

**TRAFFIC IMPACT ANALYSIS**

**BOULDER CREEK COMMONS**

**BOULDER, COLORADO**





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December 20, 2012

Mr. Gary Myre  
3195 11<sup>th</sup> Street  
Boulder, CO 80304

Re: Boulder Creek Commons  
Boulder, CO  
(LSC #110320)

Dear Mr. Myre:

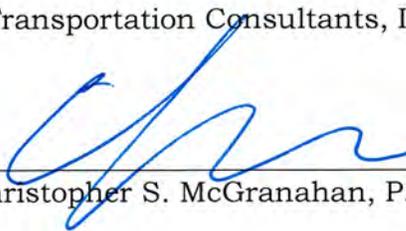
We are pleased to submit our Traffic Impact Analysis (TIA) report of the proposed Boulder Creek Commons development to be located in Boulder, Colorado. This traffic impact study first provides a summary of the existing roadways and traffic volumes in the vicinity of the proposed development, followed by estimates of the amount and directional distribution of vehicular traffic likely to be generated. This information is then combined with projected future traffic volumes in the vicinity to evaluate the impact of the new development on the existing and future roadway system and, where appropriate, to make recommendations for the necessary roadway improvements.

We trust that our findings and recommendations will assist in the planning of the proposed development. Please call if we can be of further assistance.

Respectfully submitted,

LSC Transportation Consultants, Inc.

By:

  
Christopher S. McGranahan, P.E., PTOE



CSM/wc

12-20-12

**Traffic Impact Analysis**

**Boulder Creek Commons**

**Boulder, Colorado**

Prepared for

Mr. Gary Myre  
3195 11<sup>th</sup> Street  
Boulder, CO 80304

Prepared by

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June 14, 2012  
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Revised: December 20, 2012  
(LSC #110320)

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## SECTION A Introduction

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The proposed Boulder Creek Commons is to be located west of 55<sup>th</sup> Street between South Boulder Road and Baseline Road in Boulder, Colorado. The site is proposed to contain 65 single-family detached homes, six duplex residential homes, and a 50-unit congregate care facility. Access to the site is proposed from 55<sup>th</sup> Street and Kewanee Drive. The November, 2010 *Hogan-Pancost Property Traffic Impact Study* by Drexel, Barrell & Company (Drexel Barrell TIS) estimated the impacts of a similar proposal on this site.

This analysis determines the traffic impacts of the proposed development on the surrounding roadway system. The following analysis procedures were utilized in the evaluation:

- A review and analysis of present roadway and traffic conditions in the vicinity of the site. This task included conducting updated traffic counts and a review of the planned and proposed roadway improvements in the general vicinity.
- A summary of the accident history at majority intersections in the area from the Drexel Barrell TIS.
- A projection of future background traffic volumes on the adjacent roadway system for 2032.
- An identification of potential travel demand management strategies that could reduce vehicle-trips to and from the site.
- A determination of the average weekday and peak-hour traffic that would be generated by the proposed development and an analysis of the estimated directional distribution of site-generated traffic and an assignment of that traffic to the adjacent roadway network.
- A determination of future traffic impacts associated with the proposed development. These impacts are based upon estimates of the total amount of traffic on the surrounding roadway system and the resulting Levels of Service (LOS) at the key intersections in the vicinity of the development.
- A traffic signal warrant analysis for the unsignalized intersection of South Boulder Road/55<sup>th</sup> Street.

- A determination of street and access improvements that will be necessary to mitigate the traffic impacts associated with the proposed development.

## SECTION B

# Roadway and Traffic Conditions

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The location of the proposed Boulder Creek Commons is shown in Figure 1. The site is located west of 55<sup>th</sup> Street between South Boulder Road and Baseline Road. The surrounding area is residential, education, and recreation uses.

### Area Roadways

Major roadways in the vicinity of the site are illustrated in Figure 1, with the site plan shown in Figure 2. Existing traffic volumes, lane geometry and traffic controls are shown in Figures 3 and 4. The following is a brief discussion of existing roadway conditions and anticipated future roadway improvements:

- South Boulder Road is a four-lane east-west arterial roadway connecting US 36 on the west with the City of Louisville to the east. It is posted at 35 mph in the vicinity of 55<sup>th</sup> Street, but changes to 45 mph about 400 feet to the east of 55<sup>th</sup> Street. The unsignalized intersection with Manhattan Drive is planned to be signalized by the City of Boulder in the next one to three years.
- Baseline Road is a four-lane east-west arterial roadway in the vicinity of 55<sup>th</sup> Street, but narrows to two lanes east of 55<sup>th</sup> Street. It is posted at 35 mph.
- 55<sup>th</sup> Street is a two-lane north-south collector street in the vicinity of the proposed development. It connects Pearl Parkway on the north with South Boulder Road on the south. It is posted at 25 mph in the vicinity of the site.
- Manhattan Drive is a north-south local street connecting South Boulder Road on the south with Baseline Road on the north. It is posted at 25 mph.
- Kewanee Drive is an east-west residential collector street that extends east from Manhattan Drive and terminates at the site of the proposed development.

### Existing Traffic Volumes

Peak-hour turning movement counts were conducted by Counter Measures, Inc. at the Baseline Road/Manhattan Drive, Baseline Road/55<sup>th</sup> Street, South Boulder Road/Manhattan Drive, South Boulder Road/55<sup>th</sup> Street, and Manhattan Drive/Kewanee Street intersections on Tuesday, April 24, 2012 or Wednesday, April 25, 2012. The counts were

conducted from 6:30 to 8:30 AM and from 4:00 to 6:00 PM. Twenty-four-hour counts were also conducted at various locations. The raw traffic count data is included in Appendix A.

The existing peak-hour traffic volumes are shown in Figure 3 and the existing lane geometry and traffic control is shown in Figure 4. The actual peak-hours were determined to be 7:30 AM to 8:30 AM and 5:00 PM to 6:00 PM. The existing afternoon peak-hour volumes were adjusted to account for higher activity at East Boulder Community Park than was occurring at the time the counts were conducted. The Manhattan Middle School had a late start on the day counts were conducted at the Manhattan/Kewanee intersection, so the existing peak-hour volumes at Manhattan/Kewanee were adjusted higher. To be conservative, both the morning and afternoon volumes were increased. These adjustments are detailed in Figure A1 in Appendix A.

### Accident Analysis

Accident reports were obtained by the City of Boulder Police Department for the intersections of S. Boulder Road/Manhattan Drive, S. Boulder Road/55<sup>th</sup>, Baseline/Manhattan, and Baseline/55<sup>th</sup>. The data includes accidents from Year 2005 through a portion of Year 2010. Below is a summary by intersection.

- South Boulder Road/Manhattan

A total of 17 accidents was reported at this intersection between 2005 and April 2010. One fatality was reported in October, 2007 due to a pedestrian “improperly entering the intersection”. Two injury accidents were reported in 2005 - both cited to driver error or careless driving. The details follow:

- ◆ **2005:** Four accidents occurred in 2005 and they were all rear-end type accidents. Three of the four occurred on Manhattan.
- ◆ **2006:** Three accidents occurred in 2006 and were comprised of one rear-end and two right-angle where the turning vehicle failed to yield the right-of-way. The rear end accident occurred on Manhattan and the right-angle accidents occurred on Boulder Road.
- ◆ **2007:** Four accidents occurred in 2007. Two of the four accidents were vehicles hitting the median on Boulder Road. One swerved to avoid an animal and the other was cited as reckless driving. A third accident was a rear-end type accident on Manhattan where a vehicle backed into another. The fourth was a fatality accident where an eastbound vehicle hit a northbound pedestrian that entered the intersection improperly.

- ◆ **2008:** Four accidents occurred in 2008. One was a side-swipe on Boulder Road due to icy road conditions. One was a southbound vehicle turning right that collided with a parked vehicle in the westbound direction. The site line was blocked by a fire truck. The third was a rear-end on Manhattan and the fourth was on Boulder Road where two vehicles collided due to an improper lane change.
- ◆ **2009:** One accident occurred in 2009. This accident was caused by driver error (driver's dog jumped on him) and the vehicle hit a power pole on Boulder Road.
- ◆ **2010:** One accident occurred in which a single vehicle collided with several objects on Boulder Road. Reckless driving was cited.

There does not appear to be a particular trend of accidents that could be corrected by intersection improvements or changes. Most of the accidents over the 5 year –plus period were due to driver error and reckless driving. No roadway or intersection improvements are recommended due to the accident history.

- South Boulder Road/55<sup>th</sup>

Only one accident was reported at this intersection for the study years. The accident occurred in 2006 and involved one vehicle that collided with the median on Boulder Road. Careless driving was cited. No roadway and/or intersection improvements are recommended due to the accident history.

- Baseline/55<sup>th</sup>

A total of 31 accidents occurred at this intersection between 2005 and 2009. No fatalities were reported but four injury accidents occurred.

- ◆ **2005:** Five accidents occurred in 2005. Four were rear-end accidents of which three occurred on 55<sup>th</sup> Street in the southbound direction. The fifth accident was a right-angle accident on Baseline where the turning vehicle failed to yield the right-of-way.
- ◆ **2006:** Six accidents occurred in 2006. Two involved single vehicles – one hit the median on Baseline and one hit a deer. Three were rear-end accidents – two on Baseline and one on 55<sup>th</sup>. The sixth accident was a right-angle on Baseline where the turning vehicle didn't yield the right-of-way.
- ◆ **2007:** Eight accidents occurred in 2007. Four of the eight accidents were rear-end of which three occurred on 55<sup>th</sup>. A fifth was a sideswipe on Baseline. The other three were right-angle accidents on Baseline where the reason cited was failure to yield right-of-way.
- ◆ **2008:** Eight accidents occurred in 2008. Of the eight accidents, five involved vehicles hitting bicyclists. All five occurred during daylight hours - four during the summer months, the other in November. The accidents involved vehicles turning left or right and failing to yield to a bicyclist. Three resulted in injuries. Two of the eight accidents were rear-end

accidents that occurred on 55<sup>th</sup> Street. The eighth accident occurred on Baseline and was due to an improper lane change.

- ◆ **2009:** Four accidents occurred in 2009. Two involved single vehicles that hit objects due to careless driving. A third was a vehicle that hit a bicyclist, resulting in injury. The vehicle was turning left off of Baseline and hit the bicyclist. The fourth accident was a rear-end accident on 55<sup>th</sup>.

One pattern that is shown at this intersection is the accidents between vehicles and bicyclists. Six accidents involving bicyclists is a pattern and this intersection should be annually reviewed by the City of Boulder to see if there are any treatment/improvements that would better accommodate bicycles.

- Baseline/Manhattan

A total of 14 accidents occurred at this intersection between 2005 and 2009. No fatalities were reported but three injury accidents occurred.

- ◆ **2005:** Six accidents occurred in 2005. Four were rear-end accidents of which three occurred on Manhattan in the northbound direction. The fifth accident was a right-angle accident where a vehicle turning onto Manhattan failed to yield right-of-way to a vehicle on Manhattan. The sixth accident involved a vehicle that hit a pedestrian. The vehicle was northbound on Manhattan turning left onto Baseline and failed to yield to the pedestrian crossing north on Baseline.
- ◆ **2006:** One accident occurred in 2006. The accident was a rear-end accident where an eastbound vehicle slowed to turn right onto Manhattan and was rear-ended.
- ◆ **2007:** Two accidents occurred in 2007 just south of the intersection. One vehicle hit a parked car on Manhattan and the other hit a southbound car as it pulled out of its parking place.
- ◆ **2008:** One accident occurred in 2008. It also occurred south of the intersection and involved a vehicle pulling out of a driveway hitting a northbound vehicle.
- ◆ **2009:** Four accidents occurred in 2009. One involved an eastbound vehicle hitting a pedestrian crossing Baseline. One involved an eastbound vehicle turning right onto Baseline and hitting a bicyclist. The third was a result of an illegal westbound u-turn hitting an eastbound vehicle. The fourth was a rear-end accident on Manhattan where the vehicle failed to stop.

There is no apparent pattern of accidents that appears correctable by intersection modifications.

The projected increase in traffic to the study intersections from the proposed project does not indicate that accidents would increase or that there would be improvements warranted due to accidents.

### Future Traffic Conditions

Projections of 2032 peak-hour traffic volumes have been made for the roadway system adjacent to the site in order to have a basis for determining future traffic impacts. Year 2032 traffic projections, shown in Figure 5, were made assuming a 0.5 percent annual growth rate for through movements on South Boulder Road and 1.2 percent annual growth rate for through movements on Baseline Road and the north leg of the Baseline Road/55<sup>th</sup> Street intersection. These growth rates are consistent with the Boulder TDM Model and the assumptions of the Drexel Barrell TIS.



Approximate Scale  
Scale: 1" = 1,000'



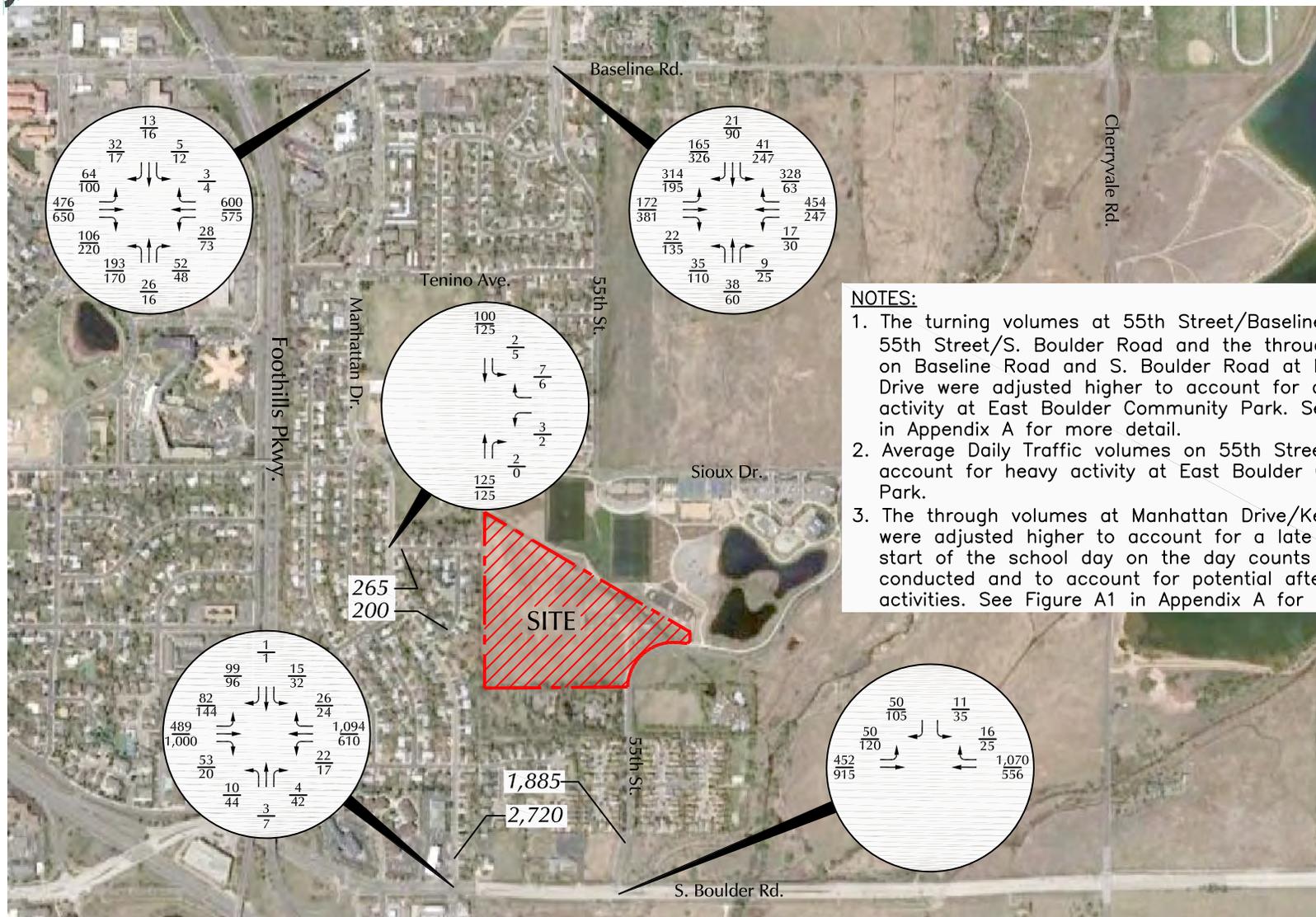
Figure 1  
**Vicinity  
Map**

Boulder Creek Commons (LSC #110320)





Approximate Scale  
Scale: 1" = 1,000'



- NOTES:**
1. The turning volumes at 55th Street/Baseline Road and 55th Street/S. Boulder Road and the through volumes on Baseline Road and S. Boulder Road at Manhattan Drive were adjusted higher to account for afternoon activity at East Boulder Community Park. See Figure A1 in Appendix A for more detail.
  2. Average Daily Traffic volumes on 55th Street do not account for heavy activity at East Boulder Community Park.
  3. The through volumes at Manhattan Drive/Kewanee Drive were adjusted higher to account for a late morning start of the school day on the day counts were conducted and to account for potential after school activities. See Figure A1 in Appendix A for more details.

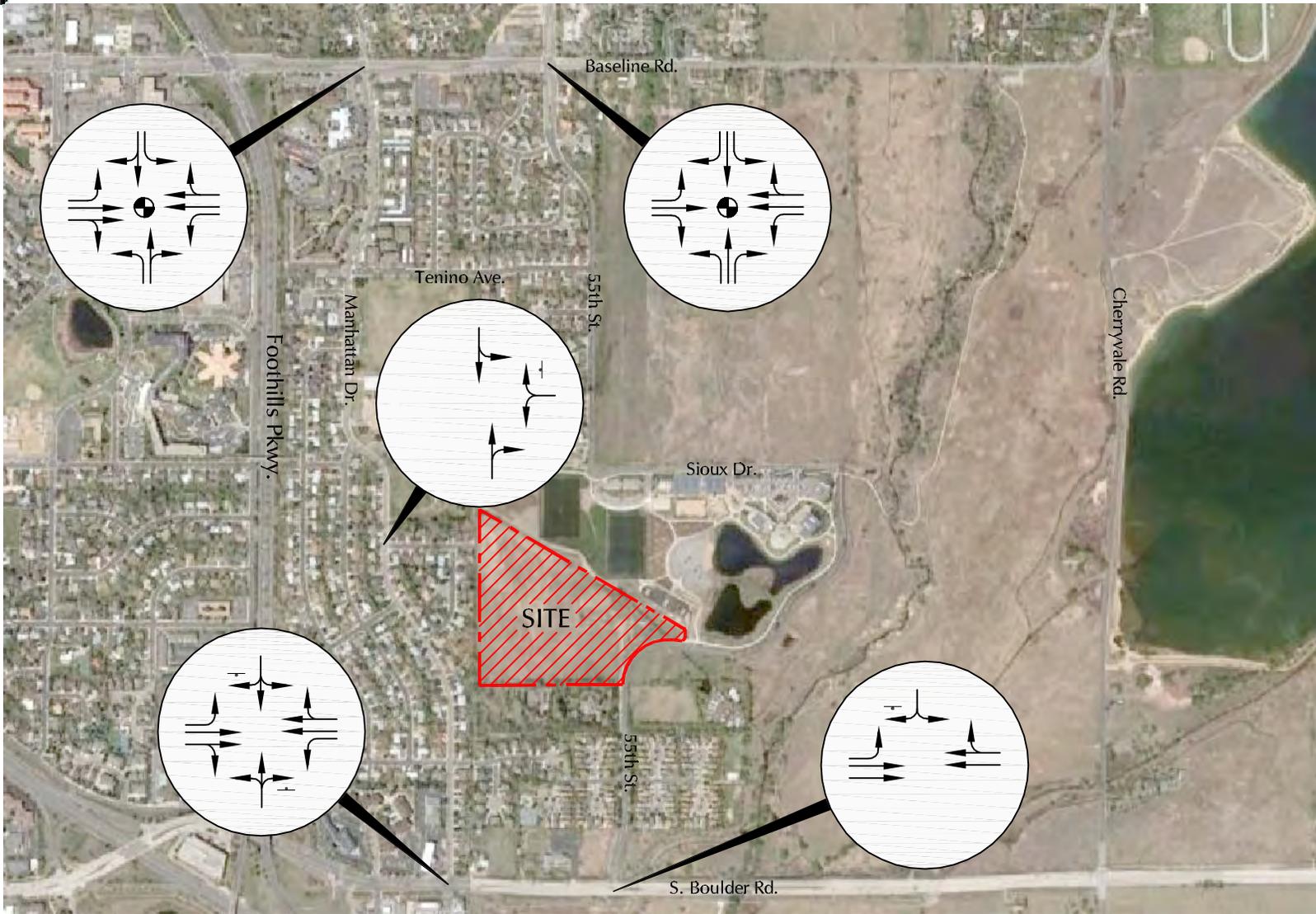
Figure 3

# Existing Traffic

Boulder Creek Commons (LSC #110320)

**LEGEND:**

- $\frac{45}{65}$  = AM Peak-Hour Traffic / PM Peak-Hour Traffic
- 1,150 = Average Daily Traffic



Approximate Scale  
 Scale: 1" = 1,000'

Figure 4

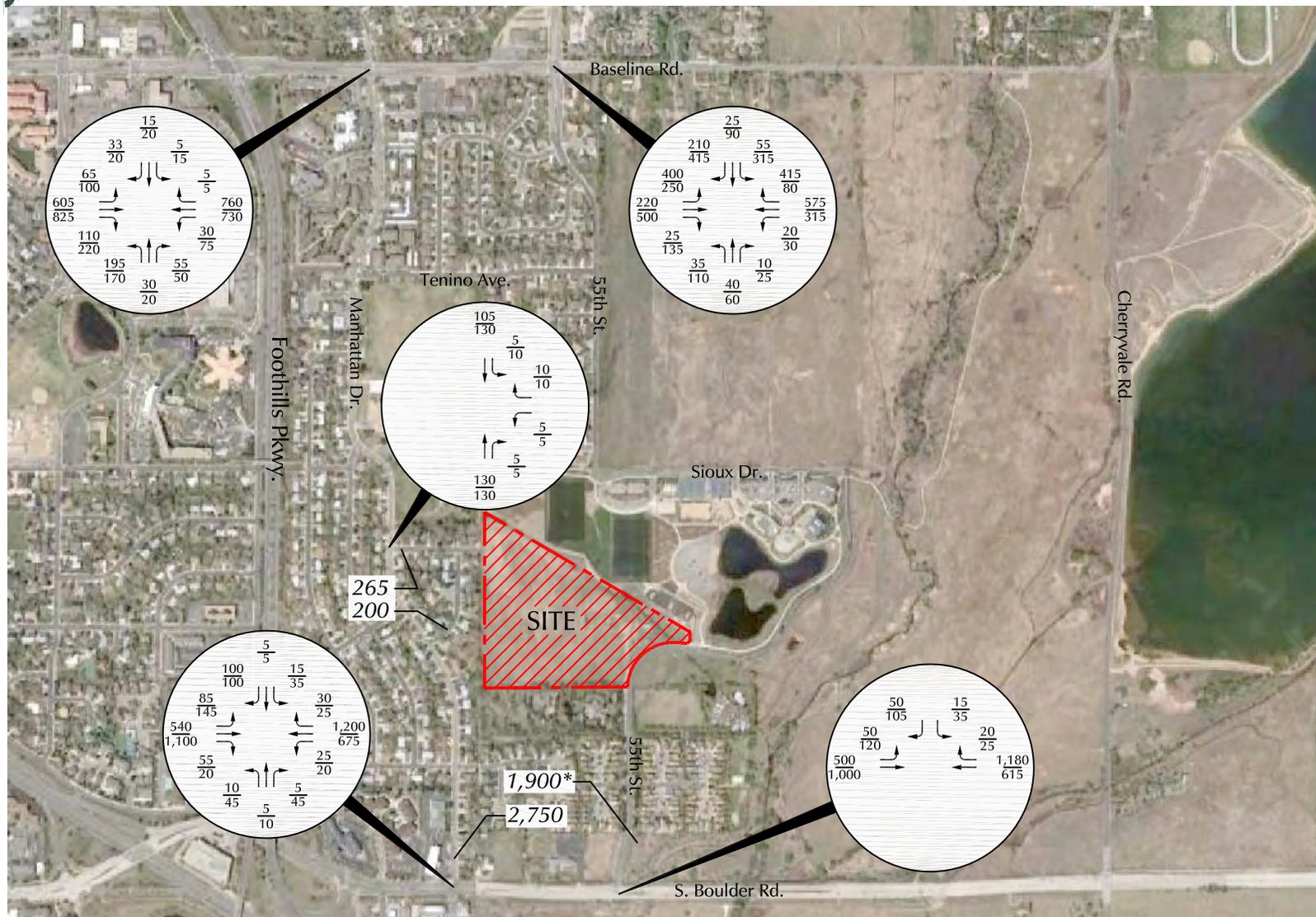
# Existing Lane Geometry & Traffic Control

Boulder Creek Commons (LSC #110320)

LEGEND:  
 T = Stop Sign  
 ● = Traffic Signal



Approximate Scale  
Scale: 1" = 1,000'



LEGEND:

- $\frac{45}{65}$  = AM Peak-Hour Traffic / PM Peak-Hour Traffic
- 1,150 = Average Daily Traffic

\* Average Daily Traffic Volumes on 55th Street do not account for heavy activity at East Boulder Community Park.

Figure 5  
**Year 2032  
Background Traffic**  
Boulder Creek Commons (LSC #110320)

## SECTION C

# Travel Demand Management

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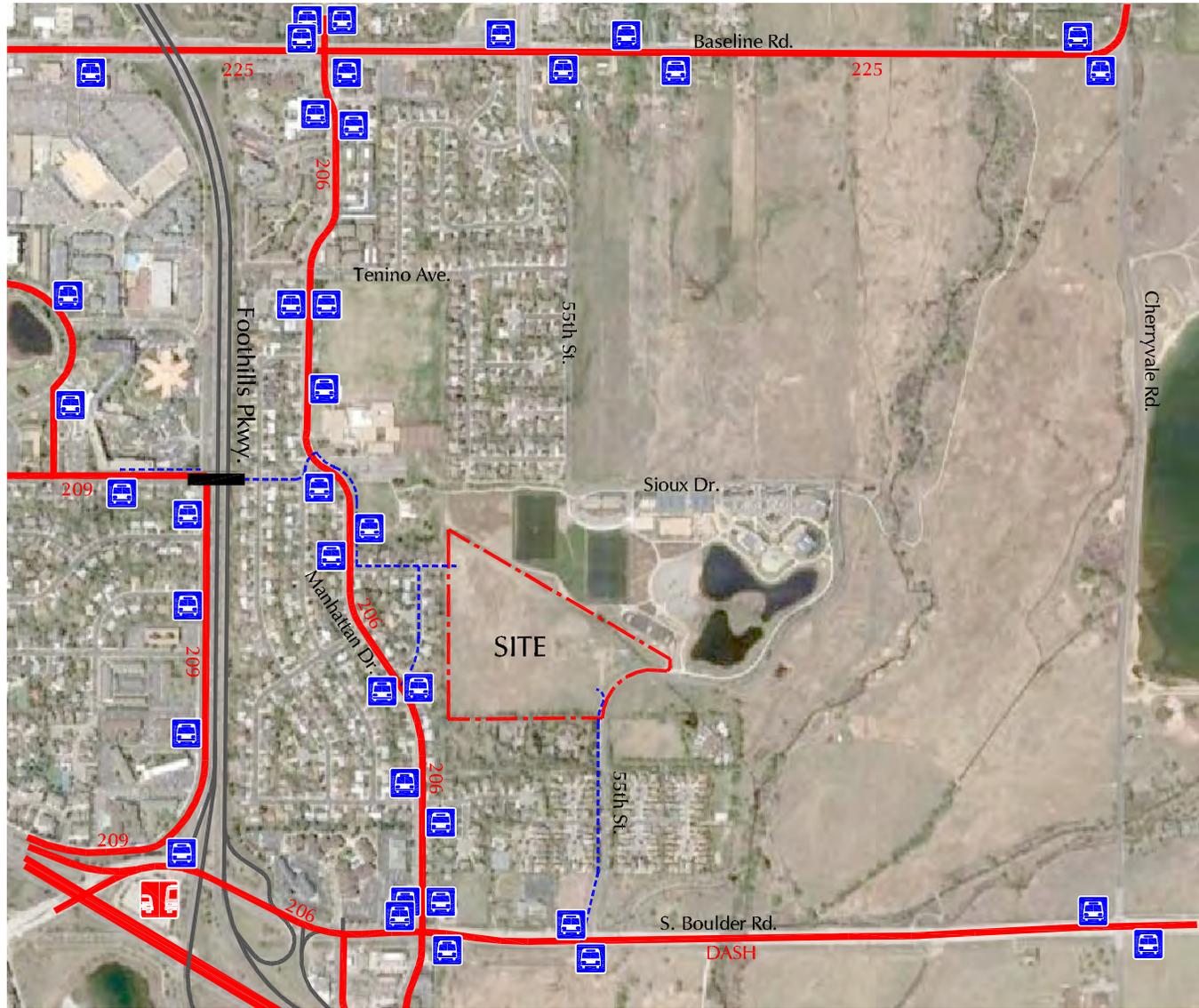
A separate plan has been developed for Travel Demand Management. The following is a brief summary of that plan.

### Alternative Modes and Internal Trip Reduction

Figures 6 and 7 depict nearby alternate modes facilities near the project site. The site is located near Boulder's extensive network of on-street and off-street bikeways. The proximity to this network and to several bus routes will likely reduce the number of vehicle-trips generated by Boulder Creek Commons. To encourage alternative mode use, the applicant will investigate and evaluate the following travel demand management strategies:

- ◆ Purchase of EcoPasses for the single-family residences and access to Via's (formerly Special Transit) demand-response services for the congregate care facility;
- ◆ Distribution of TDM orientation packets for residents and employees and coordination of annual follow-up surveys;
- ◆ Provide sidewalks on both sides of the residential streets and two pedestrian connections and one multi-use path connection (12' wide concrete);
- ◆ Provide on-street bicycle connection between the Manhattan Drive and 55<sup>th</sup> Street bike routes;
- ◆ Signage prohibiting parking along the west lane of 55<sup>th</sup> Street adjacent to the site.

An alternative mode reduction percentage of 15% was assumed based on comments contained in the City of Boulder's letter, dated August 20, 2010.

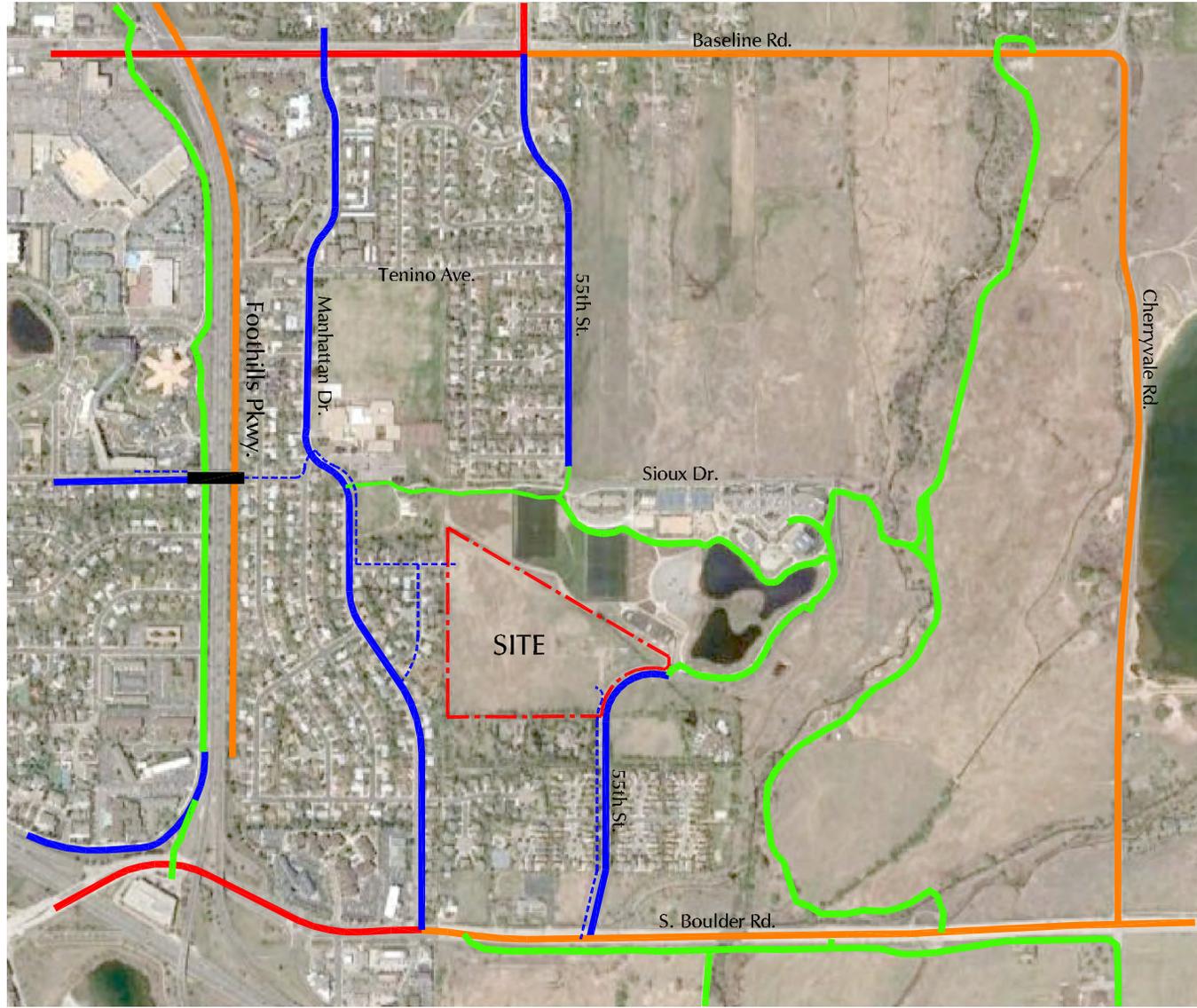


Approximate Scale  
Scale: 1" = 1,000'

- LEGEND:**
-  = Transit Route
  -  = Transit Stop
  -  = Park-n-Ride
  -  = Pedestrian Connections to Transit
  -  = Pedestrian Overpass

Figure 6

*Existing Bus Stops  
and Transit Routes*  
Boulder Creek Commons (LSC #110320)



North arrow pointing up.  
Approximate Scale  
Scale: 1" = 1,000'

LEGEND:

- = Designated Bike Route
- = On-Street Bike Lane
- = Multi-Use Path
- = Paved Shoulder
- = Pedestrian Connections to Transit
- = Pedestrian Overpass

Figure 7  
*Existing Bike and Pedestrian Routes*  
Boulder Creek Commons (LSC #110320)

## SECTION D

# Traffic Generation

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Based on generation rates cited in the current edition (2008) of *Trip Generation*, published by the Institute of Transportation Engineers (ITE), traffic generation estimates have been calculated for the proposed Boulder Creek Commons. The results of these calculations are depicted in the enclosed Table 1.

As indicated in Table 1, with an alternate mode reduction of 15%, the proposed use is expected to generate about 707 new external vehicle-trips during an average weekday. During the morning peak-hour, the site will generate a total of 49 vehicle-trips with 12 entering and 37 exiting the site. During the evening peak-hour, a total of 66 vehicle-trips will be generated with 41 vehicles entering and 25 exiting the site. Also shown in Table 1 are the trip generation estimates of the November, 2010 land use plan. The current proposal will generate about 69 less daily vehicle-trips than what was estimated in November, 2010. Note that 50 of the dwelling units are congregate care units which are estimated to generate significantly less traffic than single-family dwelling units. The intended use of the congregate care facility is expected to generate traffic more similar to the "Senior Housing - Attached" trip generation data in the ITE data. The slightly higher Senior Housing - Attached rates were used in Table 1.

**Table 1**  
**ESTIMATED TRAFFIC GENERATION**  
**Boulder Creek Commons**  
**Boulder, Colorado**  
**(LSC #110320; December, 2012)**

ITE Category	Quantity	Trip Generation Rates <sup>(1)</sup>					Alternative Mode Trip Reduction	External Vehicle - Trips Generated						
		Average Weekday	AM Peak-Hour In	PM Peak-Hour Out	PM Peak-Hour In	PM Peak-Hour Out		Average Weekday	AM Peak-Hour In	AM Peak-Hour Out	PM Peak-Hour Total	PM Peak-Hour In	PM Peak-Hour Out	PM Peak-Hour Total
<i>November, 2010 Land Use Plan</i>														
Single-Family Housing <sup>(2)</sup>	70 DU <sup>(3)</sup>	9.57	0.19	0.56	0.64	0.37	15%	569	11	33	<b>44</b>	38	22	<b>60</b>
Senior Adult Housing <sup>(4)</sup>	70 DU	3.48	0.05	0.08	0.10	0.06	15%	207	3	5	<b>8</b>	6	4	<b>10</b>
								776	14	38	52	44	26	70
<i>May, 2012 Land Use Plan</i>														
Single-Family Housing <sup>(2)</sup>	65 DU	9.57	0.19	0.56	0.64	0.37	15%	529	10	31	<b>41</b>	35	21	<b>56</b>
Senior Congregate Care <sup>(5)</sup>	50 DU	3.48	0.05	0.08	0.10	0.06	15%	148	2	4	<b>6</b>	4	3	<b>7</b>
Multi-Family Residential <sup>(6)</sup>	6 DU	5.81	0.07	0.37	0.35	0.17	15%	30	0	2	<b>2</b>	2	1	<b>3</b>
								<b>707</b>	<b>12</b>	<b>37</b>	<b>49</b>	<b>41</b>	<b>25</b>	<b>66</b>
							Difference	-69			-3			-4

Notes:

- (1) Source: *Trip Generation*, Institute of Transportation Engineers, 8th Edition, 2008.
- (2) ITE Land Use # 210, Single-Family Detached Housing
- (3) DU = Dwelling Units
- (4) ITE Land Use #252 - Senior Adult Housing - Attached
- (5) ITE Land Use #252 - Senior Adult Housing - Attached. This category generates traffic at a slightly higher rate than Congregate Care and is a closer match to the intended use of the facility.
- (6) ITE Land Use #230 - Residential Condominium/Townhouse

## SECTION E

# Distribution and Assignment

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### Traffic Distribution

The directional distribution of generated vehicular traffic on the roadways providing access to and from the proposed development is one of the most important elements in planning specific access requirements and in determining its traffic impacts on surrounding roadways and intersections. Major factors that have influenced the traffic distribution assumptions include:

- The relative location and proposed land use of the site.
- The roadway network serving the site.
- The planned access system on the site.
- The existing traffic patterns in the area as evidenced by traffic counts conducted in April, 2012.

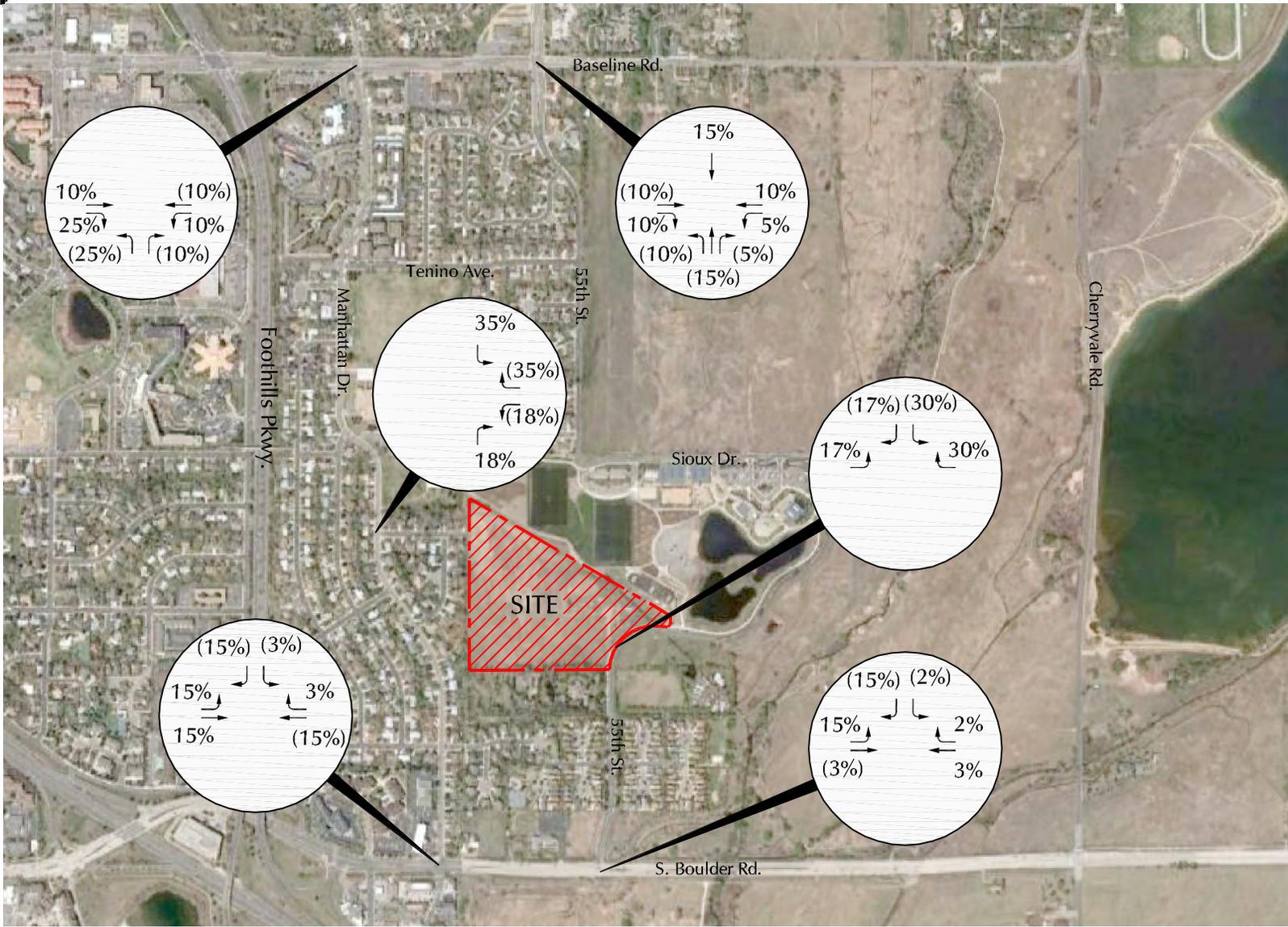
About 35 percent of site-generated traffic will utilize Baseline Road to and from the west to access the site; 30 percent will utilize South Boulder Road to and from the west; 15 percent will utilize 55<sup>th</sup> Street to and from the north; 15 percent will utilize Baseline Road to and from the east; and five percent will utilize S. Boulder Road to and from the east. These trip distribution percentages are the same as used in the Drexel Barrell TIS and were developed after discussion with the City of Boulder. These percentages are shown graphically in Figure 8.

### Project-Generated Traffic

Figure 9 illustrates the assignment of project-generated weekday peak-hour traffic onto the adjacent street system. This assignment of project-generated traffic is based upon the traffic distribution percentages shown in Figure 8 and the vehicle-trip generation estimates of Table 1.

## Total Traffic

Existing plus site-generated and 2032 total traffic volumes on the adjacent roadway network are shown in Figures 10 and 11, respectively. These total volumes were derived by adding site-generated traffic to the existing traffic and to the 2032 background traffic.



Approximate Scale  
Scale: 1" = 1,000'

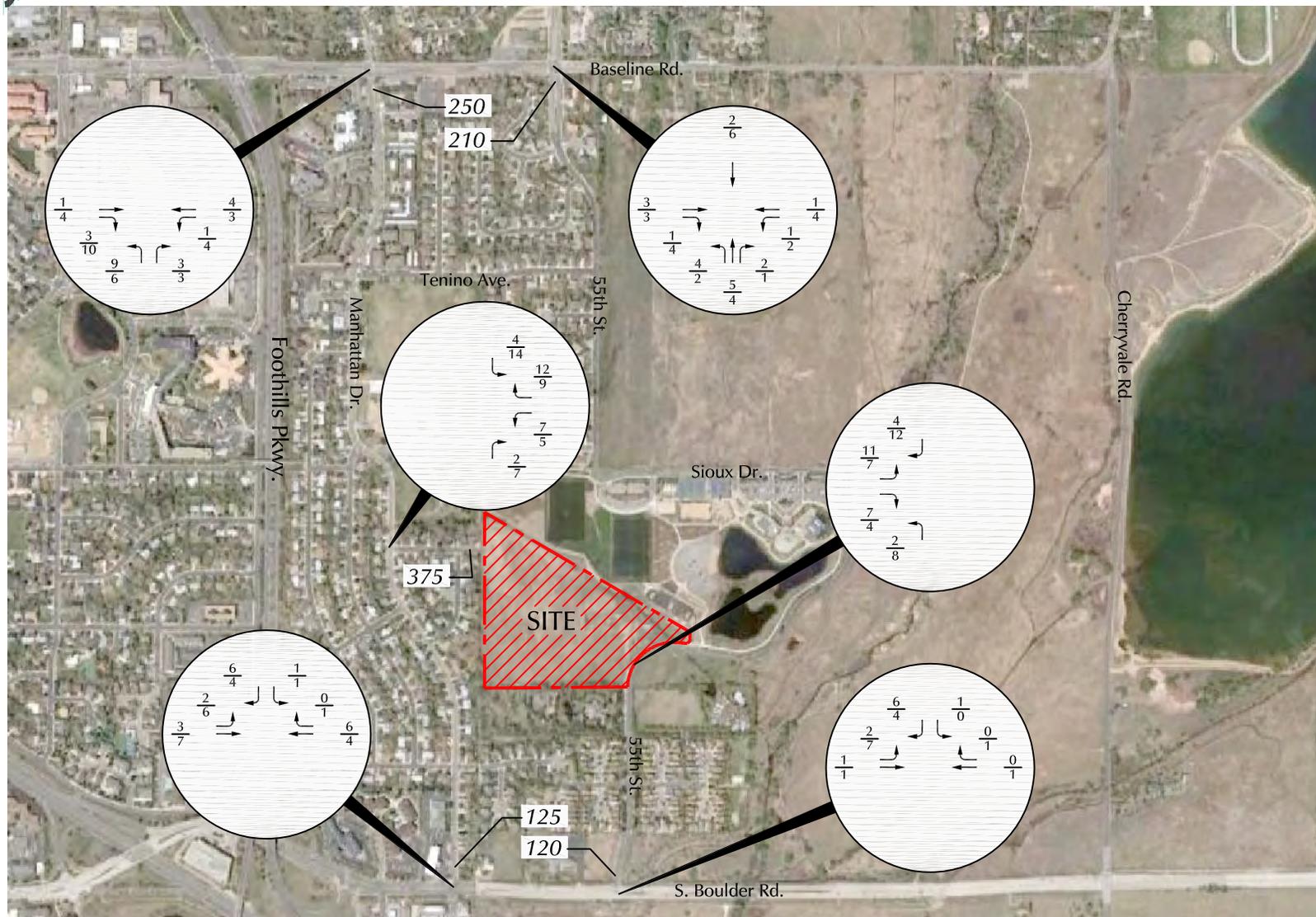
LEGEND:  
 10% = Inbound Distribution  
 (10%) = Outbound Distribution Turning Movements

Figure 8  
**Trip  
 Distribution**

Boulder Creek Commons (LSC #110320)



Approximate Scale  
Scale: 1" = 1,000'



LEGEND:

$\frac{45}{65}$  = AM Peak-Hour Traffic  
PM Peak-Hour Traffic

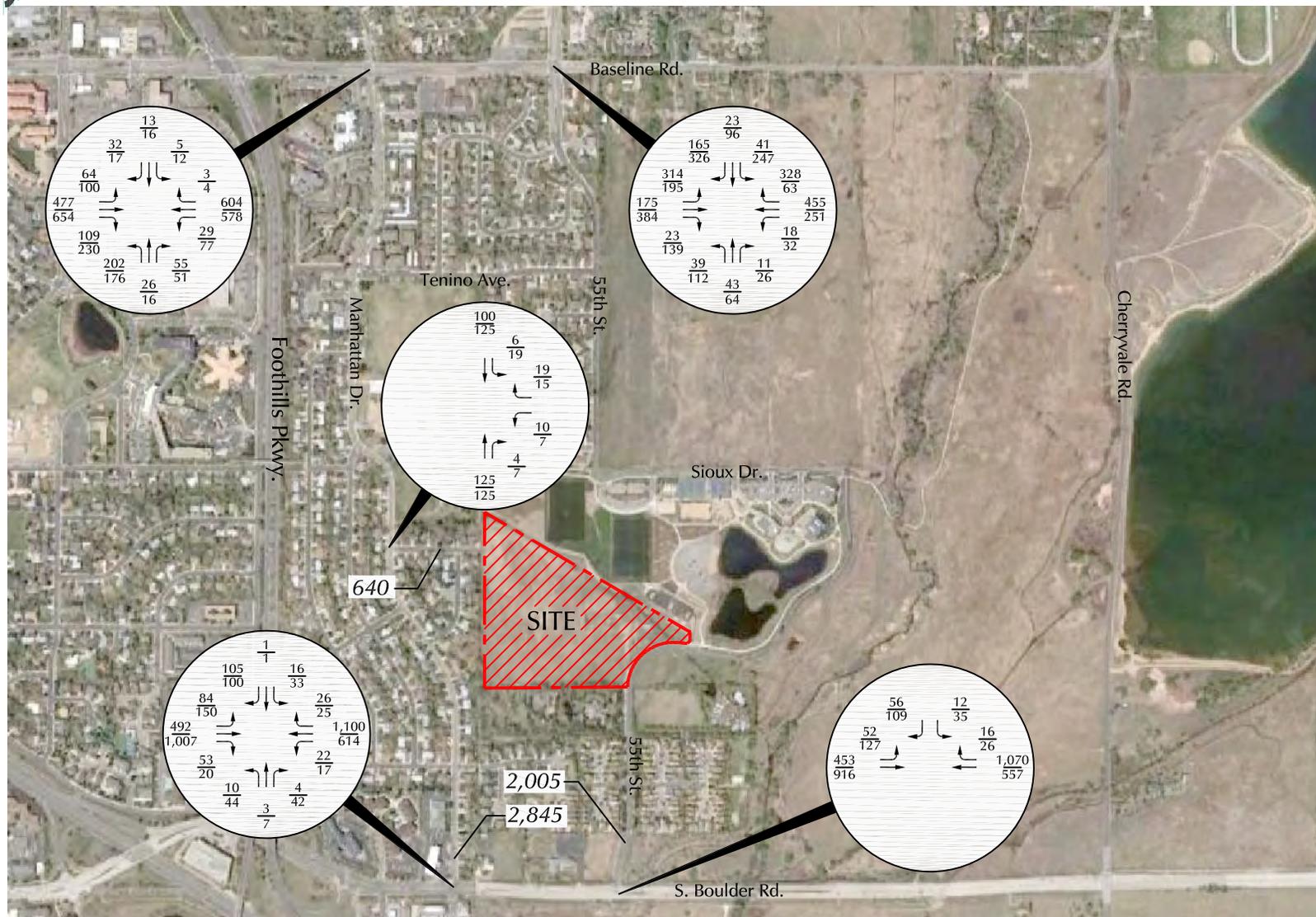
Figure 9

# Assignment of Site-Generated Traffic

Boulder Creek Commons (LSC #110320)



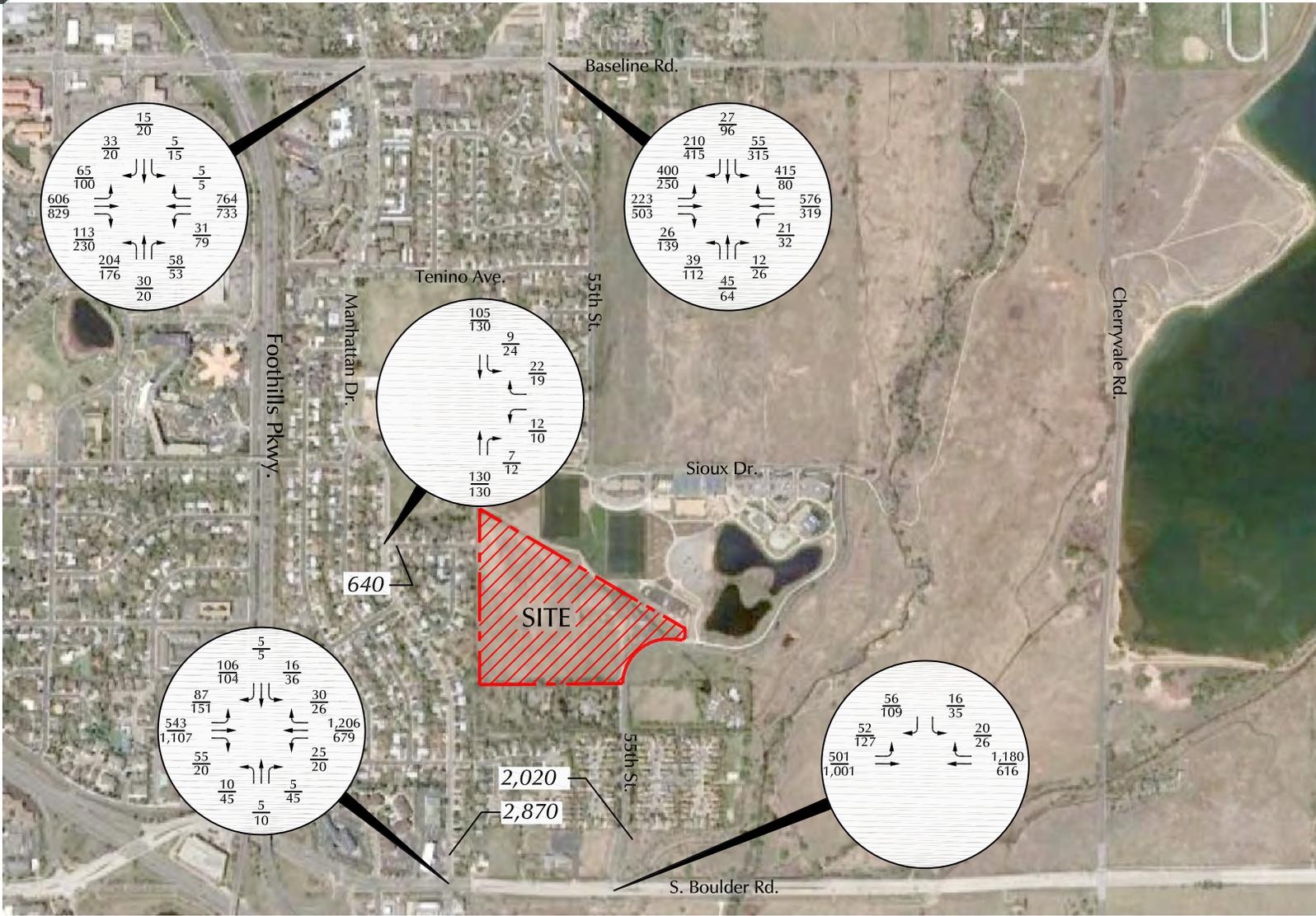
Approximate Scale  
Scale: 1" = 1,000'



LEGEND:

- $\frac{45}{65}$  = AM Peak-Hour Traffic  
PM Peak-Hour Traffic
- 1,150 = Average Daily Traffic

Figure 10  
**Existing Plus  
Site-Generated Traffic**  
Boulder Creek Commons (LSC #110320)



LEGEND:

- $\frac{45}{65}$  = AM Peak-Hour Traffic / PM Peak-Hour Traffic
- 1,150 = Average Daily Traffic

Figure 11  
Year 2032  
Total Traffic

Boulder Creek Commons (LSC #110320)

## SECTION F

# Traffic Impacts

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### Average Daily Traffic Impacts

When project-generated and total traffic volumes on nearby roadways are estimated, the relative impact of the facilities on the surrounding roadway system can be illustrated. Figure 12 shows average daily project-generated traffic as an increment of the total average daily traffic for the Year 2032 and expected roadway capacity.

### Peak-Hour Traffic Impacts and Intersection Capacity Analysis

A more significant methodology for determining traffic impacts is to examine the Levels of Service at individual intersections and access points that will be directly impacted by the development. In this particular case, the expected impacts are primarily concentrated at the intersections of Kewanee Drive/Manhattan Drive, Baseline Road/Manhattan Drive, Baseline Road/55<sup>th</sup> Street, South Boulder Road/Manhattan Drive, and South Boulder Road/55<sup>th</sup> Street. To assess the short and long-term traffic impacts of the Boulder Creek Commons, intersection Level of Service analyses have been conducted at these intersections for the weekday peak-hours. The traffic volumes of Figures 3, 5, 10 and 11 have been used in this analysis. Intersection capacities have been analyzed in accordance with the requirements of the *Highway Capacity Manual* (HCM), using the “operations” methodology. The concept of Level of Service (LOS) is used as a basis for computing combinations of roadway operating conditions. By definition, six different Levels of Service are used (A, B, C, D, E and F) with “A” being a free-flow condition and “E” representing the “capacity” of a given intersection or traffic movement. The complete analysis reports are found in Appendix B of this report and the results of the capacity analyses are shown in Table 2. This table shows LOS conditions for 2012 and 2032 both with and without the addition of site traffic.

- Kewanee Drive/Manhattan Drive: All approaches are expected to operate at LOS “B” or better through the Year 2032 with or without the addition of site traffic. A sensitivity analysis was performed that indicates LOS “B” would be maintained even if the Manhattan Drive through volumes grow to twice that shown in Figure 11.

- Baseline Road/Manhattan Drive: This signalized intersection is expected to operate at (LOS “B” with all movements operating at LOS “D” or better through 2032 with or without the addition of site traffic.
- Baseline Road/55<sup>th</sup> Street: This unsignalized intersection is expected to operate at LOS “C” or better with all movements operating at LOS “D” or better through 2032 with or without the addition of site traffic.
- South Boulder Road/Manhattan Drive: The northbound and southbound approaches currently operate at LOS “F” with stop-sign control and will continue to do so with the addition of site traffic. The City of Boulder has funding identified to signalize this intersection in the next one to three years. After signalization, the intersection will operate at an acceptable level of service through 2032 with or without the addition of site traffic.
- South Boulder Road/55<sup>th</sup> Street: The southbound approach is expected to operate at LOS “D” through 2032 with the following exception: With the addition of site traffic, the afternoon peak-hour in 2032 could operate at LOS “E” with an average delay of about 37 seconds. It is recommended, the southbound approach be restriped to separate 11-foot left- and right-turn lanes.

#### Peak-Hour Traffic Signal Warrant Study

A peak-hour warrant analysis was performed for the intersection of South Boulder Road and 55<sup>th</sup> Street based on Warrant No. 3 of the *Manual on Uniform Traffic Control Devices*. Year 2012 and 2032 traffic volumes were used for the analysis. Only 25% of southbound right-turning traffic was assumed in the calculations because it is recommend that separate right- and left-turn lanes be striped on the southbound approach. The analyses, shown in Figure 13, indicate that the South Boulder Road/55<sup>th</sup> Street intersection will not satisfy the peak-hour signal warrant through 2032 with or without the addition of site traffic.



North Arrow  
Approximate Scale  
Scale: 1" = 1,000'

LEGEND:

$\frac{1,015/110}{1,125/10\%}$	=	$\frac{\text{Daily 2012 Traffic Volume}}{\text{2012 Total Daily Traffic Volume}}$	$\frac{\text{Daily Site-Generated Traffic Volume}}{\text{Site-Generated Percentage of Total Traffic Volume}}$
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Figure 12

# Average Daily Traffic Impacts

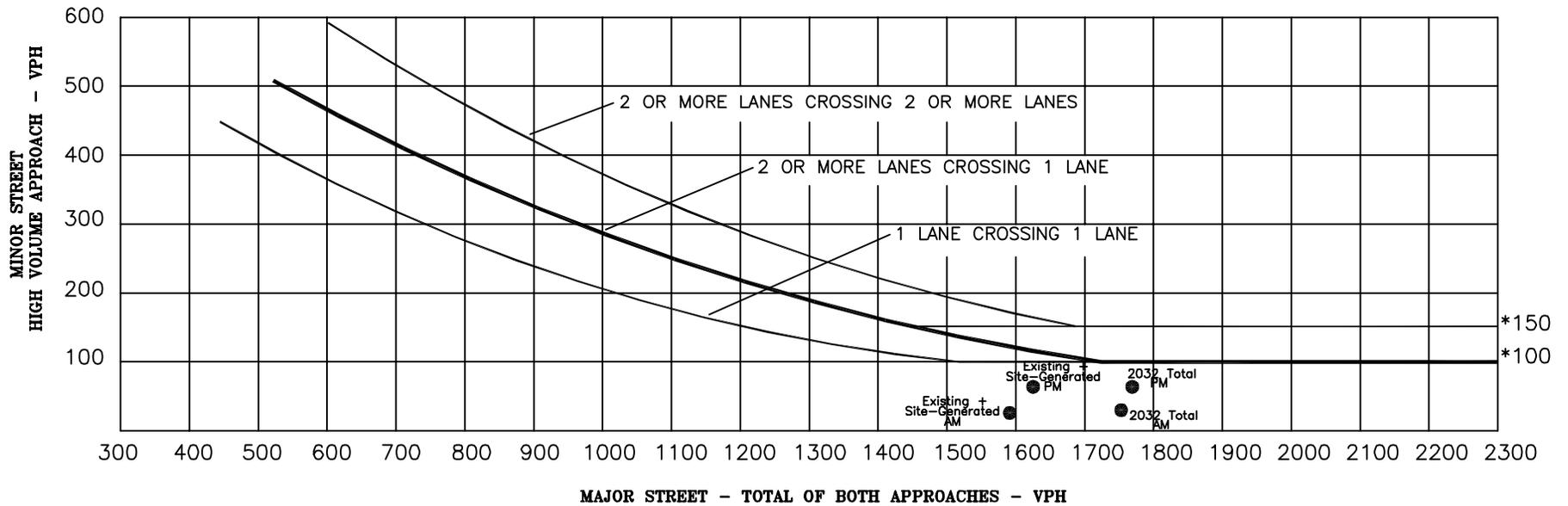
Boulder Creek Commons (LSC #110320)

**Table 2<sup>(1)</sup>**  
**Intersection Levels of Service Analysis**  
**Boulder Creek Commons**  
**Boulder, Colorado**  
**(LSC #110320; December, 2012)**

Intersection Location	Traffic Control	Existing Traffic				Existing + Site				Year 2032 Background Traffic				Year 2032 Total Traffic			
		Level of Service	Movement Delay	Level of Service	Movement Delay	Level of Service	Movement Delay	Level of Service	Movement Delay	Level of Service	Movement Delay						
		AM		PM		AM		PM		AM		PM		AM		PM	
<b><u>Kewanee Drive/Manhattan Drive</u></b>																	
	Unsignalized	A	9.4	A	9.7	A	9.6	B	10.2	A	9.5	B	10.1	A	9.7	B	10.5
WB Left/Right		A	0.2	A	0.3	A	0.5	A	1.2	A	0.4	A	0.6	A	0.7	A	1.4
SB Left/Through			9.4		9.7		9.6		10.2		9.5		10.1		9.7		10.5
Critical Movement Delay																	
<b><u>Baseline Road/55th Street</u></b>																	
	Signalized	C	22.7	A	5.9	C	22.4	A	6.0	D	54.2	A	9.3	D	54.2	A	9.4
EB Left		A	1.4	A	7.1	A	1.4	A	7.2	A	1.2	A	7.3	A	1.3	A	7.4
EB Through		A	0.8	A	1.4	A	0.8	A	1.4	A	0.4	A	1.1	A	0.4	A	1.1
EB Right		A	7.1	B	13.6	A	7.2	B	13.7	B	10.8	B	13.9	B	10.8	B	13.9
WB Left		A	9.4	B	14.5	A	9.5	B	14.5	B	15.7	B	14.9	B	15.7	B	14.9
WB Through/Right		D	39.8	C	28.1	D	40.2	C	28.3	D	39.8	C	27.8	D	40.2	C	27.9
NB Left		D	38.7	C	24.8	D	39.0	C	24.9	D	38.8	C	24.8	D	39.1	C	24.9
NB Through		D	36.7	C	23.7	D	36.7	C	23.7	D	36.7	C	23.7	D	36.7	C	23.7
NB Right		D	40.6	D	38.7	D	40.6	D	38.9	D	42.3	D	47.8	D	42.4	D	48.3
SB Left		D	37.7	C	25.6	D	37.8	C	25.7	D	37.9	C	25.5	D	38.0	C	25.6
SB Through		C	31.4	C	22.9	C	31.4	C	22.9	C	25.9	C	23.8	C	25.9	C	23.8
SB Right			15.9		17.5		16.0		17.6		24.5		19.2		24.6		19.3
Entire Intersection Delay (sec /veh)																	
Entire Intersection LOS		B		B		B		B		C		B		C		B	
<b><u>S. Boulder Road/Manhattan Drive</u></b>																	
	Unsignalized	B	12.9	A	10.0	B	13.0	B	10.1	--	--	--	--	--	--	--	--
EB Left		A	8.8	B	11.1	A	8.8	B	11.2	--	--	--	--	--	--	--	--
WB Left		F	89.7	F	737.8	F	95.8	F	810.7	--	--	--	--	--	--	--	--
NB Left/Through/Right		F	56.6	F	181.8	F	64.5	F	218.0	--	--	--	--	--	--	--	--
SB Left/Through/Right			89.7		737.8		95.8		810.7	--	--	--	--	--	--	--	--
Critical Movement Delay																	
	Signalized	--	--	--	--	--	--	--	--	A	4.6	A	3.6	A	5.1	A	3.7
EB Left		--	--	--	--	--	--	--	--	A	1.8	A	3.0	A	2.0	A	3.1
EB Through/Right		--	--	--	--	--	--	--	--	A	1.5	A	2.2	A	1.7	A	2.2
WB Left		--	--	--	--	--	--	--	--	A	2.7	A	2.4	A	2.9	A	2.4
WB Through/Right		--	--	--	--	--	--	--	--	D	43.5	E	67.2	D	42.4	E	70.0
NB Left/Through/Right		--	--	--	--	--	--	--	--	D	40.1	D	36.4	D	39.0	D	36.6
SB Left/Through/Right		--	--	--	--	--	--	--	--	5.1		7.9		5.3		8.1	
Entire Intersection Delay (sec /veh)		--	--	--	--	--	--	--	--	A		A		A		A	
Entire Intersection LOS																	
<b><u>Baseline Road/Manhattan Drive</u></b>																	
	Signalized	A	7.7	A	8.7	A	7.7	A	8.7	A	8.4	A	9.6	A	8.4	A	9.6
EB Left		A	8.0	A	9.3	A	8.0	A	9.4	A	8.6	B	10.2	A	8.6	B	10.3
EB Through/Right		A	6.7	A	7.5	A	6.8	A	7.9	B	11.3	B	10.4	B	11.2	B	11.3
WB Left		A	7.7	A	6.2	A	7.8	A	6.2	B	13.4	A	7.2	B	13.3	A	7.3
WB Through/Right		D	41.6	D	39.0	D	43.0	D	39.7	D	41.3	D	37.6	D	42.3	D	37.6
NB Left		C	29.3	C	29.0	C	29.4	C	29.1	C	28.1	C	27.0	C	27.7	C	25.9
NB Through/Right		C	28.3	C	28.6	C	28.3	C	28.6	C	28.3	C	28.7	C	28.3	C	28.8
SB Left		C	28.8	C	28.7	C	28.8	C	28.7	C	28.8	C	28.8	C	28.8	C	28.8
SB Through/Right			13.6		12.1		14.0		12.3		15.3		12.2		15.5		12.4
Entire Intersection Delay (sec /veh)																	
Entire Intersection LOS		B		B		B		B		B		B		B		B	
<b><u>S. Boulder Road/55th Street</u></b>																	
	Unsignalized	B	12.6	A	9.4	B	12.7	A	9.5	B	12.6	A	9.7	B	12.7	A	9.8
EB Left		D	27.5	D	28.4	D	28.7	D	29.5	D	31.3	D	34.4	D	32.4	E	36.0
SB Left/Right			27.5		28.4		28.7		29.5		31.3		34.4		32.4		36.0
Critical Movement Delay																	

Note:  
(1) Using Synchro Highway Capacity Manual output.

Figure 4C-3. Warrant 3, Peak-Hour



\*Note: 150 VPH applies as the lower threshold volume for a minor street approach with two or more lanes and 100 VPH applies as the lower threshold volume for a minor street approaching with one lane.

Figure 13

## South Boulder Road/55th Street Traffic Signal Warrant Analysis

Boulder Creek Commons (LSC #110320)

## SECTION G

# Conclusions

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Based on the foregoing analysis, the following conclusions may be made regarding the traffic impacts of Boulder Creek Commons:

1. The site will have a full movement access to 55<sup>th</sup> Street and to Kewanee Drive.
2. The site is located near Boulder's extensive network of on-street and off-street bikeways. The proximity to this network and to several bus routes will likely reduce the number of vehicle-trips generated by the site. Combined alternative mode use is expected to be 15 percent.
3. The site is proposed to contain 65 single-family detached homes, six duplex residential homes, and a 50-unit congregate care facility. Assuming an alternative mode and internal trips reduction of 15 percent, the proposed use is expected to generate about 707 vehicle-trips during an average weekday with about half entering the site and about half exiting the site. During the morning peak-hour, the site will generate a total of 49 vehicle-trips with 12 entering and 37 exiting the site. During the evening peak-hour, a total of 66 vehicle-trips will be generated with 41 vehicles entering and 25 exiting the site.
4. Distribution of retail and residential trips is expected to be as follows:

Baseline Road to/from the west	35%
S. Boulder Road to/from the west	30%
55 <sup>th</sup> Street to/from the north	15%
Baseline Road to/from the east	15%
S. Boulder Road to/from the east	5%

5. In order to reduce vehicular travel to and from the site a Travel Demand Management TDM Program should be implemented that considers improvements that would encourage alternative modes of travel. A separate TDM Plan has been developed.
6. All movements at the site access intersections are expected to operate at good levels of service.
7. The northbound and southbound approaches at the South Boulder Road/Manhattan Drive intersection currently operate at LOS "F" with stop-sign control. The City of Boulder has funding identified to signalize this intersection in the next one to three years. After signalization, the intersection will operate at an acceptable level of service through 2032, with or without the addition of site traffic.

8. The southbound approach at the South Boulder Road/55<sup>th</sup> Street intersection could operate at LOS “E” by 2032 with the addition of site traffic. It is recommended the approach be restriped with separate 11-foot wide right- and left-turn lanes. A peak-hour traffic signal warrant is not expected to be met through 2032.
9. Kewanee Drive is a residential collector street with a design traffic volume of between 1,000 and 2,500 vehicles per day per the City’s *Design and Construction Standards* (DCS). The average daily volume expected on Kewanee Drive after the addition of site traffic would be about 600 vehicles per day. For reference, a residential street has a design traffic volume of between 500 and 1,000 vehicles per day per the City’s DCS.
10. Traffic associated with the Boulder Creek Commons can be safely accommodated by the adjacent roadway network with the improvements recommended herein.

APPENDIX A

# Traffic Counts and Adjustments

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**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: BASELINE RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHBASE  
Site Code : 00000011  
Start Date : 4/24/2012  
Page No : 1

Groups Printed- VEHICLES

Start Time	MANHATTAN DR Southbound			BASELINE RD Westbound			MANHATTAN DR Northbound			BASELINE RD Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	0	0	2	0	44	0	12	1	1	0	37	3	100
06:45 AM	0	2	8	2	56	4	16	0	1	2	90	4	185
Total	0	2	10	2	100	4	28	1	2	2	127	7	285
07:00 AM	0	0	3	1	72	0	18	3	5	5	87	8	202
07:15 AM	0	3	10	5	122	4	32	4	7	4	93	17	301
07:30 AM	2	2	2	3	125	2	41	2	11	6	100	18	314
07:45 AM	1	2	11	5	167	0	55	9	15	14	138	14	431
Total	3	7	26	14	486	6	146	18	38	29	418	57	1248
08:00 AM	0	3	9	11	188	1	47	6	11	12	113	27	428
08:15 AM	2	6	10	9	120	0	50	9	15	32	125	47	425
Total	2	9	19	20	308	1	97	15	26	44	238	74	853
04:00 PM	2	6	5	6	123	1	38	2	12	22	172	34	423
04:15 PM	1	4	5	9	132	2	27	2	9	18	196	33	438
04:30 PM	1	3	4	12	118	2	23	5	7	20	152	36	383
04:45 PM	1	3	7	12	141	2	35	1	11	25	166	30	434
Total	5	16	21	39	514	7	123	10	39	85	686	133	1678
05:00 PM	2	4	5	15	136	1	34	3	7	28	141	52	428
05:15 PM	4	3	3	16	147	0	32	4	13	22	172	57	473
05:30 PM	4	6	5	26	143	3	58	6	11	30	158	57	507
05:45 PM	2	3	4	16	113	0	46	3	17	20	130	54	408
Total	12	16	17	73	539	4	170	16	48	100	601	220	1816
Grand Total	22	50	93	148	1947	22	564	60	153	260	2070	491	5880
Apprch %	13.3	30.3	56.4	7.0	92.0	1.0	72.6	7.7	19.7	9.2	73.4	17.4	
Total %	0.4	0.9	1.6	2.5	33.1	0.4	9.6	1.0	2.6	4.4	35.2	8.4	

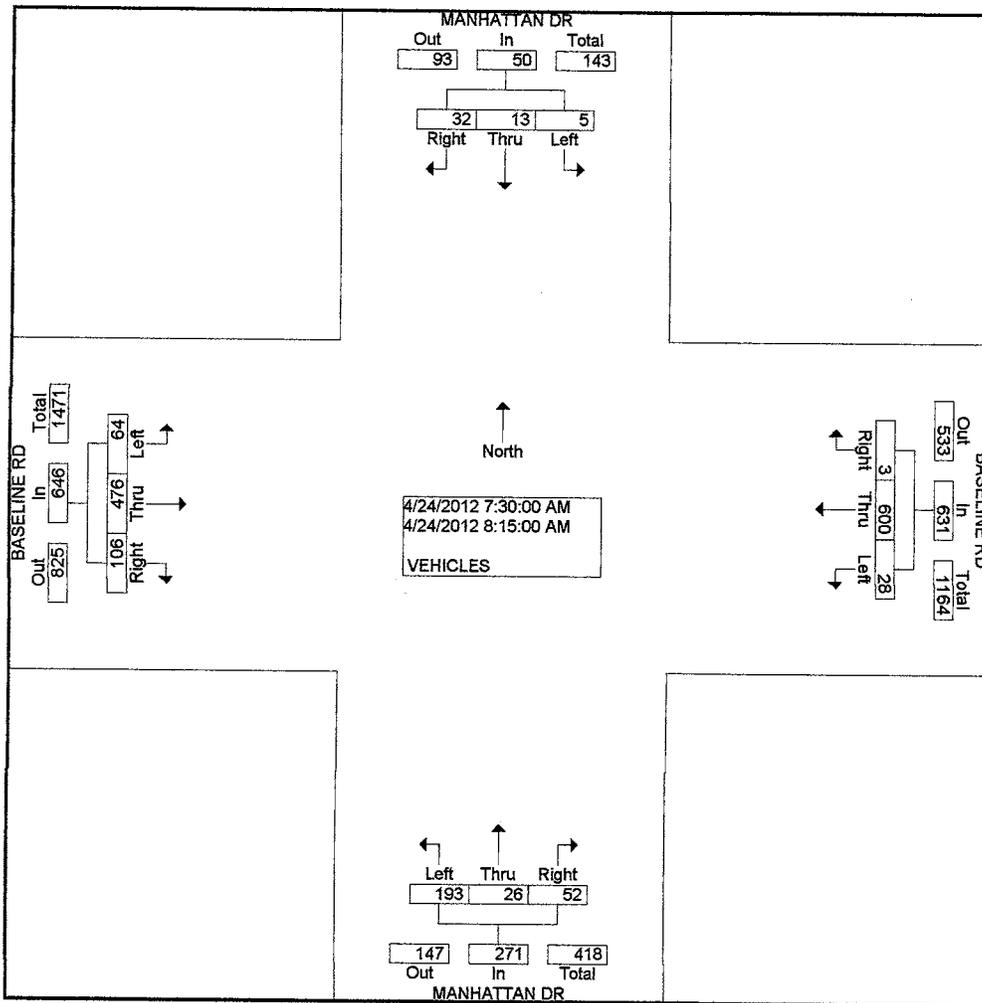
COUNTER MEASURES INC.

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: BASELINE RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHBASE  
Site Code : 00000011  
Start Date : 4/24/2012  
Page No : 2

Start Time	MANHATTAN DR Southbound				BASELINE RD Westbound				MANHATTAN DR Northbound				BASELINE RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	5	13	32	50	28	600	3	631	193	26	52	271	64	476	106	646	1598
Percent	10.0	26.0	64.0		4.4	95.1	0.5		71.2	9.6	19.2		9.9	73.7	16.4		
07:45	1	2	11	14	5	167	0	172	55	9	15	79	14	138	14	166	431
Peak Factor	0.927																
High int.	08:15 AM																
Volume	2	6	10	18	11	188	1	200	55	9	15	79	32	125	47	204	
Peak Factor	0.694								0.789				0.858				



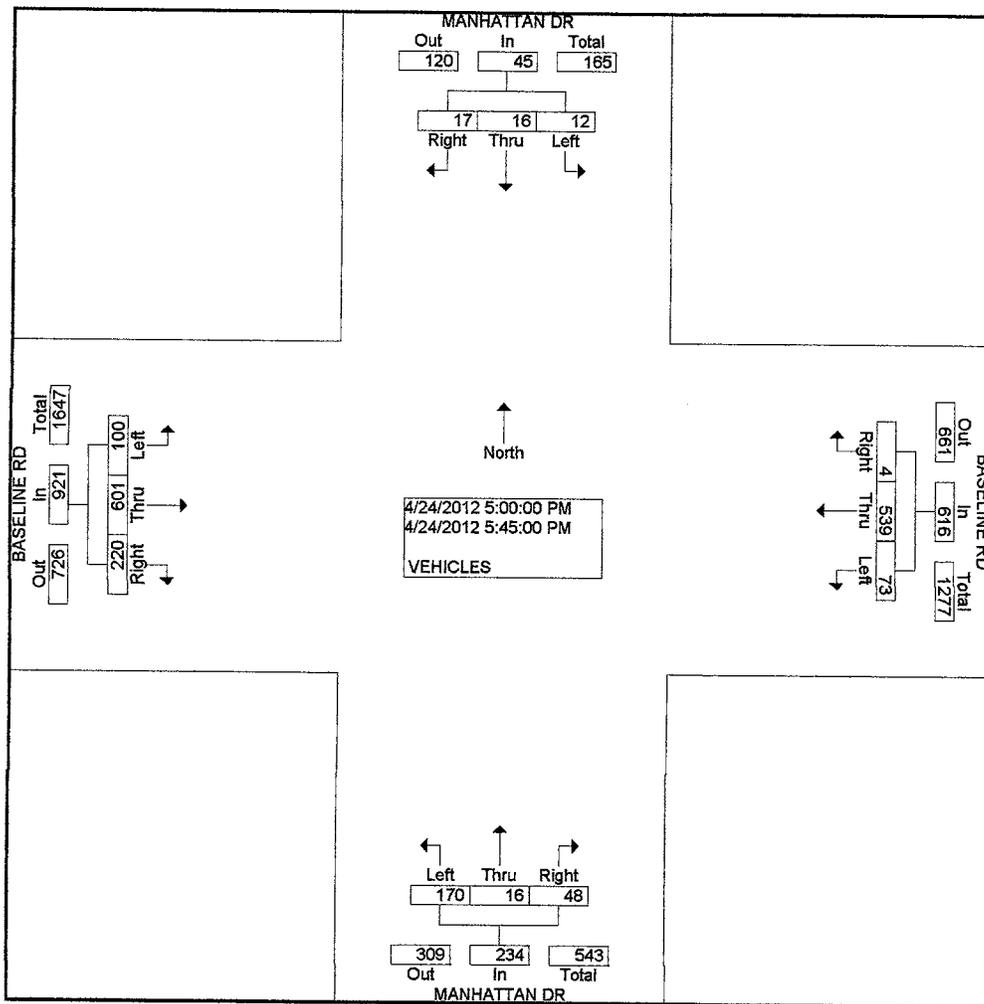
### COUNTER MEASURES INC.

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: BASELINE RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHBASE  
Site Code : 0000011  
Start Date : 4/24/2012  
Page No : 2

Start Time	MANHATTAN DR Southbound				BASELINE RD Westbound				MANHATTAN DR Northbound				BASELINE RD Eastbound				Int. Total			
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total				
Peak Hour From 05:00 PM to 05:45 PM - Peak 1 of 1																				
Intersection	05:00 PM																			
Volume	12	16	17	45	73	539	4	616	170	16	48	234	100	601	220	921	1816			
Percent	26.7	35.6	37.8		11.9	87.5	0.6		72.6	6.8	20.5		10.9	65.3	23.9					
05:30																				
Volume	4	6	5	15	26	143	3	172	58	6	11	75	30	158	57	245	507			
Peak Factor	0.895																			
High Int.	05:30 PM																			
Volume	4	6	5	15	26	143	3	172	58	6	11	75	22	172	57	251				
Peak Factor	0.750								0.895				0.780				0.917			



**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: S BOULDER RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHSBOU  
Site Code : 00000009  
Start Date : 4/24/2012  
Page No : 1

Groups Printed- VEHICLES

Start Time	MANHATTAN DR Southbound			S BOULDER RD Westbound			MANHATTAN DR Northbound			S BOULDER RD Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	2	0	11	1	93	0	0	0	0	8	41	2	158
06:45 AM	2	0	11	2	98	3	0	0	0	6	35	2	159
Total	4	0	22	3	191	3	0	0	0	14	76	4	317
07:00 AM	4	0	13	0	118	1	0	0	0	7	68	2	213
07:15 AM	2	0	18	4	235	3	1	0	0	15	76	5	359
07:30 AM	6	0	30	2	307	1	1	0	1	18	87	13	466
07:45 AM	1	0	24	5	339	5	0	1	1	17	127	15	535
Total	13	0	85	11	999	10	2	1	2	57	358	35	1573
08:00 AM	5	1	22	6	252	10	4	0	2	14	135	8	459
08:15 AM	3	0	23	9	196	10	5	2	0	33	140	17	438
Total	8	1	45	15	448	20	9	2	2	47	275	25	897
04:00 PM	3	1	17	2	150	7	16	1	10	20	198	6	431
04:15 PM	4	1	21	0	134	4	11	1	7	24	199	5	411
04:30 PM	3	0	17	3	116	3	12	1	5	18	244	2	424
04:45 PM	5	1	15	5	105	1	18	3	5	24	224	7	413
Total	15	3	70	10	505	15	57	6	27	86	865	20	1679
05:00 PM	5	0	26	3	164	4	21	2	15	42	262	10	554
05:15 PM	3	1	19	10	143	6	12	3	11	27	272	2	509
05:30 PM	13	0	26	2	132	11	4	1	7	45	215	3	459
05:45 PM	11	0	25	2	139	3	7	1	9	30	219	5	451
Total	32	1	96	17	578	24	44	7	42	144	968	20	1973
Grand Total	72	5	318	56	2721	72	112	16	73	348	2542	104	6439
Apprch %	18.2	1.3	80.5	2.0	95.5	2.5	55.7	8.0	36.3	11.6	84.9	3.5	
Total %	1.1	0.1	4.9	0.9	42.3	1.1	1.7	0.2	1.1	5.4	39.5	1.6	

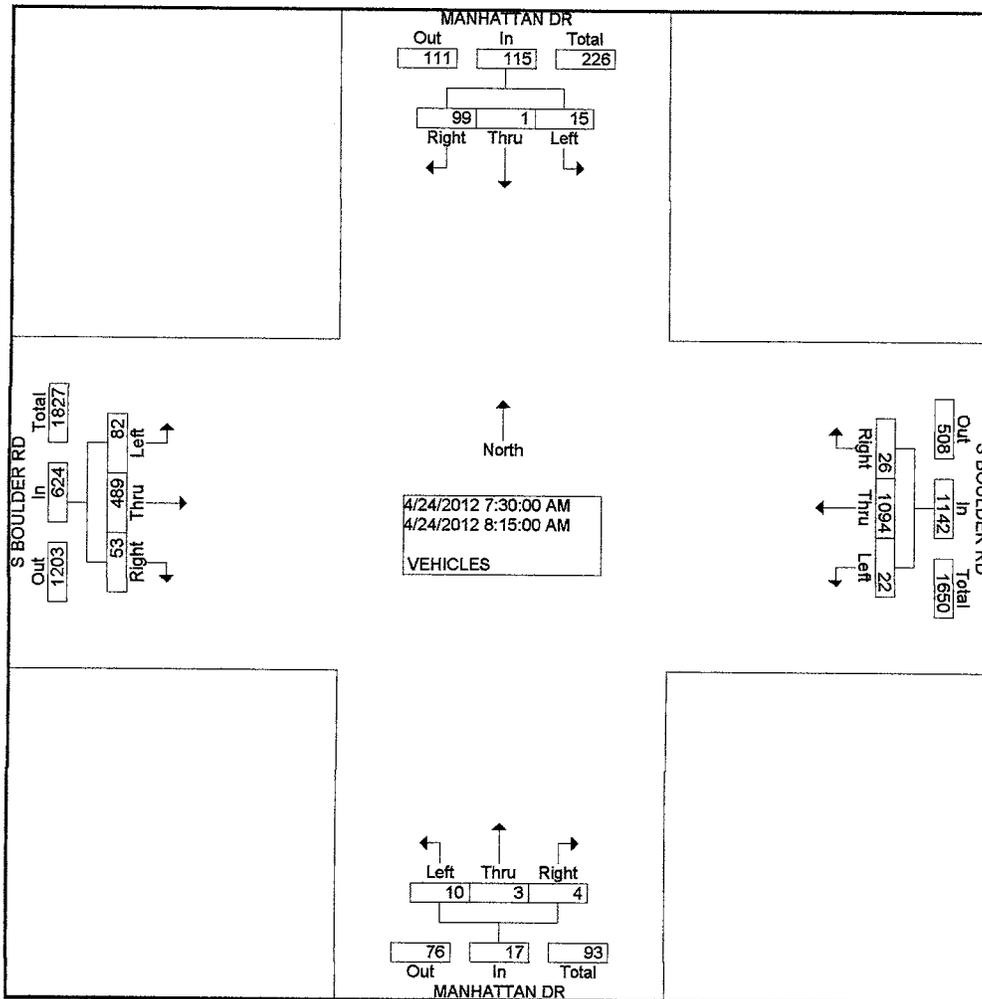
**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: S BOULDER RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHSBOU  
Site Code : 00000009  
Start Date : 4/24/2012  
Page No : 2

Start Time	MANHATTAN DR Southbound				S BOULDER RD Westbound				MANHATTAN DR Northbound				S BOULDER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	15	1	99	115	22	1094	26	1142	10	3	4	17	82	489	53	624	1898
Percent	13.0	0.9	86.1		1.9	95.8	2.3		58.8	17.6	23.5		13.1	78.4	8.5		
07:45																	
Volume	1	0	24	25	5	339	5	349	0	1	1	2	17	127	15	159	535
Peak Factor	0.887																
High Int.	07:30 AM				07:45 AM				08:15 AM				08:15 AM				
Volume	6	0	30	36	5	339	5	349	5	2	0	7	33	140	17	190	
Peak Factor	0.799				0.818				0.607				0.821				



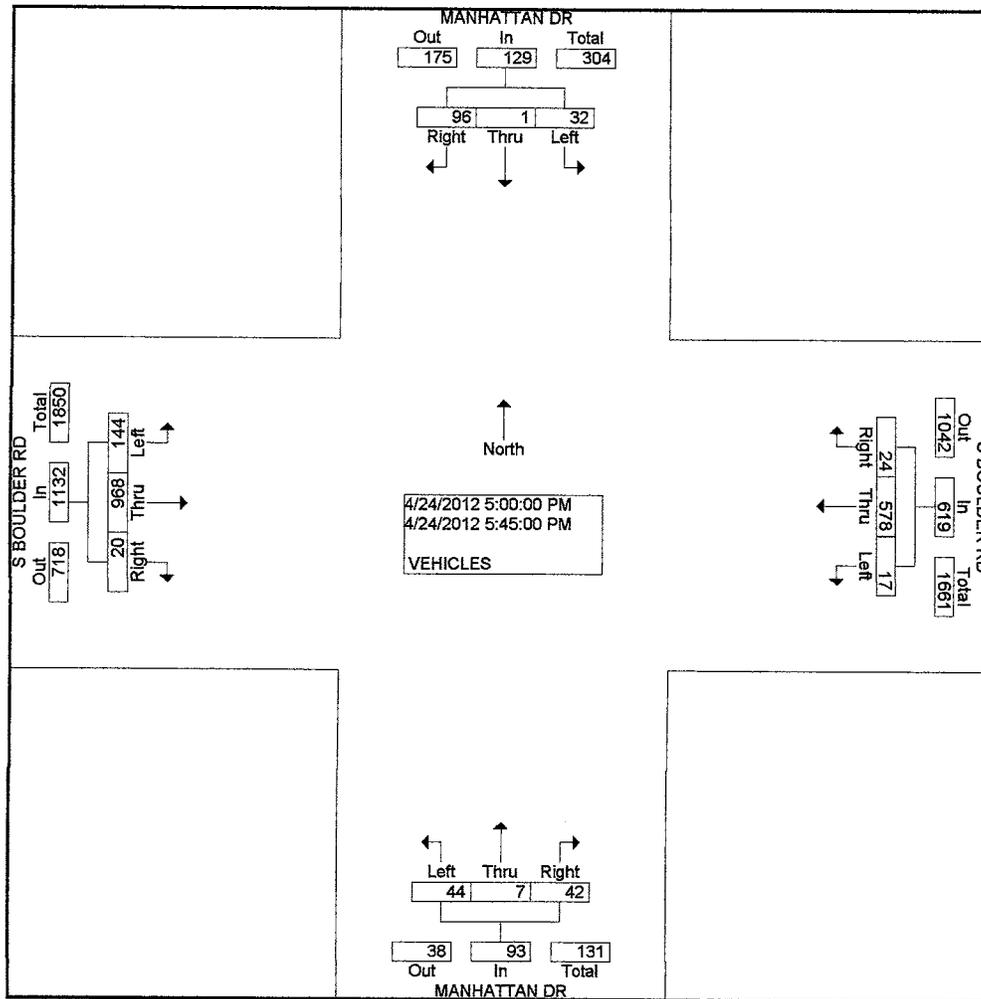
COUNTER MEASURES INC.

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Start Time	MANHATTAN DR Southbound				S BOULDER RD Westbound				MANHATTAN DR Northbound				S BOULDER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	32	1	96	129	17	578	24	619	44	7	42	93	144	968	20	1132	1973
Percent	24.8	0.8	74.4		2.7	93.4	3.9		47.3	7.5	45.2		12.7	85.5	1.8		
05:00 Volume	5	0	26	31	3	164	4	171	21	2	15	38	42	262	10	314	554
Peak Factor	0.890																
High Int.	05:30 PM																
Volume	13	0	26	39	3	164	4	171	21	2	15	38	42	262	10	314	
Peak Factor	0.827				0.905				0.612				0.901				



**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: 55TH ST  
E/W STREET: BASELINE RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : 55THBASE  
Site Code : 00000016  
Start Date : 4/25/2012  
Page No : 1

Groups Printed- VEHICLES

Start Time	55TH ST Southbound			BASELINE RD Westbound			55TH ST Northbound			BASELINE RD Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	1	0	15	3	24	7	0	2	1	31	13	4	101
06:45 AM	5	7	17	2	45	27	11	2	4	57	17	12	206
Total	6	7	32	5	69	34	11	4	5	88	30	16	307
07:00 AM	4	10	20	2	62	26	11	3	3	60	22	12	235
07:15 AM	8	8	52	5	78	39	7	6	6	73	30	9	321
07:30 AM	6	9	41	4	102	60	12	6	4	63	33	2	342
07:45 AM	11	5	45	3	116	85	9	10	1	95	45	2	427
Total	29	32	158	14	358	210	39	25	14	291	130	25	1325
08:00 AM	12	3	39	6	123	93	8	9	2	73	52	7	427
08:15 AM	12	4	40	4	113	90	6	13	2	83	42	11	420
Total	24	7	79	10	236	183	14	22	4	156	94	18	847
04:00 PM	67	22	55	14	53	5	7	13	21	18	107	52	434
04:15 PM	39	11	56	3	63	12	10	8	7	34	85	17	345
04:30 PM	43	12	65	3	48	11	17	8	1	44	89	22	363
04:45 PM	44	21	83	7	61	12	17	8	3	58	89	25	428
Total	193	66	259	27	225	40	51	37	32	154	370	116	1570
05:00 PM	80	21	86	4	60	14	12	17	5	44	112	29	484
05:15 PM	77	26	100	6	66	26	22	15	3	50	107	25	523
05:30 PM	58	19	78	7	59	17	21	12	2	51	91	28	443
05:45 PM	32	11	62	7	62	6	24	4	4	50	71	26	359
Total	247	77	326	24	247	63	79	48	14	195	381	108	1809
Grand Total	499	189	854	80	1135	530	194	136	69	884	1005	283	5858
Apprch %	32.4	12.3	55.4	4.6	65.0	30.4	48.6	34.1	17.3	40.7	46.3	13.0	
Total %	8.5	3.2	14.6	1.4	19.4	9.0	3.3	2.3	1.2	15.1	17.2	4.8	

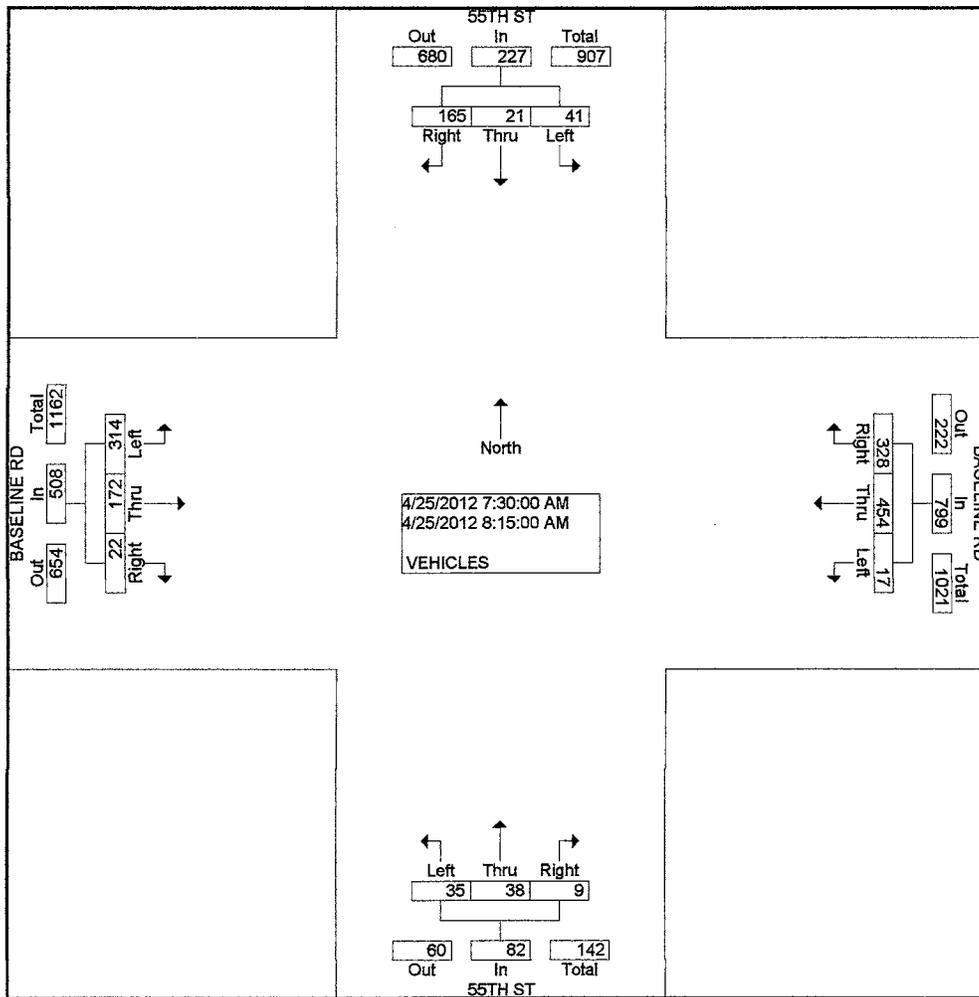
**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: 55TH ST  
E/W STREET: BASELINE RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : 55THBASE  
Site Code : 00000016  
Start Date : 4/25/2012  
Page No : 2

Start Time	55TH ST Southbound				BASELINE RD Westbound				55TH ST Northbound				BASELINE RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	41	21	165	227	17	454	328	799	35	38	9	82	314	172	22	508	1616
Percent	18.1	9.3	72.7		2.1	56.8	41.1		42.7	46.3	11.0		61.8	33.9	4.3		
08:00 Volume	12	3	39	54	6	123	93	222	8	9	2	19	73	52	7	132	427
Peak Factor	0.946																
High Int.	07:45 AM				08:00 AM				07:30 AM				07:45 AM				
Volume	11	5	45	61	6	123	93	222	12	6	4	22	95	45	2	142	
Peak Factor	0.930				0.900				0.932				0.894				



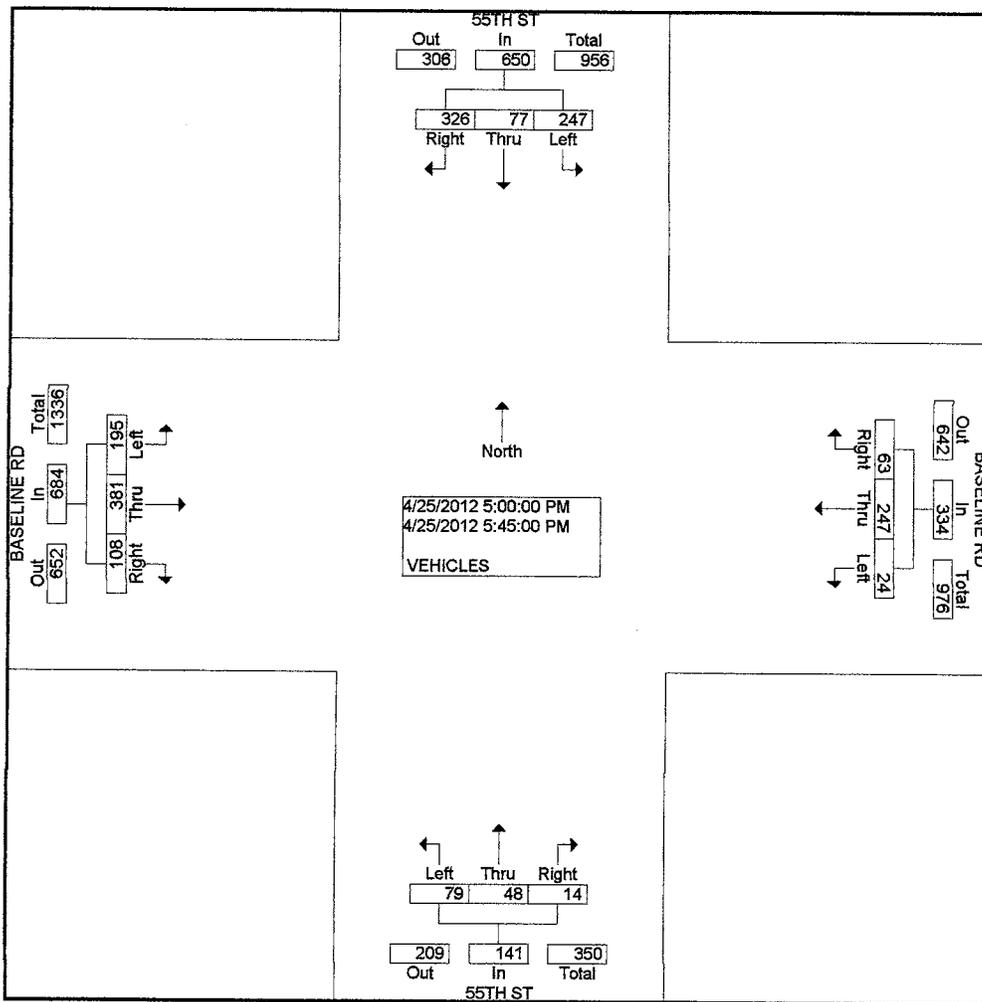
**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: 55TH ST  
E/W STREET: BASELINE RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : 55THBASE  
Site Code : 0000016  
Start Date : 4/25/2012  
Page No : 2

Start Time	55TH ST Southbound				BASELINE RD Westbound				55TH ST Northbound				BASELINE RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	247	77	326	650	24	247	63	334	79	48	14	141	195	381	108	684	1809
Percent	38.0	11.8	50.2		7.2	74.0	18.9		56.0	34.0	9.9		28.5	55.7	15.8		
05:15																	
Volume	77	26	100	203	6	66	26	98	22	15	3	40	50	107	25	182	523
Peak Factor	0.865																
High Int.	05:15 PM																
Volume	77	26	100	203	6	66	26	98	22	15	3	40	44	112	29	185	
Peak Factor	0.800				0.852				0.881				0.924				



COUNTER MEASURES INC.

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: 55TH ST  
E/W STREET: S BOULDER RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : 55THSBOU  
Site Code : 0000008  
Start Date : 4/24/2012  
Page No : 1

Groups Printed- VEHICLES

Start Time	Southbound			S BOULDER RD Westbound			55TH ST Northbound			S BOULDER RD Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	1	0	10	0	83	1	0	0	0	1	42	0	138
06:45 AM	0	0	9	0	91	4	0	0	0	1	38	0	143
Total	1	0	19	0	174	5	0	0	0	2	80	0	281
07:00 AM	3	0	6	0	117	0	0	0	0	3	67	0	196
07:15 AM	0	0	13	0	230	0	0	0	0	1	72	0	316
07:30 AM	2	0	18	0	287	2	0	0	0	4	85	0	398
07:45 AM	4	0	12	0	341	7	0	0	0	14	112	0	490
Total	9	0	49	0	975	9	0	0	0	22	336	0	1400
08:00 AM	3	0	9	0	234	3	0	0	0	14	129	0	392
08:15 AM	2	0	11	0	208	4	0	0	0	18	126	0	369
Total	5	0	20	0	442	7	0	0	0	32	255	0	761
04:00 PM	5	0	17	0	144	6	0	0	0	22	174	0	368
04:15 PM	5	0	18	0	126	4	0	0	0	17	189	0	359
04:30 PM	5	0	14	0	101	2	0	0	0	12	225	0	359
04:45 PM	3	0	8	0	110	1	0	0	0	10	226	0	358
Total	18	0	57	0	481	13	0	0	0	61	814	0	1444
05:00 PM	3	0	16	0	157	4	0	0	0	13	231	0	424
05:15 PM	14	0	22	0	134	7	0	0	0	26	256	0	459
05:30 PM	11	0	21	0	137	5	0	0	0	19	209	0	402
05:45 PM	7	0	15	0	128	2	0	0	0	18	219	0	389
Total	35	0	74	0	556	18	0	0	0	76	915	0	1674
Grand Total	68	0	219	0	2628	52	0	0	0	193	2400	0	5560
Apprch %	23.7	0.0	76.3	0.0	98.1	1.9	0.0	0.0	0.0	7.4	92.6	0.0	
Total %	1.2	0.0	3.9	0.0	47.3	0.9	0.0	0.0	0.0	3.5	43.2	0.0	

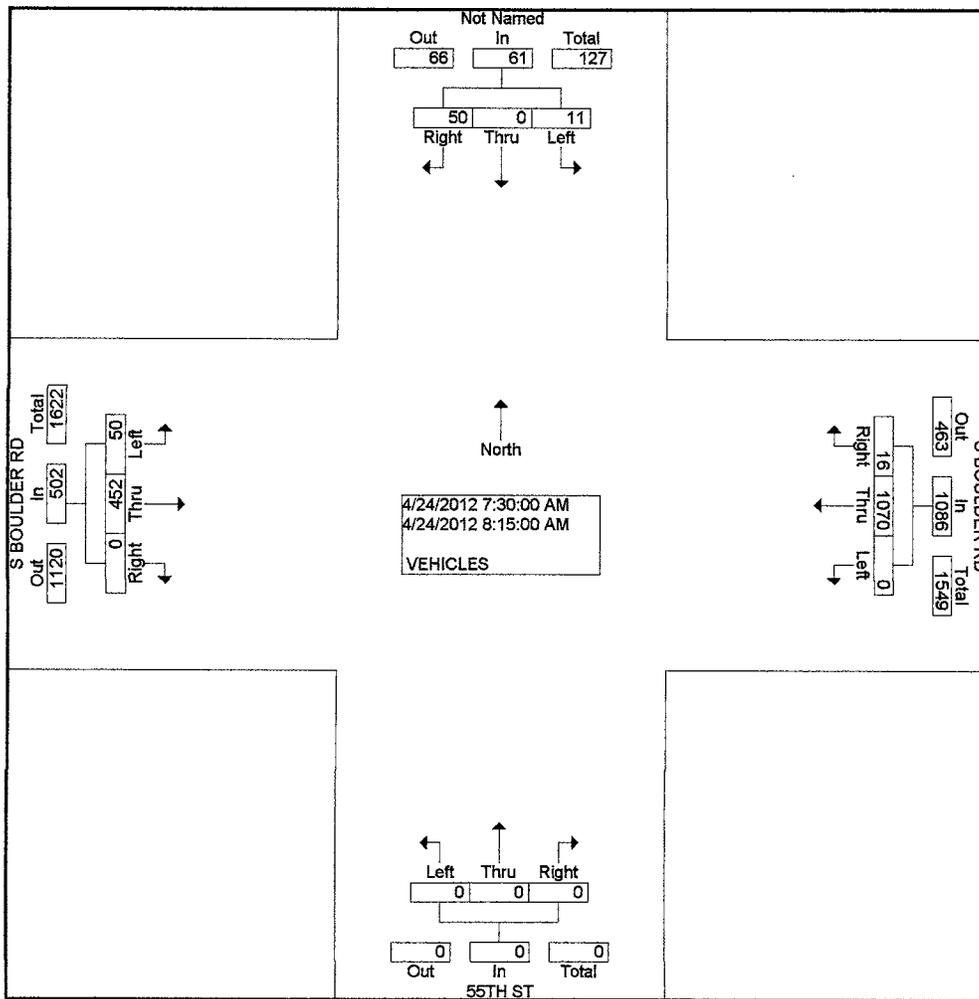
COUNTER MEASURES INC.

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: 55TH ST  
EW STREET: S BOULDER RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : 55THSBOU  
Site Code : 00000008  
Start Date : 4/24/2012  
Page No : 2

Start Time	Southbound				S BOULDER RD Westbound				55TH ST Northbound				S BOULDER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	11	0	50	61	0	1070	16	1086	0	0	0	0	50	452	0	502	1649
Percent	18.0	0.0	82.0		0.0	98.5	1.5		0.0	0.0	0.0		10.0	90.0	0.0		
07:45																	
Volume	4	0	12	16	0	341	7	348	0	0	0	0	14	112	0	126	490
Peak Factor	0.841																
High Int.	07:30 AM				07:45 AM				6:15:00 AM				08:15 AM				
Volume	2	0	18	20	0	341	7	348	0	0	0	0	18	126	0	144	
Peak Factor	0.763				0.780								0.872				



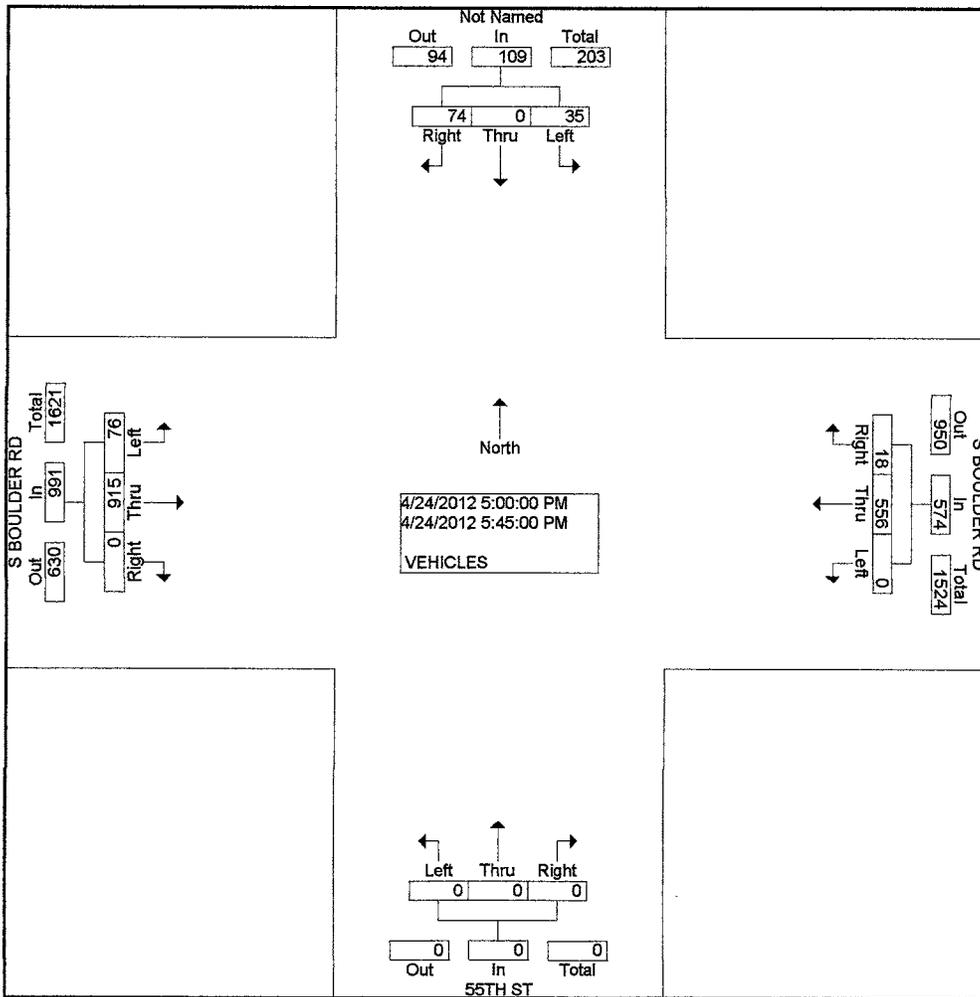
**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: 55TH ST  
E/W STREET: S BOULDER RD  
CITY: BOULDER  
COUNTY: BOULDER

File Name : 55THSBOU  
Site Code : 00000008  
Start Date : 4/24/2012  
Page No : 2

Start Time	Southbound				S BOULDER RD Westbound				55TH ST Northbound				S BOULDER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	35	0	74	109	0	556	18	574	0	0	0	0	76	915	0	991	1674
Percent	32.1	0.0	67.9		0.0	96.9	3.1		0.0	0.0	0.0		7.7	92.3	0.0		
05:15 Volume	14	0	22	36	0	134	7	141	0	0	0	0	26	256	0	282	459
Peak Factor	0.912																
High Int.	05:15 PM				05:00 PM								05:15 PM				
Volume	14	0	22	36	0	157	4	161	0	0	0	0	26	256	0	282	
Peak Factor	0.757				0.891								0.879				



COUNTER MEASURES INC.

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: KEWANEE DR  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHKEWA  
Site Code : 00000013  
Start Date : 4/25/2012  
Page No : 1

Groups Printed- 1 - VEHICLES

Start Time	MANHATTAN DR Southbound			Westbound			MANHATTAN DR Northbound			KEWANEE DR Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	0	4	0	0	0	0	0	4	0	0	0	0	8
06:45 AM	0	5	0	1	0	1	0	3	0	0	0	0	10
Total	0	9	0	1	0	1	0	7	0	0	0	0	18
07:00 AM	1	5	0	0	0	1	0	9	0	0	0	0	16
07:15 AM	0	7	0	1	0	2	0	12	0	0	0	0	22
07:30 AM	1	20	0	1	0	1	0	14	1	0	0	0	38
07:45 AM	0	6	0	1	0	3	0	15	0	0	0	0	25
Total	2	38	0	3	0	7	0	50	1	0	0	0	101
08:00 AM	0	18	0	0	0	1	0	18	1	0	0	0	38
08:15 AM	1	12	0	1	0	2	0	27	0	0	0	0	43
Total	1	30	0	1	0	3	0	45	1	0	0	0	81
04:00 PM	0	15	0	0	0	1	0	11	0	0	0	0	27
04:15 PM	0	15	0	0	0	1	0	12	0	0	0	0	28
04:30 PM	1	11	0	0	0	0	0	15	0	0	0	0	27
04:45 PM	2	14	0	0	0	0	0	11	0	0	0	0	27
Total	3	55	0	0	0	2	0	49	0	0	0	0	109
05:00 PM	1	10	0	0	0	1	0	8	0	0	0	0	20
05:15 PM	1	16	0	0	0	2	0	24	0	0	0	0	43
05:30 PM	2	26	0	0	0	2	0	29	0	0	0	0	59
05:45 PM	1	17	0	2	0	1	0	15	0	0	0	0	36
Total	5	69	0	2	0	6	0	76	0	0	0	0	158
Grand Total	11	201	0	7	0	19	0	227	2	0	0	0	467
Apprch %	5.2	94.8	0.0	26.9	0.0	73.1	0.0	99.1	0.9	0.0	0.0	0.0	
Total %	2.4	43.0	0.0	1.5	0.0	4.1	0.0	48.6	0.4	0.0	0.0	0.0	

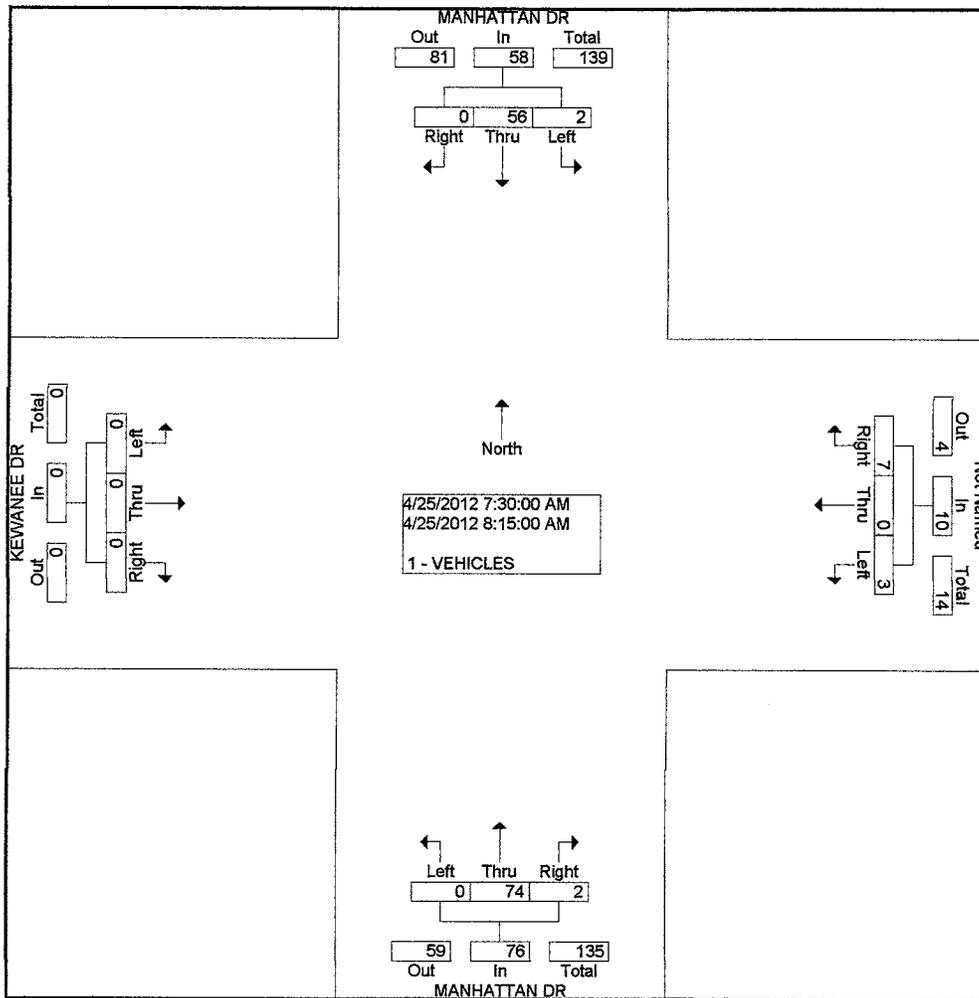
**COUNTER MEASURES INC.**

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: KEWANEE DR  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHKEWA  
Site Code : 00000013  
Start Date : 4/25/2012  
Page No : 2

Start Time	MANHATTAN DR Southbound				Westbound				MANHATTAN DR Northbound				KEWANEE DR Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	2	56	0	58	3	0	7	10	0	74	2	76	0	0	0	0	144
Percent	3.4	96.6	0.0		30.0	0.0	70.0		0.0	97.4	2.6		0.0	0.0	0.0		
08:15																	
Volume	1	12	0	13	1	0	2	3	0	27	0	27	0	0	0	0	43
Peak Factor	0.837																
High Int.	07:30 AM				07:45 AM				08:15 AM				6:15:00 AM				
Volume	1	20	0	21	1	0	3	4	0	27	0	27					
Peak Factor	0.690								0.625				0.704				



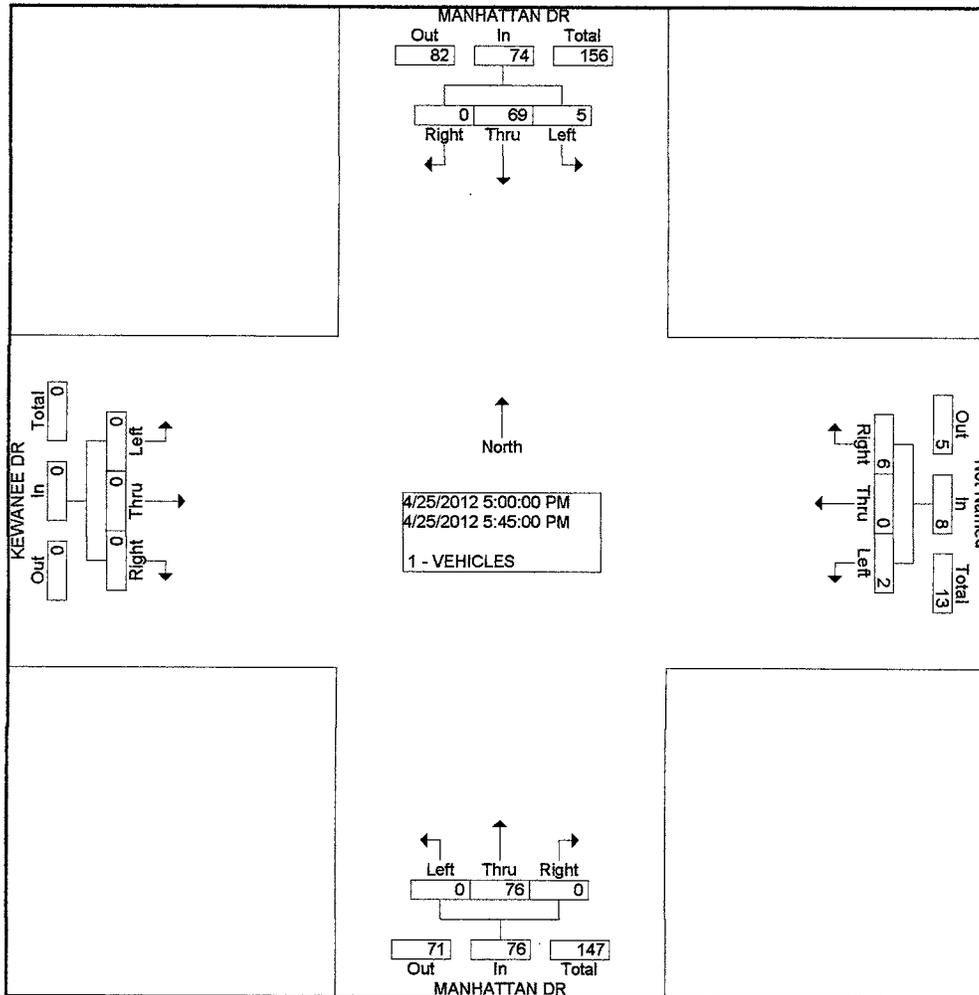
COUNTER MEASURES INC.

1889 YORK ST  
DENVER, COLORADO  
303-333-7409

N/S STREET: MANHATTAN DR  
E/W STREET: KEWANEER DR  
CITY: BOULDER  
COUNTY: BOULDER

File Name : MANHKEWA  
Site Code : 0000013  
Start Date : 4/25/2012  
Page No : 2

Start Time	MANHATTAN DR Southbound				Westbound				MANHATTAN DR Northbound				KEWANEER DR Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	5	69	0	74	2	0	6	8	0	76	0	76	0	0	0	0	158
Percent	6.8	93.2	0.0		25.0	0.0	75.0		0.0	100.0	0.0		0.0	0.0	0.0		
05:30 Volume	2	26	0	28	0	0	2	2	0	29	0	29	0	0	0	0	59
Peak Factor High Int.	05:30 PM																
Volume	2	26	0	28	2	0	1	3	0	29	0	29					0.669
Peak Factor	0.661				0.667				0.655								



# COUNTER MEASURES INC.

Location: KEWANEE DR E/O MANHATTAN DR  
 City: BOULDER  
 County: BOULDER  
 Direction: EASTBOUND-WESTBOUND

1889 YORK ST  
 DENVER, COLORADO 80206  
 303-333-7409

Site Code: 042307

Start Time	24-Apr-12 Tue	EB	WB	Total
12:00 AM		0	1	1
01:00		1	1	2
02:00		0	0	0
03:00		1	2	3
04:00		0	0	0
05:00		1	3	4
06:00		2	2	4
07:00		10	10	20
08:00		<b>13</b>	<b>12</b>	<b>25</b>
09:00		8	8	16
10:00		5	6	11
11:00		5	6	11
12:00 PM		10	10	20
01:00		6	6	12
02:00		<b>14</b>	10	24
03:00		12	<b>12</b>	24
04:00		14	12	<b>26</b>
05:00		8	5	13
06:00		5	4	9
07:00		5	4	9
08:00		11	9	20
09:00		4	2	6
10:00		3	3	6
11:00		0	0	0
<b>Total</b>		<b>138</b>	<b>128</b>	<b>266</b>
<b>Percent</b>		<b>51.9%</b>	<b>48.1%</b>	
AM Peak		08:00	08:00	08:00
Vol.		13	12	25
PM Peak		14:00	15:00	16:00
Vol.		14	12	26
<b>Grand Total</b>		<b>138</b>	<b>128</b>	<b>266</b>
<b>Percent</b>		<b>51.9%</b>	<b>48.1%</b>	
<b>ADT</b>		<b>ADT 266</b>	<b>AADT 266</b>	

# COUNTER MEASURES INC.

Location: MANHATTAN DR N/O S BOULDER RD  
 City: BOULDER  
 County: BOULDER  
 Direction: NORTHBOUND-SOUTHBOUND

1889 YORK ST  
 DENVER, COLORADO 80206  
 303-333-7409

Site Code: 042309

Start Time	24-Apr-12 Tue	NB	SB	Total
12:00 AM		8	5	13
01:00		3	2	5
02:00		1	3	4
03:00		0	0	0
04:00		1	2	3
05:00		3	14	17
06:00		16	40	56
07:00		59	98	157
08:00		<b>128</b>	<b>137</b>	<b>265</b>
09:00		58	64	122
10:00		72	56	128
11:00		70	79	149
12:00 PM		62	82	144
01:00		81	72	153
02:00		80	84	164
03:00		157	115	272
04:00		116	96	212
05:00		<b>160</b>	<b>125</b>	<b>285</b>
06:00		94	111	205
07:00		73	74	147
08:00		48	42	90
09:00		50	30	80
10:00		16	13	29
11:00		8	11	19
Total		1364	1355	2719
Percent		50.2%	49.8%	
AM Peak		08:00	08:00	08:00
Vol.		128	137	265
PM Peak		17:00	17:00	17:00
Vol.		160	125	285
Grand Total		1364	1355	2719
Percent		50.2%	49.8%	

ADT                      Not Calculated

# COUNTER MEASURES INC.

Location: 55TH AVE N/O S BOULDER RD  
 City: BOULDER  
 County: BOULDER  
 Direction: NORTHBOUND-SOUTHBOUND

1889 YORK ST  
 DENVER, COLORADO 80206  
 303-333-7409

Site Code: 042310

Start Time	24-Apr-12 Tue	NB	SB	Total
12:00 AM		0	0	0
01:00		0	1	1
02:00		1	1	2
03:00		0	0	0
04:00		4	2	6
05:00		4	4	8
06:00		30	18	48
07:00		26	57	83
08:00		<b>86</b>	47	<b>133</b>
09:00		65	46	111
10:00		46	52	98
11:00		46	<b>72</b>	118
12:00 PM		60	59	119
01:00		51	43	94
02:00		49	56	105
03:00		<b>97</b>	43	140
04:00		85	72	157
05:00		92	102	194
06:00		92	<b>110</b>	<b>202</b>
07:00		42	79	121
08:00		30	36	66
09:00		26	24	50
10:00		10	10	20
11:00		4	3	7
Total		946	937	1883
Percent		50.2%	49.8%	
AM Peak		08:00	11:00	08:00
Vol.		86	72	133
PM Peak		15:00	18:00	18:00
Vol.		97	110	202
Grand Total		946	937	1883
Percent		50.2%	49.8%	
ADT		Not Calculated		

# COUNTER MEASURES INC.

Location: CIMMARON WAY E/O MANHATTAN DR  
 City: BOULDER  
 County: BOULDER  
 Direction: EASTBOUND-WESTBOUND

1889 YORK ST  
 DENVER, COLORADO 80206  
 303-333-7409

Site Code: 042306

Start Time	24-Apr-12 Tue	EB	WB	Total
12:00 AM		1	0	1
01:00		0	0	0
02:00		0	0	0
03:00		0	0	0
04:00		0	0	0
05:00		0	0	0
06:00		3	3	6
07:00		3	3	6
08:00		<b>10</b>	<b>10</b>	<b>20</b>
09:00		6	6	12
10:00		3	4	7
11:00		4	5	9
12:00 PM		10	10	20
01:00		6	6	12
02:00		8	8	16
03:00		<b>11</b>	<b>11</b>	<b>22</b>
04:00		6	6	12
05:00		6	6	12
06:00		6	6	12
07:00		3	4	7
08:00		4	4	8
09:00		7	7	14
10:00		2	0	2
11:00		0	0	0
Total		99	99	198
Percent		50.0%	50.0%	
AM Peak		08:00	08:00	08:00
Vol.		10	10	20
PM Peak		15:00	15:00	15:00
Vol.		11	11	22
Grand Total		99	99	198
Percent		50.0%	50.0%	

ADT

ADT 198

AADT 198

APPENDIX B  
**Capacity Analysis**

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HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

Existing  
 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	3	7	125	2	2	100
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	4	8	149	2	2	119
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	274	150			151	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	274	150			151	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	715	896			1430	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	12	151	121			
Volume Left	4	0	2			
Volume Right	8	2	0			
cSH	833	1700	1430			
Volume to Capacity	0.01	0.09	0.00			
Queue Length 95th (ft)	1	0	0			
Control Delay (s)	9.4	0.0	0.2			
Lane LOS	A		A			
Approach Delay (s)	9.4	0.0	0.2			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay			0.5			
Intersection Capacity Utilization			16.9%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

Existing  
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3316		1770	1863	1583	1770	1863	1583
Flt Permitted	0.28	1.00	1.00	0.64	1.00		0.74	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	514	1863	1583	1192	3316		1383	1863	1583	1360	1863	1583
Volume (vph)	314	172	22	17	454	328	35	38	9	41	21	165
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	341	187	24	18	493	357	38	41	10	45	23	179
RTOR Reduction (vph)	0	0	6	0	107	0	0	0	9	0	0	140
Lane Group Flow (vph)	341	187	18	18	743	0	38	41	1	45	23	39
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2				6
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	76.0	76.0	76.0	64.4	64.4		16.0	16.0	16.0	16.0	16.0	23.6
Effective Green, g (s)	75.0	74.3	74.3	62.7	62.7		14.4	14.4	14.4	14.4	14.4	21.6
Actuated g/C Ratio	0.75	0.74	0.74	0.63	0.63		0.14	0.14	0.14	0.14	0.14	0.22
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	468	1384	1176	747	2079		199	268	228	196	268	421
v/s Ratio Prot	c0.05	0.10			0.22			0.02				0.01
v/s Ratio Perm	c0.50		0.01	0.02			0.03		0.00	c0.03		0.02
v/c Ratio	0.73	0.14	0.02	0.02	0.36		0.19	0.15	0.01	0.23	0.09	0.09
Uniform Delay, d1	5.4	3.7	3.3	7.1	9.0		37.7	37.5	36.7	37.9	37.1	31.4
Progression Factor	3.20	0.33	0.22	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	0.2	0.0	0.1	0.5		2.1	1.2	0.1	2.7	0.6	0.1
Delay (s)	22.7	1.4	0.8	7.1	9.4		39.8	38.7	36.7	40.6	37.7	31.4
Level of Service	C	A	A	A	A		D	D	D	D	D	C
Approach Delay (s)		14.5			9.4			38.9			33.7	
Approach LOS		B			A			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			15.9			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			10.6			
Intersection Capacity Utilization			63.0%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

Existing  
 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Volume (veh/h)	82	489	53	22	1094	26	10	3	4	15	1	99
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	92	549	60	25	1229	29	11	3	4	17	1	111
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1258			609			1539	2071	304	1758	2087	629
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1258			609			1539	2071	304	1758	2087	629
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			97			77	92	99	61	97	74
cM capacity (veh/h)	548			966			49	43	691	43	42	425
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>EB 3</b>	<b>WB 1</b>	<b>WB 2</b>	<b>WB 3</b>	<b>NB 1</b>	<b>SB 1</b>				
Volume Total	92	366	243	25	819	439	19	129				
Volume Left	92	0	0	25	0	0	11	17				
Volume Right	0	0	60	0	0	29	4	111				
cSH	548	1700	1700	966	1700	1700	61	190				
Volume to Capacity	0.17	0.22	0.14	0.03	0.48	0.26	0.32	0.68				
Queue Length 95th (ft)	15	0	0	2	0	0	28	103				
Control Delay (s)	12.9	0.0	0.0	8.8	0.0	0.0	89.7	56.6				
Lane LOS	B			A			F	F				
Approach Delay (s)	1.7			0.2			89.7	56.6				
Approach LOS							F	F				
<b>Intersection Summary</b>												
Average Delay			4.9									
Intersection Capacity Utilization			52.6%	ICU Level of Service				A				
Analysis Period (min)			15									

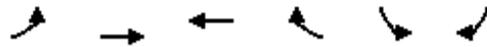
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

Existing  
 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00		1.00	0.90		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3443		1770	3537		1770	1675		1770	1663	
Flt Permitted	0.39	1.00		0.40	1.00		0.73	1.00		0.70	1.00	
Satd. Flow (perm)	717	3443		738	3537		1351	1675		1307	1663	
Volume (vph)	64	476	106	28	600	3	193	26	52	5	13	32
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	517	115	30	652	3	210	28	57	5	14	35
RTOR Reduction (vph)	0	19	0	0	0	0	0	43	0	0	26	0
Lane Group Flow (vph)	70	613	0	30	655	0	210	42	0	5	23	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	462	2217		475	2278		338	419		327	416	
v/s Ratio Prot		0.18			c0.19			0.03			0.01	
v/s Ratio Perm	0.10			0.04			c0.16			0.00		
v/c Ratio	0.15	0.28		0.06	0.29		0.62	0.10		0.02	0.05	
Uniform Delay, d1	7.0	7.7		6.6	7.8		33.3	28.9		28.2	28.5	
Progression Factor	1.00	1.00		0.98	0.95		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.3		0.2	0.3		8.3	0.5		0.1	0.3	
Delay (s)	7.7	8.0		6.7	7.7		41.6	29.3		28.3	28.8	
Level of Service	A			A			D			C		
Approach Delay (s)	8.0			7.7			38.1			28.7		
Approach LOS	A			A			D			C		
<b>Intersection Summary</b>												
HCM Average Control Delay	13.6		HCM Level of Service		B							
HCM Volume to Capacity ratio	0.38											
Actuated Cycle Length (s)	100.0		Sum of lost time (s)		10.6							
Intersection Capacity Utilization	51.1%		ICU Level of Service		A							
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

Existing  
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↕↕	↕↕↶		↶↶	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	50	452	1070	16	11	50
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	60	538	1274	19	13	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1293				1671	646
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1293				1671	646
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				83	86
cM capacity (veh/h)	532				77	414

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	60	269	269	849	444	73
Volume Left	60	0	0	0	0	13
Volume Right	0	0	0	0	19	60
cSH	532	1700	1700	1700	1700	231
Volume to Capacity	0.11	0.16	0.16	0.50	0.26	0.31
Queue Length 95th (ft)	9	0	0	0	0	32
Control Delay (s)	12.6	0.0	0.0	0.0	0.0	27.5
Lane LOS	B					D
Approach Delay (s)	1.3			0.0		27.5
Approach LOS						D

Intersection Summary						
Average Delay			1.4			
Intersection Capacity Utilization		47.1%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

Existing  
 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	2	6	125	0	5	125
Peak Hour Factor	0.67	0.67	0.67	0.67	0.67	0.67
Hourly flow rate (vph)	3	9	187	0	7	187
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	388	187			187	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	388	187			187	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			99	
cM capacity (veh/h)	612	856			1388	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	12	187	194			
Volume Left	3	0	7			
Volume Right	9	0	0			
cSH	778	1700	1388			
Volume to Capacity	0.02	0.11	0.01			
Queue Length 95th (ft)	1	0	0			
Control Delay (s)	9.7	0.0	0.3			
Lane LOS	A		A			
Approach Delay (s)	9.7	0.0	0.3			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay			0.5			
Intersection Capacity Utilization			20.6%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

Existing  
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					 							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3432		1770	1863	1583	1770	1863	1583
Flt Permitted	0.49	1.00	1.00	0.51	1.00		0.69	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	909	1863	1583	946	3432		1286	1863	1583	1326	1863	1583
Volume (vph)	195	381	135	30	247	63	110	60	25	247	90	326
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	224	438	155	34	284	72	126	69	29	284	103	375
RTOR Reduction (vph)	0	0	66	0	22	0	0	0	20	0	0	244
Lane Group Flow (vph)	224	438	89	34	334	0	126	69	9	284	103	131
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2				6
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	59.0	59.0	59.0	51.0	51.0		33.0	33.0	33.0	33.0	33.0	37.0
Effective Green, g (s)	58.0	57.3	57.3	49.3	49.3		31.4	31.4	31.4	31.4	31.4	35.0
Actuated g/C Ratio	0.58	0.57	0.57	0.49	0.49		0.31	0.31	0.31	0.31	0.31	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	553	1067	907	466	1692		404	585	497	416	585	633
v/s Ratio Prot	0.01	c0.24			0.10			0.04			0.06	0.01
v/s Ratio Perm	c0.22		0.06	0.04			0.10		0.01	c0.21		0.08
v/c Ratio	0.41	0.41	0.10	0.07	0.20		0.31	0.12	0.02	0.68	0.18	0.21
Uniform Delay, d1	12.0	11.9	9.7	13.3	14.2		26.1	24.4	23.7	30.0	24.9	22.8
Progression Factor	0.45	0.50	0.12	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.1	0.2	0.3	0.3		2.0	0.4	0.1	8.8	0.7	0.2
Delay (s)	5.9	7.1	1.4	13.6	14.5		28.1	24.8	23.7	38.7	25.6	22.9
Level of Service	A	A	A	B	B		C	C	C	D	C	C
Approach Delay (s)		5.7			14.4			26.5			29.2	
Approach LOS		A			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			17.5			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			11.3			
Intersection Capacity Utilization			57.9%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

Existing  
 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵	↑↑		↵	↑↑			↕			↕	
Sign Control	Free		Free		Free		Stop		Stop		Stop	
Grade	0%		0%		0%		0%		0%		0%	
Volume (veh/h)	144	1000	20	17	610	24	44	7	42	32	1	96
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	162	1124	22	19	685	27	49	8	47	36	1	108
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	712			1146			1948	2209	573	1674	2207	356
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	712			1146			1948	2209	573	1674	2207	356
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	82			97			0	77	90	8	97	83
cM capacity (veh/h)	883			605			26	35	463	39	35	640

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	162	749	397	19	457	255	104	145
Volume Left	162	0	0	19	0	0	49	36
Volume Right	0	0	22	0	0	27	47	108
cSH	883	1700	1700	605	1700	1700	47	129
Volume to Capacity	0.18	0.44	0.23	0.03	0.27	0.15	2.20	1.12
Queue Length 95th (ft)	17	0	0	2	0	0	269	210
Control Delay (s)	10.0	0.0	0.0	11.1	0.0	0.0	737.8	181.8
Lane LOS	A			B			F	F
Approach Delay (s)	1.2			0.3			737.8	181.8
Approach LOS							F	F

Intersection Summary		
Average Delay	46.0	
Intersection Capacity Utilization	51.4%	ICU Level of Service A
Analysis Period (min)	15	

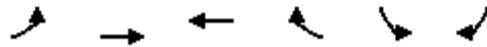
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

Existing  
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00		1.00	0.89		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3405		1770	3536		1770	1654		1770	1719	
Flt Permitted	0.39	1.00		0.26	1.00		0.73	1.00		0.71	1.00	
Satd. Flow (perm)	728	3405		480	3536		1365	1654		1324	1719	
Volume (vph)	100	650	220	73	575	4	170	16	48	12	16	17
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	722	244	81	639	4	189	18	53	13	18	19
RTOR Reduction (vph)	0	33	0	0	0	0	0	40	0	0	14	0
Lane Group Flow (vph)	111	933	0	81	643	0	189	31	0	13	23	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	469	2193		309	2277		341	414		331	430	
v/s Ratio Prot	c0.27			0.18			0.02			0.01		
v/s Ratio Perm	0.15			0.17			c0.14			0.01		
v/c Ratio	0.24	0.43		0.26	0.28		0.55	0.08		0.04	0.05	
Uniform Delay, d1	7.5	8.7		7.6	7.7		32.6	28.7		28.4	28.5	
Progression Factor	1.00	1.00		0.73	0.76		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.6		2.0	0.3		6.4	0.4		0.2	0.2	
Delay (s)	8.7	9.3		7.5	6.2		39.0	29.0		28.6	28.7	
Level of Service	A			A			D			C		
Approach Delay (s)	9.3			6.4			36.3			28.7		
Approach LOS	A			A			D			C		
<b>Intersection Summary</b>												
HCM Average Control Delay	12.1			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.46											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			10.6					
Intersection Capacity Utilization	58.6%			ICU Level of Service			B					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

Existing  
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↕↕	↕↕↶		↶↶	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	120	915	556	25	35	105
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	132	1005	611	27	38	115
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	638				1391	319
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	638				1391	319
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	86				66	83
cM capacity (veh/h)	941				114	676

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	132	503	503	407	231	154
Volume Left	132	0	0	0	0	38
Volume Right	0	0	0	0	27	115
cSH	941	1700	1700	1700	1700	304
Volume to Capacity	0.14	0.30	0.30	0.24	0.14	0.51
Queue Length 95th (ft)	12	0	0	0	0	67
Control Delay (s)	9.4	0.0	0.0	0.0	0.0	28.4
Lane LOS	A					D
Approach Delay (s)	1.1			0.0		28.4
Approach LOS						D

Intersection Summary						
Average Delay			2.9			
Intersection Capacity Utilization		41.2%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

Existing + Site  
 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	9	19	125	4	6	100
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	11	23	149	5	7	119
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	285	151			154	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	285	151			154	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			99	
cM capacity (veh/h)	702	895			1427	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	33	154	126
Volume Left	11	0	7
Volume Right	23	5	0
cSH	822	1700	1427
Volume to Capacity	0.04	0.09	0.01
Queue Length 95th (ft)	3	0	0
Control Delay (s)	9.6	0.0	0.5
Lane LOS	A		A
Approach Delay (s)	9.6	0.0	0.5
Approach LOS	A		

Intersection Summary			
Average Delay		1.2	
Intersection Capacity Utilization	20.2%	ICU Level of Service	A
Analysis Period (min)		15	

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

Existing + Site  
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					 							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3317		1770	1863	1583	1770	1863	1583
Flt Permitted	0.27	1.00	1.00	0.64	1.00		0.74	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	512	1863	1583	1188	3317		1380	1863	1583	1353	1863	1583
Volume (vph)	314	175	23	18	455	328	38	43	11	41	23	165
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	341	190	25	20	495	357	41	47	12	45	25	179
RTOR Reduction (vph)	0	0	6	0	106	0	0	0	10	0	0	140
Lane Group Flow (vph)	341	190	19	20	746	0	41	47	2	45	25	39
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2				6
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	76.0	76.0	76.0	64.3	64.3		16.0	16.0	16.0	16.0	16.0	23.7
Effective Green, g (s)	75.0	74.3	74.3	62.6	62.6		14.4	14.4	14.4	14.4	14.4	21.7
Actuated g/C Ratio	0.75	0.74	0.74	0.63	0.63		0.14	0.14	0.14	0.14	0.14	0.22
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	468	1384	1176	744	2076		199	268	228	195	268	423
v/s Ratio Prot	c0.05	0.10			0.22			0.03			0.01	0.01
v/s Ratio Perm	c0.50		0.01	0.02			0.03		0.00	c0.03		0.02
v/c Ratio	0.73	0.14	0.02	0.03	0.36		0.21	0.18	0.01	0.23	0.09	0.09
Uniform Delay, d1	5.4	3.7	3.3	7.1	9.0		37.8	37.6	36.7	37.9	37.1	31.3
Progression Factor	3.14	0.34	0.24	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	0.2	0.0	0.1	0.5		2.3	1.4	0.1	2.7	0.7	0.1
Delay (s)	22.4	1.4	0.8	7.2	9.5		40.1	39.0	36.7	40.6	37.8	31.4
Level of Service	C	A	A	A	A		D	D	D	D	D	C
Approach Delay (s)		14.3			9.5			39.2			33.7	
Approach LOS		B			A			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			16.0			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.63									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			10.6			
Intersection Capacity Utilization			63.0%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

Existing + Site  
 AM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↕			↕	
Sign Control	Free		Free				Stop				Stop	
Grade	0%		0%				0%				0%	
Volume (veh/h)	84	491	53	22	1099	26	10	3	4	16	1	104
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	94	552	60	25	1235	29	11	3	4	18	1	117
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1264			611			1554	2084	306	1770	2099	632
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1264			611			1554	2084	306	1770	2099	632
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			97			76	92	99	57	97	72
cM capacity (veh/h)	546			964			46	42	690	42	41	423

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	94	368	243	25	823	441	19	136
Volume Left	94	0	0	25	0	0	11	18
Volume Right	0	0	60	0	0	29	4	117
cSH	546	1700	1700	964	1700	1700	58	186
Volume to Capacity	0.17	0.22	0.14	0.03	0.48	0.26	0.33	0.73
Queue Length 95th (ft)	16	0	0	2	0	0	30	117
Control Delay (s)	13.0	0.0	0.0	8.8	0.0	0.0	94.9	64.0
Lane LOS	B			A			F	F
Approach Delay (s)	1.7			0.2			94.9	64.0
Approach LOS							F	F

Intersection Summary		
Average Delay	5.6	
Intersection Capacity Utilization	53.2%	ICU Level of Service A
Analysis Period (min)	15	

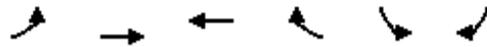
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

Existing + Site  
 AM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00		1.00	0.90		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3441		1770	3537		1770	1672		1770	1663	
Flt Permitted	0.38	1.00		0.39	1.00		0.73	1.00		0.70	1.00	
Satd. Flow (perm)	715	3441		734	3537		1351	1672		1304	1663	
Volume (vph)	64	477	109	29	603	3	201	26	55	5	13	32
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	518	118	32	655	3	218	28	60	5	14	35
RTOR Reduction (vph)	0	20	0	0	0	0	0	45	0	0	26	0
Lane Group Flow (vph)	70	616	0	32	658	0	218	43	0	5	23	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	460	2216		473	2278		338	418		326	416	
v/s Ratio Prot		0.18			c0.19			0.03			0.01	
v/s Ratio Perm	0.10			0.04			c0.16			0.00		
v/c Ratio	0.15	0.28		0.07	0.29		0.64	0.10		0.02	0.05	
Uniform Delay, d1	7.0	7.7		6.6	7.8		33.5	28.9		28.2	28.5	
Progression Factor	1.00	1.00		0.98	0.96		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.3		0.3	0.3		9.2	0.5		0.1	0.3	
Delay (s)	7.7	8.0		6.8	7.8		42.7	29.4		28.3	28.8	
Level of Service	A	A		A	A		D	C		C	C	
Approach Delay (s)		8.0			7.7			38.9			28.7	
Approach LOS		A			A			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			13.9			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.39									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			10.6			
Intersection Capacity Utilization			51.6%			ICU Level of Service				A		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

Existing + Site  
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↕↕	↕↕↶		↶↶	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	52	453	1070	16	12	55
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	62	539	1274	19	14	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1293				1677	646
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1293				1677	646
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				81	84
cM capacity (veh/h)	532				76	414

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	62	270	270	849	444	80
Volume Left	62	0	0	0	0	14
Volume Right	0	0	0	0	19	65
cSH	532	1700	1700	1700	1700	230
Volume to Capacity	0.12	0.16	0.16	0.50	0.26	0.35
Queue Length 95th (ft)	10	0	0	0	0	37
Control Delay (s)	12.7	0.0	0.0	0.0	0.0	28.7
Lane LOS	B					D
Approach Delay (s)	1.3			0.0		28.7
Approach LOS						D

Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utilization		47.5%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

Existing + Site  
 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	7	15	125	7	20	125
Peak Hour Factor	0.67	0.67	0.67	0.67	0.67	0.67
Hourly flow rate (vph)	10	22	187	10	30	187
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	438	192			197	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	438	192			197	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			98	
cM capacity (veh/h)	563	850			1376	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	33	197	216			
Volume Left	10	0	30			
Volume Right	22	10	0			
cSH	732	1700	1376			
Volume to Capacity	0.04	0.12	0.02			
Queue Length 95th (ft)	4	0	2			
Control Delay (s)	10.2	0.0	1.2			
Lane LOS	B		A			
Approach Delay (s)	10.2	0.0	1.2			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.3			
Intersection Capacity Utilization			28.0%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

Existing + Site  
PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3433		1770	1863	1583	1770	1863	1583
Flt Permitted	0.48	1.00	1.00	0.51	1.00		0.69	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	903	1863	1583	941	3433		1278	1863	1583	1320	1863	1583
Volume (vph)	195	384	139	32	251	63	113	64	26	247	96	326
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	224	441	160	37	289	72	130	74	30	284	110	375
RTOR Reduction (vph)	0	0	68	0	22	0	0	0	21	0	0	244
Lane Group Flow (vph)	224	441	92	37	339	0	130	74	9	284	110	131
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2				6
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	59.0	59.0	59.0	51.0	51.0		33.0	33.0	33.0	33.0	33.0	37.0
Effective Green, g (s)	58.0	57.3	57.3	49.3	49.3		31.4	31.4	31.4	31.4	31.4	35.0
Actuated g/C Ratio	0.58	0.57	0.57	0.49	0.49		0.31	0.31	0.31	0.31	0.31	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	550	1067	907	464	1692		401	585	497	414	585	633
v/s Ratio Prot	0.01	c0.24			0.10			0.04			0.06	0.01
v/s Ratio Perm	0.22		0.06	0.04			0.10		0.01	c0.22		0.08
v/c Ratio	0.41	0.41	0.10	0.08	0.20		0.32	0.13	0.02	0.69	0.19	0.21
Uniform Delay, d1	12.1	11.9	9.7	13.4	14.3		26.2	24.5	23.7	30.0	25.0	22.8
Progression Factor	0.46	0.51	0.12	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.5	1.1	0.2	0.3	0.3		2.1	0.4	0.1	8.9	0.7	0.2
Delay (s)	6.0	7.2	1.4	13.7	14.5		28.3	24.9	23.7	38.9	25.7	22.9
Level of Service	A	A	A	B	B		C	C	C	D	C	C
Approach Delay (s)		5.7			14.5			26.7			29.2	
Approach LOS		A			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			17.6			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			11.3			
Intersection Capacity Utilization			58.1%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

Existing + Site  
 PM Peak



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↕		↖	↕			↕			↕	
Sign Control	Free		Free		Free		Stop		Stop		Stop	
Grade	0%		0%		0%		0%		0%		0%	
Volume (veh/h)	150	1006	20	17	614	25	44	7	42	33	1	100
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	169	1130	22	19	690	28	49	8	47	37	1	112
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	718			1153			1975	2235	576	1696	2232	359
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	718			1153			1975	2235	576	1696	2232	359
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	81			97			0	76	90	0	97	82
cM capacity (veh/h)	879			602			25	33	460	37	33	638

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	169	754	399	19	460	258	104	151
Volume Left	169	0	0	19	0	0	49	37
Volume Right	0	0	22	0	0	28	47	112
cSH	879	1700	1700	602	1700	1700	45	124
Volume to Capacity	0.19	0.44	0.23	0.03	0.27	0.15	2.34	1.21
Queue Length 95th (ft)	18	0	0	2	0	0	276	234
Control Delay (s)	10.1	0.0	0.0	11.2	0.0	0.0	808.3	217.3
Lane LOS	B			B			F	F
Approach Delay (s)	1.3			0.3			808.3	217.3
Approach LOS							F	F

Intersection Summary			
Average Delay	51.5		
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

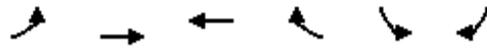
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

Existing + Site  
 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Fr <sub>t</sub>	1.00	0.96		1.00	1.00		1.00	0.89		1.00	0.92	
Fl <sub>t</sub> Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3401		1770	3536		1770	1650		1770	1719	
Fl <sub>t</sub> Permitted	0.39	1.00		0.25	1.00		0.73	1.00		0.71	1.00	
Satd. Flow (perm)	725	3401		468	3536		1365	1650		1319	1719	
Volume (vph)	100	654	231	77	578	4	176	16	51	12	16	17
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	727	257	86	642	4	196	18	57	13	18	19
RTOR Reduction (vph)	0	36	0	0	0	0	0	43	0	0	14	0
Lane Group Flow (vph)	111	948	0	86	646	0	196	32	0	13	23	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	467	2190		301	2277		341	413		330	430	
v/s Ratio Prot	c0.28			0.18			0.02			0.01		
v/s Ratio Perm	0.15			0.18			c0.14			0.01		
v/c Ratio	0.24	0.43		0.29	0.28		0.57	0.08		0.04	0.05	
Uniform Delay, d <sub>1</sub>	7.5	8.8		7.8	7.8		32.8	28.7		28.4	28.5	
Progression Factor	1.00	1.00		0.73	0.77		1.00	1.00		1.00	1.00	
Incremental Delay, d <sub>2</sub>	1.2	0.6		2.3	0.3		6.9	0.4		0.2	0.2	
Delay (s)	8.7	9.4		7.9	6.2		39.7	29.1		28.6	28.7	
Level of Service	A			A			D			C		
Approach Delay (s)	9.3			6.4			36.8			28.7		
Approach LOS	A			A			D			C		
<b>Intersection Summary</b>												
HCM Average Control Delay	12.3			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.47											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			10.6					
Intersection Capacity Utilization	59.6%			ICU Level of Service			B					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

Existing + Site  
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↑↑	↑↑		↶	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	126	916	557	26	36	109
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	138	1007	612	29	40	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	641				1407	320
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	641				1407	320
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				64	82
cM capacity (veh/h)	940				111	675

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	138	503	503	408	233	159
Volume Left	138	0	0	0	0	40
Volume Right	0	0	0	0	29	120
cSH	940	1700	1700	1700	1700	298
Volume to Capacity	0.15	0.30	0.30	0.24	0.14	0.53
Queue Length 95th (ft)	13	0	0	0	0	74
Control Delay (s)	9.5	0.0	0.0	0.0	0.0	30.1
Lane LOS	A					D
Approach Delay (s)	1.1			0.0		30.1
Approach LOS						D

Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization		41.9%		ICU Level of Service		A
Analysis Period (min)			15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	5	10	130	5	5	105
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	6	12	155	6	6	125
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	295	158			161	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	295	158			161	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			100	
cM capacity (veh/h)	693	888			1418	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	18	161	131			
Volume Left	6	0	6			
Volume Right	12	6	0			
cSH	812	1700	1418			
Volume to Capacity	0.02	0.09	0.00			
Queue Length 95th (ft)	2	0	0			
Control Delay (s)	9.5	0.0	0.4			
Lane LOS	A		A			
Approach Delay (s)	9.5	0.0	0.4			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay			0.7			
Intersection Capacity Utilization			19.6%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

2032 Background  
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3317		1770	1863	1583	1770	1863	1583
Flt Permitted	0.18	1.00	1.00	0.61	1.00		0.74	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	328	1863	1583	1136	3317		1378	1863	1583	1358	1863	1583
Volume (vph)	400	220	25	20	575	415	35	40	10	55	25	210
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	239	27	22	625	451	38	43	11	60	27	228
RTOR Reduction (vph)	0	0	7	0	130	0	0	0	9	0	0	160
Lane Group Flow (vph)	435	239	20	22	946	0	38	43	2	60	27	68
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2			6	7
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	76.0	76.0	76.0	56.0	56.0		16.0	16.0	16.0	16.0	16.0	32.0
Effective Green, g (s)	75.0	74.3	74.3	54.3	54.3		14.4	14.4	14.4	14.4	14.4	30.0
Actuated g/C Ratio	0.75	0.74	0.74	0.54	0.54		0.14	0.14	0.14	0.14	0.14	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	462	1384	1176	617	1801		198	268	228	196	268	554
v/s Ratio Prot	c0.14	0.13			0.29			0.02			0.01	0.02
v/s Ratio Perm	c0.57		0.01	0.02			0.03		0.00	c0.04		0.02
v/c Ratio	0.94	0.17	0.02	0.04	0.53		0.19	0.16	0.01	0.31	0.10	0.12
Uniform Delay, d1	18.4	3.8	3.3	10.6	14.6		37.7	37.5	36.7	38.3	37.2	25.4
Progression Factor	1.38	0.26	0.12	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.8	0.3	0.0	0.1	1.1		2.1	1.3	0.1	4.0	0.8	0.5
Delay (s)	54.2	1.2	0.4	10.8	15.7		39.8	38.8	36.7	42.3	37.9	25.9
Level of Service	D	A	A	B	B		D	D	D	D	D	C
Approach Delay (s)		34.0			15.6			39.0			30.1	
Approach LOS		C			B			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			24.5			HCM Level of Service				C		
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		10.6				
Intersection Capacity Utilization			74.7%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
9: South Boulder Road & Manhattan Drive

2032 Background  
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.97			0.89	
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.99	
Satd. Flow (prot)	1770	3490		1770	3526			1757			1642	
Flt Permitted	0.19	1.00		0.41	1.00			0.62			0.96	
Satd. Flow (perm)	351	3490		756	3526			1119			1583	
Volume (vph)	85	540	55	25	1200	30	10	5	5	15	5	100
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	587	60	27	1304	33	11	5	5	16	5	109
RTOR Reduction (vph)	0	4	0	0	1	0	0	5	0	0	87	0
Lane Group Flow (vph)	92	643	0	27	1336	0	0	16	0	0	43	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	83.6	83.6		83.6	83.6			8.4			8.4	
Effective Green, g (s)	83.6	83.6		83.6	83.6			8.4			8.4	
Actuated g/C Ratio	0.84	0.84		0.84	0.84			0.08			0.08	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	293	2918		632	2948			94			133	
v/s Ratio Prot		0.18			c0.38							
v/s Ratio Perm	0.26			0.04				0.01			c0.03	
v/c Ratio	0.31	0.22		0.04	0.45			0.17			0.32	
Uniform Delay, d1	1.8	1.6		1.4	2.2			42.6			43.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.92	
Incremental Delay, d2	2.8	0.2		0.1	0.5			0.9			1.4	
Delay (s)	4.6	1.8		1.5	2.7			43.5			41.2	
Level of Service	A	A		A	A			D			D	
Approach Delay (s)		2.2			2.6			43.5			41.2	
Approach LOS		A			A			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			5.1			HCM Level of Service					A	
HCM Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				8.0		
Intersection Capacity Utilization			56.2%			ICU Level of Service					B	
Analysis Period (min)			15									
c Critical Lane Group												

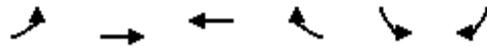
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

2032 Background  
 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Fr <sub>t</sub>	1.00	0.98		1.00	1.00		1.00	0.90		1.00	0.90	
Fl <sub>t</sub> Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3457		1770	3536		1770	1682		1770	1669	
Fl <sub>t</sub> Permitted	0.31	1.00		0.33	1.00		0.72	1.00		0.70	1.00	
Satd. Flow (perm)	574	3457		615	3536		1347	1682		1298	1669	
Volume (vph)	65	605	110	30	760	5	195	30	55	5	15	33
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	658	120	33	826	5	212	33	60	5	16	36
RTOR Reduction (vph)	0	15	0	0	0	0	0	45	0	0	27	0
Lane Group Flow (vph)	71	763	0	33	831	0	212	48	0	5	25	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	370	2226		396	2277		337	421		325	417	
v/s Ratio Prot		0.22			c0.23			0.03			0.01	
v/s Ratio Perm	0.12			0.05			c0.16			0.00		
v/c Ratio	0.19	0.34		0.08	0.36		0.63	0.11		0.02	0.06	
Uniform Delay, d <sub>1</sub>	7.2	8.1		6.7	8.3		33.4	29.0		28.2	28.6	
Progression Factor	1.00	1.00		1.63	1.57		0.97	0.94		1.00	1.00	
Incremental Delay, d <sub>2</sub>	1.2	0.4		0.4	0.4		8.6	0.5		0.1	0.3	
Delay (s)	8.4	8.6		11.3	13.4		41.1	27.7		28.3	28.8	
Level of Service	A			B			D			C		
Approach Delay (s)		8.5			13.3			37.0			28.8	
Approach LOS		A			B			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			15.3			HCM Level of Service		B				
HCM Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		10.6				
Intersection Capacity Utilization			55.7%			ICU Level of Service		B				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

2032 Background  
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↕↕	↕↕		↶	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	50	500	1180	20	15	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	543	1283	22	16	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		1029				
pX, platoon unblocked						
vC, conflicting volume	1304				1674	652
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1304				1674	652
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	90				79	87
cM capacity (veh/h)	527				77	410

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	54	272	272	855	449	71
Volume Left	54	0	0	0	0	16
Volume Right	0	0	0	0	22	54
cSH	527	1700	1700	1700	1700	206
Volume to Capacity	0.10	0.16	0.16	0.50	0.26	0.34
Queue Length 95th (ft)	9	0	0	0	0	36
Control Delay (s)	12.6	0.0	0.0	0.0	0.0	31.3
Lane LOS	B					D
Approach Delay (s)	1.1			0.0		31.3
Approach LOS						D

Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization		50.5%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

2032 Background  
 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	5	10	130	5	10	130
Peak Hour Factor	0.67	0.67	0.67	0.67	0.67	0.67
Hourly flow rate (vph)	7	15	194	7	15	194
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	422	198			201	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	422	198			201	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			99	
cM capacity (veh/h)	582	843			1370	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	22	201	209			
Volume Left	7	0	15			
Volume Right	15	7	0			
cSH	734	1700	1370			
Volume to Capacity	0.03	0.12	0.01			
Queue Length 95th (ft)	2	0	1			
Control Delay (s)	10.1	0.0	0.6			
Lane LOS	B		A			
Approach Delay (s)	10.1	0.0	0.6			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			0.8			
Intersection Capacity Utilization			25.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

2032 Background  
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3432		1770	1863	1583	1770	1863	1583
Flt Permitted	0.44	1.00	1.00	0.42	1.00		0.69	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	824	1863	1583	777	3432		1292	1863	1583	1331	1863	1583
Volume (vph)	250	500	135	30	315	80	110	60	25	315	90	415
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	1.00
Adj. Flow (vph)	272	543	147	33	342	87	120	65	27	342	98	415
RTOR Reduction (vph)	0	0	63	0	22	0	0	0	19	0	0	270
Lane Group Flow (vph)	272	543	84	33	407	0	120	65	8	342	98	145
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2			6	7
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	59.0	59.0	59.0	51.0	51.0		33.0	33.0	33.0	33.0	33.0	37.0
Effective Green, g (s)	58.0	57.3	57.3	49.3	49.3		31.4	31.4	31.4	31.4	31.4	35.0
Actuated g/C Ratio	0.58	0.57	0.57	0.49	0.49		0.31	0.31	0.31	0.31	0.31	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	506	1067	907	383	1692		406	585	497	418	585	633
v/s Ratio Prot	0.02	c0.29			0.12			0.03			0.05	0.01
v/s Ratio Perm	c0.30		0.05	0.04			0.09		0.01	c0.26		0.08
v/c Ratio	0.54	0.51	0.09	0.09	0.24		0.30	0.11	0.02	0.82	0.17	0.23
Uniform Delay, d1	13.8	12.9	9.6	13.4	14.6		25.9	24.4	23.7	31.7	24.8	23.0
Progression Factor	0.41	0.45	0.09	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	1.5	0.2	0.4	0.3		1.8	0.4	0.1	16.2	0.6	0.8
Delay (s)	9.3	7.3	1.1	13.9	14.9		27.8	24.8	23.7	47.8	25.5	23.8
Level of Service	A	A	A	B	B		C	C	C	D	C	C
Approach Delay (s)		6.9			14.8			26.3			33.6	
Approach LOS		A			B			C			C	

Intersection Summary

HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.3
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

2032 Background  
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.94			0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1770	3530		1770	3520			1711			1662	
Flt Permitted	0.36	1.00		0.21	1.00			0.56			0.85	
Satd. Flow (perm)	666	3530		397	3520			987			1433	
Volume (vph)	145	1100	20	20	675	25	45	10	45	35	5	100
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1196	22	22	734	27	49	11	49	38	5	109
RTOR Reduction (vph)	0	1	0	0	2	0	0	33	0	0	98	0
Lane Group Flow (vph)	158	1217	0	22	759	0	0	76	0	0	54	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	81.6	81.6		81.6	81.6			10.4			10.4	
Effective Green, g (s)	81.6	81.6		81.6	81.6			10.4			10.4	
Actuated g/C Ratio	0.82	0.82		0.82	0.82			0.10			0.10	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	543	2880		324	2872			103			149	
v/s Ratio Prot	c0.34		0.22		0.22		c0.08		c0.08		0.04	
v/s Ratio Perm	0.24			0.06				c0.08			0.04	
v/c Ratio	0.29	0.42		0.07	0.26			0.74			0.36	
Uniform Delay, d1	2.2	2.6		1.8	2.2			43.5			41.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.86	
Incremental Delay, d2	1.4	0.5		0.4	0.2			23.7			1.4	
Delay (s)	3.6	3.0		2.2	2.4			67.2			37.4	
Level of Service	A	A		A	A			E			D	
Approach Delay (s)	3.1		2.4		2.4		67.2		67.2		37.4	
Approach LOS	A		A		A		E		E		D	
<b>Intersection Summary</b>												
HCM Average Control Delay	7.9		7.9		7.9		7.9		7.9		7.9	
HCM Volume to Capacity ratio	0.46		0.46		0.46		0.46		0.46		0.46	
Actuated Cycle Length (s)	100.0		100.0		100.0		100.0		100.0		100.0	
Intersection Capacity Utilization	54.5%		54.5%		54.5%		54.5%		54.5%		54.5%	
Analysis Period (min)	15		15		15		15		15		15	
c Critical Lane Group												

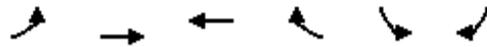
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

2032 Background  
 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00		1.00	0.89		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3428		1770	3536		1770	1664		1770	1730	
Flt Permitted	0.32	1.00		0.20	1.00		0.73	1.00		0.71	1.00	
Satd. Flow (perm)	599	3428		379	3536		1359	1664		1318	1730	
Volume (vph)	100	825	220	75	730	5	170	20	50	15	20	20
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	1.00
Adj. Flow (vph)	109	897	239	82	793	5	185	22	54	16	22	20
RTOR Reduction (vph)	0	24	0	0	0	0	0	41	0	0	15	0
Lane Group Flow (vph)	109	1112	0	82	798	0	185	36	0	16	27	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	386	2208		244	2277		340	416		330	433	
v/s Ratio Prot	c0.32			0.23			0.02			0.02		
v/s Ratio Perm	0.18			0.22			c0.14			0.01		
v/c Ratio	0.28	0.50		0.34	0.35		0.54	0.09		0.05	0.06	
Uniform Delay, d1	7.7	9.4		8.1	8.2		32.6	28.7		28.5	28.6	
Progression Factor	1.00	1.00		0.86	0.83		0.95	0.88		1.00	1.00	
Incremental Delay, d2	1.8	0.8		3.5	0.4		6.0	0.4		0.3	0.3	
Delay (s)	9.6	10.2		10.4	7.2		36.9	25.8		28.7	28.8	
Level of Service	A			B			D			C		
Approach Delay (s)	10.1			7.5			33.7			28.8		
Approach LOS	B			A			C			C		
<b>Intersection Summary</b>												
HCM Average Control Delay	12.2			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.52											
Actuated Cycle Length (s)	100.0			Sum of lost time (s)			10.6					
Intersection Capacity Utilization	63.6%			ICU Level of Service			B					
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

2032 Background  
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↷	↶↷		↶	↷
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	120	1000	615	25	35	105
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	130	1087	668	27	38	114
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		1029				
pX, platoon unblocked					0.97	
vC, conflicting volume	696				1486	348
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	696				1472	348
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				61	82
cM capacity (veh/h)	896				98	648

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	130	543	543	446	250	152
Volume Left	130	0	0	0	0	38
Volume Right	0	0	0	0	27	114
cSH	896	1700	1700	1700	1700	269
Volume to Capacity	0.15	0.32	0.32	0.26	0.15	0.56
Queue Length 95th (ft)	13	0	0	0	0	80
Control Delay (s)	9.7	0.0	0.0	0.0	0.0	34.4
Lane LOS	A					D
Approach Delay (s)	1.0			0.0		34.4
Approach LOS						D

Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization		42.9%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

2032 Total  
 AM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	11	22	130	7	9	105
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	13	26	155	8	11	125
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	305	159			163	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	305	159			163	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			99	
cM capacity (veh/h)	681	886			1416	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	39	163	136			
Volume Left	13	0	11			
Volume Right	26	8	0			
cSH	806	1700	1416			
Volume to Capacity	0.05	0.10	0.01			
Queue Length 95th (ft)	4	0	1			
Control Delay (s)	9.7	0.0	0.7			
Lane LOS	A		A			
Approach Delay (s)	9.7	0.0	0.7			
Approach LOS	A					
<b>Intersection Summary</b>						
Average Delay			1.4			
Intersection Capacity Utilization			23.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

2032 Total  
AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3317		1770	1863	1583	1770	1863	1583
Flt Permitted	0.18	1.00	1.00	0.61	1.00		0.74	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	327	1863	1583	1133	3317		1375	1863	1583	1351	1863	1583
Volume (vph)	400	223	26	21	576	415	38	45	12	55	27	210
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	242	28	23	626	451	41	49	13	60	29	228
RTOR Reduction (vph)	0	0	7	0	130	0	0	0	11	0	0	160
Lane Group Flow (vph)	435	242	21	23	947	0	41	49	2	60	29	68
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2				6
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	76.0	76.0	76.0	56.0	56.0		16.0	16.0	16.0	16.0	16.0	32.0
Effective Green, g (s)	75.0	74.3	74.3	54.3	54.3		14.4	14.4	14.4	14.4	14.4	30.0
Actuated g/C Ratio	0.75	0.74	0.74	0.54	0.54		0.14	0.14	0.14	0.14	0.14	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	462	1384	1176	615	1801		198	268	228	195	268	554
v/s Ratio Prot	c0.14	0.13			0.29			0.03				0.02
v/s Ratio Perm	c0.57		0.01	0.02			0.03		0.00	c0.04		0.02
v/c Ratio	0.94	0.17	0.02	0.04	0.53		0.21	0.18	0.01	0.31	0.11	0.12
Uniform Delay, d1	18.5	3.8	3.3	10.7	14.6		37.8	37.6	36.7	38.3	37.2	25.4
Progression Factor	1.38	0.26	0.12	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.8	0.3	0.0	0.1	1.1		2.4	1.5	0.1	4.0	0.8	0.5
Delay (s)	54.2	1.3	0.4	10.8	15.7		40.1	39.1	36.7	42.4	38.0	25.9
Level of Service	D	A	A	B	B		D	D	D	D	D	C
Approach Delay (s)		33.9			15.6			39.2			30.1	
Approach LOS		C			B			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			24.6			HCM Level of Service					C	
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		10.6				
Intersection Capacity Utilization			74.7%			ICU Level of Service					D	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

2032 Total  
 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.97			0.89	
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.99	
Satd. Flow (prot)	1770	3490		1770	3526			1757			1642	
Flt Permitted	0.19	1.00		0.41	1.00			0.62			0.96	
Satd. Flow (perm)	348	3490		755	3526			1118			1582	
Volume (vph)	87	542	55	25	1205	30	10	5	5	16	5	105
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	589	60	27	1310	33	11	5	5	17	5	114
RTOR Reduction (vph)	0	4	0	0	1	0	0	5	0	0	86	0
Lane Group Flow (vph)	95	645	0	27	1342	0	0	16	0	0	50	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	83.3	83.3		83.3	83.3			8.7			8.7	
Effective Green, g (s)	83.3	83.3		83.3	83.3			8.7			8.7	
Actuated g/C Ratio	0.83	0.83		0.83	0.83			0.09			0.09	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	290	2907		629	2937			97			138	
v/s Ratio Prot		0.18			c0.38							
v/s Ratio Perm	0.27			0.04				0.01			c0.03	
v/c Ratio	0.33	0.22		0.04	0.46			0.17			0.36	
Uniform Delay, d1	1.9	1.7		1.4	2.3			42.3			43.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.88	
Incremental Delay, d2	3.0	0.2		0.1	0.5			0.8			1.6	
Delay (s)	4.9	1.9		1.6	2.8			43.1			39.5	
Level of Service	A	A		A	A			D			D	
Approach Delay (s)		2.3			2.7			43.1			39.5	
Approach LOS		A			A			D			D	
<b>Intersection Summary</b>												
HCM Average Control Delay			5.2	HCM Level of Service				A				
HCM Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			100.0	Sum of lost time (s)				8.0				
Intersection Capacity Utilization			56.8%	ICU Level of Service				B				
Analysis Period (min)			15									
c Critical Lane Group												

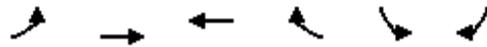
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

2032 Total  
 AM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.90		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3456		1770	3536		1770	1679		1770	1669	
Flt Permitted	0.31	1.00		0.33	1.00		0.72	1.00		0.69	1.00	
Satd. Flow (perm)	572	3456		611	3536		1347	1679		1294	1669	
Volume (vph)	65	606	113	31	763	5	203	30	58	5	15	33
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	659	123	34	829	5	221	33	63	5	16	36
RTOR Reduction (vph)	0	15	0	0	0	0	0	47	0	0	27	0
Lane Group Flow (vph)	71	767	0	34	834	0	221	49	0	5	25	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	368	2226		393	2277		337	420		324	417	
v/s Ratio Prot		0.22			c0.24			0.03			0.01	
v/s Ratio Perm	0.12			0.06			c0.16			0.00		
v/c Ratio	0.19	0.34		0.09	0.37		0.66	0.12		0.02	0.06	
Uniform Delay, d1	7.2	8.1		6.7	8.3		33.6	29.0		28.2	28.6	
Progression Factor	1.00	1.00		1.61	1.56		0.97	0.94		1.00	1.00	
Incremental Delay, d2	1.2	0.4		0.4	0.4		9.5	0.6		0.1	0.3	
Delay (s)	8.4	8.6		11.2	13.3		42.2	27.7		28.3	28.8	
Level of Service	A			B			D			C		
Approach Delay (s)		8.6			13.3			37.8			28.8	
Approach LOS		A			B			D			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			15.5			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				10.6		
Intersection Capacity Utilization			56.3%			ICU Level of Service				B		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

2032 Total  
 AM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↕↕	↕↶		↶	
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	52	501	1180	20	16	55
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	545	1283	22	17	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		1029				
pX, platoon unblocked						
vC, conflicting volume	1304				1679	652
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1304				1679	652
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	89				77	85
cM capacity (veh/h)	527				77	410

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	57	272	272	855	449	77
Volume Left	57	0	0	0	0	17
Volume Right	0	0	0	0	22	60
cSH	527	1700	1700	1700	1700	207
Volume to Capacity	0.11	0.16	0.16	0.50	0.26	0.37
Queue Length 95th (ft)	9	0	0	0	0	41
Control Delay (s)	12.7	0.0	0.0	0.0	0.0	32.4
Lane LOS	B					D
Approach Delay (s)	1.2			0.0		32.4
Approach LOS						D

Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utilization		50.9%		ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 5: Kewanee Drive & Manhattan Drive

2032 Total  
 PM Peak



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	10	19	130	12	25	130
Peak Hour Factor	0.67	0.67	0.67	0.67	0.67	0.67
Hourly flow rate (vph)	15	28	194	18	37	194
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	472	203			212	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	472	203			212	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	97			97	
cM capacity (veh/h)	536	838			1358	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>			
Volume Total	43	212	231			
Volume Left	15	0	37			
Volume Right	28	18	0			
cSH	701	1700	1358			
Volume to Capacity	0.06	0.12	0.03			
Queue Length 95th (ft)	5	0	2			
Control Delay (s)	10.5	0.0	1.4			
Lane LOS	B		A			
Approach Delay (s)	10.5	0.0	1.4			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			1.6			
Intersection Capacity Utilization			29.1%	ICU Level of Service		A
Analysis Period (min)	15					

HCM Signalized Intersection Capacity Analysis  
6: Baseline Road & 55th Street

2032 Total  
PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.7	5.7	5.7	5.7		5.6	5.6	5.6	5.6	5.6	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	3433		1770	1863	1583	1770	1863	1583
Flt Permitted	0.44	1.00	1.00	0.41	1.00		0.69	1.00	1.00	0.71	1.00	1.00
Satd. Flow (perm)	818	1863	1583	771	3433		1285	1863	1583	1325	1863	1583
Volume (vph)	250	503	139	32	319	80	113	64	26	315	96	415
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	1.00
Adj. Flow (vph)	272	547	151	35	347	87	123	70	28	342	104	415
RTOR Reduction (vph)	0	0	64	0	22	0	0	0	19	0	0	270
Lane Group Flow (vph)	272	547	87	35	412	0	123	70	9	342	104	145
Turn Type	pm+pt		Perm	Perm			Perm		Perm	Perm		pm+ov
Protected Phases	7	4			8			2				6
Permitted Phases	4		4	8			2		2	6		6
Actuated Green, G (s)	59.0	59.0	59.0	51.0	51.0		33.0	33.0	33.0	33.0	33.0	37.0
Effective Green, g (s)	58.0	57.3	57.3	49.3	49.3		31.4	31.4	31.4	31.4	31.4	35.0
Actuated g/C Ratio	0.58	0.57	0.57	0.49	0.49		0.31	0.31	0.31	0.31	0.31	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	503	1067	907	380	1692		403	585	497	416	585	633
v/s Ratio Prot	0.02	c0.29			0.12			0.04			0.06	0.01
v/s Ratio Perm	c0.30		0.05	0.05			0.10		0.01	c0.26		0.08
v/c Ratio	0.54	0.51	0.10	0.09	0.24		0.31	0.12	0.02	0.82	0.18	0.23
Uniform Delay, d1	13.9	12.9	9.6	13.5	14.6		26.0	24.4	23.7	31.7	24.9	23.0
Progression Factor	0.41	0.45	0.09	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.7	1.6	0.2	0.5	0.3		1.9	0.4	0.1	16.6	0.7	0.8
Delay (s)	9.4	7.4	1.1	13.9	14.9		28.0	24.9	23.7	48.3	25.6	23.8
Level of Service	A	A	A	B	B		C	C	C	D	C	C
Approach Delay (s)		7.0			14.9			26.5			33.7	
Approach LOS		A			B			C			C	
<b>Intersection Summary</b>												
HCM Average Control Delay			19.3			HCM Level of Service				B		
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			11.3			
Intersection Capacity Utilization			68.1%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 9: South Boulder Road & Manhattan Drive

2032 Total  
 PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.94			0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1770	3530		1770	3520			1711			1661	
Flt Permitted	0.36	1.00		0.21	1.00			0.55			0.85	
Satd. Flow (perm)	662	3530		394	3520			966			1433	
Volume (vph)	151	1106	20	20	679	26	45	10	45	36	5	104
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	164	1202	22	22	738	28	49	11	49	39	5	113
RTOR Reduction (vph)	0	1	0	0	2	0	0	33	0	0	101	0
Lane Group Flow (vph)	164	1223	0	22	764	0	0	76	0	0	56	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	81.5	81.5		81.5	81.5			10.5			10.5	
Effective Green, g (s)	81.5	81.5		81.5	81.5			10.5			10.5	
Actuated g/C Ratio	0.82	0.82		0.82	0.82			0.10			0.10	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	540	2877		321	2869			101			150	
v/s Ratio Prot	c0.35		0.22		0.22		c0.08		c0.08		0.04	
v/s Ratio Perm	0.25			0.06				c0.08			0.04	
v/c Ratio	0.30	0.43		0.07	0.27			0.75			0.37	
Uniform Delay, d1	2.3	2.6		1.8	2.2			43.5			41.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.84	
Incremental Delay, d2	1.4	0.5		0.4	0.2			26.5			1.4	
Delay (s)	3.7	3.1		2.2	2.4			70.0			36.6	
Level of Service	A	A		A	A			E			D	
Approach Delay (s)	3.2		2.4		2.4		70.0		70.0		36.6	
Approach LOS	A		A		A		E		E		D	
<b>Intersection Summary</b>												
HCM Average Control Delay	8.1		HCM Level of Service		A							
HCM Volume to Capacity ratio	0.46											
Actuated Cycle Length (s)	100.0		Sum of lost time (s)		8.0							
Intersection Capacity Utilization	54.7%		ICU Level of Service		A							
Analysis Period (min)	15											
c Critical Lane Group												

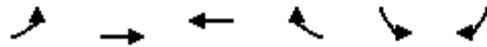
HCM Signalized Intersection Capacity Analysis  
 11: Baseline Road & Manhattan Drive

2032 Total  
 PM Peak

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.6	5.6		5.6	5.6		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00		1.00	0.89		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3424		1770	3536		1770	1660		1770	1730	
Flt Permitted	0.32	1.00		0.20	1.00		0.73	1.00		0.70	1.00	
Satd. Flow (perm)	596	3424		370	3536		1359	1660		1313	1730	
Volume (vph)	100	829	231	79	733	5	176	20	53	15	20	20
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	1.00
Adj. Flow (vph)	109	901	251	86	797	5	191	22	58	16	22	20
RTOR Reduction (vph)	0	25	0	0	0	0	0	44	0	0	15	0
Lane Group Flow (vph)	109	1127	0	86	802	0	191	37	0	16	27	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		8		2		2		6	
Actuated Green, G (s)	66.0	66.0		66.0	66.0		26.0	26.0		26.0	26.0	
Effective Green, g (s)	64.4	64.4		64.4	64.4		25.0	25.0		25.0	25.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64		0.25	0.25		0.25	0.25	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	384	2205		238	2277		340	415		328	433	
v/s Ratio Prot	c0.33				0.23		0.02				0.02	
v/s Ratio Perm	0.18		0.23				c0.14		0.01			
v/c Ratio	0.28	0.51		0.36	0.35		0.56	0.09		0.05	0.06	
Uniform Delay, d1	7.8	9.4		8.3	8.2		32.7	28.8		28.5	28.6	
Progression Factor	1.00	1.00		0.89	0.84		0.95	0.89		1.00	1.00	
Incremental Delay, d2	1.8	0.8		4.0	0.4		6.5	0.4		0.3	0.3	
Delay (s)	9.6	10.3		11.3	7.3		37.6	25.9		28.8	28.8	
Level of Service	A	B		B	A		D	C		C	C	
Approach Delay (s)	10.2				7.7		34.1				28.8	
Approach LOS	B				A		C				C	
<b>Intersection Summary</b>												
HCM Average Control Delay			12.4		HCM Level of Service						B	
HCM Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			100.0		Sum of lost time (s)						10.6	
Intersection Capacity Utilization			64.6%		ICU Level of Service						C	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis  
 19: South Boulder Road & 55th Street

2032 Total  
 PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↕↕	↕↶		↶	↷
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	126	1001	616	26	36	109
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	137	1088	670	28	39	118
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)		1029				
pX, platoon unblocked					0.97	
vC, conflicting volume	698				1502	349
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	698				1487	349
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	85				59	82
cM capacity (veh/h)	894				95	647

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	137	544	544	446	251	158
Volume Left	137	0	0	0	0	39
Volume Right	0	0	0	0	28	118
cSH	894	1700	1700	1700	1700	264
Volume to Capacity	0.15	0.32	0.32	0.26	0.15	0.60
Queue Length 95th (ft)	13	0	0	0	0	88
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	36.9
Lane LOS	A					E
Approach Delay (s)	1.1			0.0		36.9
Approach LOS						E

Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization		43.5%		ICU Level of Service		A
Analysis Period (min)			15			