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# Town of Basalt Southside

## Traffic Impact Study


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10/11/2016

# Table of Contents

## List of Figures



## List of Tables

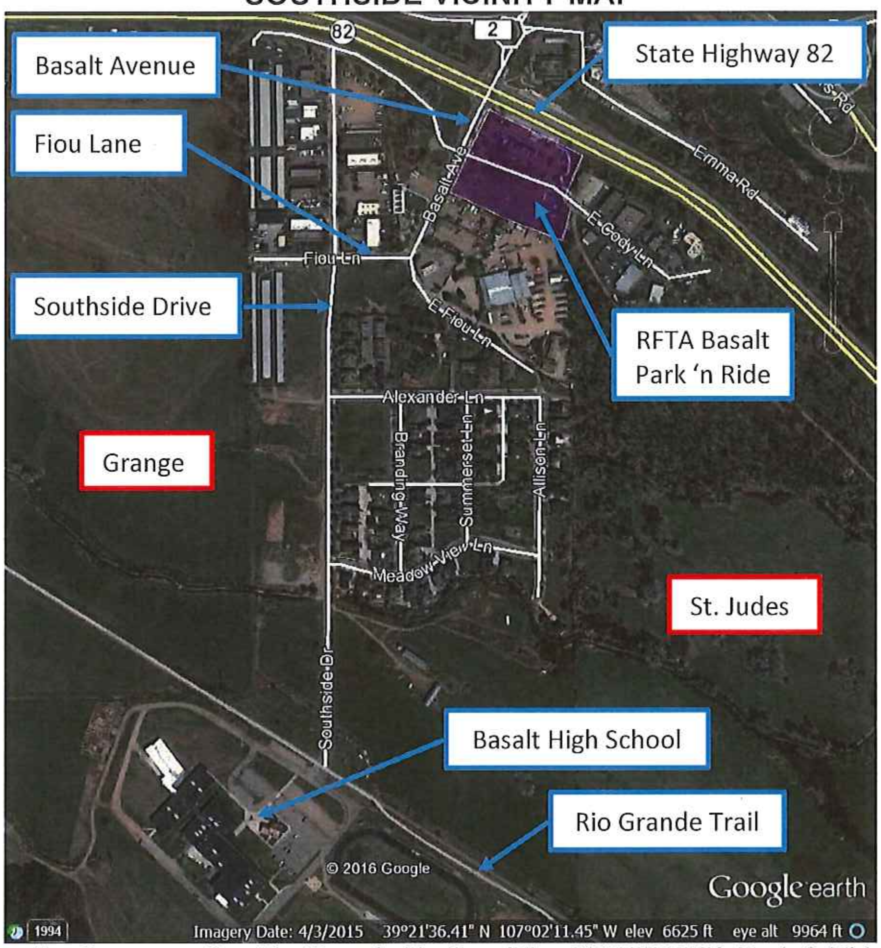
## APPENDIX

## 1.0 Introduction

This Traffic Impact Study was prepared for the Town of Basalt to estimate future traffic impacts created by several known proposed developments located in the Town of Basalt and in unincorporated Pitkin County, Colorado. The project area south of SH 82 accessed solely by Basalt Avenue is known as the "Southside" of Basalt. The purpose of this traffic impact analysis is to document the existing traffic conditions accessing the Southside from Highway 82, estimate background traffic volumes for the 20-year planning horizon, analyze the trip generation and trip assignments of the proposed developments in the 20-year planning horizon, determine buildout traffic and pedestrian impacts, and recommend mitigation measures that will improve overall traffic conditions entering and leaving the Southside via Basalt Avenue.

The vicinity map below shows the major streets in the Southside and includes Basalt High School for reference.

**Figure 1**
**SOUTHSIDE VICINITY MAP**




Also shown on the figure are the Rio Grande Trail and the CDOT/RFTA Park & Ride which provides approximately 200 parking spaces for regional BRT service between Glenwood and Aspen. Abutting the Southside area to the east and west are two large parcels that have historically served as ranchland. The property to the west, owned by the Grange family, is in a conservation easement with Aspen Valley Land Trust and will not be developed in the future. The property to the east is owned by St. Judes which has no current plans for development.

These two properties limit the available land for development accessed by Basalt Avenue and constrain the options for improving access to this area.

## 2.0 Study Area

The project study area includes the signalized intersection of Basalt Avenue and SH 82. The unsignalized intersection of Basalt Avenue/Cody Lane was also included in the study area and analysis due to its close proximity to the signal. A primary area of focus for the Town of Basalt is alleviating the queuing on the northbound and southbound approaches to the SH 82/Basalt signal. These approaches frequently see queues which extend to and through the adjacent Cody Lane stop-controlled intersection and the Emma Road roundabout, causing temporary blockage of these intersections during peak hours. The study area is shown below:

**Figure 2**
**STUDY AREA**

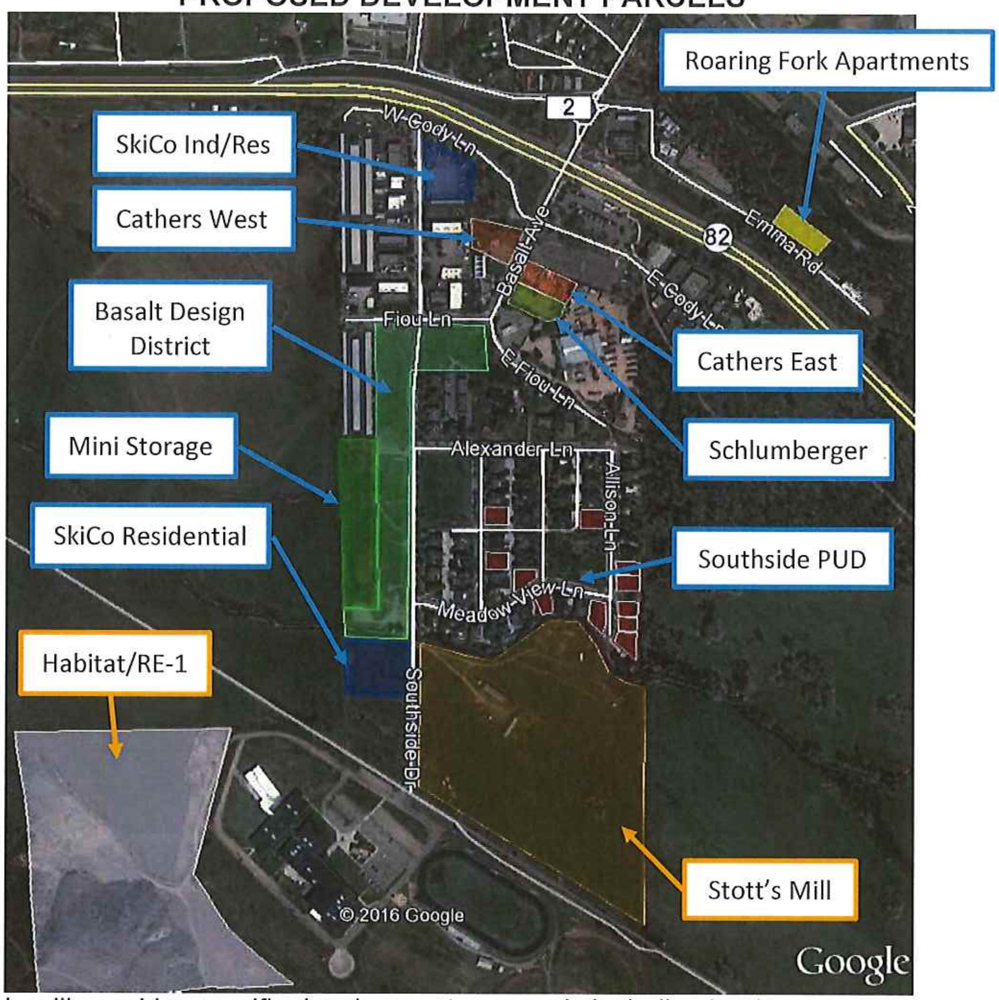

The red stars in Figure 3 indicate the two study intersections. The Basalt Ave/Cody Lane intersection is located 180 feet south of the stop bar on the northbound approach to the SH 82/Basalt Avenue signalized intersection, so this intersection's operations are significantly influenced by the highway signal's operations. Similarly, the Emma Road roundabout is located north of the SH 82 signal and provides approximately 110' of storage in the southbound approach lanes to the signal. Fiou Lane is located approximately 400' south of the Cody/Basalt intersection.

The Town of Basalt will construct the SH 82/Basalt Avenue underpass beginning this fall. This project will remove pedestrians from the at-grade signalized SH 82 crossings and also reassign the northbound approach laneage allowing for an exclusive right turn lane. This project and its associated improvements will be assumed in place during all future year scenarios that are analyzed in this traffic impact study.

## 3.0 Proposed Development

The properties included in this analysis are all located in the Southside, with the exception of the proposed Roaring Fork Apartments along Emma Road. The two specific development plans analyzed in this study include the Stott's Mill and Habitat for Humanity proposals. The other undeveloped Southside properties (and one northside property) included in the analysis are the Roaring Fork Apartments, Cathers East and West parcels, the Schlumberger parcel, the Aspen Skiing Company Industrial/Residential parcel, Basalt Mini Storage, Basalt Design District, buildout of the Southside PUD, and the Pitkin County/Aspen Skiing Company residential parcel. The figure below shows the location of the properties included in this 20-year analysis.

**Figure 3**
**PROPOSED DEVELOPMENT PARCELS**




This analysis will consider specific development proposals including land uses and number of units for the Stott's Mill and Habitat sites; and general estimates for the remaining undeveloped parcels shown above since development plans have not been submitted for these other parcels.

Development totals for all the proposed projects include 338 new residential units, 57,100 square feet of additional mini-storage space, 35,000 square feet of industrial space, 1,260 square feet of retail/commercial space, and 16,600 square feet of office space. A breakdown of the specific developments and general use totals will be shown in the trip generation section of this study.

## 4.0 Methodology and Assumptions

This traffic analysis has been prepared in accordance with section 2.3(5) of the *State Highway Access Code (Code)*. For this study, an existing conditions and a 20-year buildout plan will be analyzed. The assumptions and methodology were discussed with the Town's planning staff in order to provide a conservative analysis of traffic impacts resulting from buildout of the Southside parcels and the Roaring Fork Apartments along Emma Road.

Intersection analysis was performed using the Synchro/Simtraffic 8 traffic modeling and analysis package to estimate the operations of the signalized intersection at Basalt Avenue and SH 82 and the stop-controlled intersection to the south at Cody Lane. The measures of effectiveness (MOE's) that are compared for this study include:

- Level of Service (LOS),
- average delay per vehicle, and
- $95^{th}$ percentile queue lengths.

The estimated $95^{th}$ percentile queue lengths will be reported for the existing and future buildout analysis to determine if the current lanes are adequately sized or need extensions today or in the future. All signalized and unsignalized analyses contained in this report are consistent with *Highway Capacity Manual 2010 (HCM 2010)* methodology. The results of the Simtraffic model runs are provided in the Operational Summary Tables since Simtraffic analyzes the intersections as a system, rather than individually (in Synchro module). This allows for the results to better represent the influence of closely spaced adjacent intersection operations.

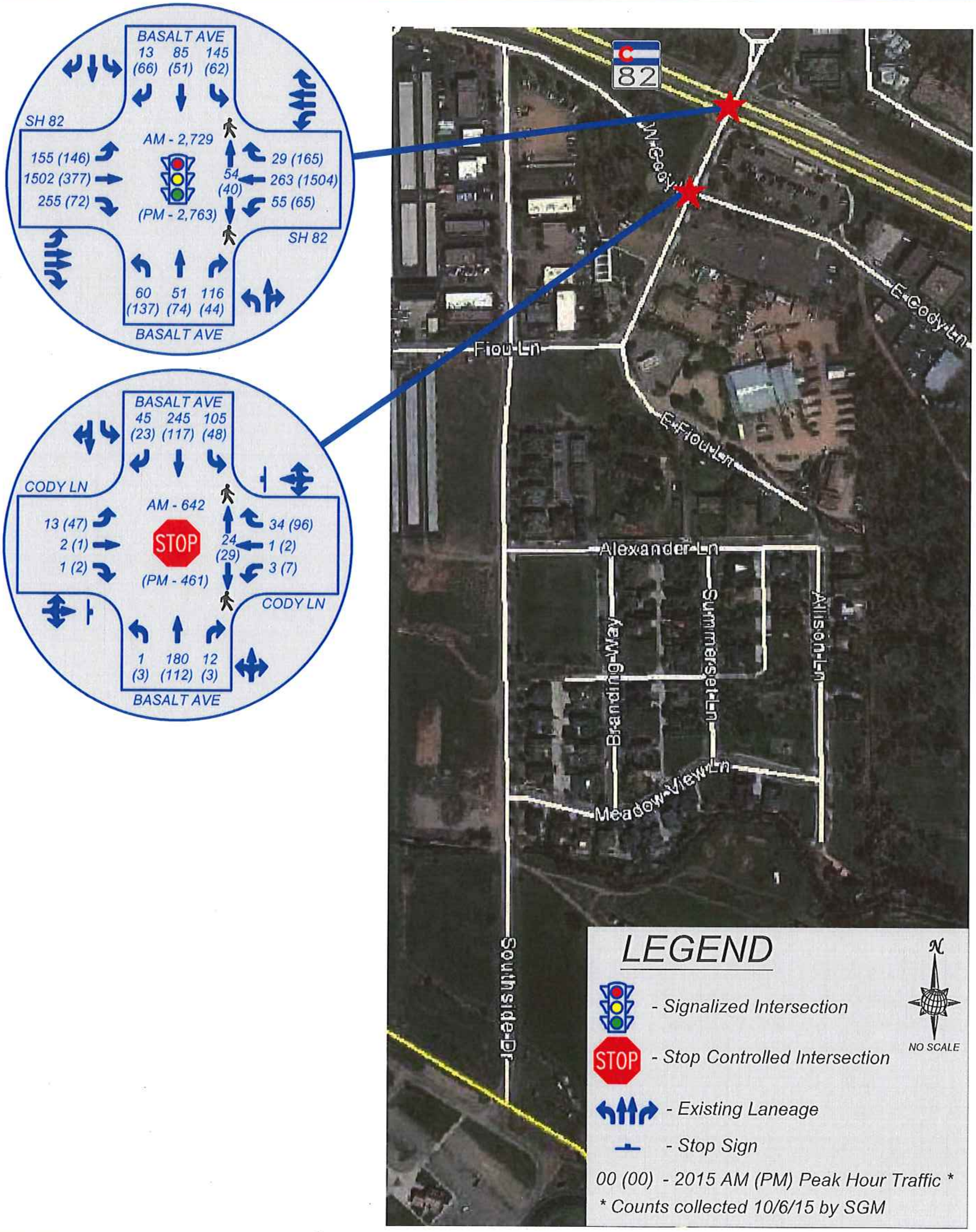
Peak hour factors, heavy vehicle percentages, turning movement percentages and other inputs were developed based on existing traffic counts taken in October 2015. CDOT considers 180 seconds the maximum cycle length allowable on SH 82, with a maximum of 120 seconds provided to the eastbound and westbound signal timing during peaks.

CDOT's OTIS (Online Traffic Information System) website indicates a 20-year factor for this section of SH 82 northwest of Two Rivers Road and southeast of the junction of Basalt Avenue of 1.35. Through volumes on SH 82 were increased by the 20-year factor, while the future traffic accessing the highway from the proposed Southside developments and the Roaring Fork Apartments will be increased according to the trip generation rates for the proposed new uses and assigned according to the existing turning movement percentages at the SH 82 signal.

The majority of the properties included in this study (those north of the Rio Grande Trail) are located within 0.5 miles of the SH 82 intersection and the BRT station. Area residents have many transportation modal options to choose from including pedestrian, bicycle, carpool, transit, or other trips rather than using a single-occupancy vehicle, which lessen the overall impact of the proposed developments. Traffic reductions for multi-modal users are most common during the summer months when the weather is fair and highway traffic volumes are at their annual peaks. Historically, RFTA ridership peaks in the summer and winter months and the Basalt Park and Ride is one of the few transit lots in the BRT corridor that does not fill on a daily basis today. Section 6.2 provides discussion of trip reductions applied in this analysis.

## 5.0 Existing Traffic Conditions (2015)

Existing traffic data for this study was collected by SGM and Pitkin County in October 2015 using Miovision video collection, radar counters, and pneumatic tube counters. Traffic data from CDOT's OTIS website was also consulted to determine the existing AADT on SH 82 in the project area. Based on CDOT's data (Station ID #103516), this section of SH 82 carries approximately 17,000 vehicles per day including 3.7% trucks. All existing traffic data is presented on the following Figures 4 and 5. Raw traffic count data is contained in the appendix.

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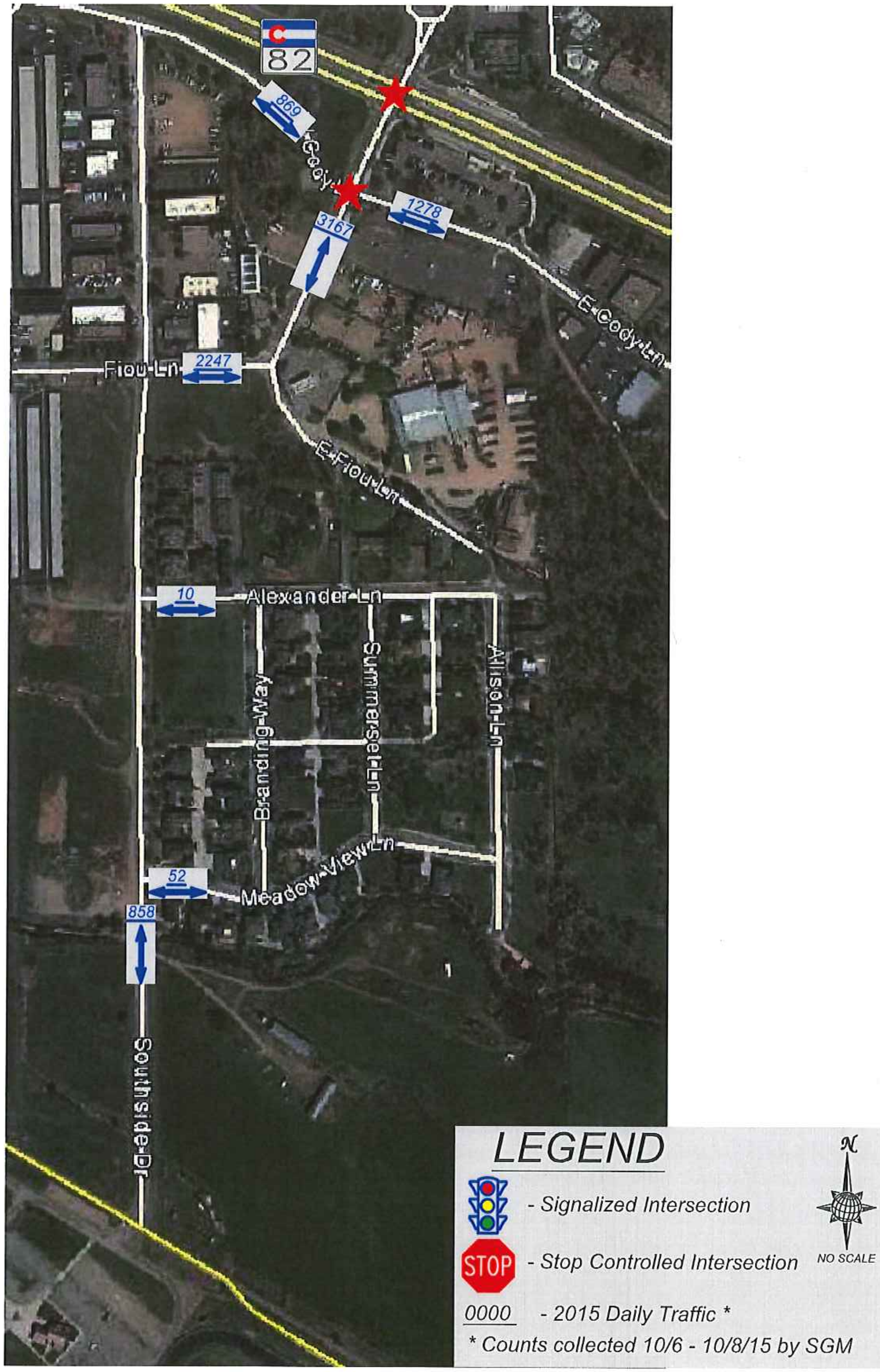
**Traffic Impact Study**

## Figure 4
## Existing Peak Hour Traffic

| Job No. 90040E-09 | Date: 7/5/16 | Drawn by: LMB | File: FIGS |
|---|---|---|---|

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**Town of Basalt Southside Traffic Impact Study**

**Figure 5**
**Existing Daily Traffic**

Job No. 90040E-09 | Date: 7/5/16 | Drawn by: LMB | File: FIGS

### 5.1. Local Circulation Network

The Southside area is geographically constrained by State Highway 82 on the north, the Rio Grande Trail and Basalt High School on the south, the Roaring Fork River on the east, and two large undeveloped lands held under conservation easements (St Jude's parcel and the Grange Family Ranch). It is unlikely that this area will get another highway access without being granted an access line (A-line) break approved by CDOT and the FHWA. For this to happen, the new access must meet CDOT's spacing requirements and provide a clear benefit to SH 82 safety and traffic operations. The primary roads in the study area include:

***State Highway 82*** is the primary arterial highway that serves the Roaring Fork Valley. It is classified as an Expressway by CDOT's State Highway Category Assignment Schedule and has a posted speed of 45 mph within the project area. There are no existing or proposed access points along the highway within 1,000 feet of Basalt Avenue. There are two field accesses to the Grange Ranch that start approximately 2000' west of Basalt Avenue, while Two Rivers Road (signal) is the nearest access to the east, located approximately 3000' east of Basalt Avenue.

***Basalt Avenue*** is a two-lane collector roadway that provides the primary access from the state highway to the Southside roadway network. The travel width includes two wide 17.5' travel lanes with curb and gutter or gravel shoulders. The posted speed along Basalt Avenue is 25 mph. A continuous pathway exists from Fiou Lane to SH 82 along the east side of Basalt Avenue that serves the BRT Park and Ride.

***Fiou Lane and Southside Drive*** are two-lane collector roadways with posted speeds of 25 mph. The travel widths generally include two 11' travel lanes. Fiou Lane does not allow parking, while Southside Drive has parallel parking spaces along the east side. A paved trail also exists along the east side of Southside Drive and the north side of Fiou Lane, with marked crosswalks at Fiou Lane/Southside Drive and at Fiou Lane/Basalt Avenue.

### 5.2. Baseline Traffic Volumes

Peak hour turning movement counts were collected at the intersections of SH 82/Basalt Avenue and Cody Lane/Basalt Avenue on Tuesday October 6, 2015. Additionally, several 24-hour traffic counts were collected in the project area during a mid-week time period in October 2015 including:

- Cody Lane, west of Basalt Avenue
- Cody Lane, east of Basalt Avenue
- Basalt Avenue, south of Cody Lane
- Fiou Lane, west of Basalt Avenue
- Alexander Lane, east of Southside Drive
- Meadow View Lane, east of Southside Drive
- Southside Drive, south of Meadow View Lane

Figure 4 shows the existing peak hour turning movements collected in October. The volumes between the SH 82 and Cody Lane intersections were balanced so that there were no gains or losses of traffic in either direction on this section of roadway. Figure 4 also shows pedestrian movements, intersection laneage, traffic control devices, and intersection peak hour totals for the study intersections.

Figure 5 shows the existing average daily volumes on the roads within the study area. Currently, with the exception of the leg of Basalt Avenue that accesses SH 82 (between Cody and SH 82), no road on the Southside carries more than 4,000 trips per day. The counts along Alexander and Meadow View may be low due to interference from parked cars adjacent to the traffic counter locations. These two daily volumes should be considered for information only.

The current CDOT daily count found on OTIS for SH 82 near Basalt Avenue is 17,000 vehicles per day. During the traffic counts, truck percentages were found to be 5.1% in the AM peak and 3.5% in the PM peak, while bus percentages were found to be 1.1% in the AM peak and 0.9% in the PM peak. These percentages are consistent with other locations in the corridor as well as CDOT's published daily truck percentage of 3.7%, found on the OTIS website.

The peak hour factors (PHF) were calculated to be 0.89 in the AM peak and 0.96 in the PM peak for the intersection of SH 82/Basalt Avenue. Lower PHF's were found at Cody Lane (0.65 AM / 0.94 PM). Typically, there's a "high" 15-minute interval during a peak hour. The PHF is calculated using the total hourly peak volume divided by 4 times the highest 15-minute volume collected during the hour. The closer the PHF is to 1.00, the more evenly distributed the peak volumes are throughout the hour, as measured in 15 minute increments. The PHF is applied to volumes during the capacity analysis calculations to give the best estimation of "peak conditions" knowing that substantial short-term fluctuations can frequently occur during the peak hour.

Figure 4 shows that the study intersection on SH 82 in October processed between 2,729 and 2,763 vehicles per hour during the peak hours. From recent studies along SH 82 in the midvalley, the Basalt Avenue intersection serves about 200 – 300 less vehicles per hour than the signals at Willits/Tree Farm and El Jebel Road do during peak hours. The morning peak at the signal was from 7:15 – 8:15 AM and the afternoon peak was from 4:15 – 5:15. The 24-hour counts collected on the south side streets show afternoon peaks occurring during the 3 PM and 5 PM hours, which coincide with an end of school peak as well as the afternoon commuter peak hour. During the data collection effort, the stop-controlled intersection at Cody/Basalt served 642 vehicles during the AM peak hour and 461 during the PM peak.

### 5.3. Baseline Intersection Capacity and Queuing Analysis

AM and PM level of service estimates were prepared in accordance with the *Highway Capacity Manual* (Transportation Research Board, 2010). For signalized intersections, the *HCM* measures level of service in terms of seconds of delay per vehicle. This is also a measure of driver discomfort, fuel consumption, and lost travel time. The table below relates the LOS to seconds of delay per vehicle at a signalized intersection.

**LEVEL OF SERVICE CRITERIA**
**SIGNALIZED INTERSECTIONS**

| Level of Service | Delay (seconds) |
|---|---|
| A (Highly Desirable) | < 10.0 |
| B (Desirable) | 10.1 to 20 |
| C (Acceptable) | 20.1 to 35 |
| D (Acceptable to CDOT) | 35.1 to 55 |
| E (Unacceptable) | 55.1 to 80 |
| F (Unacceptable) | > 80.0 |

**Source: *Highway Capacity Manual*, 2010**

For unsignalized or "stop-controlled" intersections, the *Highway Capacity Manual* defines level of service and delay in terms of seconds of stopped delay per vehicle, which is based on the number of acceptable gaps in the conflicting traffic stream. In general, the traffic movements analyzed are those controlled by stop signs or yield signs, and the left turn movements from the uncontrolled major street. The following table represents the level of service criteria for unsignalized intersections:

**LEVEL OF SERVICE CRITERIA**
**UNSIGNALIZED INTERSECTIONS**

| Level of Service | Delay (seconds) |
|---|---|
| A (Highly Desirable) | < 10.0 |
| B (Desirable) | 10.1 to 15 |
| C (Acceptable) | 15.1 to 25 |
| D (Acceptable to CDOT) | 25.1 to 35 |
| E (Unacceptable) | 35.1 to 50 |
| F (Unacceptable) | > 50.0 |

**Source:** ***Highway Capacity Manual*, 2010**

The "overall" intersection level of service at unsignalized intersections corresponds with the highest delay experienced on a minor street or stop-controlled approach, in this case. In general, CDOT and the Town of Basalt consider overall intersection operations of LOS "D" or better acceptable operations during the peak hours. During peaks, CDOT understands that some minor intersection movements may operate at LOS "E" or "F", but the goal is to keep the overall intersection Level of Service at LOS "D" or better. The AM and PM baseline models are shown below:

**Figure 6**
**2015 AM PEAK HOUR VOLUMES**


**Figure 7**
**2015 PM PEAK HOUR VOLUMES**


Using the baseline volumes shown above, the capacity analysis was run in Simtraffic to determine level of service, delay, and 95th percentile queue lengths for the study intersections. The following table shows the overall results for the two study intersections. The LOS and delays reported for the unsignalized intersections at Cody/Basalt correspond with the worst or poorest performing side street approach (controlled by stop sign). The uncontrolled movements at this intersection all operate at LOS "A" during peak hours, except when the intersection of Cody/Basalt is blocked by queues extending on the northbound approach to SH 82.

**Table 1**
**Baseline Intersection Level of Service Summary**

| Intersection | AM | | PM | |
|---|---|---|---|---|
| | LOS | DELAY 1 (s) | LOS | DELAY (s) |
| SH 82 & Basalt Avenue | D | 39.3 | D | 41.0 |
| Cody Lane & Basalt Avenue | A | 6.0 | E | 56.5 |

1 – Delay expressed as average delay per vehicle in seconds/vehicle.

As the table shows, the intersections within the study area currently operate within acceptable standards, with the exception of Cody/Basalt in the PM peak. The LOS "E" results from the heavy queuing that momentarily blocks the Cody Lane/Basalt intersection during the PM peak. Detailed operational results for the signal are provided on Table A1 in the appendix that show the MOE's by movement on each approach.

Although the stop-controlled intersection south of the highway is shown to operate with generally low average delays, intersection blockage is common at Cody/Basalt during the peak hours of most weekdays. However, the northbound green phase generally allows the Cody/Basalt intersection to typically clear each cycle. The signal cycle currently operates in "split-phase" mode throughout the day, allowing southbound and northbound traffic separate green phases with the pedestrian crossing phase occurring during the lagging northbound green phase. The existing peak hour cycle length of 180 seconds is set by CDOT to maximize highway flows and minimize delays for the predominant direction during the peak hours.

The following table shows the baseline analysis 95th percentile queue lengths estimated by the Simtraffic model.

**Table 2**
**Baseline 95th Percentile Queue Summary**

| SH 82 & Basalt Avenue | AM | PM | Available Length (ft) |
|---|---|---|---|
| Northbound Approach | 163' | 174' | 180' |
| Eastbound Approach (Left) | 331' | 279' | 370' |
| Southbound Approach | 227' | 160' | 110' |
| Westbound Approach (Left) | 151' | 167' | 370' |

The 95th percentile queue length represents the maximum queue length that occurs during 95% of the hour, so there may be times when it is exceeded for a short period of time. As the baseline model results show, the 95th percentile queue lengths for the northbound approach do not exceed the available storage length (but they are close), while the southbound queue lengths exceed the available storage length of 110' and spill into the roundabout during both peaks. Eastbound and westbound left turns are estimated to be accommodated in the turn lanes provided. There is room in the median of the highway to restripe these turn lanes to allow more storage in the future, if necessary.

### 5.4. Baseline Capacity and Queuing Analysis with Underpass

The proposed pedestrian underpass project will improve existing operations at the signal by removing the pedestrian phase, restriping the northbound approach to allow for a shared left-through lane and an exclusive right turn lane, and adjusting the split-phase signal operations to permissive for northbound and southbound approaches. With these changes, the intersection is estimated to operate with about 18 seconds less overall delay in the AM peak (LOS C) and about 12 seconds less overall delay in the PM peak (LOS C) than it does today. The following tables show the results of the capacity and queuing analyses using existing volumes and assuming the above laneage and phasing changes occurring with the underpass project. Although not shown in the table below, the intersection of Cody/Basalt operates at acceptable levels of service during both peaks with the underpass.

**Table 3**
**Improved Baseline Intersection Level of Service Summary**

SH 82 / Basalt Avenue Intersection - Approach Performance

2015 PERFORMANCE COMPARISON TABLE A1

| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OVERALL | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT |
| 2015 AM Peak | LOS | D | F | C | A | F | C | A | E | F | E | E | E | A |
| *Baseline* | Delay | 39.3 | 81.5 | 32.5 | 7.7 | 117.1 | 26.3 | 3.6 | 72.5 | 86.4 | 55.6 | 73.5 | 63.8 | 5.3 |
| | Queue | | 331 | 526 | 85 | 151 | 142 | 30 | 113 | 163 | 163 | **188** | **227** | 62 |
| 2015 AM Peak | LOS | C | D | B | A | E | B | A | C | C | B | D | C | A |
| *w/ Underpass* | Delay | 21.3 | 45.8 | 18.6 | 7.2 | 58.5 | 13.1 | 2.3 | 31.8 | 28.5 | 18.8 | 44.0 | 32.6 | 4.1 |
| | Queue | | 191 | 965 | 73 | 84 | 83 | 16 | 94 | 94 | 94 | **143** | **163** | 25 |
| 2015 PM Peak | LOS | D | F | B | A | F | C | A | F | F | E | F | E | C |
| *Baseline* | Delay | 41.0 | 93.0 | 15.4 | 3.2 | 108.4 | 33.1 | 9.5 | 98.3 | 107.6 | 62.9 | 89.4 | 74.7 | 33.8 |
| | Queue | | 279 | 149 | 41 | 167 | 1309 | 248 | 146 | 174 | 174 | **126** | **160** | 100 |
| 2015 PM Peak | LOS | C | F | B | A | D | C | A | D | D | A | D | C | B |
| *w/ Underpass* | Delay | 28.5 | 85.3 | 12.1 | 3.4 | 50.3 | 26.7 | 9.0 | 48.5 | 46.6 | 7.0 | 42.6 | 34.0 | 19.3 |
| | Queue | | 223 | 108 | 46 | 79 | 406 | 53 | 152 | 152 | 63 | 82 | 86 | 54 |

*Signal runs actuated-uncoordinated with protected-only phasing for mainline left turns*
*95th Percentile Queues exceeding available storage shown in* **BOLD**
*Simtraffic Results - CDOT Existing Cycle Length of 180 Seconds*

7/15/2016

1 – Delay expressed as average delay per vehicle in seconds/vehicle.

As Table 3 above shows, the signal will operate with less delay when the underpass is installed and the northbound laneage is reassigned with an exclusive right turn lane. The northbound and southbound approaches show the greatest improvements in reduction of average delays when the underpass is in place. The following table shows the estimated queue lengths for the improved baseline scenario when the underpass is in place.

**Table 4**
**Improved Baseline 95th Percentile Queue Summary**

| SH 82 & Basalt Avenue | AM | PM | Available Length (ft) |
|---|---|---|---|
| Northbound Approach | 94' | 152' | 180' |
| Eastbound Approach (Left) | 191' | 223' | 370' |
| Southbound Approach | 163' | 86' | 110' |
| Westbound Approach (Left) | 84' | 79' | 370' |

As Table 4 and Table A1 of the appendix show, the queue lengths are reduced when compared to the Baseline scenario (Table 2 results). The results show the queue lengths all fall within their available lane lengths, with the exception of the southbound approach to the highway during the AM peak hour.

The underpass improvement demonstrates a first, significant step to improving access to the Southside and reducing delays for all intersection users at the SH 82 signal and adjacent intersections. Additional data collection and modeling efforts are recommended after the underpass is in place to confirm these findings and develop a new baseline condition for CDOT permitting purposes in the future.

## 6.0 20-Year Traffic Conditions (2035)

The Town of Basalt planning staff has developed a 20-year development plan for the Southside that reflects current land use proposals and as well as a generalized plan for the remaining known parcels slated for development in the next 20 years.

New traffic turning to and from the highway or crossing it at Basalt Avenue was increased using land use estimates and ITE trip rates for specific development proposed for the Southside. Traffic entering and leaving the Southside was assigned using the existing turning splits occurring at the SH 82 signal to estimate percentages turning up or down valley or crossing the highway during the AM and PM peak hours. Through movements along the highway at the signal (not influenced by the Southside 20-year development plan or the Roaring Fork Apartments) were increased using CDOT's 20-year factor of 1.35. The following sections detail the travel demand forecasting techniques that estimate the peak hour volumes for the 20-year development scenario.

### 6.1. Traffic Generation

According to the Town of Basalt Planning Department, several southside parcels are planned for development in the next twenty years. These parcels are color coded in Figure 6 below and include:

- Cathers East (Residential/Commerical mix / Orange)
- Cathers West (Industrial / Orange)
- Schlumberger (Industrial/Residential mix / Yellow-green)
- Skico Industrial/Residential parcel (Industrial/Residential mix / Blue near Hwy 82)
- Basalt Design District Housing (Residential/Office mix / Light green)
- Basalt Mini Storage (Mini warehousing / Green)
- Southside PUD (Approved Residential / Red)
- Skico Housing (Residential / Blue)

General development totals for the uses proposed on these properties were assumed for this analysis. Actual development proposals by these other projects could be lower or higher with regards to project scope.

Specific land use plans from Stott's Mill, Habitat for Humanity, and the Roaring Fork apartments were included since these represent current proposals in front of the Town. Development totals for these proposals include:

- Stott's Mill (60 Single-family units, 96 Multi-family units / Gold)
- RE-1/Habitat for Humanity (27 Multi-family units / White)
- Roaring Fork Apartments (56 Apartment units / Yellow)

Stott's Mill is also planning to construct a 4,000 square foot daycare facility and 3 ~~outdoor~~ tennis courts for public use.

**Figure 8**
**20-YEAR DEVELOPMENT PARCELS**


Trip generation rates for the proposed land uses for the Town's 20-year development plan were based on average trip rates found in the nationally accepted publication, *Trip Generation* (Institute of Transportation Engineers, 9th Edition, 2012). Trip estimates shown on Table 5 summarize the total trips expected to be generated by the development during the AM and PM peak hours and on an average weekday. These estimates are based on average trip rates provided for Single-Family Homes, Apartments, Condominium/Townhomes, General Office, General Light Industrial, Specialty Retail (for commercial use), Mini-Warehousing, Tennis Courts, and Daycare Center. Below are the total trip generation results that could be produced by the 20-year development plan.

**Table 5**
**Estimated 20-Year Total Traffic Generation**

| Unit Type | # of UNITS | DAILY TRIPS | AM IN | AM OUT | PM IN | PM OUT |
|---|---|---|---|---|---|---|
| Single-Family Detached Homes 1 | 71 du | 676 | 13 | 40 | 45 | 26 |
| Multi-Family Attached Units 2 | 186 du | 1,081 | 13 | 69 | 65 | 32 |
| Apartments 3 | 56 du | 372 | 6 | 23 | 22 | 12 |
| General Office 4 | 11.9 ksf | 130 | 16 | 2 | 3 | 15 |
| Light Industrial 5 | 25 ksf | 174 | 20 | 3 | 3 | 21 |
| Mini Warehousing 6 | 81.6 ksf | 204 | 7 | 5 | 11 | 11 |
| Specialty Retail 7 | 0.9 ksf | 40 | - | - | 1 | 1 |
| Tennis Courts 8 | 3 Courts | 93 | - | - | 6 | 6 |
| Day Care 9 | 4 ksf | 296 | 26 | 23 | 23 | 26 |
| **Total Traffic Generation** | | **3,066** | **101** | **165** | **179** | **150** |
| | | ***TOTAL*** | ***AM*** | ***266*** | ***PM*** | ***329*** |

1 – ITE Land Use Code #210 – Single-family Detached Housing, trip rate based on number of dwelling units
2 – ITE Land Use Code #230 – Condominium/Townhouse, trip rate based on number of dwelling units
3 – ITE Land Use Code #220 – Apartments, trip rate based on number of dwelling units
4 – ITE Land Use Code #710 – General Office, trip rate based on 1,000 square feet of space
5 – ITE Land Use Code #110 – Light Industrial, trip rate based on 1,000 square feet of space
6 – ITE Land Use Code #151 – Mini-Warehousing, trip rate based on 1,000 square feet of space
7 – ITE Land Use Code #726 – Specialty Retail Center, trip rate based on 1,000 square feet of space
8 – ITE Land Use Code #490 – Tennis Courts, trip rate based on number of courts
9 – ITE Land Use Code #565 – Day Care Center, trip rate based on 1,000 square feet of space

With no reductions for transit, internal trips, pass-by trips, car-pool, or other modal choices, the 20-year development plan for Basalt's Southside (and Roaring Fork Apartments) could generate approximately 3,066 daily trips on an average weekday. The 20-year buildout is expected to generate approximately 266 trips in the AM peak hour and 329 trips in the PM peak hour, based on the current development plans and nationally accepted trip rates. Table A2 in the appendix provides a trip generation breakdown by individual development parcel (for the three current development proposals) and generalized estimates for the remaining land uses.

In the trip generation table, the Roaring Fork Apartment traffic has been isolated from the rest of the proposed Southside development traffic because traffic from the north side and south side of the highway should be kept separate for the purposes of highway access permitting.

### 6.2. Trip Reductions

Adjustments to the total traffic generation estimates in Table 5 are necessary to more accurately predict external traffic generation for the mix of uses planned for the Southside. All proposed Southside housing units, with the exception of the RE-1 Habitat Housing, is located within one-half mile of the RFTA BRT station and residents may choose to make future work and shopping trips via bicycle or foot to and from this station. For the purpose of this study, approximately 5% of traffic generated by the residential, office, and retail uses proposed for the 20-year development plan was assumed to be made by transit. Additionally, the growing mix of uses on the Southside may increase the amount of internal trips being made between uses in the future by attracting trips from other uses (such as new restaurant/service uses near office or residential uses). In previous studies of Southside traffic for the Town of Basalt, a 15% reduction factor was applied to new traffic generated by residential, office, and retail uses to account for trip making between complementary uses on the Southside, transit, and other trips.

No internal or transit trips were assumed for the proposed industrial and warehousing units on the Southside. Overall, the traffic generation totals for residential, office, and retail uses for this study were reduced by about 15% to account for transit and internal trip making. As agreed to by the Town, traffic generated by the daycare was reduced by an additional 5% (or 20% total reduction) to account for trips made within the Southside between the daycare center and the residential or high school uses. The Town plans that the daycare will allow prioritized admissions for Southside residents, in an effort to maximize trip reductions for this use. Traffic for the tennis courts was reduced by 15%, similar to other residential, office and retail uses.

This study does not assume any trip reductions for pass-by traffic, car-pools, or other traffic demand management (TDM) measures that the Town of Basalt has begun to implement in other parts of Town to reduce traffic generation by certain land uses. The proposed uses in the Southside are generally not visible from the highway and may not create pass-by opportunities for highway users (shopping for instance). Through this study, TDM measures may be determined appropriate for proposed uses on the Southside that should reduce traffic pressure on the signal at SH 82 during the peak periods. The following table shows the total trip generation estimates that would be external to the Southside, i.e. one trip end would be located outside the Southside.

**Table 6**
**Estimated 20-Year External Traffic Generation**

| Unit Type | # of UNITS | DAILY TRIPS | AM IN | AM OUT | PM IN | PM OUT |
|---|---|---|---|---|---|---|
| Single-Family Detached Homes | 71 du | 676 | 13 | 40 | 45 | 26 |
| Multi-Family Attached Units | 186 du | 1,081 | 13 | 69 | 65 | 32 |
| Apartments | 56 du | 372 | 6 | 23 | 22 | 12 |
| General Office | 11.9 ksf | 130 | 16 | 2 | 3 | 15 |
| Light Industrial * | 25 ksf | 174 | 20 | 3 | 3 | 21 |
| Mini Warehousing * | 81.6 ksf | 204 | 7 | 5 | 11 | 11 |
| Specialty Retail | 0.9 ksf | 40 | - | - | 1 | 1 |
| Tennis Courts | 3 Courts | 93 | - | - | 6 | 6 |
| Day Care | 4 ksf | 296 | 26 | 23 | 23 | 26 |
| **Total Traffic Generation** | | **3,066** | **101** | **165** | **179** | **150** |
| **(Internal/Transit Reduction) **** | | **(418)** | **(12)** | **(25)** | **(26)** | **(19)** |
| **Total External Traffic Generation** | | **2,648** | **89** | **140** | **153** | **131** |
| | | ***TOTAL*** | ***AM*** | ***229*** | ***PM*** | ***284*** |

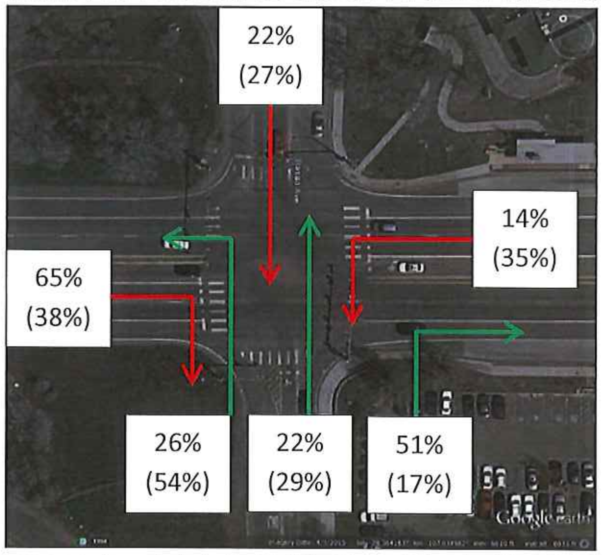
* – No Internal or Transit Traffic Reduction
** – 5% Transit and 10% Internal Traffic reductions applied to SF, MF, Office, and Retail uses; additional 5% applied to Day Care trips

The table above estimates the 20-year development plan will generate approximately 2,648 external daily trips to/from the Southside, including 229 trips in the AM peak and 284 trips in the PM peak. This better represents the potential increase in traffic demand at the highway intersection during the morning and afternoon peak hours when considering different modal uses and internal trip making potential of the Southside developments (and the Roaring Fork Apartments).

### 6.3. Trip Distribution and Assignment

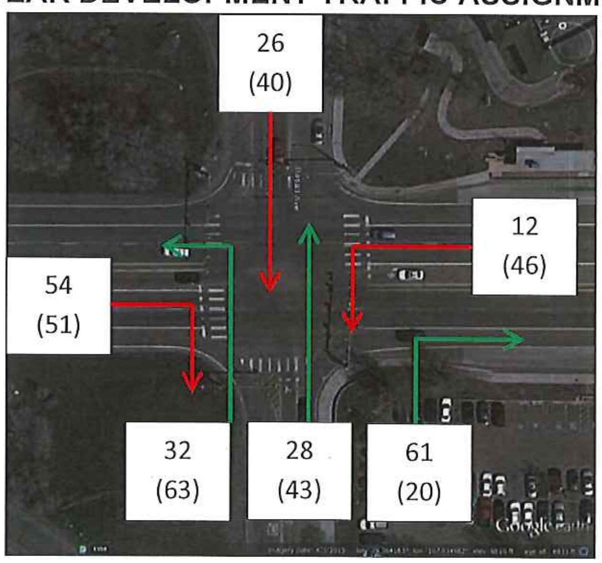
Traffic generated by the 20-year development plan for the Southside was assumed to follow the existing peak hour traffic patterns that were observed when counts were collected in October. Using the counts during the AM and PM peaks at the signal, left, through, and right turning percentages were calculated for traffic entering and leaving the Southside. These percentages were applied to the external traffic generated by the 20-year plan to assign inbound and outbound volumes to the primary study intersec tion. The assumed trip distribution percentages are shown below for the AM and (PM) peaks at the signal below.

**Figure 9**
**TRAFFIC DISTRIBUTION PERCENTAGES**




Using the external traffic generation totals in Table 6 and the traffic distribution percentages in Figure 9, traffic generated by the 20-year Southside development plan was assigned to the intersection at SH 82 and Basalt Avenue as shown below for the AM and (PM) peaks.

**Figure 10**
**20-YEAR DEVELOPMENT TRAFFIC ASSIGNMENT**




### 6.4. 20-Year Buildout Volumes

The resulting total traffic volumes for the 20-year development plan for the Southside are shown on Figures 11 and 12. Turning movements not affected by Southside development, i.e. mainline through traffic was factored up by 1.35 to account for CDOT's 20-year growth projections. All volumes generated by new Southside development were assigned as through volumes at the Cody/Basalt intersection.

**Figure 11**
**2035 AM PEAK HOUR VOLUMES**


**Figure 12**
**2035 PM PEAK HOUR VOLUMES**


The 2035 AM and PM volumes shown above will be used in the alternative improvement scenarios that are evaluated in this report.

### 6.5. 20-Year Buildout Capacity and Queueing Analysis

Using the 20-year buildout volumes shown on Figures 11 and 12, the capacity analysis was run in Synchro/Simtraffic to determine level of service, delay, and queuing estimates for the study intersections. The following tables show the overall results of the capacity analysis for the SH 82 signalized intersection and the 95$^{th}$ percentile queueing results at this intersection for the "Buildout Baseline" scenario. The Buildout Baseline scenario represents the buildout conditions for all parcels in this study and no additional improvements to the highway intersection or Cody Lane intersection beyond the underpass project.

**Table 7**
**Buildout Baseline**
**Intersection Level of Service Summary**

| Intersection | AM | | PM | |
|---|---|---|---|---|
| | LOS | DELAY [1] (s) | LOS | DELAY (s) |
| SH 82 & Basalt Avenue | D | 46.8 | F | 83.5 |
| Cody Lane & Basalt Avenue | A | 9.1 | F | 253.6 |

1 – Delay expressed as average delay per vehicle in seconds/vehicle.

As Table 7 shows, the signalized highway intersection is forecast to operate acceptably in 20 years during the AM peak but not the PM peak (LOS "F"). Based on the applied CDOT growth rates and site specific traffic generation, this is to be expected along the highway within the midvalley area as SGM found in other recent studies along the SH 82 corridor (The Fields, Eagle County). The forecast 20-year increase in most areas has shown that over-saturated (LOS "F") conditions are likely to exist along the corridor during peak hours without the addition of lanes to the highway or the implementation of transportation demand measures like transit, bike commuting, and ride sharing options.

Table 8 summarizes the 95$^{th}$ percentile queue lengths estimated for the Buildout Baseline scenario.

**Table 8**
**Buildout Baseline**
**95$^{th}$ Percentile Queue Summary**

| SH 82 & Basalt Avenue | AM | PM | Available Length (ft) |
|---|---|---|---|
| Northbound Approach | 204' | 184' | 180' |
| Eastbound Approach (Left) | 265' | 846' | 370' |
| Southbound Approach | 360' | 453' | 110' |
| Westbound Approach (Left) | 237' | 475' | 370' |

As Table 8 shows, the additional traffic will create queue lengths at the signal that will exceed the available storage length that exists today on the northbound and southbound approaches as well as for the left turns from the highway during most peak hours. Of significance to Southside development, the westbound left turn queue increased from 79' in the Improved Baseline scenario (Table 4) to 475' in the Buildout Baseline scenario as a result of the increased traffic demand on the Southside. Additionally, the northbound queue is estimated to extend through the Cody Lane intersection in the Buildout Baseline scenario, whereas it was not shown to extend through this intersection in the Improved Baseline scenario (increases from 94' to 204' in AM peak). These increases show the effects of additional traffic demand from Southside developments on the current system and how they impact signal operations.

Improvements to the left turn lanes on the highway could be accomplished easily by restriping the proper lengths within the paved medians. There is about 700' of pavement available for the westbound left turn lane and 800' available for the eastbound left turn lane if they were extended to the existing median barrier sections on the highway. Striping these lanes longer as their demand grows is a simple improvement.

The following three improvement scenarios will address the need for additional capacity for vehicles turning to and from the highway at Basalt Avenue.

## 7.0 Improvement Alternatives

The layout of the intersection at SH 82 and Basalt Avenue where nearby frontage roads limit the available queue storage for the approaches to the signal is a situation that occurs in many places in the valley and the Town including the signalized intersections of SH 82/El Jebel/Valley, SH 82/Willits Lane/Tree Farm Drive, SH 82/Original Road, SH 82/Emma Road, and SH 82/Baltic Avenue at the AABC in Aspen. This layout is a function of the topographic and property constraints that exist and would not have been designed this way if designers had unlimited land to work with.

Given the level of buildout and property ownership on the Southside, there are few options to improve the intersection operations that do not impact private property or require a new access point to the highway be granted by CDOT and FHWA. SGM, with the Town of Basalt planning staff, has developed the following three alternatives that could improve access to the Southside at Basalt Avenue. The three alternatives are:

1. Basalt Avenue Laneage Improvements
2. Cody Lane Mini Roundabout and Laneage Improvements
3. Underpass at Midland Avenue/Southside Drive

The first alternative explores a low-cost, low impact option that formalizes the laneage on the Basalt Avenue approach to better organize traffic queued at the signal. The second alternative was deliberated during the underpass design process, but the available funding did not allow the intersection and laneage improvements to be added to the underpass construction project. The third alternative is a vehicular and pedestrian underpass that was preliminarily designed by Sopris Engineering for the Town in 2012.

### 7.1 Alternative 1 – Basalt Avenue Laneage Improvements

The 180' spacing between the Cody/Basalt intersection and the highway signal creates difficulties in developing additional turn lanes for this approach. The challenge is transitioning from one lane on the northbound approach to Cody/Basalt to a three lane approach at the signal. This can be accomplished by transitioning to two northbound lanes south of Cody Lane in the existing roadway provided. Although this isn't striped today with the additional northbound lane, observations generally showed motorists forming two northbound lanes when traffic queuing from the signal would extend through the Cody intersection during peaks.

Alternative 1 improves the northbound approach to the signal by adding an exclusive left turn lane, creating a three-lane approach to the signal (and two lanes southbound). This can allow the intersection signal timing to be adjusted to operate on a protected-permissive timing plan rather than the current split-phase timing plan, which can be more efficient. Another improvement in Alternative 1 includes extending the eastbound and westbound left turn lanes on the highway to 600 feet in total length to account for the turn lane overflow that occurred during the 20-year buildout baseline queuing analysis. The Simtraffic models showing the intersection improvements studied for Alternative 1 are shown in Figures 13 and 14 below.

**Figure 13**
**Alternative 1 AM Simtraffic Model**

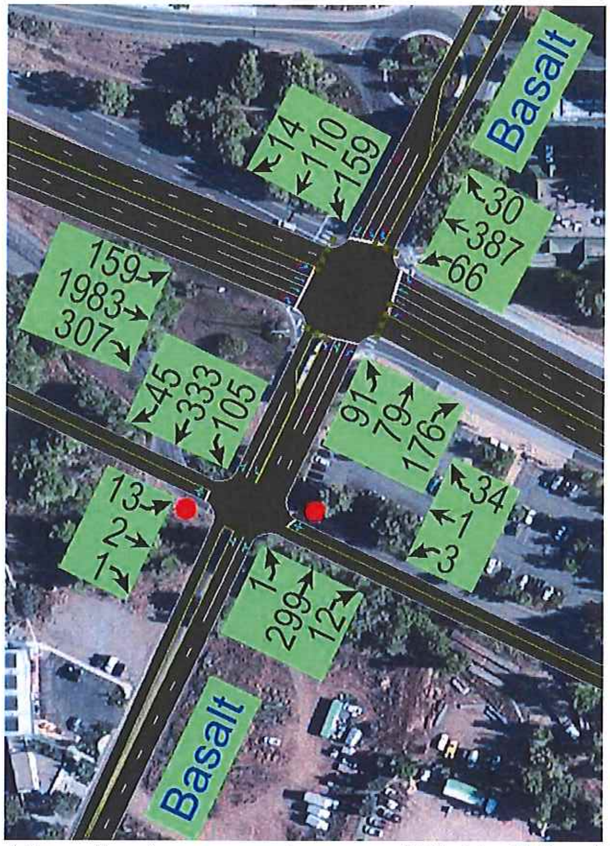
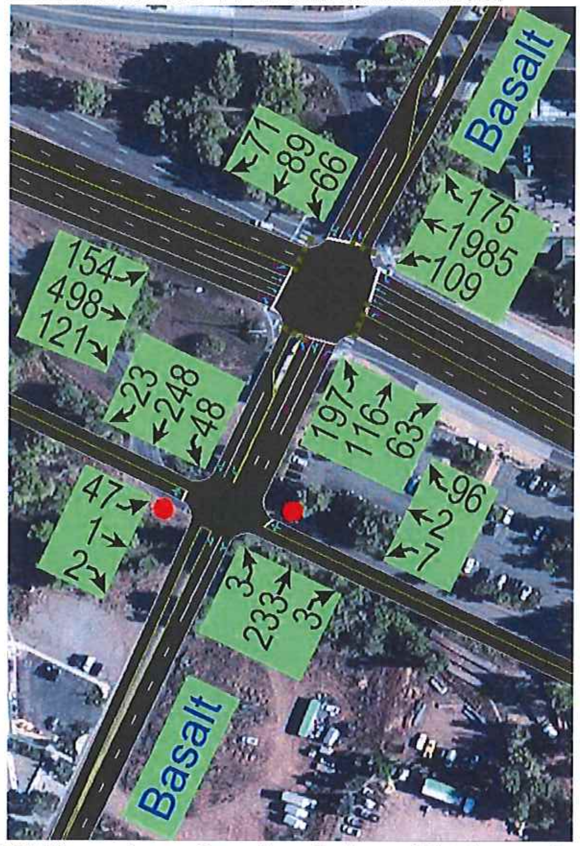



**Figure 14**
**Alternative 1 PM Simtraffic Model**




Alternative 1 may require a small Right-of-Way (ROW) purchase from the Cathers West parcel to accommodate the lane shift and additional lane on Basalt Avenue. This improvement is the simplest and cheapest alternative explored. The underpass plans were developed to include this improvement without major changes to the underpass approach south of SH 82 or the traffic signal poles and mast arms. This improvement would cost less than $250,000 to construct.

### 7.2 Alternative 2 – Mini Roundabout and Laneage Improvements

The 180' spacing between the Cody/Basalt intersection and the highway signal creates difficulties in developing additional turn lanes for this approach. The challenge is transitioning from one lane on the northbound approach to Cody/Basalt to a three lane approach at the signal. This transition is easier to accomplish for lanes exiting a roundabout as is evident from the laneage configuration for the southbound approach to the signal. This approach is 110' long from the roundabout at Emma Road to the stop bar, providing three approach lanes to the highway.

Alternative 2 improves the northbound approach to the signal by adding an exclusive left turn lane, creating a three-lane approach to the signal (and two lanes southbound). Similar to Alternative 1, this improvement includes extending the eastbound and westbound left turn lanes on the highway to 600 feet in total length to account for the turn lane overflow that occurred during the 5-year buildout queuing analysis. The final feature includes installing a mini roundabout at Cody Lane and Basalt Avenue and developing an additional turn lane on the northbound approach to the Cody Lane intersection. This will generally be a single-lane mini roundabout, but will allow for a second lane on the northbound approach, which is not shown in the plan below, but shows up on the Simtraffic model figure. The improvement plan and Simtraffic model showing the intersection improvements studied for Alternative 2 are shown in Figures 15 and 16 below.

**Figure 15**
**Alternative 2 Improvement Plan**

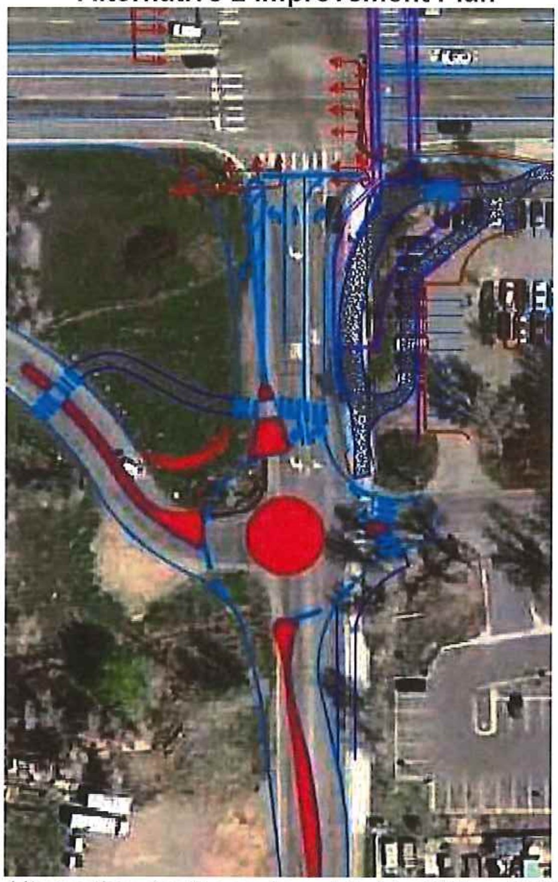


**Figure 16**
**Alternative 2 AM Simtraffic Model**


Alternative 2 will require a Right-of-Way (ROW) purchase from the Cathers West parcel to accommodate the lane shift, additional lane, and widened intersection on Basalt Avenue. This improvement could also provide safer crossings for pedestrians at Cody Lane using the splitter islands of the roundabout. The underpass plans were developed to include this improvement without major changes to the underpass approach south of SH 82 or the traffic signal poles and mast arms. This improvement would cost less than $1M to construct.

### 7.3 Alternative 3 – Underpass at Midland Avenue/Southside Drive

Alternative 3 consists of a vehicular and pedestrian underpass connecting Midland Avenue with Southside Drive. This alternative provides additional access to the Southside but avoids having to be granted new access to the highway. Alternative 3 is shown in Figure 17.

**Figure 17**
**Alternative 3 Improvement Plan**

The improvement plan shown in Figure 16 includes an on- and off-ramp for eastbound SH 82, which would require amendment to the Access Control Plan. As considered for this study, no access will be provided to the highway for this alternative beyond the existing access at Basalt Avenue, so these ramps were not considered a part of this improvement. For the purpose of the traffic model, the through volumes crossing the highway at the Basalt Avenue intersection (north- and southbound traffic) were reassigned to the underpass, and removed from impacting the signalized intersection. The signal will not prohibit through movements, but it is likely that the majority of travelers will use the underpass to get across the highway rather than wait at the signal. A cost estimate of this concept was not developed for the Town, but based on the current underpass construction budget, it would be significant.

## 8.0 Alternative Analysis Capacity and Queuing Results

Using the 20-year buildout volumes shown on Figures 11 and 12, the capacity analysis was run in Simtraffic to determine level of service, delay, and 95$^{th}$ percentile queue lengths for the signalized intersection under each of the alternatives. The following tables show the overall results of the capacity analysis for the signal at SH 82 and the 95$^{th}$ percentile queueing results for the Buildout Baseline and the three alternative improvement scenarios.

**Table 9**
**20-Year Buildout Alternatives Level of Service Summary**

| Intersection | AM | | PM | |
|---|---|---|---|---|
| | LOS | DELAY 1 (s) | LOS | DELAY (s) |
| Buildout Baseline | D | 46.8 | **F** | **83.5** |
| Alternative 1 | D | 47.9 | D | 50.8 |
| Alternative 2 | D | 51.0 | **E** | **64.3** |
| Alternative 3 | D | 36.7 | C | 32.2 |

1 – Delay expressed as average delay per vehicle in seconds/vehicle.

As the table shows, Alternative 1 and Alternative 3 allow acceptable operations during both peak hours; whereas the Baseline Buildout scenario and Alternative 2 operate at LOS "E/F" in the PM peak hour. Alternative 3 provides the best overall benefit by removing the through traffic crossing the highway from the analysis. This allows the signal to operate within acceptable standards (LOS "D" or better) during both peak hours.

The 95th percentile queuing results estimated by Synchro/Simtraffic are provided in Table 10 below.

**Table 10**
**20-Year Buildout Alternatives**
**95th Percentile Queue Summary**

| SH 82 & Basalt Avenue | | AM | PM | Available Length (ft) |
|---|---|---|---|---|
| Northbound Approach | Base | 204' | 184' | 180' |
| | ALT 1 | 198' | 195' | |
| | ALT 2 | 198' | 210' | |
| | ALT 3 | 186' | 200' | |
| Eastbound Approach (Left) | Base | 265' | 846' | 370' |
| | ALT 1 | 235' | 373' | |
| | ALT 2 | 311' | 669' | |
| | ALT 3 | 234' | 238' | |
| Southbound Approach | Base | 360' | 453' | 110' |
| | ALT 1 | 531' | 336' | |
| | ALT 2 | 547' | 514' | |
| | ALT 3 | 229' | 111' | |
| Westbound Approach (Left) | Base | 237' | 475' | 370' |
| | ALT 1 | 217' | 176' | |
| | ALT 2 | 206' | 169' | |
| | ALT 3 | 135' | 188' | |

When focusing on the northbound approach, all alternatives estimate 95th percentile queue lengths similar to those estimated for the Buildout Baseline scenario. Alternative 3 shows that the potential still exists for queue backup through the Cody Lane/Basalt Avenue intersection during both peak hours. Alternative 3 also provides the best improvement for queuing on the southbound approach to the signal. The westbound PM peak left turn queue also improves significantly for all alternatives in the PM peak with the turn lane striping extension in place. In general, Alternative 3 provides the best benefit to the signal operations and Cody Lane intersection operations for the long-term. Alternative 1 will provide the most benefit with the lowest cost and will allow better stacking conditions south of the highway. This alternative operates acceptably based on the current 20-year buildout estimates during both peak periods.

Table A3 in the appendix shows the detailed comparative results at the Basalt/SH 82 intersection while A4 shows the detailed comparative operational results at the Cody Lane intersection.

## 9.0 CDOT Access Permit Analysis

CDOT requires an access permit for any new development that contributes 20% or more additional traffic to an approach to an intersection to their highway. For this study, many of the proposed developments on the Southside would likely not trigger an access permit on their own. A more detailed breakdown of traffic generation is necessary for the Town to determine the impact that each of the known proposed developments in the 20-year plan will have on the signal at the highway, since there is only one way in or out of the Southside by vehicle.

Table A2 in the Appendix shows the traffic generation breakdown by development. The percentage impact of each development on the intersection at SH 82 (AM % and PM %) is shown, as well as the AM and PM "Permit Threshold". The permit threshold is 20% of the total traffic crossing the ROW line during the AM or PM peaks. For instance, during the AM peak, 442 vehicles cross the ROW line on Basalt Avenue (20% of 442 is 88). During the PM peak, 244 vehicles cross the ROW line on Basalt Avenue (20% of 244 is 49). If the external trips generated by a site equal or exceed either of the peak hour triggers, a highway access permit will be required. The final column in the table shows the percentage impact based on the PM peak hour trip generation and the 20% threshold. Two calculations were made for Stott's Mill: the 38.3% impact results from the residential units only, while the 58.5% impact results from adding the day care and tennis court uses to the residential uses, or the impact of the entire Stott's Mill proposal.

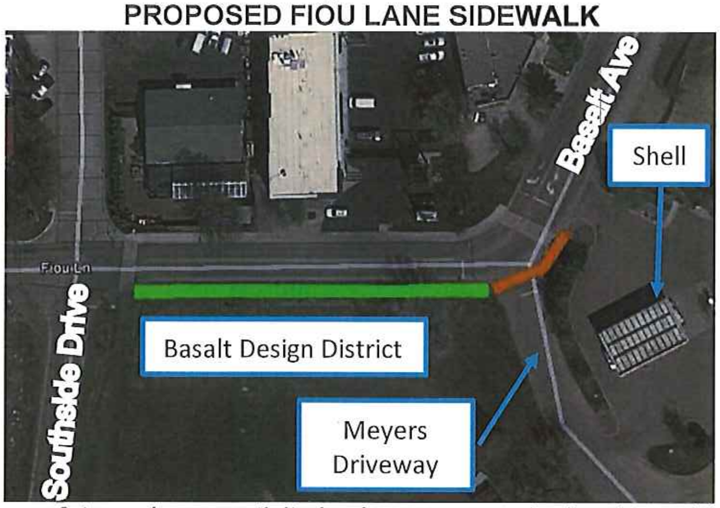
Based on each site's individual impact to the highway, the Stott's Mill development will trigger an access permit. The day care facility produces a significant volume of peak hour traffic, but the housing units alone proposed for Stott's Mill will cause this development to trigger an access permit with CDOT.

In areas experiencing congestion along the SH 82 corridor today, CDOT has recently begun to take a cumulative approach to evaluating traffic impacts from new developments. That is, the 20% calculation needs to account for recent developments that have occurred but haven't tipped the 20% threshold alone. With pressure for development in this area, this is the likely the approach that CDOT will take, given the existing morning and afternoon peak hour operations.

## 10.0 Trails and Sidewalk Connectivity

Trails and sidewalks create connections that allow better modal choices for area residents, employees, and visitors. A continuous pathway connects from the Rio Grande Trail (RGT) to the SH 82 intersection, but there are some existing deficiencies that could be improved upon to strengthen the connection between the Park and Ride and local trail system. The pedestrian route to the RGT requires a crossing of Fiou Lane at Southside Drive and a crossing of Basalt Avenue at Fiou Lane.

**Figure 15**
**PROPOSED FIOU LANE SIDEWALK**




An option to improve safety and connectivity is shown conceptually above. This would provide a continuous 10' sidewalk along the south side of Fiou Lane, between Southside and Basalt (along the Basalt Design District frontage). This would allow the pedestrians to avoid the two at-grade crossings of the main access route to the Southside and the High School. Figure 14 shows this simple connection that would include a marked pedestrian crossing for the Meyers driveway and connectivity to the existing sidewalk by the Shell station. This sidewalk and trail connection would significantly improve the pedestrian experience and reduce the interaction of pedestrians, cyclists, and traffic on Fiou Lane and Basalt Ave. The construction cost of this approximate 300 trail connection is under $50,000.

## 11.0 Conclusions and Recommendations

The scale of proposed development for the next 20 years on the Southside will create operational deficiencies at the SH 82/Basalt Avenue intersection upon Buildout if no additional capacity improvements are made. Upon buildout and based on conservative assumptions, the proposed Southside development and Roaring Fork Apartments will generate approximately 2,546 external daily trips to/from the Southside, including 222 trips in the AM peak and 272 trips in the PM peak. This equates to a 50% increase in AM peak hour traffic and 111% increase to PM peak hour traffic over today's volumes on the northbound approach.

The Stott's Mill development will require an access permit with CDOT because it would contribute more than 20% traffic (over today's volumes) to the northbound approach to SH 82/Basalt Avenue. The State's permitting process would seek improvements from the developer to mitigate the LOS "E" that would exist if nothing were done to improve the intersection or the northbound approach in the meantime.

This report explores three potential solutions, with the Alternative 1providing the best overall and individual operations for the traffic signal and adjacent Cody Lane intersection. CDOT's acceptable standard means LOS "D" overall operations and 95$^{th}$ percentile queue lengths accommodated within the allowable turn lanes provided. Alternative 3 meets all of CDOT's standards with the exception of satisfying the northbound and southbound 95$^{th}$ percentile queue needs. Laneage options may be available for the southbound approach (exiting the Emma roundabout) that were not included in this study. With improvements to the SH 82/Basalt signal operations under Alternative 1, the Basalt Avenue/Cody Lane intersection will function acceptably during peak hours. Alternative 1 includes the additional lane on Basalt Avenue and on the northbound approach and improving the eastbound and westbound left turn pockets by striping them for 600' of storage.

Other mitigation solutions that were not explored in depth could include:

- Eastbound slip lanes to and from SH 82 to Cody Lane
- Relocation of the Basalt Avenue/Cody Lane intersection to the south

These options create major property impacts to multiple properties (similar to Alternative 3), and the slip lanes to and from the highway would require amending the Access Control Plan. Both options could improve intersection operations at SH 82/Basalt Avenue, but were not studied due to the excessive property impacts.

A final recommendation this report offers is to construct a sidewalk connection on the south side of Fiou Lane between Southside Drive and Basalt Avenue. This would create a safer connection between the highway and the Rio Grande Trail, which is used heavily by school children, residents, tourists, and others.

SH 82 / Basalt Avenue Intersection - Approach Performance

## 2015 PERFORMANCE COMPARISON TABLE A1

| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OVERALL | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT |
| 2015 AM Peak | LOS | D | F | C | A | F | C | A | E | F | E | E | E | A |
| ***Baseline*** | Delay | 39.3 | 81.5 | 32.5 | 7.7 | 117.1 | 26.3 | 3.6 | 72.5 | 86.4 | 55.6 | 73.5 | 63.8 | 5.3 |
| | Queue | | 331 | 526 | 85 | 151 | 142 | 30 | 113 | 163 | 163 | **188** | **227** | 62 |
| 2015 AM Peak | LOS | C | D | B | A | E | B | A | C | C | B | D | C | A |
| ***w/ Underpass*** | Delay | 21.3 | 45.8 | 18.6 | 7.2 | 58.5 | 13.1 | 2.3 | 31.8 | 28.5 | 18.8 | 44.0 | 32.6 | 4.1 |
| | Queue | | 191 | 965 | 73 | 84 | 83 | 16 | 94 | 94 | 94 | **143** | **163** | 25 |
| 2015 PM Peak | LOS | D | F | B | A | F | C | A | F | F | E | F | E | C |
| ***Baseline*** | Delay | 41.0 | 93.0 | 15.4 | 3.2 | 108.4 | 33.1 | 9.5 | 98.3 | 107.6 | 62.9 | 89.4 | 74.7 | 33.8 |
| | Queue | | 279 | 149 | 41 | 167 | 1309 | 248 | 146 | 174 | 174 | **126** | **160** | 100 |
| 2015 PM Peak | LOS | C | F | B | A | D | C | A | D | D | A | D | C | B |
| ***w/ Underpass*** | Delay | 28.5 | 85.3 | 12.1 | 3.4 | 50.3 | 26.7 | 9.0 | 48.5 | 46.6 | 7.0 | 42.6 | 34.0 | 19.3 |
| | Queue | | 223 | 108 | 46 | 79 | 406 | 53 | 152 | 152 | 63 | 82 | 86 | 54 |

*Signal runs actuated-uncoordinated with protected-only phasing for mainline left turns*
*95th Percentile Queues exceeding available storage shown in* **BOLD**
*Simtraffic Results - CDOT Existing Cycle Length of 180 Seconds*

7/15/2016

Cody Lane / Basalt Avenue Intersection - Approach Performance

| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OVERALL | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT |
| 2015 AM Peak | LOS | A | C | F | A | C | A | C | B | B | A | A | A | A |
| ***Baseline*** | Delay | 6.0 | 21.3 | 97.9 | 2.3 | 27.5 | 5.5 | 26.6 | 10.5 | 10.5 | 6.2 | 2.7 | 0.8 | 0.6 |
| | Queue | | 47 | 47 | 47 | 82 | 82 | 82 | 127 | 127 | 127 | 56 | 56 | 56 |
| 2015 AM Peak | LOS | A | A | A | A | B | B | A | A | A | A | A | A | A |
| ***w/ Underpass*** | Delay | 1.4 | 7.0 | 4.3 | 2.2 | 14.2 | 19.6 | 4.7 | 0.3 | 0.3 | 0.3 | 2.6 | 0.9 | 0.9 |
| | Queue | | 40 | 40 | 40 | 50 | 50 | 50 | 54 | 54 | 54 | 10 | 10 | 10 |
| 2015 PM Peak | LOS | E | F | A | F | F | F | F | B | D | F | A | A | A |
| ***Baseline*** | Delay | 56.5 | 140.2 | 2.7 | 125.8 | 90.7 | 147.1 | 150.2 | 19.9 | 49.4 | 172.6 | 2.7 | 1.3 | 0.8 |
| | Queue | | 136 | 136 | 136 | 285 | 285 | 285 | 234 | 234 | 234 | 40 | 40 | 40 |
| 2015 PM Peak | LOS | B | C | A | B | A | A | D | A | B | B | A | A | A |
| ***w/ Underpass*** | Delay | 19.0 | 30.6 | 2.2 | 13.7 | 5.4 | 7.7 | 49.5 | 2.0 | 18.4 | 13.3 | 2.6 | 0.9 | 0.9 |
| | Queue | | 100 | 100 | 100 | 176 | 176 | 176 | 138 | 138 | 138 | 32 | 32 | 32 |

*Simtraffic Results*

7/15/2016

## Scenario 2035 Totals

| | Initial | 50% Redux (from PC Presented Numbers 8/16/16) |
|---|---|---|
| RE-1 Habitat for Humanity | 27 MF | |
| Stotts Mill Single-Family | 60 SF | |
| Stotts Mill Multi-Family | 96 MF | |
| Southside Residential (MF) | 126 MF | 63 |
| Southside Commercial | 1800 sf | 900 |
| Southside Office | 23700 sf | 11850 |
| Southside Industrial | 50000 sf | 25000 |
| Southside Warehouse | 81600 sf | 81600 |

| | |
|---|---|
| Roaring Fork Apartments | 56 Apartments |
| Approved Unbuilt (Southside PUD) | 11 SF |
| Stotts Mill Other | 3 Tennis Courts<br>4000 sf Daycare |

## SOUTHSIDE TRIP GENERATION TABLE A2 REVISED 10/14/16

| *Southside 20-Year Development* | Number of Units | ITE Code | Average Weekday Rate | AM Entering | Peak Hour Rates AM Exiting | PM Entering | PM Exiting | Average Weekday Traffic | AM IN | Peak Hour Traffic AM OUT | PM IN | PM OUT | % Impact |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RE-1 Habitat For Humanity | 27 | 230 | 5.81 | 0.07 | 0.37 | 0.35 | 0.17 | 157 | 2 | 10 | 9 | 5 | 4.9% |
| Stotts Mill Single Family | 60 | 210 | 9.52 | 0.19 | 0.56 | 0.63 | 0.37 | 571 | 11 | 34 | 38 | 22 | 38.3% |
| Stotts Mill Multi-Family | 96 | 230 | 5.81 | 0.07 | 0.37 | 0.35 | 0.17 | 558 | 7 | 36 | 34 | 16 | |
| Stotts Mill Daycare | 4 | 565 | 74.06 | 6.46 | 5.72 | 5.80 | 6.54 | 296 | 26 | 23 | 23 | 26 | 58.5% |
| Stotts Mill Tennis Center | 3 | 490 | 31.04 | n/a | n/a | 1.94 | 1.94 | 93 | - | - | 6 | 6 | |
| Southside Residential (MF) | 63 | 230 | 5.81 | 0.07 | 0.37 | 0.35 | 0.17 | 366 | 4 | 23 | 22 | 11 | |
| Southside Commercial | 0.9 | 826 | 44.32 | - | - | 1.19 | 1.52 | 40 | 0 | 0 | 1 | 1 | |
| Southside Office | 11.85 | 710 | 11.01 | 1.36 | 0.19 | 0.25 | 1.24 | 130 | 16 | 2 | 3 | 15 | |
| Southside Industrial | 25 | 110 | 6.97 | 0.81 | 0.11 | 0.12 | 0.85 | 174 | 20 | 3 | 3 | 21 | |
| Southside Warehouse | 81.6 | 151 | 2.5 | 0.08 | 0.06 | 0.13 | 0.13 | 204 | 7 | 5 | 11 | 11 | |
| Southside PUD (Approved / Unbuil | 11 | 210 | 9.52 | 0.19 | 0.56 | 0.63 | 0.37 | 105 | 2 | 6 | 7 | 4 | |
| **TOTAL TRIPS:** | | | | | | | | **2,695** | **95** | **141** | **156** | **138** | |
| **INTERNAL TRIP REDUCTION:** | | | | | | | | 362 | 12 | 21 | 23 | 17 | |
| **TOTAL 2035 EXTERNAL TRIPS:** | | | | | | | | **2,332** | **84** | **120** | **134** | **121** | |
| TOTALS: | | | | | | | | | 204 | | 254 | | |
| **CDOT PERMIT THRESHOLD FOR SOUTHSIDE:** | | | | | | | | | **442** | | **244** | | |

313 Residential units
0.9 ksf Commercial/Retail
11.85 ksf Office
25.00 ksf Industrial
81.6 ksf Mini storage

***ITE Ttrip Generation Manual, 9th Edition***
ITE Code 110 - General Light Industrial, Units in 1000 SF
ITE Code 151 - Mini-Warehousing, Units in 1000 SF
ITE Code 210 - Single-Family Residential, Units in # of dwelling units
ITE Code 230 - Residential Condominium/Townhome, Units in # of dewlling units
ITE Code 490 - Tennit Courts, Units in # of Courts
ITE Code 565 - Day Care Center, Units in 1000 SF
ITE Code 710 - General Office Building, Units in 1000 SF
ITE Code 826 - Specialty Retail Center, Units in 1000 SF
Assumptions:
Internal Trip Reductions: 15% Res, 15% Commercial, 15% Office, 0% Industrial, 20% Daycare
++ - 40% SF Homes; or 100% Daycare / Tennis

| *Northside 20-Year Development* | Number of Units | ITE Code | Average Weekday Rate | AM Entering | Peak Hour Rates AM Exiting | PM Entering | PM Exiting | Average Weekday Traffic | AM IN | Peak Hour Traffic AM OUT | PM IN | PM OUT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roaring Fork Apartments | 56 | 220 | 6.65 | 0.10 | 0.41 | 0.40 | 0.22 | 372 | 6 | 23 | 22 | 12 |
| ITE Code 220 - Apartments, Units in # of dwelling units | | | | | | | | 56 | 1 | 3 | 3 | 2 |
| TOTAL NORTHSIDE EXTERNAL TRAFFIC: | | | | | | | | 317 | 5 | 20 | 19 | 10 |
| TOTAL REDUX | | | | | | | | 418 | 12 | 25 | 26 | 19 |
| TOTAL 20-YEAR EXTERNAL TRAFFIC FROM NORTH- SOUTHSIDE DEVELOPMENT: | | | | | | | | 2,649 | 88 | 140 | 153 | 131 |

## SH 82 / Basalt Avenue Intersection - Approach Performance

### 2035 PERFORMANCE COMPARISON TABLE A2

| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OVERALL | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT |
| 2035 AM Peak | LOS | D | F | C | B | F | B | A | F | F | E | F | F | F |
| ***Buildout Baseline*** | Delay | 46.8 | 86.8 | 31.2 | 13.8 | 190.2 | 18.2 | 1.4 | 104.0 | 94.1 | 71.3 | 117.2 | 133.2 | 89.6 |
| | Queue | | 265 | 1420 | 103 | 237 | 142 | 12 | **204** | **204** | **198** | **207** | **360** | **360** |
| 2035 AM Peak | LOS | D | F | C | B | F | B | A | E | F | E | F | F | F |
| ***Alternative 1*** | Delay | 47.9 | 81.3 | 26.7 | 11.2 | 160.4 | 15.8 | 2.3 | 77.7 | 88.5 | 73.4 | 181.9 | 195.0 | 166.1 |
| | Queue | | 235 | 1095 | 113 | 217 | 132 | 12 | 156 | 151 | **198** | **221** | **531** | **531** |
| 2035 AM Peak | LOS | D | F | C | B | F | B | A | F | F | E | F | F | F |
| ***Alternative 2*** | Delay | 51.0 | 86.6 | 26.4 | 12.8 | 161.7 | 19.8 | 3.3 | 101.8 | 80.9 | 59.9 | 228.1 | 209.1 | 210.0 |
| | Queue | | 311 | 1406 | 112 | 206 | 173 | 25 | **184** | **198** | 167 | **208** | **547** | **547** |
| 2035 AM Peak | LOS | D | F | C | B | F | B | A | E | - | E | F | - | A |
| ***Alternative 3*** | Delay | 36.7 | 87.2 | 28.2 | 11.1 | 92.5 | 15.4 | 2.7 | 66.7 | - | 57.4 | 133.7 | - | 8.6 |
| | Queue | | 243 | 1662 | 80 | 135 | 139 | 21 | 139 | - | **186** | **229** | - | 87 |
| 2035 PM Peak | LOS | F | F | C | A | F | D | B | E | E | A | F | F | F |
| ***Buidlout Baseline*** | Delay | 83.5 | 530.8 | 26.4 | 4.6 | 103.1 | 54.8 | 18.2 | 79.1 | 70.9 | 8.0 | 153.5 | 203.7 | 173.9 |
| | Queue | | 846 | 1147 | 61 | 475 | 1486 | 534 | **184** | **184** | 61 | **187** | **453** | **453** |
| 2035 PM Peak | LOS | D | F | B | A | F | D | B | F | F | A | F | F | F |
| ***Alternative 1*** | Delay | 50.8 | 174.4 | 14.3 | 3.9 | 80.1 | 39.6 | 14.7 | 87.7 | 103.6 | 5.5 | 105.5 | 156.7 | 127.6 |
| | Queue | | 373 | 161 | 59 | 176 | 665 | 72 | **195** | **191** | 47 | **194** | **336** | **336** |
| 2035 PM Peak | LOS | E | F | B | A | F | D | B | F | E | D | F | F | F |
| ***Alternative 2*** | Delay | 64.3 | 208.8 | 17.9 | 5.2 | 82.4 | 45.3 | 17.4 | 139.5 | 79.2 | 37.2 | 198.1 | 224.5 | 228.9 |
| | Queue | | 669 | 343 | 61 | 169 | 820 | 475 | **210** | **181** | **190** | **194** | **514** | **514** |
| 2035 PM Peak | LOS | C | F | C | A | F | C | B | F | - | D | E | - | D |
| ***Alternative 3*** | Delay | 32.2 | 96.3 | 26.0 | 8.8 | 91.0 | 28.8 | 10.8 | 84.2 | - | 44.6 | 68.1 | - | 42.3 |
| | Queue | | 238 | 1080 | 65 | 188 | 516 | 59 | **200** | - | 76 | **111** | - | 82 |

*Signal runs actuated-uncoordinated with protected-only phasing for mainline left turns*

*95th Percentile Queues exceeding available storage shown in* **BOLD**

*Simtraffic Results - CDOT Existing Cycle Length of 180 Seconds*

10/4/2016

## Cody Lane / Basalt Avenue Intersection - Approach Performance

### 2035 PERFORMANCE COMPARISON TABLE A3

| | | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | OVERALL | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT | LEFT | THRU | RIGHT |
| 2035 AM Peak | LOS | A | C | B | A | F | B | B | C | C | B | A | A | A |
| ***Buildout Baseline*** | Delay | 9.1 | 22.0 | 10.4 | 3.8 | 70.5 | 11.0 | 11.0 | 20.7 | 20.7 | 12.8 | 3.9 | 1.0 | 0.8 |
| | Queue | | 42 | 42 | 42 | 45 | 45 | 45 | 307 | 307 | 307 | 43 | 43 | 43 |
| 2035 AM Peak | LOS | A | D | D | B | A | D | C | A | A | A | A | A | A |
| ***Alternative 1*** | Delay | 3.3 | 32.1 | 25.3 | 10.7 | 4.0 | 30.9 | 19.2 | 3.4 | 3.4 | 0.2 | 4.1 | 1.1 | 0.8 |
| | Queue | | 46 | 46 | 46 | 52 | 52 | 52 | 10 | 105 | 105 | 67 | 67 | 67 |
| 2035 AM Peak | LOS | A | A | A | A | A | A | A | A | A | A | A | A | A |
| ***Alternative 2*** | Delay | 3.2 | 1.6 | 0.3 | 0.2 | 0.8 | 0.4 | 4.0 | 3.1 | 3.1 | 4.9 | 3.0 | 3.3 | 2.9 |
| | Queue | | 14 | 14 | 14 | 39 | 39 | 39 | 33 | 56 | 56 | 99 | 99 | 99 |
| 2035 AM Peak | LOS | A | B | C | C | C | B | A | A | A | A | A | A | A |
| ***Alternative 3*** | Delay | 2.2 | 12.0 | 16.2 | 16.2 | 18.6 | 10.7 | 3.9 | 2.4 | 2.4 | 2.7 | 3.3 | 0.5 | 0.3 |
| | Queue | | 38 | 38 | 38 | 49 | 49 | 49 | 65 | 65 | 65 | 55 | 55 | 55 |
| 2035 PM Peak | LOS | F | F | F | F | F | F | F | F | F | F | A | A | A |
| ***Buidlout Baseline*** | Delay | 253.6 | 839.9 | 246.7 | 246.7 | 1156.7 | 1367.2 | 1367.2 | 77.4 | 59.4 | 53.0 | 5.2 | 1.2 | 0.6 |
| | Queue | | 415 | 415 | 415 | **1436** | **1436** | **1436** | 380 | 380 | 380 | 28 | 28 | 28 |
| 2035 PM Peak | LOS | B | D | A | E | F | A | E | A | B | A | A | A | A |
| ***Alternative 1*** | Delay | 13.6 | 27.0 | 2.4 | 41.8 | 52.0 | 7.2 | 41.4 | 1.7 | 14.4 | 0.0 | 2.5 | 1.2 | 0.9 |
| | Queue | | 88 | 88 | 88 | 154 | 154 | 154 | 68 | 139 | 139 | 30 | 30 | 30 |
| 2035 PM Peak | LOS | C | A | A | A | F | F | C | F | F | A | A | A | A |
| ***Alternative 2*** | Delay | 24.6 | 9.0 | 9.3 | 0.1 | 72.2 | 55.9 | 22.3 | 75.0 | 55.0 | 8.1 | 3.9 | 3.3 | 2.6 |
| | Queue | | 69 | 69 | 69 | 116 | 116 | 116 | 251 | 160 | 160 | 49 | 49 | 49 |
| 2035 PM Peak | LOS | C | F | E | E | F | A | F | C | C | A | A | A | A |
| ***Alternative 3*** | Delay | 22.7 | 55.1 | 41.2 | 41.2 | 68.2 | 2.5 | 79.9 | 22.2 | 22.2 | 0.0 | 2.0 | 0.4 | 0.3 |
| | Queue | | 103 | 103 | 103 | 258 | 258 | 258 | 130 | 130 | 130 | 26 | 26 | 26 |

*Simtraffic Results*

10/4/2016