



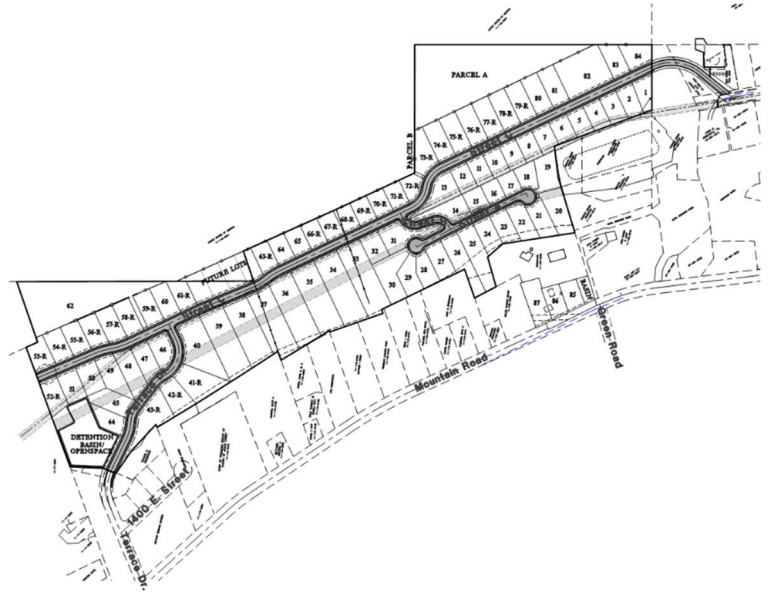
Solutions you can build on™

Traffic Impact Study

Rock Loft Ridge Subdivision – Fruit Heights, UT

Submitted to:

Brandon Green
City Manager/Recorder
910 S. Mountain Road
Fruit Heights City, UT 84037



Prepared by:
Reeve & Associates, Inc.
5160 South 1500 West
Riverdale, UT 84405
801.621.3100
www.reeve.co

Prepared: July, 2018
Revised: September 23, 2021
Reeve Job Number: 4825-12

Executive Summary

This study addresses the traffic impact associated with the proposed residential development to be located in Fruit Heights City, UT. This subdivision will have 87 total lots, 84 of which will affect the study intersection. Access to the proposed subdivision will be achieved by connecting Terrace Drive and 1800 East. It is estimated that 80% of 10 existing homes will utilize this new connection when entering, and 70% will when exiting.

Study Objectives:

The objectives of this study are:

- Document how the study intersections and accesses currently operate.
- Forecast the amount of traffic expected to be generated by the proposed development.
- Determine how the study intersections and accesses will operate in the future with and without the proposed development.
- Recommend appropriate mitigation measures if poor operations are identified.

Results:

The principal results of the study are:

- The proposed residential development is expected to generate 61 new trips to the study intersection during the AM peak hours and 80 new trips during the PM peak hours.
- The rerouted 10 existing homes will generate 6 new trips to the study intersection during the AM peak hours and 8 new trips during the PM peak hours.
- The studied Terrace Drive and Mountain Road intersection will operate at an acceptable approach LOS A after completion of the Rock Loft Ridge Subdivision.





Solutions you can build on™

Table of Contents

Traffic Impact Study

Rock Loft Ridge Subdivision – Fruit Heights, UT

Item	Section
Introduction	1
Analysis Method	2
Existing Conditions	3
Projected Traffic	4
Conclusion	5
Appendices	6



1.0 Introduction

1.1 Proposed Development

At the request of Fruit Heights City, Reeve & Associates has performed a traffic impact study involving the proposed Rock Loft Ridge Subdivision. Figure 1 contains a vicinity map showing the area of the proposed development.

Following are key attributes of the proposed development:

- a) The project will obtain access by connecting Terrace Drive and 1800 East.
- b) The project contains 87 total lots, 84 of which will affect the study intersection.
- c) 80% of the trips from 10 existing houses are estimated to utilize the new connection of Terrace Drive and 1800 East when entering, and 70% when exiting.

1.2 Purpose of Study

The traffic study area was determined by analyzing the roadway to be influenced by the development. Highest traffic volumes are found during the PM peak hour. Existing and proposed traffic conditions for the impacted intersection are included.

The study intersection for the proposed development, and where the greatest impact is expected, was recommended for review and includes:

- a) Terrace Drive and Mountain Road intersection.



Figure 1
Vicinity Map – Rock Loft Ridge, Fruit Heights, UT



2.0 Analysis Method

2.1 Level of Service Analysis

For this traffic impact study, the LOS was determined by calculating the average delay time per vehicle in seconds using HCM 6th Edition in Synchro 10. Each LOS is associated with a designated range of delay times in seconds per vehicle.

Table 1 demonstrates the LOS for a signalized intersection based on the delay in seconds per vehicle.

Table 1 - Signalized Intersections Level of Service

LOS	Intersection Delay per Vehicle (sec/veh)
A	≤ 10
B	> 10 - 20
C	> 20 - 35
D	> 35 - 55
E	> 55 - 80
F	> 80

Source: Highway Capacity Manual (HCM 6th), Transportation Research Board
National Research Council Washington D.C. 2000.

Table 2 demonstrates the LOS for an unsignalized intersection based on the delay in seconds per vehicle.

Table 2 - Unsignalized Intersections Level of Service

LOS	Intersection Delay per Vehicle (sec/veh)
A	≤ 10
B	> 10 - 15
C	> 15 - 25
D	> 25 - 35
E	> 35 - 50
F	> 50

Source: Highway Capacity Manual (HCM 6th), Transportation Research Board
National Research Council Washington D.C. 2000.

According to the Highway Capacity Manual, most facilities are designed for a service flow rate at LOS D or better to ensure acceptable operating conditions to users.



3.0 Existing Conditions

3.1 Existing Corridor Characteristics

The studied corridors include Terrace Drive and Mountain Road located in Fruit Heights, UT. Corridor characteristics are shown below in Table 3.

Table 3 – Corridor Characteristics

<i>Name</i>	<i>Classification</i>	<i>Speed Limit</i>	<i>Lanes</i>
<i>Terrace Drive</i>	Local	25	Two Lanes
<i>Mountain Road</i>	Local	25	Two Lanes

3.2 Existing Traffic Volumes

Existing traffic counts are based off the UDOT AADT Traffic Statistics and UDOT's AADT curve. The AADT for Mountain Road is 2,200 trips, and applying this to the AADT curve estimates the total number of trips during the PM peak hour as 188 trips.

There are 5 existing homes on Terrace Drive, and 8 existing homes on the 1400 East cul-de-sac that utilize the Mountain Road and Terrace Drive intersection. The amount trips generated by these homes are calculated to be 13 trips during the PM peak hour. Of the 13 trips, 8 will be entering and 5 will be exiting according to the Trip Generation Manual.

A 50/50 split is assumed for estimating existing traffic along Mountain Road. The peak hour for traffic on the roadway is the PM peak hour, and the peak traffic generation for the Rock Loft Ridge Subdivision is the PM peak hour.

PM peak hour conditions are considered the worst-case scenario, and are therefore included in this analysis. The existing traffic volumes assisted in determining the existing LOS and studying the proposed impact, see Figure 2. See the results section for the existing approach LOS.



**Figure 2
Existing PM Traffic Volumes**



4.0 Projected Traffic

4.1 Trip Generation

The number of trips generated from the subdivision was determined using ITE's (Institute of Transportation Engineers) 10th Edition Trip Generation Manual for a Single-Family Detached Housing (Land Use: 210). For this land use, the trips generated per hour per housing unit are 0.76 trips in the AM peak hour and 1 trip generated in the PM peak hours.

The proposed development will have 87 total lots, 84 of which will affect the intersection of Terrace Drive and Mountain Road. The remaining 3 lots are not located along the proposed connection of Terrace Drive and 1800 N. The 3 lots will not significantly alter any existing traffic movements in their proposed location. The proposed trip generation based on 84 houses is 64 trips per hour during the AM peak hour and 84 trips per hour during the PM peak hour.

ITE suggests for that Single-Family Housing, 26% of the generated traffic will be entering and 74% leaving in the AM. ITE suggests 64% of the generated traffic will be entering and 36% leaving in the PM. See Table 4 below for the vehicle trip generation breakdown.

Table 4 – Rock Loft Trip Generation (Single-Family Housing AM/PM)

<i>Peak Hour</i>	<i>Generated Trips</i>	<i>Trips Entering</i>	<i>Trips Exiting</i>
<i>AM Peak</i>	<i>64</i>	17	47
<i>PM Peak</i>	<i>84</i>	54	30

In addition, it is also estimated that 80% of the trips from 10 existing houses will utilize the new connection of Terrace Drive and 1800 East. The proposed rerouted trips are 8 trips per hour during the AM peak hour and 10 trips per hour during the PM peak hour. Table 5 provides the trips per these values.

Table 5 – Existing Rerouted Traffic (Single-Family Housing AM/PM)

<i>Peak Hour</i>	<i>Rerouted Trips</i>	<i>Trips Entering</i>	<i>Trips Exiting</i>
<i>AM Peak</i>	<i>8</i>	2	6
<i>PM Peak</i>	<i>10</i>	6	4



4.2 Trip Distribution

Trip distribution is based on the existing traffic volumes with consideration made to site access and the regional transportation system. The trip distribution estimates are used to model the PM Peak Hour generated traffic at the study intersection.

It is estimated that 95% of the proposed development generated trips will utilize the Mountain Road and Terrace Drive intersection. Of the 10 rerouted homes, it is estimated that 80% will utilize the study intersection while entering, and 70% will while exiting. Traffic not using the study intersection will use the connection provided by 1800 East. Table 6 shows the trips utilizing the study intersection. See Figure 3 for the trip distribution assignments for the development.

Table 6 – Trips Utilizing Study Intersection

<i>Peak Hour</i>	<i>Combined Trips</i>	<i>Trips Entering</i>	<i>Trips Exiting</i>
<i>AM Peak</i>	<i>67</i>	18	49
<i>PM Peak</i>	<i>88</i>	56	32

4.3 Total Projected Traffic

The Total Projected Traffic Volumes, Figure 4, shows the total traffic for the new proposed development. Projected total traffic conditions include existing traffic volumes with the addition of the generated trips described above.

4.4 Queuing Analysis

Queue lengths were calculated to the 95th percentile queue lengths for each movement using Synchro 10's traffic simulator. Sufficient queueing is anticipated for the studied intersection. See the full queuing report in the Appendix.

Table 7 – Queuing by Movement (95th percentile)

<i>Studied Intersection</i>	<i>PM Peak Hour</i>	<i>WB</i>	<i>SB</i>
<i>Terrace Drive & Mountain Road</i>	<i>Proposed</i>	LR: 40 ft	LT: 25 ft

Due to the lack of a left-turn lane, the average delay on southbound Mountain Road due to the 25-ft queue created by left turning traffic is 2.8 seconds. The westbound queue of 40-ft will be managed by the existing stop sign located on Terrace Drive. As neither queue significantly affects the flow of traffic, no remedial changes to the existing roadway are recommended for Mountain Road or Terrace Drive.



**Figure 3
Proposed PM Trip Distribution**



Figure 4
Proposed PM Traffic Volumes



5.0 Conclusion

5.1 Results and Conclusion

This report analyzes the study intersection affected by the development of the Rock Loft Ridge subdivision. This was done with the projected traffic flows from the proposed development in conjunction with the existing traffic conditions. The results of the study are shown in Table 8.

Table 8 – Approach LOS and Delay (s/veh)

<i>Studied Intersection</i>	<i>PM Peak Hour</i>	<i>EB</i>	<i>WB</i>	<i>NB</i>	<i>SB</i>
<i>Terrace Drive & Mountain Road</i>	<i>Existing</i>	-	9.2	0	0.3
		-	A	A	A
	<i>Proposed</i>	-	9.2	0	2.8
		-	A	A	A

Source: HCM 6th Edition delay times and LOS determined using Synchro 10.

The principal findings from the traffic impact analysis have determined the following results. During the PM peak hours, the Terrace Drive and Mountain Road intersection currently has an approach LOS of A and, with the completion of the project, the intersection will continue to have an approach LOS of A. The studied intersection will have adequate queuing for the proposed residential development.

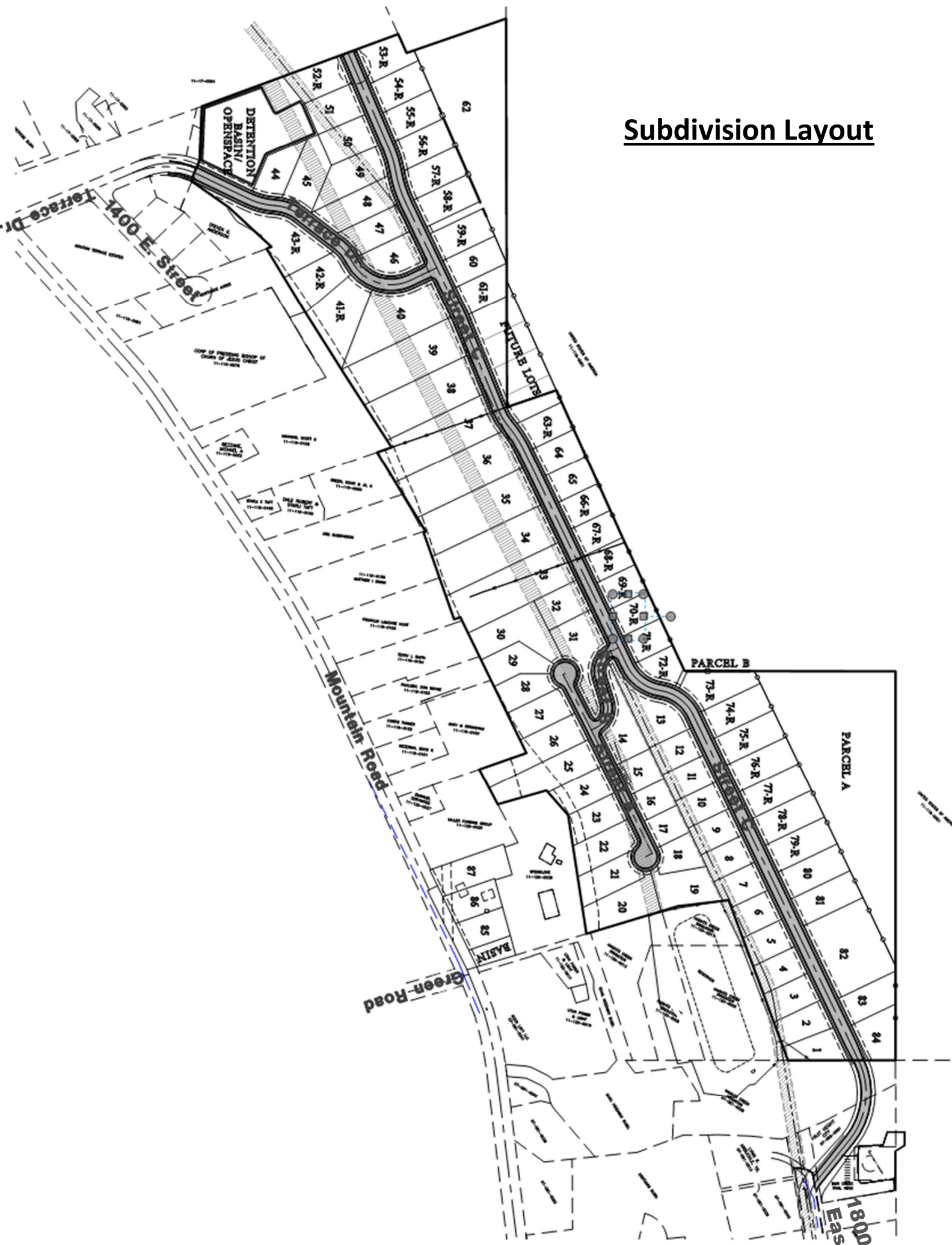
Therefore, it is our professional opinion, upon the completion of this project, the residential development will not significantly alter the existing traffic conditions and should be permitted per the traffic data contained within this report.



Appendix



Subdivision Layout





Trip Generation

Rock Loft Ridge Subdivision

9/23/21 JFL
7735-01

Input
Output

Land Use: Single-Family Detached Housing
Code: 210
per ITE Trip Generation Manual 10th Edition

A.M. Peak Hour Trip Generation

Building Units =	84
Trips per Unit =	0.76
Total Trips Generated =	64
Trip Directional Distribution:	
26% entering,	74% exiting.
Entering =	17
Exiting =	47
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Entering Passerby Trips =	0
Entering New Trips =	17
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Exiting Passerby Trips =	0
Exiting New Trips =	47

P.M. Peak Hour Trip Generation

Building Units =	84
Trips per Unit =	1.00
Total Trips Generated =	84
Trip Directional Distribution:	
64% entering,	36% exiting.
Entering =	54
Exiting =	30
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Entering Passerby Trips =	0
Entering New Trips =	54
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Exiting Passerby Trips =	0
Exiting New Trips =	30

Land Use: Single-Family Detached Housing
Code: 210
per ITE Trip Generation Manual 10th Edition

A.M. Peak Hour Trip Generation

Building Units =	10
Trips per Unit =	0.76
Total Trips Generated =	8
Trip Directional Distribution:	
26% entering,	74% exiting.
Entering =	2
Exiting =	6
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Entering Passerby Trips =	0
Entering New Trips =	2
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Exiting Passerby Trips =	0
Exiting New Trips =	6

P.M. Peak Hour Trip Generation

Building Units =	10
Trips per Unit =	1.00
Total Trips Generated =	10
Trip Directional Distribution:	
64% entering,	36% exiting.
Entering =	6
Exiting =	4
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Entering Passerby Trips =	0
Entering New Trips =	6
Passerby/ New Trip Distribution:	
0% passerby,	100% new.
Exiting Passerby Trips =	0
Exiting New Trips =	4



Trip Generation

Rock Loft Ridge Subdivision

9/23/21 JFL
7735-01

Input
Output

Land Use: Single-Family Detached Housing
Code: 210
per ITE Trip Generation Manual 10th Edition

A.M. Peak Hour Trip Generation

Building Units =	10
Trips per Unit =	0.76
Total Trips Generated =	8

Trip Directional Distribution:	26%	entering,	74%	exiting.
Entering =	2			
Exiting =	6			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Entering Passerby Trips =	0			
Entering New Trips =	2			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Exiting Passerby Trips =	0			
Exiting New Trips =	6			

P.M. Peak Hour Trip Generation

Building Units =	10
Trips per Unit =	1.00
Total Trips Generated =	10

Trip Directional Distribution:	64%	entering,	36%	exiting.
Entering =	6			
Exiting =	4			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Entering Passerby Trips =	0			
Entering New Trips =	6			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Exiting Passerby Trips =	0			
Exiting New Trips =	4			



Trip Generation

Rock Loft Ridge Subdivision

9/23/21 JFL
7735-01

Input
Output

Land Use: Single-Family Detached Housing
Code: 210
per ITE Trip Generation Manual 10th Edition

A.M. Peak Hour Trip Generation

Building Units =	13
Trips per Unit =	0.76
Total Trips Generated =	10

Trip Directional Distribution:	26%	entering,	74%	exiting.
Entering =	3			
Exiting =	7			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Entering Passerby Trips =	0			
Entering New Trips =	3			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Exiting Passerby Trips =	0			
Exiting New Trips =	7			

P.M. Peak Hour Trip Generation

Building Units =	13
Trips per Unit =	1.00
Total Trips Generated =	13

Trip Directional Distribution:	64%	entering,	36%	exiting.
Entering =	8			
Exiting =	5			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Entering Passerby Trips =	0			
Entering New Trips =	8			

Passerby/ New Trip Distribution:	0%	passerby,	100%	new.
Exiting Passerby Trips =	0			
Exiting New Trips =	5			

HCM 6th TWSC
3: Mountain Rd & Terrace Dr

09/17/2021

PM Existing

Intersection						
Int Delay, s/veh	0.3					
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Vol, veh/h	2	2	4	90	90	4
Future Vol, veh/h	2	2	4	90	90	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	2	4	98	98	4
Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	206	100	102	0	-	0
Stage 1	100	-	-	-	-	-
Stage 2	106	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	782	956	1490	-	-	-
Stage 1	924	-	-	-	-	-
Stage 2	918	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	780	956	1490	-	-	-
Mov Cap-2 Maneuver	780	-	-	-	-	-
Stage 1	921	-	-	-	-	-
Stage 2	918	-	-	-	-	-
Approach	WB		SE		NW	
HCM Control Delay, s	9.2		0.3		0	
HCM LOS	A					
Minor Lane/Major Mvmt	NWT		NWRWBLn1		SEL	SET
Capacity (veh/h)	-		-		859	1490
HCM Lane V/C Ratio	-		-		0.005	0.003
HCM Control Delay (s)	-		-		9.2	7.4
HCM Lane LOS	-		-		A	A
HCM 95th %tile Q(veh)	-		-		0	0

HCM 6th TWSC

3: Mountain Rd & Terrace Dr

PM Proposed

Intersection						
Int Delay, s/veh	2.6					
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Vol, veh/h	5	31	54	90	90	10
Future Vol, veh/h	5	31	54	90	90	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	34	59	98	98	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	320	104	109	0	-	0
Stage 1	104	-	-	-	-	-
Stage 2	216	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	673	951	1481	-	-	-
Stage 1	920	-	-	-	-	-
Stage 2	820	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	645	951	1481	-	-	-
Mov Cap-2 Maneuver	645	-	-	-	-	-
Stage 1	881	-	-	-	-	-
Stage 2	820	-	-	-	-	-
Approach	WB	SE		NW		
HCM Control Delay, s	9.2	2.8		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NWT	NWRWBLn1	SEL	SET		
Capacity (veh/h)	-	-	892	1481	-	
HCM Lane V/C Ratio	-	-	0.044	0.04	-	
HCM Control Delay (s)	-	-	9.2	7.5	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-	

Summary of All Intervals

Run Number	1	2	3	4	5	Avg
Start Time	4:57	4:57	4:57	4:57	4:57	4:57
End Time	6:00	6:00	6:00	6:00	6:00	6:00
Total Time (min)	63	63	63	63	63	63
Time Recorded (min)	60	60	60	60	60	60
# of Intervals	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1
Vehs Entered	266	293	280	277	234	270
Vehs Exited	266	293	281	275	232	269
Starting Vehs	0	0	1	0	0	0
Ending Vehs	0	0	0	2	2	0
Travel Distance (mi)	26	29	28	27	23	27
Travel Time (hr)	1.3	1.4	1.3	1.2	1.1	1.2
Total Delay (hr)	0.1	0.1	0.1	0.1	0.1	0.1
Total Stops	42	32	37	31	30	34
Fuel Used (gal)	1.0	1.1	1.0	0.9	0.8	1.0

Interval #0 Information Seeding

Start Time	4:57
End Time	5:00
Total Time (min)	3
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

Interval #1 Information Recording

Start Time	5:00
End Time	6:00
Total Time (min)	60
Volumes adjusted by Growth Factors.	

Run Number	1	2	3	4	5	Avg
Vehs Entered	266	293	280	277	234	270
Vehs Exited	266	293	281	275	232	269
Starting Vehs	0	0	1	0	0	0
Ending Vehs	0	0	0	2	2	0
Travel Distance (mi)	26	29	28	27	23	27
Travel Time (hr)	1.3	1.4	1.3	1.2	1.1	1.2
Total Delay (hr)	0.1	0.1	0.1	0.1	0.1	0.1
Total Stops	42	32	37	31	30	34
Fuel Used (gal)	1.0	1.1	1.0	0.9	0.8	1.0

Queuing and Blocking Report

Baseline

09/17/2021

Intersection: 3: Mountain Rd & Terrace Dr

Movement	WB	SE
Directions Served	LR	LT
Maximum Queue (ft)	55	36
Average Queue (ft)	16	5
95th Queue (ft)	40	25
Link Distance (ft)	247	247
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

HCM 6th TWSC
3: Mountain Rd & Terrace Dr

09/17/2021

AM Proposed

Intersection						
Int Delay, s/veh	2.9					
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Vol, veh/h	7	46	19	67	67	5
Future Vol, veh/h	7	46	19	67	67	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	50	21	73	73	5
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	191	76	78	0	-	0
Stage 1	76	-	-	-	-	-
Stage 2	115	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	798	985	1520	-	-	-
Stage 1	947	-	-	-	-	-
Stage 2	910	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	787	985	1520	-	-	-
Mov Cap-2 Maneuver	787	-	-	-	-	-
Stage 1	934	-	-	-	-	-
Stage 2	910	-	-	-	-	-
Approach	WB	SE		NW		
HCM Control Delay, s	9	1.6		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NWT	NWR	WBLn1	SEL	SET	
Capacity (veh/h)	-	-	953	1520	-	
HCM Lane V/C Ratio	-	-	0.06	0.014	-	
HCM Control Delay (s)	-	-	9	7.4	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0.2	0	-	



Solutions you can build

Reeve & Associates, Inc.

5160 South 1500 West
Riverdale, UT 84405
801.621.3100
office@reeve.co
www.reeve.co

Land Planning

Project Feasibility

Site Acquisition

Civil Engineering

Traffic Engineering

Structural Engineering

Land Surveying

Landscape Architecture

Construction Services

Project Management