 95th (ft)	6	0	11	12	19	9	3	0				
Control Delay (s)	7.9	0.0	17.8	11.5	19.2	11.9	7.6	0.0				
Lane LOS	A		C	B	C	B	A					
Approach Delay (s)	3.1		13.6		15.5		1.6					
Approach LOS			B		C							
Intersection Summary												
Average Delay			6.4									
Intersection Capacity Utilization			36.6%	ICU Level of Service					A			
Analysis Period (min)			15									

2035 No Build Conditions – PM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	640	220	470	590	335	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.42	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1523	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	696	239	511	641	364	500
RTOR Reduction (vph)	0	125	0	0	0	305
Lane Group Flow (vph)	696	114	511	641	364	195
Turn Type	Perm		Perm	Perm		
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	28.6	28.6	23.4	23.4	23.4	23.4
Effective Green, g (s)	28.6	28.6	23.4	23.4	23.4	23.4
Actuated g/C Ratio	0.48	0.48	0.39	0.39	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	844	755	594	727	727	617
v/s Ratio Prot	c0.39			c0.34	0.20	
v/s Ratio Perm		0.07	0.34			0.12
v/c Ratio	0.82	0.15	0.86	0.88	0.50	0.32
Uniform Delay, d1	13.5	8.9	16.8	17.0	13.9	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.0	0.4	12.1	12.1	0.5	0.3
Delay (s)	22.5	9.3	28.9	29.2	14.4	13.0
Level of Service	C	A	C	C	B	B
Approach Delay (s)	19.1			29.1	13.6	
Approach LOS	B			C	B	
Intersection Summary						
HCM Average Control Delay			21.4	HCM Level of Service		C
HCM Volume to Capacity ratio			0.85			
Actuated Cycle Length (s)			60.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			76.5%	ICU Level of Service		D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

With 4-Way Ranch Phases 1&2

2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	45	70	110	140	35	195	810	155	40	565	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.95			0.98		1.00	0.98		1.00	0.99	
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1797		1770	1818		1770	1846	
Flt Permitted		0.69			0.76		0.32	1.00		0.10	1.00	
Satd. Flow (perm)		1229			1390		601	1818		180	1846	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	49	76	120	152	38	212	880	168	43	614	38
RTOR Reduction (vph)	0	30	0	0	8	0	0	11	0	0	3	0
Lane Group Flow (vph)	0	187	0	0	302	0	212	1037	0	43	649	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	15.6			15.6			41.4			41.4		
Effective Green, g (s)	15.6			15.6			41.4			41.4		
Actuated g/C Ratio	0.24			0.24			0.64			0.64		
Clearance Time (s)	4.0			4.0			4.0			4.0		
Vehicle Extension (s)	3.0			3.0			3.0			3.0		
Lane Grp Cap (vph)	295			334			383			115		
v/s Ratio Prot							c0.57			0.35		
v/s Ratio Perm	0.15			c0.22			0.35			0.24		
v/c Ratio	0.63			0.91			0.55			0.37		
Uniform Delay, d1	22.1			24.0			6.6			5.6		
Progression Factor	1.00			1.00			1.00			1.00		
Incremental Delay, d2	4.4			26.6			5.7			9.1		
Delay (s)	26.5			50.6			12.3			14.7		
Level of Service	C			D			B			B		
Approach Delay (s)	26.5			50.6			19.4			8.9		
Approach LOS	C			D			B			A		
Intersection Summary												
HCM Average Control Delay			21.0			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			84.7%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

6: S Blue Gill Drive & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

									
Movement	WBL	WBR	NBT	NBR	SBL	SBT			
Lane Configurations									
Volume (veh/h)	15	5	1190	25	5	760			
Sign Control	Stop		Free			Free			
Grade	0%		0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92			
Hourly flow rate (vph)	16	5	1293	27	5	826			
Pedestrians									
Lane Width (ft)									
Walking Speed (ft/s)									
Percent Blockage									
Right turn flare (veh)									
Median type			None			None			
Median storage (veh)									
Upstream signal (ft)									
pX, platoon unblocked									
vC, conflicting volume	2144	1307			1321				
vC1, stage 1 conf vol									
vC2, stage 2 conf vol									
vCu, unblocked vol	2144	1307			1321				
tC, single (s)	6.4	6.2			4.1				
tC, 2 stage (s)									
tF (s)	3.5	3.3			2.2				
p0 queue free %	69	97			99				
cM capacity (veh/h)	53	195			523				
Direction, Lane #	WB 1	NB 1	SB 1						
Volume Total	22	1321	832						
Volume Left	16	0	5						
Volume Right	5	27	0						
cSH	65	1700	523						
Volume to Capacity	0.34	0.78	0.01						
Queue Length 95th (ft)	31	0	1						
Control Delay (s)	86.6	0.0	0.3						
Lane LOS	F		A						
Approach Delay (s)	86.6	0.0	0.3						
Approach LOS	F								
Intersection Summary									
Average Delay		1.0							
Intersection Capacity Utilization		74.1%	ICU Level of Service	D					
Analysis Period (min)		15							

HCM Unsignalized Intersection Capacity Analysis

8: Judge Orr Road & Curtis Road

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	40	25	10	20	110	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	27	11	22	120	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			71		101	57
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			71		101	57
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		87	99
cM capacity (veh/h)			1530		892	1009
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	71	33	130			
Volume Left	0	11	120			
Volume Right	27	0	11			
cSH	1700	1530	900			
Volume to Capacity	0.04	0.01	0.14			
Queue Length 95th (ft)	0	1	13			
Control Delay (s)	0.0	2.5	9.7			
Lane LOS		A	A			
Approach Delay (s)	0.0	2.5	9.7			
Approach LOS			A			
Intersection Summary						
Average Delay			5.7			
Intersection Capacity Utilization			21.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

10: Cotton Tail Trail & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	5	1175	20	5	750
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	5	1277	22	5	815
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2114	1288			1299	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2114	1288			1299	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	70	97			99	
cM capacity (veh/h)	55	200			533	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	22	1299	821			
Volume Left	16	0	5			
Volume Right	5	22	0			
cSH	67	1700	533			
Volume to Capacity	0.32	0.76	0.01			
Queue Length 95th (ft)	30	0	1			
Control Delay (s)	82.0	0.0	0.3			
Lane LOS	F		A			
Approach Delay (s)	82.0	0.0	0.3			
Approach LOS	F					
Intersection Summary						
Average Delay		1.0				
Intersection Capacity Utilization		73.1%		ICU Level of Service		D
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

11: Stapleton Road & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	70	255	165	695	380	175
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	277	179	755	413	190
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		11				
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1149	413	413			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1149	413	413			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	53	53	84			
cM capacity (veh/h)	162	588	1142			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	353	431	504	413	190	
Volume Left	76	179	0	0	0	
Volume Right	277	0	0	0	190	
cSH	750	1142	1700	1700	1700	
Volume to Capacity	0.47	0.16	0.30	0.24	0.11	
Queue Length 95th (ft)	64	14	0	0	0	
Control Delay (s)	22.7	4.6	0.0	0.0	0.0	
Lane LOS	C	A				
Approach Delay (s)	22.7	2.1		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			5.3			
Intersection Capacity Utilization			57.9%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

14: Rio Lane & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

									
Movement	WBL	WBR	NBT	NBR	SBL	SBT			
Lane Configurations									
Volume (veh/h)	25	15	1200	30	5	770			
Sign Control	Stop		Free			Free			
Grade	0%		0%			0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92			
Hourly flow rate (vph)	27	16	1304	33	5	837			
Pedestrians									
Lane Width (ft)									
Walking Speed (ft/s)									
Percent Blockage									
Right turn flare (veh)									
Median type			None			None			
Median storage veh									
Upstream signal (ft)			986						
pX, platoon unblocked	0.68	0.68			0.68				
vC, conflicting volume	2168	1321			1337				
vC1, stage 1 conf vol									
vC2, stage 2 conf vol									
vCu, unblocked vol	2476	1238			1262				
tC, single (s)	6.4	6.2			4.1				
tC, 2 stage (s)									
tF (s)	3.5	3.3			2.2				
p0 queue free %	0	89			99				
cM capacity (veh/h)	22	147			377				
Direction, Lane #	WB 1	NB 1	SB 1						
Volume Total	43	1337	842						
Volume Left	27	0	5						
Volume Right	16	33	0						
cSH	33	1700	377						
Volume to Capacity	1.34	0.79	0.01						
Queue Length 95th (ft)	119	0	1						
Control Delay (s)	460.2	0.0	0.5						
Lane LOS	F		A						
Approach Delay (s)	460.2	0.0	0.5						
Approach LOS	F								
Intersection Summary									
Average Delay		9.2							
Intersection Capacity Utilization		75.0%	ICU Level of Service	D					
Analysis Period (min)		15							

HCM Unsignalized Intersection Capacity Analysis 17: N Blue Gill Drive & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	5	1155	25	5	740
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	5	1255	27	5	804
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						192
pX, platoon unblocked	0.80					
vC, conflicting volume	2084	1269			1283	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2235	1269			1283	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	56	97			99	
cM capacity (veh/h)	37	205			541	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	22	1283	810			
Volume Left	16	0	5			
Volume Right	5	27	0			
cSH	46	1700	541			
Volume to Capacity	0.47	0.75	0.01			
Queue Length 95th (ft)	43	0	1			
Control Delay (s)	138.2	0.0	0.3			
Lane LOS	F		A			
Approach Delay (s)	138.2	0.0	0.3			
Approach LOS	F					
Intersection Summary						
Average Delay		1.5				
Intersection Capacity Utilization		72.3%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

21: Falcon Big R & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	10	875	50	10	620
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	11	951	54	11	674
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1647	951			1005	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1647	951			1005	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	97			98	
cM capacity (veh/h)	107	315			689	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	27	951	54	11	674	
Volume Left	16	0	0	11	0	
Volume Right	11	0	54	0	0	
cSH	146	1700	1700	689	1700	
Volume to Capacity	0.19	0.56	0.03	0.02	0.40	
Queue Length 95th (ft)	16	0	0	1	0	
Control Delay (s)	35.2	0.0	0.0	10.3	0.0	
Lane LOS	E			B		
Approach Delay (s)	35.2	0.0		0.2		
Approach LOS	E					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			56.1%		ICU Level of Service	B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis 38: Stapleton Road & W Frontage Road

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	145	90	65	200	75	60	20	120	60	20	120
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	158	98	71	217	82	65	22	130	65	22	130
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	299			255			815	755	207	807	764	258
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	299			255			815	755	207	807	764	258
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			95			70	93	84	71	93	83
cM capacity (veh/h)	1262			1310			216	306	834	222	302	780
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	54	255	71	299	65	152	65	152				
Volume Left	54	0	71	0	65	0	65	0				
Volume Right	0	98	0	82	0	130	0	130				
cSH	1262	1700	1310	1700	216	669	222	637				
Volume to Capacity	0.04	0.15	0.05	0.18	0.30	0.23	0.29	0.24				
Queue Length 95th (ft)	3	0	4	0	30	22	29	23				
Control Delay (s)	8.0	0.0	7.9	0.0	28.7	12.0	27.8	12.4				
Lane LOS	A		A		D	B	D	B				
Approach Delay (s)	1.4		1.5		17.0		17.0					
Approach LOS					C		C					
Intersection Summary												
Average Delay			7.5									
Intersection Capacity Utilization			43.5%	ICU Level of Service		A						
Analysis Period (min)			15									

2035 Interim Build Conditions – AM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	410	255	295	335	660	585
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.18	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	640	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	446	277	321	364	717	636
RTOR Reduction (vph)	0	117	0	0	0	323
Lane Group Flow (vph)	446	160	321	364	717	313
Turn Type	Perm		Perm	Perm		
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	22.5	22.5	29.5	29.5	29.5	29.5
Effective Green, g (s)	22.5	22.5	29.5	29.5	29.5	29.5
Actuated g/C Ratio	0.38	0.38	0.49	0.49	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	664	594	315	916	916	778
v/s Ratio Prot	c0.25			0.20	0.38	
v/s Ratio Perm		0.10	c0.50			0.20
v/c Ratio	0.67	0.27	1.02	0.40	0.78	0.40
Uniform Delay, d1	15.7	13.0	15.2	9.6	12.6	9.7
Progression Factor	1.00	1.00	1.00	1.00	0.77	0.62
Incremental Delay, d2	5.4	1.1	55.7	0.3	2.3	0.2
Delay (s)	21.0	14.2	70.9	9.9	12.0	6.2
Level of Service	C	B	E	A	B	A
Approach Delay (s)	18.4			38.5	9.3	
Approach LOS	B			D	A	
Intersection Summary						
HCM Average Control Delay			18.9	HCM Level of Service		B
HCM Volume to Capacity ratio			0.87			
Actuated Cycle Length (s)			60.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			75.9%	ICU Level of Service		D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	15	220	275	190	40	25	60	610	50	15	735	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.99		1.00	0.99		1.00	1.00	
Flt Protected		1.00			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1725			1772		1770	1842		1770	1854	
Flt Permitted		0.99			0.36		0.14	1.00		0.15	1.00	
Satd. Flow (perm)		1707			665		266	1842		282	1854	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	239	299	207	43	27	65	663	54	16	799	27
RTOR Reduction (vph)	0	68	0	0	7	0	0	5	0	0	2	0
Lane Group Flow (vph)	0	486	0	0	270	0	65	712	0	16	824	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		24.0			24.0		28.0	28.0		28.0	28.0	
Effective Green, g (s)		24.0			24.0		28.0	28.0		28.0	28.0	
Actuated g/C Ratio		0.40			0.40		0.47	0.47		0.47	0.47	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		683			266		124	860		132	865	
v/s Ratio Prot								0.39			c0.44	
v/s Ratio Perm		0.28			c0.41		0.24			0.06		
v/c Ratio		0.71			1.02		0.52	0.83		0.12	0.95	
Uniform Delay, d1		15.1			18.0		11.3	13.9		9.0	15.4	
Progression Factor		1.00			1.00		0.90	0.86		1.00	1.00	
Incremental Delay, d2		3.5			59.5		13.3	8.1		1.9	21.0	
Delay (s)		18.6			77.5		23.5	20.1		10.9	36.4	
Level of Service		B			E		C	C		B	D	
Approach Delay (s)		18.6			77.5			20.4			35.9	
Approach LOS		B			E			C			D	
Intersection Summary												
HCM Average Control Delay			31.7			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			60.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			100.3%			ICU Level of Service				G		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

With 4-Way Ranch Phases 1&2

11: Stapleton Road & US 24

2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	45	155	50	50	30	70	525	50	55	570	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.73	1.00	1.00	0.33	1.00	1.00	0.36	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1351	1863	1583	612	1863	1583	672	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	49	168	54	54	33	76	571	54	60	620	130
RTOR Reduction (vph)	0	0	150	0	0	30	0	0	21	0	0	50
Lane Group Flow (vph)	22	49	18	54	54	3	76	571	33	60	620	80
Turn Type	Split		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	4	4			8			2			6	
Permitted Phases			4	8		8	2		2	6		6
Actuated Green, G (s)	7.7	7.7	7.7	7.2	7.2	7.2	43.1	43.1	43.1	43.1	43.1	43.1
Effective Green, g (s)	7.7	7.7	7.7	7.2	7.2	7.2	43.1	43.1	43.1	43.1	43.1	43.1
Actuated g/C Ratio	0.11	0.11	0.11	0.10	0.10	0.10	0.62	0.62	0.62	0.62	0.62	0.62
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	195	205	174	139	192	163	377	1147	975	414	1147	975
v/s Ratio Prot	0.01	c0.03			0.03			0.31			c0.33	
v/s Ratio Perm			0.01	c0.04		0.00	0.12		0.02	0.09		0.05
v/c Ratio	0.11	0.24	0.11	0.39	0.28	0.02	0.20	0.50	0.03	0.14	0.54	0.08
Uniform Delay, d1	28.1	28.5	28.1	29.3	29.0	28.2	5.9	7.5	5.3	5.7	7.7	5.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.6	0.3	1.8	0.8	0.1	1.2	1.5	0.1	0.7	1.8	0.2
Delay (s)	28.3	29.1	28.3	31.1	29.8	28.3	7.1	9.0	5.3	6.4	9.6	5.6
Level of Service	C	C	C	C	C	C	A	A	A	A	A	A
Approach Delay (s)		28.5			30.0			8.5			8.7	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM Average Control Delay			12.7				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.48									
Actuated Cycle Length (s)			70.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			53.3%				ICU Level of Service			A		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: Judge Orr Road & Stapleton Road

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	10	125	10	55	10	140	35	0	0	85	25
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	11	136	11	60	11	152	38	0	0	92	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	71			147			321	258	79	204	321	65
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	71			147			321	258	79	204	321	65
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			99			71	94	100	100	84	97
cM capacity (veh/h)	1530			1435			525	623	982	700	575	999
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	43	147	11	71	152	38	0	120				
Volume Left	43	0	11	0	152	0	0	0				
Volume Right	0	136	0	11	0	0	0	27				
cSH	1530	1700	1435	1700	525	623	1700	636				
Volume to Capacity	0.03	0.09	0.01	0.04	0.29	0.06	0.00	0.19				
Queue Length 95th (ft)	2	0	1	0	30	5	0	17				
Control Delay (s)	7.4	0.0	7.5	0.0	14.6	11.2	0.0	12.0				
Lane LOS	A		A		B	B	A	B				
Approach Delay (s)	1.7		1.0		13.9		12.0					
Approach LOS					B		B					
Intersection Summary												
Average Delay	7.7											
Intersection Capacity Utilization	30.0%			ICU Level of Service					A			
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis 25: Stapleton Road & W Frontage Road

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Movement	WBL	WBR	WBR2	NBL	NBT	NBR	SBL	SBT	SBR	SEL2	SEL	SER
Lane Configurations												
Volume (veh/h)	95	95	50	40	20	60	60	20	40	50	100	95
Sign Control	Free				Stop				Stop			
Grade	0%				0%				0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	103	54	43	22	65	65	22	43	54	109	103
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None										None	
Median storage (veh)												
Upstream signal (ft)	405											
pX, platoon unblocked												
vC, conflicting volume	212			633		633	160	603	630	103	158	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212			633		633	160	603	630	103	158	
tC, single (s)	4.1			7.1		6.5	6.2	7.1	6.5	6.2	4.1	
tC, 2 stage (s)												
tF (s)	2.2			3.5		4.0	3.3	3.5	4.0	3.3	2.2	
p0 queue free %	92			87		94	93	80	94	95	96	
cM capacity (veh/h)	1358			327		353	885	332	354	952	1422	
Direction, Lane #	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2	SE 1	SE 2			
Volume Total	103	103	54	43	87	65	65	54	212			
Volume Left	103	0	0	43	0	65	0	54	0			
Volume Right	0	0	54	0	65	0	43	0	103			
cSH	1358	1700	1700	327	643	332	609	1422	1700			
Volume to Capacity	0.08	0.06	0.03	0.13	0.14	0.20	0.11	0.04	0.12			
Queue Length 95th (ft)	6	0	0	11	12	18	9	3	0			
Control Delay (s)	7.9	0.0	0.0	17.7	11.5	18.5	11.6	7.6	0.0			
Lane LOS	A			C	B	C	B	A				
Approach Delay (s)	3.1			13.6		15.0		1.6				
Approach LOS				B		C						
Intersection Summary												
Average Delay	6.3											
Intersection Capacity Utilization	36.6%			ICU Level of Service					A			
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

48: Stapleton Road & E Frontage Road

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	100	45	5	75	0	50	0	5	0	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	109	49	5	82	0	54	0	5	0	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage veh												
Upstream signal (ft)	402											
pX, platoon unblocked												
vC, conflicting volume	82			158			242	236	133	217	261	82
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	82			158			242	236	133	217	261	82
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			92	100	99	100	100	99
cM capacity (veh/h)	1516			1422			704	659	916	730	639	978
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	5	158	5	82	60	5						
Volume Left	5	0	5	0	54	0						
Volume Right	0	49	0	0	5	5						
cSH	1516	1700	1422	1700	719	978						
Volume to Capacity	0.00	0.09	0.00	0.05	0.08	0.01						
Queue Length 95th (ft)	0	0	0	0	7	0						
Control Delay (s)	7.4	0.0	7.5	0.0	10.5	8.7						
Lane LOS	A		A		B	A						
Approach Delay (s)	0.2		0.5		10.5	8.7						
Approach LOS					B	A						
Intersection Summary												
Average Delay			2.4									
Intersection Capacity Utilization			24.4%		ICU Level of Service		A					
Analysis Period (min)			15									

2035 Interim Build Conditions – PM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	640	220	470	590	335	460
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.42	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1523	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	696	239	511	641	364	500
RTOR Reduction (vph)	0	125	0	0	0	305
Lane Group Flow (vph)	696	114	511	641	364	195
Turn Type	Perm		Perm	Perm		
Protected Phases	6			4	8	
Permitted Phases	6		4	8		
Actuated Green, G (s)	28.6	28.6	23.4	23.4	23.4	23.4
Effective Green, g (s)	28.6	28.6	23.4	23.4	23.4	23.4
Actuated g/C Ratio	0.48	0.48	0.39	0.39	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	844	755	594	727	727	617
v/s Ratio Prot	c0.39			c0.34	0.20	
v/s Ratio Perm	0.07		0.34	0.12		
v/c Ratio	0.82	0.15	0.86	0.88	0.50	0.32
Uniform Delay, d1	13.5	8.9	16.8	17.0	13.9	12.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.0	0.4	12.1	12.1	0.5	0.3
Delay (s)	22.5	9.3	28.9	29.2	14.4	13.0
Level of Service	C	A	C	C	B	B
Approach Delay (s)	19.1			29.1	13.6	
Approach LOS	B			C	B	
Intersection Summary						
HCM Average Control Delay			21.4	HCM Level of Service		C
HCM Volume to Capacity ratio			0.85			
Actuated Cycle Length (s)			60.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			76.5%	ICU Level of Service		D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	45	70	110	110	5	195	810	155	20	565	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.95			1.00		1.00	0.98		1.00	0.99	
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1813		1770	1818		1770	1846	
Flt Permitted		0.75			0.71		0.33	1.00		0.10	1.00	
Satd. Flow (perm)		1333			1317		614	1818		186	1846	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	49	76	120	120	5	212	880	168	22	614	38
RTOR Reduction (vph)	0	31	0	0	2	0	0	10	0	0	3	0
Lane Group Flow (vph)	0	186	0	0	243	0	212	1038	0	22	649	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	14.7			14.7			42.3			42.3		
Effective Green, g (s)	14.7			14.7			42.3			42.3		
Actuated g/C Ratio	0.23			0.23			0.65			0.65		
Clearance Time (s)	4.0			4.0			4.0			4.0		
Vehicle Extension (s)	3.0			3.0			3.0			3.0		
Lane Grp Cap (vph)	301			298			400			121		
v/s Ratio Prot							c0.57			0.35		
v/s Ratio Perm	0.14			c0.18			0.35			0.12		
v/c Ratio	0.62			0.82			0.53			0.18		
Uniform Delay, d1	22.6			23.9			6.1			4.5		
Progression Factor	1.00			1.00			1.00			1.00		
Incremental Delay, d2	3.8			15.8			5.0			3.3		
Delay (s)	26.4			39.6			11.0			7.8		
Level of Service	C			D			B			A		
Approach Delay (s)	26.4			39.6			17.3			7.9		
Approach LOS	C			D			B			A		
Intersection Summary												
HCM Average Control Delay			17.7	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			65.0	Sum of lost time (s)			8.0					
Intersection Capacity Utilization			81.9%	ICU Level of Service			D					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

With 4-Way Ranch Phases 1&2

11: Stapleton Road & US 24

2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	40	255	20	90	15	125	690	80	40	340	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.73	1.00	1.00	0.50	1.00	1.00	0.25	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1358	1863	1583	935	1863	1583	460	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	43	277	22	98	16	136	750	87	43	370	136
RTOR Reduction (vph)	0	0	246	0	0	14	0	0	33	0	0	52
Lane Group Flow (vph)	33	43	31	22	98	2	136	750	54	43	370	84
Turn Type	Split		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	4	4			8			2			6	
Permitted Phases			4	8		8	2		2	6		6
Actuated Green, G (s)	8.4	8.4	8.4	8.1	8.1	8.1	46.5	46.5	46.5	46.5	46.5	46.5
Effective Green, g (s)	8.4	8.4	8.4	8.1	8.1	8.1	46.5	46.5	46.5	46.5	46.5	46.5
Actuated g/C Ratio	0.11	0.11	0.11	0.11	0.11	0.11	0.62	0.62	0.62	0.62	0.62	0.62
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	198	209	177	147	201	171	580	1155	981	285	1155	981
v/s Ratio Prot	0.02	c0.02			c0.05			c0.40			0.20	
v/s Ratio Perm			0.02	0.02		0.00	0.15		0.03	0.09		0.05
v/c Ratio	0.17	0.21	0.18	0.15	0.49	0.01	0.23	0.65	0.05	0.15	0.32	0.09
Uniform Delay, d1	30.1	30.3	30.2	30.3	31.5	29.9	6.3	9.1	5.6	6.0	6.8	5.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.5	0.5	0.5	1.9	0.0	0.9	2.8	0.1	1.1	0.7	0.2
Delay (s)	30.5	30.8	30.6	30.8	33.4	29.9	7.3	11.9	5.7	7.1	7.5	5.9
Level of Service	C	C	C	C	C	C	A	B	A	A	A	A
Approach Delay (s)		30.6			32.5			10.7			7.1	
Approach LOS		C			C			B			A	
Intersection Summary												
HCM Average Control Delay			14.7				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			75.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			58.0%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

8: Judge Orr Road & Stapleton Road

With 4-Way Ranch Phases 1&2

2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	20	45	10	0	5	110	25	10	5	30	20
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	22	49	11	0	5	120	27	11	5	33	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	5			71			236	204	46	201	226	3
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	5			71			236	204	46	201	226	3
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			99			82	96	99	99	95	98
cM capacity (veh/h)	1616			1530			652	660	1023	700	642	1081
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	65	71	11	5	120	38	5	54				
Volume Left	65	0	11	0	120	0	5	0				
Volume Right	0	49	0	5	0	11	0	22				
cSH	1616	1700	1530	1700	652	734	700	766				
Volume to Capacity	0.04	0.04	0.01	0.00	0.18	0.05	0.01	0.07				
Queue Length 95th (ft)	3	0	1	0	17	4	1	6				
Control Delay (s)	7.3	0.0	7.4	0.0	11.8	10.2	10.2	10.1				
Lane LOS	A		A		B	B	B	B				
Approach Delay (s)	3.5		4.9		11.4		10.1					
Approach LOS					B		B					
Intersection Summary												
Average Delay	8.0											
Intersection Capacity Utilization	29.4%			ICU Level of Service			A					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis

38: Stapleton Road & W Frontage Road

With 4-Way Ranch Phases 1&2

2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	145	90	65	200	75	60	20	120	60	20	120
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	158	98	71	217	82	65	22	130	65	22	130
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)					400							
pX, platoon unblocked												
vC, conflicting volume	299			255			815	755	207	766	723	217
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	299			255			815	755	207	766	723	217
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			95			70	93	84	72	93	84
cM capacity (veh/h)	1262			1310			219	306	834	237	319	822
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2			
Volume Total	54	255	71	217	82	65	152	65	152			
Volume Left	54	0	71	0	0	65	0	65	0			
Volume Right	0	98	0	0	82	0	130	0	130			
cSH	1262	1700	1310	1700	1700	219	669	237	671			
Volume to Capacity	0.04	0.15	0.05	0.13	0.05	0.30	0.23	0.28	0.23			
Queue Length 95th (ft)	3	0	4	0	0	30	22	27	22			
Control Delay (s)	8.0	0.0	7.9	0.0	0.0	28.2	12.0	25.9	11.9			
Lane LOS	A		A			D	B	D	B			
Approach Delay (s)	1.4		1.5			16.8		16.1				
Approach LOS						C		C				
Intersection Summary												
Average Delay			7.3									
Intersection Capacity Utilization			41.8%			ICU Level of Service			A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

47: Stapleton Road & E Frontage Road

With 4-Way Ranch Phases 1&2

2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	65	90	10	85	5	35	0	0	0	0	5
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	71	98	11	92	5	38	0	0	0	0	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (ft)	402											
pX, platoon unblocked												
vC, conflicting volume	98			168			250	250	120	198	296	95
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	98			168			250	250	120	198	296	95
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			95	100	100	100	100	99
cM capacity (veh/h)	1495			1409			693	645	932	754	608	962
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	5	168	11	98	38	5						
Volume Left	5	0	11	0	38	0						
Volume Right	0	98	0	5	0	5						
cSH	1495	1700	1409	1700	693	962						
Volume to Capacity	0.00	0.10	0.01	0.06	0.05	0.01						
Queue Length 95th (ft)	0	0	1	0	4	0						
Control Delay (s)	7.4	0.0	7.6	0.0	10.5	8.8						
Lane LOS	A		A		B	A						
Approach Delay (s)	0.2		0.8		10.5	8.8						
Approach LOS					B	A						
Intersection Summary												
Average Delay				1.7								
Intersection Capacity Utilization				25.4%	ICU Level of Service			A				
Analysis Period (min)				15								

2035 Build Conditions – AM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

With 4-Way Ranch Buildout
2035 AM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	410	255	295	345	685	585
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.17	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	613	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	446	277	321	375	745	636
RTOR Reduction (vph)	0	109	0	0	0	321
Lane Group Flow (vph)	446	168	321	375	745	315
Turn Type	Perm		Perm	Perm		
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	17.2	17.2	24.8	24.8	24.8	24.8
Effective Green, g (s)	17.2	17.2	24.8	24.8	24.8	24.8
Actuated g/C Ratio	0.34	0.34	0.50	0.50	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	609	545	304	924	924	785
v/s Ratio Prot	c0.25			0.20	0.40	
v/s Ratio Perm		0.11	c0.52			0.20
v/c Ratio	0.73	0.31	1.06	0.41	0.81	0.40
Uniform Delay, d1	14.4	12.0	12.6	8.0	10.6	7.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.6	1.5	67.1	0.3	5.2	0.3
Delay (s)	22.0	13.5	79.7	8.2	15.8	8.3
Level of Service	C	B	E	A	B	A
Approach Delay (s)	18.7			41.2	12.3	
Approach LOS	B			D	B	
Intersection Summary						
HCM Average Control Delay			21.2	HCM Level of Service		C
HCM Volume to Capacity ratio			0.92			
Actuated Cycle Length (s)			50.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			77.2%	ICU Level of Service		D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

With 4-Way Ranch Buildout
2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	15	220	275	190	40	55	60	620	50	15	715	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.93			0.97		1.00	0.99		1.00	0.99	
Flt Protected		1.00			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1725			1755		1770	1842		1770	1848	
Flt Permitted		0.99			0.39		0.13	1.00		0.13	1.00	
Satd. Flow (perm)		1706			710		248	1842		248	1848	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	239	299	207	43	60	65	674	54	16	777	43
RTOR Reduction (vph)	0	65	0	0	13	0	0	4	0	0	3	0
Lane Group Flow (vph)	0	489	0	0	297	0	65	724	0	16	817	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		27.0			27.0		30.0	30.0		30.0	30.0	
Effective Green, g (s)		27.0			27.0		30.0	30.0		30.0	30.0	
Actuated g/C Ratio		0.42			0.42		0.46	0.46		0.46	0.46	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		709			295		114	850		114	853	
v/s Ratio Prot								0.39			c0.44	
v/s Ratio Perm		0.29			c0.42		0.26			0.06		
v/c Ratio		0.69			1.01		0.57	0.85		0.14	0.96	
Uniform Delay, d1		15.6			19.0		12.8	15.5		10.1	16.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.8			53.7		19.1	10.5		2.6	22.1	
Delay (s)		18.4			72.7		31.9	26.0		12.6	39.0	
Level of Service		B			E		C	C		B	D	
Approach Delay (s)		18.4			72.7			26.5			38.5	
Approach LOS		B			E			C			D	
Intersection Summary												
HCM Average Control Delay			34.5			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			65.0			Sum of lost time (s)			8.0			
Intersection Capacity Utilization			101.9%			ICU Level of Service			G			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

With 4-Way Ranch Buildout

11: Stapleton Road & US 24

2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	110	155	50	110	30	185	450	50	30	560	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.91		1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1593	2907		1593	3082		1593	1676	1425	1593	1676	1425
Flt Permitted	0.95	1.00		0.58	1.00		0.33	1.00	1.00	0.41	1.00	1.00
Satd. Flow (perm)	1593	2907		965	3082		557	1676	1425	689	1676	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	120	168	54	120	33	201	489	54	33	609	158
RTOR Reduction (vph)	0	147	0	0	29	0	0	0	20	0	0	59
Lane Group Flow (vph)	98	141	0	54	124	0	201	489	34	33	609	99
Turn Type	Split			Perm			Perm			Perm		Perm
Protected Phases	4	4			8			2		2		6
Permitted Phases				8			2		2	6		6
Actuated Green, G (s)	11.1	11.1		10.6	10.6		56.3	56.3	56.3	56.3	56.3	56.3
Effective Green, g (s)	11.1	11.1		10.6	10.6		56.3	56.3	56.3	56.3	56.3	56.3
Actuated g/C Ratio	0.12	0.12		0.12	0.12		0.63	0.63	0.63	0.63	0.63	0.63
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	196	359		114	363		348	1048	891	431	1048	891
v/s Ratio Prot	c0.06	0.05			0.04			0.29			c0.36	
v/s Ratio Perm				c0.06			0.36		0.02	0.05		0.07
v/c Ratio	0.50	0.39		0.47	0.34		0.58	0.47	0.04	0.08	0.58	0.11
Uniform Delay, d1	36.9	36.3		37.1	36.5		9.9	8.9	6.5	6.6	9.9	6.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.7		3.1	0.6		6.8	1.5	0.1	0.3	2.4	0.3
Delay (s)	38.9	37.1		40.2	37.1		16.7	10.4	6.5	7.0	12.3	7.0
Level of Service	D	D		D	D		B	B	A	A	B	A
Approach Delay (s)		37.5			37.9			11.8			11.0	
Approach LOS		D			D			B			B	
Intersection Summary												
HCM Average Control Delay			18.7			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.55									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			69.7%			ICU Level of Service			C			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

25: Stapleton Road & W Frontage Road

With 4-Way Ranch Buildout
2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	100	175	165	125	150	115	20	140	115	20	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.90		1.00	0.92		1.00	0.87		1.00	0.87	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3202		1770	3250		1770	1619		1770	1619	
Flt Permitted	0.57	1.00		0.57	1.00		0.65	1.00		0.65	1.00	
Satd. Flow (perm)	1060	3202		1060	3250		1206	1619		1206	1619	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	109	190	179	136	163	125	22	152	125	22	152
RTOR Reduction (vph)	0	134	0	0	115	0	0	75	0	0	75	0
Lane Group Flow (vph)	152	165	0	179	184	0	125	99	0	125	99	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	11.8	11.8		11.8	11.8		20.2	20.2		20.2	20.2	
Effective Green, g (s)	11.8	11.8		11.8	11.8		20.2	20.2		20.2	20.2	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.50	0.50		0.50	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	313	945		313	959		609	818		609	818	
v/s Ratio Prot	0.05			0.06			0.06			0.06		
v/s Ratio Perm	0.14			c0.17			c0.10			0.10		
v/c Ratio	0.49	0.17		0.57	0.19		0.21	0.12		0.21	0.12	
Uniform Delay, d1	11.6	10.5		12.0	10.5		5.5	5.2		5.5	5.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.1		2.5	0.1		0.8	0.3		0.8	0.3	
Delay (s)	12.8	10.6		14.5	10.6		6.2	5.5		6.2	5.5	
Level of Service	B	B		B	B		A	A		A	A	
Approach Delay (s)	11.3			12.1			5.8			5.8		
Approach LOS	B			B			A			A		
Intersection Summary												
HCM Average Control Delay			9.4	HCM Level of Service			A					
HCM Volume to Capacity ratio			0.34									
Actuated Cycle Length (s)			40.0	Sum of lost time (s)			8.0					
Intersection Capacity Utilization			46.9%	ICU Level of Service			A					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

41: Stapleton Road & E Frontage Road

With 4-Way Ranch Buildout
2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	140	45	5	135	5	50	0	5	0	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.96		1.00	1.00		1.00	0.85			0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1770	3410		1770	3522		1770	1583			1583	
Flt Permitted	0.66	1.00		0.66	1.00		0.75	1.00			1.00	
Satd. Flow (perm)	1221	3410		1221	3522		1405	1583			1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	152	49	5	147	5	54	0	5	0	0	5
RTOR Reduction (vph)	0	42	0	0	4	0	0	2	0	0	2	0
Lane Group Flow (vph)	5	159	0	5	148	0	54	3	0	0	3	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	6.1	6.1		6.1	6.1		25.9	25.9			25.9	
Effective Green, g (s)	6.1	6.1		6.1	6.1		25.9	25.9			25.9	
Actuated g/C Ratio	0.15	0.15		0.15	0.15		0.65	0.65			0.65	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	186	520		186	537		910	1025			1025	
v/s Ratio Prot	c0.05			0.04			0.00			0.00		
v/s Ratio Perm	0.00			0.00			c0.04					
v/c Ratio	0.03	0.31		0.03	0.28		0.06	0.00			0.00	
Uniform Delay, d1	14.4	15.1		14.4	15.0		2.6	2.5			2.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	0.3		0.1	0.3		0.1	0.0			0.0	
Delay (s)	14.5	15.4		14.5	15.3		2.7	2.5			2.5	
Level of Service	B	B		B	B		A	A			A	
Approach Delay (s)	15.4			15.2			2.7			2.5		
Approach LOS	B			B			A			A		
Intersection Summary												
HCM Average Control Delay			13.4	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.11									
Actuated Cycle Length (s)			40.0	Sum of lost time (s)			8.0					
Intersection Capacity Utilization			21.4%	ICU Level of Service			A					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

36: Stapleton Road & Bandanero Drive

With 4-Way Ranch Buildout
2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	395	5	20	355	5	10	0	10	10	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	429	5	22	386	5	11	0	11	11	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	391			435			717	899	217	690	899	196
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	391			435			717	899	217	690	899	196
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			98			96	100	99	97	100	98
cM capacity (veh/h)	1164			1121			303	268	787	318	268	813
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	231	220	215	198	11	11	11	16				
Volume Left	16	0	22	0	11	0	11	0				
Volume Right	0	5	0	5	0	11	0	16				
cSH	1164	1700	1121	1700	303	787	318	813				
Volume to Capacity	0.01	0.13	0.02	0.12	0.04	0.01	0.03	0.02				
Queue Length 95th (ft)	1	0	1	0	3	1	3	2				
Control Delay (s)	0.7	0.0	1.0	0.0	17.3	9.6	16.7	9.5				
Lane LOS	A		A		C	A	C	A				
Approach Delay (s)	0.4		0.5		13.5		12.4					
Approach LOS					B		B					
Intersection Summary												
Average Delay			1.1									
Intersection Capacity Utilization			38.8%		ICU Level of Service					A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

48: Stapleton Road & Collector Roadway

With 4-Way Ranch Buildout
2035 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	110	10	0	105	0	20	0	5	5	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	120	11	0	114	0	22	0	5	5	0	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	114			130			258	293	65	234	299	57
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	114			130			258	293	65	234	299	57
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			97	100	99	99	100	98
cM capacity (veh/h)	1473			1453			650	605	985	688	601	997
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2		
Volume Total	27	80	51	0	76	38	22	5	5	22		
Volume Left	27	0	0	0	0	0	22	0	5	0		
Volume Right	0	0	11	0	0	0	0	5	0	22		
cSH	1473	1700	1700	1700	1700	1700	650	985	688	997		
Volume to Capacity	0.02	0.05	0.03	0.00	0.04	0.02	0.03	0.01	0.01	0.02		
Queue Length 95th (ft)	1	0	0	0	0	0	3	0	1	2		
Control Delay (s)	7.5	0.0	0.0	0.0	0.0	0.0	10.7	8.7	10.3	8.7		
Lane LOS	A						B	A	B	A		
Approach Delay (s)	1.3			0.0			10.3		9.0			
Approach LOS							B		A			
Intersection Summary												
Average Delay			2.2									
Intersection Capacity Utilization			22.5%			ICU Level of Service			A			
Analysis Period (min)			15									

2035 Build Conditions – PM Peak Hour

HCM Signalized Intersection Capacity Analysis

4: Woodmen Road & US 24

With 4-Way Ranch Buildout
2035 PM Peak Hour

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	620	220	470	600	340	455
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	1863	1583
Flt Permitted	0.95	1.00	0.42	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1527	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	674	239	511	652	370	495
RTOR Reduction (vph)	0	128	0	0	0	296
Lane Group Flow (vph)	674	111	511	652	370	199
Turn Type	Perm		Perm	Perm		
Protected Phases	6			4	8	
Permitted Phases		6	4			8
Actuated Green, G (s)	27.9	27.9	24.1	24.1	24.1	24.1
Effective Green, g (s)	27.9	27.9	24.1	24.1	24.1	24.1
Actuated g/C Ratio	0.46	0.46	0.40	0.40	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	823	736	613	748	748	636
v/s Ratio Prot	c0.38			c0.35	0.20	
v/s Ratio Perm		0.07	0.33			0.13
v/c Ratio	0.82	0.15	0.83	0.87	0.49	0.31
Uniform Delay, d1	13.9	9.2	16.1	16.5	13.4	12.3
Progression Factor	1.00	1.00	1.00	1.00	0.73	0.24
Incremental Delay, d2	8.9	0.4	9.5	10.9	0.4	0.2
Delay (s)	22.8	9.7	25.6	27.4	10.2	3.2
Level of Service	C	A	C	C	B	A
Approach Delay (s)	19.4			26.6	6.2	
Approach LOS	B			C	A	
Intersection Summary						
HCM Average Control Delay			18.4	HCM Level of Service		B
HCM Volume to Capacity ratio			0.84			
Actuated Cycle Length (s)			60.0	Sum of lost time (s)		8.0
Intersection Capacity Utilization			75.7%	ICU Level of Service		D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

7: Judge Orr Road & US 24

With 4-Way Ranch Buildout
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	85	45	70	110	140	35	195	800	155	40	565	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.95			0.98		1.00	0.98		1.00	0.99	
Flt Protected		0.98			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1797		1770	1818		1770	1846	
Flt Permitted		0.71			0.77		0.31	1.00		0.11	1.00	
Satd. Flow (perm)		1258			1408		585	1818		202	1846	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	49	76	120	152	38	212	870	168	43	614	38
RTOR Reduction (vph)	0	33	0	0	8	0	0	11	0	0	3	0
Lane Group Flow (vph)	0	184	0	0	302	0	212	1027	0	43	649	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		15.1			15.1		36.9	36.9		36.9	36.9	
Effective Green, g (s)		15.1			15.1		36.9	36.9		36.9	36.9	
Actuated g/C Ratio		0.25			0.25		0.61	0.61		0.61	0.61	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		317			354		360	1118		124	1135	
v/s Ratio Prot							c0.56				0.35	
v/s Ratio Perm		0.15			c0.21		0.36			0.21		
v/c Ratio		0.58			0.85		0.59	0.92		0.35	0.57	
Uniform Delay, d1		19.7			21.4		7.0	10.2		5.7	6.9	
Progression Factor		1.00			1.00		0.89	0.86		1.00	1.00	
Incremental Delay, d2		2.7			17.6		3.9	8.3		7.5	2.1	
Delay (s)		22.4			39.0		10.2	17.1		13.2	8.9	
Level of Service		C			D		B	B		B	A	
Approach Delay (s)		22.4			39.0			15.9			9.2	
Approach LOS		C			D			B			A	
Intersection Summary												
HCM Average Control Delay		17.5			HCM Level of Service			B				
HCM Volume to Capacity ratio		0.90										
Actuated Cycle Length (s)		60.0			Sum of lost time (s)			8.0				
Intersection Capacity Utilization		84.2%			ICU Level of Service			E				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

With 4-Way Ranch Buildout

11: Stapleton Road & US 24

2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	185	275	110	115	30	230	625	60	40	250	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.91		1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1593	2900		1593	3086		1593	1676	1425	1593	1676	1425
Flt Permitted	0.95	1.00		0.47	1.00		0.54	1.00	1.00	0.20	1.00	1.00
Satd. Flow (perm)	1593	2900		786	3086		912	1676	1425	329	1676	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	201	299	120	125	33	250	679	65	43	272	152
RTOR Reduction (vph)	0	248	0	0	27	0	0	0	33	0	0	77
Lane Group Flow (vph)	174	252	0	120	131	0	250	679	32	43	272	75
Turn Type	Split			Perm			Perm			Perm		Perm
Protected Phases	4	4			8			2		2		6
Permitted Phases				8			2		2	6		6
Actuated Green, G (s)	13.7	13.7		14.7	14.7		39.6	39.6	39.6	39.6	39.6	39.6
Effective Green, g (s)	13.7	13.7		14.7	14.7		39.6	39.6	39.6	39.6	39.6	39.6
Actuated g/C Ratio	0.17	0.17		0.18	0.18		0.50	0.50	0.50	0.50	0.50	0.50
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	273	497		144	567		451	830	705	163	830	705
v/s Ratio Prot	c0.11	0.09			0.04			c0.41			0.16	
v/s Ratio Perm				c0.15			0.27		0.02	0.13		0.05
v/c Ratio	0.64	0.51		0.83	0.23		0.55	0.82	0.05	0.26	0.33	0.11
Uniform Delay, d1	30.8	30.1		31.5	27.8		14.1	17.1	10.4	11.7	12.2	10.8
Progression Factor	0.86	0.74		0.74	0.72		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.4	0.7		31.8	0.2		4.8	8.8	0.1	3.9	1.1	0.3
Delay (s)	30.7	23.0		55.0	20.2		18.9	25.9	10.6	15.6	13.2	11.1
Level of Service	C	C		E	C		B	C	B	B	B	B
Approach Delay (s)		25.0			35.2			23.2			12.8	
Approach LOS		C			D			C			B	
Intersection Summary												
HCM Average Control Delay			23.0			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			80.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			75.5%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

25: Stapleton Road & W Frontage Road

With 4-Way Ranch Buildout
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	100	240	240	95	150	170	40	260	260	40	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.89		1.00	0.91		1.00	0.87		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3165		1770	3214		1770	1620		1770	1636	
Flt Permitted	0.59	1.00		0.53	1.00		0.62	1.00		0.54	1.00	
Satd. Flow (perm)	1095	3165		990	3214		1148	1620		1001	1636	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	163	109	261	261	103	163	185	43	283	283	43	185
RTOR Reduction (vph)	0	170	0	0	106	0	0	155	0	0	101	0
Lane Group Flow (vph)	163	200	0	261	160	0	185	171	0	283	127	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	13.9	13.9		13.9	13.9		18.1	18.1		18.1	18.1	
Effective Green, g (s)	13.9	13.9		13.9	13.9		18.1	18.1		18.1	18.1	
Actuated g/C Ratio	0.35	0.35		0.35	0.35		0.45	0.45		0.45	0.45	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	381	1100		344	1117		519	733		453	740	
v/s Ratio Prot	0.06			0.05			0.11			0.08		
v/s Ratio Perm	0.15			0.26			0.16			0.28		
v/c Ratio	0.43	0.18		0.76	0.14		0.36	0.23		0.62	0.17	
Uniform Delay, d1	10.0	9.1		11.6	9.0		7.1	6.7		8.4	6.5	
Progression Factor	1.00	1.00		1.16	1.34		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	0.1		8.8	0.1		1.9	0.7		6.4	0.5	
Delay (s)	10.8	9.2		22.1	12.0		9.1	7.4		14.7	7.0	
Level of Service	B	A		C	B		A	A		B	A	
Approach Delay (s)	9.7			17.0			8.0			11.3		
Approach LOS	A			B			A			B		
Intersection Summary												
HCM Average Control Delay			11.5	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			40.0	Sum of lost time (s)			8.0					
Intersection Capacity Utilization			69.7%	ICU Level of Service			C					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

41: Stapleton Road & E Frontage Road

With 4-Way Ranch Buildout
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	205	75	5	210	0	40	0	5	0	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frt	1.00	0.96		1.00	1.00		1.00	0.85			0.85	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1770	3396		1770	3539		1770	1583			1583	
Flt Permitted	0.61	1.00		0.57	1.00		0.75	1.00			1.00	
Satd. Flow (perm)	1135	3396		1054	3539		1405	1583			1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	223	82	5	228	0	43	0	5	0	0	5
RTOR Reduction (vph)	0	65	0	0	0	0	0	2	0	0	2	0
Lane Group Flow (vph)	5	240	0	5	228	0	43	3	0	0	3	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	8.3	8.3		8.3	8.3		23.7	23.7			23.7	
Effective Green, g (s)	8.3	8.3		8.3	8.3		23.7	23.7			23.7	
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.59	0.59			0.59	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	236	705		219	734		832	938			938	
v/s Ratio Prot	c0.07			0.06			0.00			0.00		
v/s Ratio Perm	0.00			0.00			c0.03					
v/c Ratio	0.02	0.34		0.02	0.31		0.05	0.00			0.00	
Uniform Delay, d1	12.6	13.5		12.6	13.4		3.4	3.3			3.3	
Progression Factor	0.64	0.65		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.0	0.3		0.0	0.2		0.1	0.0			0.0	
Delay (s)	8.0	9.1		12.7	13.7		3.5	3.3			3.3	
Level of Service	A	A		B	B		A	A			A	
Approach Delay (s)	9.1			13.6			3.5			3.3		
Approach LOS	A			B			A			A		
Intersection Summary												
HCM Average Control Delay			10.4	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.13									
Actuated Cycle Length (s)			40.0	Sum of lost time (s)			8.0					
Intersection Capacity Utilization			23.6%	ICU Level of Service			A					
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis

36: Stapleton Road & Bandanero Drive

With 4-Way Ranch Buildout
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	460	5	40	385	10	10	0	20	10	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	500	5	43	418	11	11	0	22	11	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	429			505			848	1052	253	815	1049	215
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	429			505			848	1052	253	815	1049	215
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			96			95	100	97	96	100	98
cM capacity (veh/h)	1127			1055			239	213	747	250	214	790
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2				
Volume Total	266	255	253	220	11	22	11	16				
Volume Left	16	0	43	0	11	0	11	0				
Volume Right	0	5	0	11	0	22	0	16				
cSH	1127	1700	1055	1700	239	747	250	790				
Volume to Capacity	0.01	0.15	0.04	0.13	0.05	0.03	0.04	0.02				
Queue Length 95th (ft)	1	0	3	0	4	2	3	2				
Control Delay (s)	0.6	0.0	1.8	0.0	20.8	10.0	20.0	9.7				
Lane LOS	A		A		C	A	C	A				
Approach Delay (s)	0.3		1.0		13.6		13.8					
Approach LOS					B		B					
Intersection Summary												
Average Delay			1.4									
Intersection Capacity Utilization			42.7%		ICU Level of Service			A				
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

48: Stapleton Road & Collector Roadway

With 4-Way Ranch Buildout
2035 PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	135	45	0	150	0	45	0	5	5	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	147	49	0	163	0	49	0	5	5	0	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	163			196			340	399	98	307	424	82
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	163			196			340	399	98	307	424	82
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			91	100	99	99	100	98
cM capacity (veh/h)	1413			1375			567	525	939	608	508	962
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2		
Volume Total	33	98	98	0	109	54	49	5	5	22		
Volume Left	33	0	0	0	0	0	49	0	5	0		
Volume Right	0	0	49	0	0	0	0	5	0	22		
cSH	1413	1700	1700	1700	1700	1700	567	939	608	962		
Volume to Capacity	0.02	0.06	0.06	0.00	0.06	0.03	0.09	0.01	0.01	0.02		
Queue Length 95th (ft)	2	0	0	0	0	0	7	0	1	2		
Control Delay (s)	7.6	0.0	0.0	0.0	0.0	0.0	12.0	8.9	11.0	8.8		
Lane LOS	A						B	A	B	A		
Approach Delay (s)	1.1			0.0			11.6		9.3			
Approach LOS							B		A			
Intersection Summary												
Average Delay			2.4									
Intersection Capacity Utilization			27.7%			ICU Level of Service			A			
Analysis Period (min)			15									

Appendix D: Queue Analysis Model Output/Reports

Queues

4: Woodmen Road & US 24

With 4-Way Ranch Phases 1&2

2035 AM Peak Hour



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	446	277	321	364	717	636
v/c Ratio	0.67	0.39	1.02	0.40	0.78	0.58
Control Delay	23.8	7.4	75.4	10.5	13.2	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.8	7.4	75.4	10.5	13.2	1.7
Queue Length 50th (ft)	141	23	51	69	136	3
Queue Length 95th (ft)	#272	72	#129	118	m165	m2
Internal Link Dist (ft)	216			489	906	
Turn Bay Length (ft)			350			400
Base Capacity (vph)	663	710	341	994	994	1141
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.39	0.94	0.37	0.72	0.56

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
7: Judge Orr Road & US 24

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour



Lane Group	EBT	WBT	NEL	NET	SWL	SWT
Lane Group Flow (vph)	554	277	65	717	16	826
v/c Ratio	0.74	1.01	0.52	0.83	0.12	0.95
Control Delay	19.5	81.9	28.5	21.8	11.9	39.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	81.9	28.5	21.8	11.9	39.3
Queue Length 50th (ft)	129	~97	12	141	3	268
Queue Length 95th (ft)	#255	#238	m31	#389	14	#503
Internal Link Dist (ft)	3550	2108		112		2673
Turn Bay Length (ft)			800		600	
Base Capacity (vph)	751	273	124	864	132	867
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	1.01	0.52	0.83	0.12	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues

11: Stapleton Road & US 24

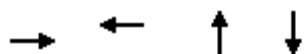
With 4-Way Ranch Phases 1&2

2035 AM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	22	49	168	54	54	33	76	571	54	60	620	130
v/c Ratio	0.11	0.24	0.52	0.34	0.24	0.15	0.20	0.49	0.05	0.14	0.53	0.12
Control Delay	28.2	30.5	11.4	33.2	29.7	11.8	9.8	10.6	2.9	8.9	11.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.2	30.5	11.4	33.2	29.7	11.8	9.8	10.6	2.9	8.9	11.3	2.2
Queue Length 50th (ft)	9	20	0	22	22	0	13	122	0	10	138	0
Queue Length 95th (ft)	26	47	48	51	50	22	44	261	15	34	294	23
Internal Link Dist (ft)		325			322			470			2545	
Turn Bay Length (ft)	215			215		150	215		280	215		390
Base Capacity (vph)	405	426	491	309	426	387	385	1169	1014	422	1169	1042
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.12	0.34	0.17	0.13	0.09	0.20	0.49	0.05	0.14	0.53	0.12
Intersection Summary												

Queues
12: Stapleton Road & Eastonville Road

With 4-Way Ranch Phases 1&2
2035 AM Peak Hour



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	255	195	604	473
v/c Ratio	0.71	0.37	0.58	0.54
Control Delay	26.8	8.4	10.3	8.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	26.8	8.4	10.3	8.3
Queue Length 50th (ft)	60	17	94	51
Queue Length 95th (ft)	121	54	197	131
Internal Link Dist (ft)	1948	2445	929	768
Turn Bay Length (ft)				
Base Capacity (vph)	446	622	1034	881
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.57	0.31	0.58	0.54
Intersection Summary				

Queues
4: Woodmen Road & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	696	239	511	641	364	500
v/c Ratio	0.82	0.27	0.86	0.88	0.50	0.54
Control Delay	24.7	2.5	34.3	33.6	16.6	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.7	2.5	34.3	33.6	16.6	3.9
Queue Length 50th (ft)	208	0	82	204	94	0
Queue Length 95th (ft)	#402	31	#166	#386	161	50
Internal Link Dist (ft)	284			763	906	
Turn Bay Length (ft)			350			400
Base Capacity (vph)	845	880	608	745	745	933
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.27	0.84	0.86	0.49	0.54

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
7: Judge Orr Road & US 24

With 4-Way Ranch Phases 1&2
2035 PM Peak Hour



Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	217	245	212	1048	22	652
v/c Ratio	0.65	0.82	0.53	0.88	0.18	0.54
Control Delay	28.3	46.9	12.8	20.9	9.4	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.3	46.9	12.8	20.9	9.4	8.5
Queue Length 50th (ft)	61	89	41	298	3	124
Queue Length 95th (ft)	127	#196	103	#611	14	203
Internal Link Dist (ft)	3550	2108		112		2673
Turn Bay Length (ft)			800		600	
Base Capacity (vph)	358	326	399	1193	121	1205
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.75	0.53	0.88	0.18	0.54

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues

11: Stapleton Road & US 24

With 4-Way Ranch Phases 1&2

2035 PM Peak Hour

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	33	43	277	22	98	16	136	750	87	43	370	136
v/c Ratio	0.17	0.21	0.65	0.13	0.43	0.08	0.23	0.64	0.08	0.15	0.32	0.13
Control Delay	30.1	30.9	11.9	29.6	35.3	14.4	9.9	15.0	2.8	10.6	9.3	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.1	30.9	11.9	29.6	35.3	14.4	9.9	15.0	2.8	10.6	9.3	2.4
Queue Length 50th (ft)	15	19	0	9	43	0	25	196	0	7	72	0
Queue Length 95th (ft)	35	43	60	28	83	16	75	#505	21	32	171	26
Internal Link Dist (ft)		320			322			356			2545	
Turn Bay Length (ft)	150			150		100			280	215		390
Base Capacity (vph)	378	397	556	290	397	350	589	1174	1030	290	1174	1048
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.11	0.50	0.08	0.25	0.05	0.23	0.64	0.08	0.15	0.32	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Queues

4: Woodmen Road & US 24

With 4-Way Ranch Buildout

2035 AM Peak Hour



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	446	277	321	375	745	636
v/c Ratio	0.73	0.42	1.06	0.41	0.81	0.58
Control Delay	25.1	8.2	85.6	9.2	19.0	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	8.2	85.6	9.2	19.0	3.1
Queue Length 50th (ft)	116	23	~43	59	155	0
Queue Length 95th (ft)	#245	70	#117	106	#338	38
Internal Link Dist (ft)	300			489	906	
Turn Bay Length (ft)			350			400
Base Capacity (vph)	609	653	319	969	969	1128
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.42	1.01	0.39	0.77	0.56

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Queues
7: Judge Orr Road & US 24

With 4-Way Ranch Buildout
2035 AM Peak Hour



Lane Group	EBT	WBT	NEL	NET	SWL	SWT
Lane Group Flow (vph)	554	310	65	728	16	820
v/c Ratio	0.72	1.01	0.57	0.85	0.14	0.96
Control Delay	18.8	76.0	37.9	27.7	13.9	41.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.8	76.0	37.9	27.7	13.9	41.6
Queue Length 50th (ft)	139	~114	18	239	3	294
Queue Length 95th (ft)	251	#269	#77	#446	16	#535
Internal Link Dist (ft)	3550	2108		112		2673
Turn Bay Length (ft)			800		600	
Base Capacity (vph)	774	308	114	854	114	856
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.72	1.01	0.57	0.85	0.14	0.96

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
11: Stapleton Road & US 24

With 4-Way Ranch Buildout
2035 AM Peak Hour

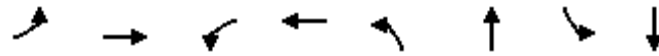
										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	98	288	54	153	201	489	54	33	609	158
v/c Ratio	0.50	0.57	0.48	0.39	0.58	0.47	0.06	0.08	0.58	0.17
Control Delay	44.5	19.5	49.8	30.5	21.6	12.4	3.3	9.8	14.6	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.5	19.5	49.8	30.5	21.6	12.4	3.3	9.8	14.6	2.3
Queue Length 50th (ft)	53	33	29	33	59	130	0	7	180	0
Queue Length 95th (ft)	96	68	63	59	#204	277	17	25	382	29
Internal Link Dist (ft)		194		404		480			2545	
Turn Bay Length (ft)	100		100		600		800			390
Base Capacity (vph)	283	655	171	575	348	1048	912	431	1048	951
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.44	0.32	0.27	0.58	0.47	0.06	0.08	0.58	0.17

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
12: Stapleton Road & Eastonville Road

With 4-Way Ranch Buildout
2035 AM Peak Hour



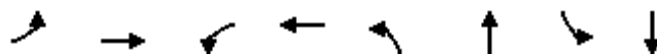
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	141	196	33	380	22	631	158	386
v/c Ratio	0.83	0.38	0.10	0.67	0.04	0.62	0.50	0.38
Control Delay	56.4	15.3	13.0	16.6	6.2	11.1	15.2	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.4	15.3	13.0	16.6	6.2	11.1	15.2	5.0
Queue Length 50th (ft)	36	41	7	60	3	113	27	30
Queue Length 95th (ft)	#114	83	22	131	11	206	#82	70
Internal Link Dist (ft)		1948		2445		929		768
Turn Bay Length (ft)	100				100		100	
Base Capacity (vph)	207	631	396	661	511	1014	313	1023
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.31	0.08	0.57	0.04	0.62	0.50	0.38

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
25: Stapleton Road & W Frontage Road

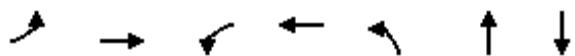
With 4-Way Ranch Buildout
2035 AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	152	299	179	299	125	174	125	174
v/c Ratio	0.49	0.28	0.57	0.28	0.21	0.20	0.21	0.20
Control Delay	15.8	4.3	18.4	5.1	8.3	3.0	8.3	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.8	4.3	18.4	5.1	8.3	3.0	8.3	3.0
Queue Length 50th (ft)	26	8	32	11	14	2	14	2
Queue Length 95th (ft)	55	23	65	25	43	27	43	27
Internal Link Dist (ft)		2773		136		248		811
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	424	1395	424	1397	608	892	608	892
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.21	0.42	0.21	0.21	0.20	0.21	0.20
Intersection Summary								

Queues
41: Stapleton Road & E Frontage Road

With 4-Way Ranch Buildout
2035 AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	5	201	5	152	54	5	5
v/c Ratio	0.02	0.31	0.02	0.24	0.06	0.00	0.00
Control Delay	12.8	11.8	12.8	14.0	3.7	0.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.8	11.8	12.8	14.0	3.7	0.0	0.0
Queue Length 50th (ft)	1	15	1	15	4	0	0
Queue Length 95th (ft)	6	33	6	30	13	0	0
Internal Link Dist (ft)		404		1638		646	131
Turn Bay Length (ft)	10		100		100		
Base Capacity (vph)	489	1393	489	1412	965	1298	1301
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.14	0.01	0.11	0.06	0.00	0.00
Intersection Summary							

Queues
4: Woodmen Road & US 24

With 4-Way Ranch Buildout
2035 PM Peak Hour

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	674	239	511	652	370	495
v/c Ratio	0.82	0.28	0.83	0.87	0.49	0.53
Control Delay	25.3	2.6	30.4	31.2	11.8	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	2.6	30.4	31.2	11.8	2.2
Queue Length 50th (ft)	204	0	79	202	59	1
Queue Length 95th (ft)	#395	32	#160	#382	m103	m8
Internal Link Dist (ft)	300			489	906	
Turn Bay Length (ft)			350			400
Base Capacity (vph)	822	863	635	776	776	948
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.28	0.80	0.84	0.48	0.52
Intersection Summary						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues
7: Judge Orr Road & US 24

With 4-Way Ranch Buildout
2035 PM Peak Hour



Lane Group	EBT	WBT	NEL	NET	SWL	SWT
Lane Group Flow (vph)	217	310	212	1038	43	652
v/c Ratio	0.62	0.85	0.59	0.92	0.35	0.57
Control Delay	24.0	44.8	12.3	20.2	15.9	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	44.8	12.3	20.2	15.9	9.6
Queue Length 50th (ft)	53	101	41	236	7	124
Queue Length 95th (ft)	117	#225	m61	m#540	33	207
Internal Link Dist (ft)	3550	2108		112		2673
Turn Bay Length (ft)			800		600	
Base Capacity (vph)	368	383	359	1128	124	1137
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.81	0.59	0.92	0.35	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
11: Stapleton Road & US 24

With 4-Way Ranch Buildout
2035 PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	174	500	120	158	250	679	65	43	272	152
v/c Ratio	0.64	0.67	0.83	0.27	0.56	0.82	0.09	0.26	0.33	0.19
Control Delay	35.8	13.0	66.4	16.6	21.7	29.4	4.0	19.3	14.9	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	13.0	66.4	16.6	21.7	29.4	4.0	19.3	14.9	3.1
Queue Length 50th (ft)	65	28	39	16	91	301	0	13	86	0
Queue Length 95th (ft)	m125	53	#150	40	174	#521	21	40	143	31
Internal Link Dist (ft)		194		404		480			2545	
Turn Bay Length (ft)	100		100		600		800	600		390
Base Capacity (vph)	319	819	158	646	450	828	737	163	828	781
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.61	0.76	0.24	0.56	0.82	0.09	0.26	0.33	0.19

Intersection Summary

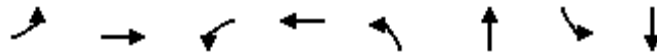
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
12: Stapleton Road & Eastonville Road

With 4-Way Ranch Buildout
2035 PM Peak Hour



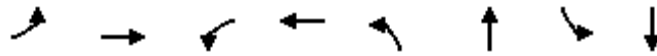
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	141	218	38	408	22	652	185	386
v/c Ratio	0.88	0.41	0.12	0.68	0.04	0.65	0.65	0.38
Control Delay	68.9	15.6	13.2	15.2	6.2	11.8	24.1	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.9	15.6	13.2	15.2	6.2	11.8	24.1	5.1
Queue Length 50th (ft)	37	47	8	57	3	118	36	30
Queue Length 95th (ft)	#120	92	24	132	11	216	#129	70
Internal Link Dist (ft)		1948		2445		929		768
Turn Bay Length (ft)	100				100		100	
Base Capacity (vph)	185	622	368	673	499	999	285	1011
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.35	0.10	0.61	0.04	0.65	0.65	0.38

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
25: Stapleton Road & W Frontage Road

With 4-Way Ranch Buildout
2035 PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	163	370	261	266	185	326	283	228
v/c Ratio	0.43	0.29	0.76	0.22	0.36	0.37	0.62	0.27
Control Delay	13.0	3.5	27.0	4.7	10.9	3.5	19.6	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.0	3.5	27.0	4.7	10.9	3.5	19.6	3.6
Queue Length 50th (ft)	24	7	42	6	28	6	49	6
Queue Length 95th (ft)	58	25	106	27	65	40	#146	34
Internal Link Dist (ft)		2773		136		248		805
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	438	1422	396	1383	519	888	453	841
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.26	0.66	0.19	0.36	0.37	0.62	0.27

Intersection Summary

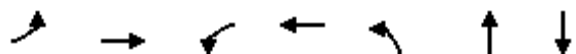
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues

With 4-Way Ranch Buildout

41: Stapleton Road & E Frontage Road

2035 PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	5	305	5	228	43	5	5
v/c Ratio	0.02	0.40	0.02	0.31	0.05	0.00	0.00
Control Delay	7.4	7.6	11.4	14.0	4.4	0.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.4	7.6	11.4	14.0	4.4	0.0	0.0
Queue Length 50th (ft)	1	20	1	23	3	0	0
Queue Length 95th (ft)	m1	24	6	39	13	0	0
Internal Link Dist (ft)		404		1638		642	131
Turn Bay Length (ft)	10		100		100		
Base Capacity (vph)	454	1408	422	1416	834	1156	1153
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.22	0.01	0.16	0.05	0.00	0.00

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Appendix E: Signal Progression Analysis Results

***** BEST PROGRESSION SOLUTION SUMMARY *****

Falcon, CO US 24 DISTRICT 01/25/13 RUN
 NO. 0

CYCLE LENGTH =120 SECS (MAXIMIN CYCLE > 120 SECS)
 EFFICIENCY = .37 (GREAT PROGRESSION)
 ATTAINABILITY = .77 (FINE-TUNING NEEDED)

BAND A = 32 SECS AVERAGE SPEED = 55 MPH
 BAND B = 56 SECS AVERAGE SPEED = 61 MPH

NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA

 EFFICIENCY 0.00 - 0.12 - "POOR PROGRESSION"
 0.13 - 0.24 - "FAIR PROGRESSION"
 0.25 - 0.36 - "GOOD PROGRESSION"
 0.37 - 1.00 - "GREAT PROGRESSION"

ATTAINABILITY 1.00 - 0.99 - "INCREASE MIN THRU PHASE"
 0.99 - 0.70 - "FINE-TUNING NEEDED"
 0.69 - 0.00 - "MAJOR CHANGES NEEDED"

(INT.SUMY)

***** INTERSECTION PERFORMANCE SUMMARY *****

CYCLE LENGTH = 120 SECS SYSTEM MAXIMIN CYCLE = 285 SECS

INT DELAY	CROSS STREET INT	PHASE ART CRS	MIN. DELAY CYCLE (SECS)	INTERSECTION V/C RATIO	AVERAGE (SECS/VEH)
NO	INTERSECTION				

1	1	Woodmen Rd	2 4	89	.89 28.7
2	2	Judge Orr Rd	2 2	285	1.07 311935.5
3	3	Stapleton Rd	2 2	77	.69 22.7

NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART) CROSS STREET (CRS)

 -
 1 - LEFT TURN FIRST OR DUAL LEFTS LEADING OR DUAL LEFTS
 (1+5)

(2+6) 2 - THROUGH FIRST OR DUAL THRU LEADING OR DUAL THRU
 (2+5) 3 - LEADING GREEN OR NO. 5 LEADING OR LT 5 LEADS
 (1+6) 4 - LAGGING GREEN OR NO. 1 LEADING OR LT 1 LEADS

(BEST.SOLN)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

**** BEST SOLUTION.... NEMA PHASE DESIGNATION ****
 *** INT. 1 .0 SEC OFFSET ART ST PHASE SEQ IS DUAL THRU
 (2+6) Woodmen Rd .0 % OFFSET CROSS ST PHASE SEQ IS LT 7 LEADS
 (4+7)

CONCURRENT PHASES	ARTERIAL STREET				4+7	CROSS STREET	
	2+6	2+5	1+5	TOTAL		4+8	3+8
TOTAL							
PHASE TIME (SECS)	61.1	19.0	.0	80.1	39.9	.0	.0
39.9							
PHASE TIME (%)	50.9	15.8	.0	66.7	33.3	.0	.0
33.3							
----- MEASURES OF EFFECTIVENESS -----							
PHASE (NEMA)	5[5]	6	1[5]	2	3[5]	4	7[5]
8							
PHASE DIRECTION	NBLTPR	SBTHRU	SBLTPR	NBTHRU	WBLTPR	EBTHRU	EBLTPR
WBTHRU							
PHASE TIME (SEC)	19.0	61.1	.0	80.1	.0	39.9	39.9
.0							
V/C-RATIO	.77	.80	.00	.31	.00	.48	.82
.00							
LEVEL OF SERVICE	C	C		A		A	D
DELAY (SECS/VEH)	50.1	24.9	.0	8.6	.0	29.9	41.0
.0							
LEVEL OF SERVICE	D	C		B		C	D
QUEUE (VEH/LANE)	5.4	12.2	.0	4.1	.0	5.9	11.6
.0							
STOPS (STOPS/HR)	277.	1169.	0.	311.	0.	232.	373.
0.							
TOTAL INTERSECTION DELAY			FUEL CONSUMPTION		MINIMUM DELAY		
CYCLE							
	28.67 SECS/VEH		119.52 GAL/HR		89 SECS		

(BEST.SOLN)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

**** BEST SOLUTION CONTINUED.... NEMA PHASE DESIGNATION ****

*** INT. 2 15.1 SEC OFFSET ART ST PHASE SEQ IS DUAL THRU
 (2+6)
 Judge Orr Rd 12.6 % OFFSET CROSS ST PHASE SEQ IS DUAL THRU
 (4+8)

CONCURRENT PHASES	ARTERIAL STREET				TOTAL	4+8	CROSS STREET	
	2+6	1+6	1+5				3+8	3+7
TOTAL								
PHASE TIME (SECS)	57.7	.0	15.0		72.7	32.3	.0	15.0
47.3								
PHASE TIME (%)	48.1	.0	12.5		60.6	26.9	.0	12.5
39.4								
----- MEASURES OF EFFECTIVENESS -----								
PHASE (NEMA)	5[2]	6	1[2]	2		3[2]	4	7[2]
8								
PHASE DIRECTION	NBLTPR	SBTHRU	SBLTPR	NBTHRU		WBLTPR	EBTHRU	EBLTPR
WBTHRU								
PHASE TIME (SEC)	15.0	57.7	15.0	57.7		15.0	32.3	15.0
32.3								
*V/C-RATIO	.00	8.21	.00	1.66		.00	1.25	.00
23.75								
LEVEL OF SERVICE		F		F			F	
F								
DELAY (SECS/VEH)	.0	*****	.0	747.7		.0	207.1	
.0								
LEVEL OF SERVICE		F		F			F	
F								
QUEUE (VEH/LANE)	.0	15778.2	.0	167.4		.0	47.3	
.0								
STOPS (STOPS/HR)	0.1	29646.	0.	2797.		0.	972.	
0.153810.								
TOTAL INTERSECTION DELAY					FUEL CONSUMPTION	MINIMUM DELAY		
CYCLE								
311935.50 SECS/VEH					***** GAL/HR	> 120 SECS		

(BEST.SOLN)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0
 DEC 90

***** BEST SOLUTION CONTINUED.... NEMA PHASE DESIGNATION *****

*** INT. 3 62.2 SEC OFFSET ART ST PHASE SEQ IS DUAL THRU
 (2+6)
 Stapleton Rd 51.8 % OFFSET CROSS ST PHASE SEQ IS DUAL THRU
 (4+8)

CONCURRENT PHASES	ARTERIAL STREET				TOTAL	4+8	CROSS STREET	
	2+6	1+6	1+5				3+8	3+7
TOTAL								
PHASE TIME (SECS)	72.1	.0	15.0		87.1	18.7	.0	14.2
32.9								
PHASE TIME (%)	60.1	.0	12.5		72.6	15.6	.0	11.8
27.4								

```

----- MEASURES OF EFFECTIVENESS -----
-----
PHASE (NEMA)          5[6]   6       1[5]   2       3[5]   4       7[5]
8
PHASE DIRECTION      NBLTPP SBTHRU SBLTPR NBTHRU  WBLTPR EBTHRU EBLTPR
WBTHRU
PHASE TIME (SEC)     15.0   72.1   15.0   72.1   14.2   18.7   14.2
18.7
V/C-RATIO            .35    .37    .19    .34    .34    .63    .62
.33
LEVEL OF SERVICE      A       A       A       A       A       B       B
A
DELAY (SECS/VEH)     12.3   12.1   43.0   11.8   44.7   44.9   51.0
41.1
LEVEL OF SERVICE      B       B       D       B       D       D       D
D
QUEUE (VEH/LANE)      2.7    5.2    .9     4.7    1.5    4.0    3.0
2.1
STOPS (STOPS/HR)     116.   635.   25.    151.   44.    246.   85.
127.
TOTAL INTERSECTION DELAY          FUEL CONSUMPTION          MINIMUM DELAY
CYCLE
      22.67 SECS/VEH          56.27 GAL/HR          77 SECS

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(ART.MOE)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0
 DEC 90

**** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

Falcon, CO US 24 DISTRICT 01/25/13 RUN
 NO. 0

CYCLE LENGTH = 120 SECS BAND A = 32 SECS BAND B = 56
 SECS
 AVERAGE PROGRESSION SPEED - BAND A = 55 MPH BAND B = 61
 MPH

.37 EFFICIENCY .77 ATTAINABILITY

AVERAGE INTERSECTION DELAY	TOTAL SYSTEM DELAY	TOTAL NUMBER
VEHICLES		
***** SECS/VEH	174628.9 VEH-HR/HR	6370.
TOTAL SYSTEM FUEL CONSUMPTION	TOTAL SYSTEM STOPS	MAXIMIN CYCLE
132392.30 GAL/HR	291017. STOPS	> 120 SECS

(ART.MOE)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

EFFICIENCY VERSUS CYCLE LENGTH

CYCLE LENGTH	CUMULATIVE EFFICIENCY
60	.09
70	.24
80	.34
90	.34
100	.34
110	.34
120	.37
130	.37
140	.37
150	.37

(ART.MOE)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

EFFICIENCY VERSUS CYCLE LENGTH

	CYCLE LENGTH	CUMULATIVE EFFICIENCY
BEST SOLUTION	120	.37

(PIN.SET)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

***** BEST PROGRESSION SOLUTION SUMMARY *****

Falcon, CO US 24 DISTRICT 01/25/13 RUN
 NO. 0

CYCLE LENGTH = 90 SECS (MAXIMIN CYCLE > 120 SECS)
 EFFICIENCY = .21 (FAIR PROGRESSION)
 ATTAINABILITY = 1.00 (INCREASE MIN. THROUGH PHASE)

BAND A = 18 SECS AVERAGE SPEED = 50 MPH
 BAND B = 18 SECS AVERAGE SPEED = 50 MPH

NOTE: ARTERIAL PROGRESSION EVALUATION CRITERIA

 EFFICIENCY 0.00 - 0.12 - "POOR PROGRESSION"
 0.13 - 0.24 - "FAIR PROGRESSION"
 0.25 - 0.36 - "GOOD PROGRESSION"
 0.37 - 1.00 - "GREAT PROGRESSION"

ATTAINABILITY 1.00 - 0.99 - "INCREASE MIN THRU PHASE"
 0.99 - 0.70 - "FINE-TUNING NEEDED"
 0.69 - 0.00 - "MAJOR CHANGES NEEDED"

(INT.SUMY)

***** INTERSECTION PERFORMANCE SUMMARY *****

CYCLE LENGTH = 90 SECS SYSTEM MAXIMIN CYCLE = 159 SECS

INT DELAY	CROSS STREET INT	PHASE	MIN. DELAY	INTERSECTION	AVERAGE
NO	INTERSECTION	ART CRS	CYCLE (SECS)	V/C RATIO	(SECS/VEH)

1	1	Woodmen Rd	2 4	102	.97 28.9
2	2	Judge Orr Rd	2 2	159	1.04 26048.6
3	3	Stapleton Rd	2 2	69	.78 42.2

NOTE: PHASE SEQUENCE CODE FOR ARTERIAL (ART) CROSS STREET (CRS)

 -
 (1+5) 1 - LEFT TURN FIRST OR DUAL LEFTS LEADING OR DUAL LEFTS

(2+6) 2 - THROUGH FIRST OR DUAL THRU LEADING OR DUAL THRU
 (2+5) 3 - LEADING GREEN OR NO. 5 LEADING OR LT 5 LEADS
 (1+6) 4 - LAGGING GREEN OR NO. 1 LEADING OR LT 1 LEADS

(BEST.SOLN)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

**** BEST SOLUTION.... NEMA PHASE DESIGNATION ****
 *** INT. 1 .0 SEC OFFSET ART ST PHASE SEQ IS DUAL THRU
 (2+6) Woodmen Rd .0 % OFFSET CROSS ST PHASE SEQ IS LT 7 LEADS
 (4+7)

CONCURRENT PHASES	ARTERIAL STREET				4+7	CROSS STREET	
	2+6	2+5	1+5	TOTAL		4+8	3+8
TOTAL							
PHASE TIME (SECS)	28.8	20.3	.0	49.1	40.9	.0	.0
40.9							
PHASE TIME (%)	32.0	22.6	.0	54.6	45.4	.0	.0
45.4							
----- MEASURES OF EFFECTIVENESS -----							
PHASE (NEMA)	5[5]	6	1[5]	2	3[5]	4	7[5]
8							
PHASE DIRECTION	NBLTPR	SBTHRU	SBLTPR	NBTHRU	WBLTPR	EBTHRU	EBLTPR
WBTHRU							
PHASE TIME (SEC)	20.3	28.8	.0	49.1	.0	40.9	40.9
.0							
V/C-RATIO	.85	.86	.00	.68	.00	.30	.90
.00							
LEVEL OF SERVICE	D	E		B		A	E
DELAY (SECS/VEH)	39.2	33.1	.0	16.2	.0	15.3	33.1
.0							
LEVEL OF SERVICE	D	D		B		B	D
QUEUE (VEH/LANE)	6.6	8.9	.0	7.9	.0	3.2	13.6
.0							
STOPS (STOPS/HR)	459.	777.	0.	555.	0.	199.	606.
0.							
TOTAL INTERSECTION DELAY			FUEL CONSUMPTION		MINIMUM DELAY		
CYCLE							
	28.94 SECS/VEH		91.56 GAL/HR		102 SECS		

(BEST.SOLN)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

**** BEST SOLUTION CONTINUED.... NEMA PHASE DESIGNATION ****

*** INT. 2 40.1 SEC OFFSET ART ST PHASE SEQ IS DUAL THRU
 (2+6)
 Judge Orr Rd 44.6 % OFFSET CROSS ST PHASE SEQ IS DUAL THRU
 (4+8)

CONCURRENT PHASES	ARTERIAL STREET				TOTAL	4+8	CROSS STREET	
	2+6	1+6	1+5				3+8	3+7
TOTAL								
PHASE TIME (SECS)	50.0	.0	10.0		60.0	15.0	.0	15.0
30.0								
PHASE TIME (%)	55.6	.0	11.1		66.7	16.7	.0	16.7
33.3								
----- MEASURES OF EFFECTIVENESS -----								
PHASE (NEMA)	5[2]	6	1[2]	2		3[2]	4	7[2]
8								
PHASE DIRECTION	NBLTPR	SBTHRU	SBLTPR	NBTHRU		WBLTPR	EBTHRU	EBLTPR
WBTHRU								
PHASE TIME (SEC)	10.0	50.0	10.0	50.0		15.0	15.0	15.0
15.0								
*V/C-RATIO	.00	1.39	.00	5.34		.00	1.95	.00
3.57								
LEVEL OF SERVICE		F		F			F	
F								
DELAY (SECS/VEH)	.0	325.1	.0475	27.1		.0	1585.0	
.013108.1								
LEVEL OF SERVICE		F		F			F	
F								
QUEUE (VEH/LANE)	.0	133.7	.0	4626.4		.0	50.9	.0
361.9								
STOPS (STOPS/HR)	0.	1890.	0.	85880.		0.	1023.	0.
6565.								
TOTAL INTERSECTION DELAY			FUEL CONSUMPTION			MINIMUM DELAY		
CYCLE								
26048.57 SECS/VEH			***** GAL/HR			> 120 SECS		

(BEST.SOLN)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0
 DEC 90

***** BEST SOLUTION CONTINUED.... NEMA PHASE DESIGNATION *****

*** INT. 3 59.7 SEC OFFSET ART ST PHASE SEQ IS DUAL THRU
 (2+6)
 Stapleton Rd 66.3 % OFFSET CROSS ST PHASE SEQ IS DUAL THRU
 (4+8)

CONCURRENT PHASES	ARTERIAL STREET				TOTAL	4+8	CROSS STREET	
	2+6	1+6	1+5				3+8	3+7
TOTAL								
PHASE TIME (SECS)	18.7	.0	33.3		52.0	21.5	.0	16.5
38.0								
PHASE TIME (%)	20.8	.0	37.0		57.8	23.9	.0	18.3
42.2								

```

----- MEASURES OF EFFECTIVENESS -----
-----
PHASE (NEMA)          5[6]   6       1[5]   2       3[5]   4       7[5]
8
PHASE DIRECTION      NBLTPP SBTHRU SBLTPR NBTHRU   WBLTPR EBTHRU EBLTPR
WBTHRU
PHASE TIME (SEC)     33.3   18.7   33.3   18.7   16.5   21.5   16.5
21.5
V/C-RATIO            1.03   .72   .07   .00   .46   .69   .68
.22
LEVEL OF SERVICE      F       C       A       A       A       B       B
A
DELAY (SECS/VEH)     61.7   33.7   28.6   .0     31.5   31.0   36.9
26.0
LEVEL OF SERVICE      E       D       C       A       C       C       D
C
QUEUE (VEH/LANE)     24.4   4.6   .9     .0     2.4   4.9   3.9
1.5
STOPS (STOPS/HR)     880.   370.   25.    0.     95.   430.   150.
131.
TOTAL INTERSECTION DELAY          FUEL CONSUMPTION          MINIMUM DELAY
CYCLE
      42.18 SECS/VEH          72.59 GAL/HR          69 SECS

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(ART.MOE)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
 PASSER II-90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0
 DEC 90

**** TOTAL ARTERIAL SYSTEM PERFORMANCE ****

Falcon, CO US 24 DISTRICT 01/25/13 RUN
 NO. 0

CYCLE LENGTH = 90 SECS BAND A = 18 SECS BAND B = 18
 SECS
 AVERAGE PROGRESSION SPEED - BAND A = 50 MPH BAND B = 50
 MPH

.21 EFFICIENCY 1.00 ATTAINABILITY

AVERAGE INTERSECTION DELAY	TOTAL SYSTEM DELAY	TOTAL NUMBER
VEHICLES		
7373.4 SECS/VEH	13395.0 VEH-HR/HR	6540.
TOTAL SYSTEM FUEL CONSUMPTION	TOTAL SYSTEM STOPS	MAXIMIN CYCLE
11408.79 GAL/HR	100033. STOPS	> 120 SECS

(ART.MOE)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

EFFICIENCY VERSUS CYCLE LENGTH

CYCLE LENGTH	CUMULATIVE EFFICIENCY
60	.19
70	.19
80	.19
90	.21
100	.21
110	.21
120	.21
130	.21
140	.21
150	.21

(ART.MOE)

PASSER II-90 TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION
DEC 90 MULTIPHASE ARTERIAL PROGRESSION - 145101 VER 1.0

EFFICIENCY VERSUS CYCLE LENGTH

CYCLE LENGTH	CUMULATIVE EFFICIENCY
BEST SOLUTION 90	.21

(PIN.SET)

TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

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