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SH 7 Cherryvale Road to 75<sup>th</sup> Street Environmental Assessment Information  
 Level of Service Definitions  
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## 6400 ARAPAHOE TRAFFIC ACCESS STUDY

### 1.0 Introduction

The Fox Higgins Transportation Group, LLC has completed a traffic access study, per City of Boulder requirements, for the proposed waste reduction facility located at 6400 Arapahoe Road. The project is proposing to relocate Eco-Cycle offices, the Center for Hard to Recycle Materials (CHARM), and the ReSource building materials recycling yard to a new, combined facility on the south side of Arapahoe Road just east of 63<sup>rd</sup> Street.

This analysis has evaluated existing traffic operations in the area and projected site-access impacts for the existing, Year 2015, and Year 2030 planning horizons. The study has also incorporated the planned CDOT improvements in the vicinity along Arapahoe Road, and reviewed a traffic accident history in the area. A transportation demand management (TDM) plan for the site has also been prepared. This report summarizes our analysis, findings, and recommendations.

City staff has indicated that the study area for this analysis includes Arapahoe Road and the intersections at 63<sup>rd</sup> Street and the site driveway. Analysis periods include the AM and PM weekday peak hours at both intersections and the Saturday afternoon peak hour at the site access driveway.

### 2.0 Proposed Development and Site Access

The proposed waste reduction facility is to be located on a 9.5 acre parcel of land that is zoned for Performance Industrial (PI) uses. The parcel will be annexed into the City of Boulder and rezoned General Industrial (IG). The site is located just west of the Boulder Valley School District (BVSD) administrative campus and north of the Sombrero Marsh. The site vicinity is illustrated on Figure 1. This site was previously occupied by a building materials store and yard, and is served by a single driveway onto Arapahoe Road.

The existing site driveway is not aligned with any driveway on the north side of Arapahoe Road. A driveway serving the north side of Arapahoe is located 210 feet to the west. Driveways that align and serve both sides of Arapahoe are located 340 feet to the east.

#### Phased Development:

Site improvements at the waste reduction facility will be completed in phases. Phase I will include the Eco-Cycle, CHARM and ReSource uses operating on approximately 7.5 acres of the site, using the existing buildings and two

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reconstructed warehouses. Automobile access will continue to be provided by the existing driveway onto Arapahoe Road.

Phase II will include the same three uses on the same land area, with an additional building constructed to provide more space and improved operations. An illustrative site plan for Phase II is included on Figure 2. Phase II will include relocating the site driveway approximately fifty feet to the east to better align with Phase II internal operations. The relocated driveway will include separate northbound left-turn and right-turn lanes. Phase II will leave a vacant two acre parcel on the eastern half of the property that will accommodate potential additional waste reduction uses in the future.

Phase III site development anticipates that additional waste reduction uses have been added to the two acre parcel described above. While the specific users of this parcel are not known at this time, it has been assumed that Phase III represents an approximate 30% increase in site use and access traffic.

Potential future secondary access to 63<sup>rd</sup> Street via the BVSD driveway:

It is projected that the site will be able to function with the single site driveway onto Arapahoe Road. However, it is the goal of the City of Boulder to secure a secondary access at the rear of the site onto an existing driveway serving the BVSD site. This BVSD driveway extends to the west, across the rear of the 6400 parcel and connects to the 63<sup>rd</sup> Street alignment south of Arapahoe Road. This BVSD driveway currently provides access to the traffic signal at 63<sup>rd</sup> / Arapahoe for school buses that exit the BVSD site and head west on Arapahoe Road. The traffic signal helps the buses turn left out onto Arapahoe Road. This BVSD driveway also provides access to the Thorne Ecological Center on the edge of the Sombrero Marsh.

City of Boulder staff is currently working with BVSD staff to explore the potential to allow 6400 site traffic to utilize this BVSD drive as a secondary access. This secondary access could:

- provide a secondary emergency access route
- allow 6400 site truck traffic outbound access to the traffic signal at 63<sup>rd</sup> Street
- provide a secondary outbound access point for site users during periods of peak congestion at the main driveway on Arapahoe.

Since this process is on-going and it is not known what future access may be allowed at the rear of the parcel (if any), this study has assumed that all site access traffic uses the main driveway onto Arapahoe Road in all phases.

Finally, it should be noted that residents of the existing mobile home park on the west side of 63<sup>rd</sup> Street and south of Arapahoe Road have expressed concern about additional traffic from the 6400 site that may use the BVSD drive/63<sup>rd</sup> Street connection given the close proximity of the roadway to their homes.

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### 3.0 Existing Roadways and Proposed Expansion to Arapahoe Road (SH 7)

Arapahoe Road is an east-west arterial roadway linking the City of Boulder with Lafayette, Erie, and other land to the east. This section of Arapahoe Road is also part of Colorado State Highway 7, and is classified by CDOT as a Non-Rural Regional Highway (NR-A). In the vicinity of the 6400 site, Arapahoe Road has a single travel lane in each direction and paved shoulders ranging in width from 2 to 8 feet. There are no turn lanes at the driveways in the area, and vehicles turning into driveways currently cause backups for through traffic along Arapahoe Road.

Traffic signals exist at 63<sup>rd</sup> Street, 750 feet to the west, and at the main BVSD driveway, 900 feet to the east. These signals do create gaps in the through vehicle traffic flow along Arapahoe Road. CDOT would not allow any additional traffic signals in this stretch of Arapahoe Road.

Bike lanes exist on Arapahoe Road west of 63<sup>rd</sup> Street.

#### Arapahoe Road widening:

CDOT has developed plans to widen Arapahoe Road to provide enhanced capacity, safety, operations, and multi-modal facilities between Cherryvale Road and 75<sup>th</sup> Street. An Environmental Assessment (EA) for this project was completed in 2008 which identified the preferred improvements to this corridor. In the vicinity of the 6400 site, this project will include a continuous two-way center turn lane, an additional travel lane in each direction which will be limited to buses and right turns only, on-street bike lanes, an attached sidewalk on the south side and a multi-use path on the north side. The project will also add lanes to the northbound and southbound approaches to the 63<sup>rd</sup> Street intersection. Illustrative graphics from the EA are included in the Appendix for reference.

CDOT has indicated that this widening project will be constructed during Years 2011 and 2012. City of Boulder staff held a meeting with CDOT staff to discuss the 6400 site access driveway relative to the CDOT widening project. CDOT indicated that no additional turn lanes will be required to serve the site driveway other than those that are already planned in the widening project. When the project is complete, the 6400 driveway will be served by a continuous left turn lane in the center of Arapahoe Road, and right turns into the site will be allowed to use the new outside eastbound bus/turn lane.

Finally, CDOT staff also indicated that they had no objection to the proposed relocation of the site driveway in Phase II. However, the City should anticipate the need to procure a new access permit for the site driveway with the addition of Phase III development.

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## 4.0 Existing Traffic Volume and Operations

Existing traffic volumes from the CDOT EA have been updated based on more recent traffic data in the Arapahoe corridor. The existing traffic volumes in the study area are illustrated on Figure 3. There are no traffic volumes accessing the 6400 site on this Figure because until recently the site was vacant.

Existing traffic operations were evaluated at the Arapahoe/63<sup>rd</sup> intersection using this existing count information and analysis procedures documented in the Highway Capacity Manual<sup>1</sup>. Traffic operations are described using a level of service (LOS) scale that assigns a letter grade (A through F) based on the calculated average delay per vehicle on each approach to the intersection during the peak hour analyzed. LOS A represents minimal delay to the average motorist and LOS F represents congested conditions and significant delay. A more detailed description of LOS letter grades, traffic conditions, and the associated vehicular delay is contained in the appendix.

For this analysis, the existing traffic signal cycle lengths (100 seconds in the AM and 120 seconds in the PM) and phasing have been used. Existing weekday peak hour traffic operations are summarized in Table 1. It can be seen that this intersection currently operates at LOS D overall in the AM peak hour and LOS C in the PM peak hour. Individual approach movements that currently operate at LOS E include the westbound through-right movement in the AM and the southbound left-through movement in the PM (detailed LOS calculation sheets are included in the Appendix). The CDOT widening project will provide additional capacity for both of these approaches in the near future.

## 5.0 Vehicle Trip Generation

The proposed waste reduction uses at 6400 Arapahoe do not lend themselves to standard Institute of Transportation Engineers (ITE) trip generation rates. Therefore, a set of detailed conversations were held with staff from each of three site users to enable an estimate of future site trip making. The trip generation patterns of employees, visitors, customers, drop-off patrons, and trucks accessing the site were all estimated for weekday and weekend operations. This analysis also included an estimate of increased activity that may occur at the new site (relative to the use at existing facilities). The results are detailed in Table 2. It can be seen that the Phase I/II operation is anticipated to generate approximately 1,060 vehicle trips per day on a typical weekday. Hourly trip estimates were also made for the weekday AM and PM roadway peak hours, the weekday peak hour of site use, and the Saturday peak hour of site use. It should be noted that the highest hourly traffic accessing the site will likely occur on Saturday or mid-day on a weekday when the adjacent traffic on Arapahoe is not at its peak.

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<sup>1</sup> Highway Capacity Manual, Transportation Research Board, Third Edition, 2000

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If/when the additional 2.1 acres are occupied by waste reduction uses, it is estimated that Phase III traffic will be approximately 30% higher than Phase I/II traffic (see Table 2).

Given the nature of the site uses, and to be conservative at this point, no alternative mode trip reductions were estimated, although some of the site employees may chose to commute to work using an alternative mode to the automobile.

## 6.0 Distribution and Assignment of Site Access Traffic

Directional trip distribution estimates are used to assign the new site traffic to the existing roadway network. The estimated site trips presented in Table 2 were distributed onto the adjacent street network based on existing and future land use, traffic patterns in the area, and the location of this site relative to the population in Boulder and surrounding communities. Assumed site distribution percentages are shown on Figure 6. These distribution assumptions project that the majority of traffic (80%) will be to/from the City of Boulder (which is largely to the west of the site), but the site will also serve some traffic from County residents arriving to/from the east on Arapahoe. This estimated trip distribution pattern may prove to be conservative from a traffic operations perspective if a higher percentage of traffic accesses the site to/from the east on Arapahoe. The left-in/right-out movements will be easier to make than the access to/from Boulder to the west.

The estimated site trips were assigned to the study area intersections along Arapahoe using the trip distribution assumptions. The Phase I/II weekday AM and PM peak hour access volumes are shown on Figure 7. This figure also includes an estimate of peak weekend traffic at the site driveway. Projected Phase III traffic is illustrated on Figure 8.

## 7.0 Existing Plus Site Generated (Phase I/II) Traffic Operations

The exact schedule for site development and the reconstruction of Arapahoe Road by CDOT are not known. If CDOT construction does occur in Years 2011 and 2012, it is likely that the improvements will be in place before (or concurrent with) the full development of Phase I/II. In this scenario there would be no need to analyze Phase I/II traffic with the existing roadway configuration along Arapahoe Road. However, if CDOT construction is delayed and site development continues, there could be a short period of time when new site traffic will need to access the existing roadway. Therefore, the “existing plus site-generated traffic” has been analyzed, but it is anticipated that this scenario may never occur.

The projected site generated Phase I/II traffic volumes have been added to the existing traffic in the study area as illustrated on Figure 9. This traffic has been

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analyzed using the same LOS evaluation procedures described above. The results of this analysis are summarized in Table 1. It can be seen that the site traffic will have very little impact on the operation of the 63<sup>rd</sup> Street traffic signal, and there will be no reduction in LOS letter grades on any of the intersection approaches.

At the site access driveway there will be little delay for vehicles entering the site. However, traffic exiting the site onto the existing roadway configuration will experience significant delay in the PM peak hour. While we believe the calculated outbound delay to be conservatively high (based on actual experience and observations compared to calculated delays at stop sign controlled side street approaches), there will be congestion for traffic that does exit the site during the weekday PM peak hour. On Saturdays, the traffic will be able to exit the site much more efficiently with an outbound LOS of E when the background traffic on Arapahoe Road is lower than during the weekday peak hours.

## 8.0 Background Traffic Growth and Operation for Years 2015 and 2030

It is necessary to project the increase in background traffic on Arapahoe Road for the Year 2015 and 2030 planning horizons to allow an analysis of traffic with and without the 6400 site in the future. It is projected that the background traffic will increase by 20% between now and the Year 2030. This estimate is based on the following:

- traffic growth rate information for this corridor developed in the CDOT EA
- historic traffic growth in this area (CDOT and City sources)
- the City's regional travel model (a comparison of base year and future year projections)
- traffic count information for the past 10 years on Arapahoe compiled for another site to the west.

Year 2030 background traffic volumes are illustrated on Figure 5. The Year 2015 background traffic projections have been interpolated between the existing and Year 2030 projections. They are illustrated on Figure 4.

The operation of the Arapahoe/63<sup>rd</sup> intersection has been evaluated with these background traffic growth estimates, without the addition of the 6400 site traffic. For this analysis it has been assumed that the CDOT widening project is complete. The results are summarized in Table 1.

In the Year 2015 it is projected that the intersection will operate at LOS C during both the AM and PM peak hours on a weekday. All approach movements will operate at LOS D or better except the southbound left turn during the PM peak which will operate at LOS E.

In the Year 2030 it is projected that the intersection will operate at LOS D overall during both the AM and PM peak hours on a weekday. The heavy westbound through movement in the AM and the eastbound through movement in the PM are

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projected to operate at LOS E. The southbound left turn will operate in the E (AM) or F (PM) range since most of the cycle length will need to be devoted to the heavy east-west traffic flow.

## 9.0 Year 2015 Plus Site Generated Traffic Operations

Study area intersections have been evaluated in the Year 2015 with the addition of the 6400 site Phase I/II traffic. This projected traffic is illustrated on Figure 10 and the LOS results are summarized in Table 1.

At the 63<sup>rd</sup> Street intersection, the addition of the site traffic did not change the overall LOS in either the weekday AM or PM peak hours, and only marginally increased the delay on individual approaches. The intersection will continue to operate comfortably at LOS C in both peaks.

At the site driveway, the outbound traffic will operate at LOS C in the weekday AM peak hour and LOS E (D/E borderline) in the PM peak hour. This is typical and acceptable delay for a side street approach to an arterial roadway with stop sign control. On Saturday afternoon, the outbound traffic accessing Arapahoe Road will operate at LOS C.

## 10.0 Year 2030 Plus Site Generated Traffic Operations

Study area intersections have also been evaluated in the Year 2030 with the addition of the 6400 site Phase III traffic. This projected traffic is illustrated on Figure 11 and the LOS results are summarized in Table 1.

At the 63<sup>rd</sup> Street intersection, the addition of the site traffic did not change the overall LOS (relative to the 2030 background condition) in either the weekday AM or PM peak hours, and only marginally increased the delay on individual approaches. The intersection will continue to operate acceptably at LOS D in both peaks, although, as discussed above under the 2030 Background traffic analysis, there will be LOS E or F operations on some of the heavier approaches.

At the site driveway, the outbound traffic will operate at LOS C in the weekday AM peak hour and LOS E/F borderline in the PM peak hour. Side street approach delays of this magnitude are not unusual, as exiting motorists will wait an average of approximately one minute to access Arapahoe Road. It is also possible that some of the site users, particularly ReSource customers who are not tied to peak hour travel, may adjust their access schedule to avoid the PM peak period. This will help mitigate this outbound delay in the PM peak hour.

On Saturday afternoon, the outbound traffic accessing Arapahoe Road will operate comfortably at LOS C.

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## 11.0 Bicycle, Pedestrian and Transit Access

As noted above, the planned CDOT improvements in the Arapahoe Road corridor will greatly improve the bicycle, pedestrian, and transit access facilities in the area that serve the 6400 site. Bike lanes on Arapahoe Road and a multi-use path along the north side of the road will provide choices for anyone accessing the site on a bicycle.

The multi-use path and the new sidewalk on the south side of Arapahoe will provide improved pedestrian access in the area along Arapahoe. These facilities will serve the site and will also connect the site with nearby transit stops.

Transit bus efficiency and access along Arapahoe Road (the JUMP corridor) will be enhanced by the continuous bus/right turn lanes along the outside of Arapahoe Road.

Within the site there will be a series of defined pedestrian corridors or walkways (specialty pavement or painted pathways on the pavement) installed to organize and facilitate the most pronounced pedestrian movements. This will help minimize the interaction between pedestrians and vehicle traffic (including trucks) that must circulate through the site. It is also our understanding that any school groups that visit the site will be closely monitored and accompanied by adult supervision.

## 12.0 Transportation Demand Management Plan

Working with City TDM staff, a TDM Plan has been developed for the 6400 Arapahoe project to help minimize automobile trips accessing the site. The plan includes both physical facilities and programmatic measures as follows:

- Provide EcoPasses for all employees of the site to encourage access by transit (approximately 35 employees anticipated)
- Provide an informational kiosk or bulletin board to distribute information about transit and other alternative modes and also include in new employee orientation
- Assign at least one employee transportation coordinator (ETC) for the site, and possibly two with one for EcoCycle /Charm and one for Resource
- Provide information and encourage employee participation in the DRCOG iCarpool program
- Provide preferential parking for carpools and vanpools
- Provide showers and changing facilities for employees who bike to work (completed as part of Phase I)
- Provide short term (outside) bike parking. There will also be the ability for employees to access covered or indoor bike parking as needed.

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- Providing a separate sidewalk entrance into the site from the Arapahoe sidewalk to allow pedestrians and bicyclists to enter the site without conflicting with traffic at the main driveway
  - Finally, the site will have staggered arrival and departure times for employees and trucks and site visitors that will have the effect of distributing access traffic, much of which will be outside of the typical peak traffic hours along Arapahoe.

### **13.0 Traffic Accident Review After ReSource Moved to the Site**

As noted above, the 6400 Arapahoe site historically was used as a building supply store and yard, but it had sat vacant for a number of years. ReSource relocated its operation to the site at the end of 2009 and has been open to the public for just over a year. City staff has requested a review of the traffic accident history (if any) at the site driveway on Arapahoe during the past 12 months to see if there are any operational or safety issues that may need to be addressed prior to CDOT completing the widening project in front of the site.

ReSource staff has indicated that they are not aware of any accidents at the driveway since they have been using the site.

The Colorado State Patrol provided accident reports for all of the accidents in the past year that occurred in the one mile long segment of Arapahoe between the two mile posts that bracket the 6400 site. There were 30 accidents reported in this section of Arapahoe, but none of them directly involved a vehicle accessing the 6400 site driveway. In fact, there were no accidents reported that directly involved vehicles accessing any of the site driveways in this area. The vast majority of accidents were “rear-end” collisions related to the congested flow of traffic along Arapahoe.

### **14.0 Summary and Conclusions**

This traffic access study for the proposed 6400 Arapahoe facility has documented and evaluated existing traffic conditions, conservatively projected future traffic increases generated by the project, projected future traffic conditions, and evaluated operational issues. This study has also incorporated the planned CDOT widening project on Arapahoe Road and reviewed a recent traffic accident history in the area. Finally, this study has reviewed the future site access improvements for bicycles, pedestrians and transit users, and has prepared a TDM Plan for the project.

Significant findings and conclusions include:

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- It is projected that the peak traffic access to the site will occur on Saturday afternoons when the background traffic on Arapahoe is significantly lower than during weekday peak hours.
  - There have been no traffic accidents at the site driveway onto Arapahoe since ReSource has been operating at the site.
  - Phase I/II site development will generate approximately 30 vehicle trips in the AM peak hour and 80 trips in the PM peak hour on weekdays. This traffic will increase by approximately 30% with the development of Phase III.
  - Currently the Arapahoe/63<sup>rd</sup> intersection operates at LOS D in the AM and LOS C in the PM peak hours on weekdays.
  - CDOT is planning a widening project along Arapahoe Road in the vicinity. It will include a center turn lane, outside bus/right-turn lanes in each direction, bike lanes, a multi-use path and sidewalks. CDOT has indicated that construction is planned for Years 2011 and 2012.
  - The Arapahoe widening project will significantly improve the traffic flow along the corridor and at the site access driveway.
  - If Phase I/II site development is in place before the CDOT widening project is completed, there will be significant congestion for traffic exiting the site onto Arapahoe Road during the PM peak hour on weekdays. Outbound traffic would operate acceptably (LOS D/E) on Saturdays when traffic on Arapahoe is lower.
  - In the Year 2015, with CDOT widening completed, the Phase I/II traffic exiting the site will operate well at LOS C in the AM peak hour and LOS D/E in the PM peak hour.
  - It is projected that traffic in the Arapahoe corridor will increase 20% by the Year 2030.
  - In the Year 2030, with Phase III site development completed, traffic exiting the site will operate at LOS C in the AM peak hour and LOS E/F in the PM peak hour. This level of PM peak hour delay is common where side streets with stop sign control intersect major arterial roadways.
  - CDOT will not allow any additional traffic signals to be constructed in this area on Arapahoe (between 63<sup>rd</sup> Street and the BVSD Access signal).
  - With the CDOT widening in place, it is projected that the site will be able to function with the single access driveway on Arapahoe.
  - The City of Boulder is currently discussing options with the BVSD for creating a secondary “back door” access onto the BVSD driveway that connects to the 63<sup>rd</sup> Street alignment. That said however, this analysis has assumed that all traffic utilizes the site driveway onto Arapahoe Road.
  - The proposed TDM Plan will help minimize automobile traffic accessing the site (particularly by employees).

6400 Arapahoe Traffic Access Study



Table 1 - Intersection Level of Service Summary

Intersection and Critical Movements	Existing				Existing + Site Weekday <sup>(1)</sup>				Exist.+Site Sat. <sup>(1)</sup>		2015 Background Weekday				2015 + Site Weekday				2015+Site Sat.		2030 Background				2030 + Site Weekday				2030+Site Sat.					
	AM Peak		PM Peak		AM Peak		PM Peak		Afternoon PK		AM Peak		PM Peak		AM Peak		PM Peak		Afternoon PK		AM Peak		PM Peak		AM Peak		PM Peak		Afternoon PK					
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS				
<b>STOP SIGN CONTROL</b>																																		
<b>Arapahoe / Site Access Drive</b>					<b>0.2</b>	<b>A</b>	<b>12.4</b>	<b>B</b>	<b>3.7</b>	<b>A</b>					<b>0.0</b>	<b>A</b>	<b>0.9</b>	<b>A</b>	<b>1.5</b>	<b>A</b>									<b>0.1</b>	<b>A</b>	<b>1.7</b>	<b>A</b>	<b>2.1</b>	<b>A</b>
Eastbound Left-Through-Right					0.0	A	0.0	A	0.0	A																								
Westbound Left-Through-Right					0.3	A	0.5	A	0.7	A																								
Eastbound Right															0.0	A	0.0	A	0.0	A									0.0	A	0.0	A	0.0	A
Westbound Left															9.2	A	14.1	B	9.2	A									9.6	A	16.2	C	9.7	A
Northbound Approach					37.1	E	475.3	F	38.4	E					17.8	C	37.6	E	16.2	C									20.3	C	61.0	F	19.7	C
<b>SIGNAL CONTROL</b>																																		
<b>Arapahoe / 63<sup>rd</sup> Street</b>	<b>41.4</b>	<b>D</b>	<b>27.7</b>	<b>C</b>	<b>41.3</b>	<b>D</b>	<b>29.0</b>	<b>C</b>			<b>31.2</b>	<b>C</b>	<b>32.7</b>	<b>C</b>	<b>31.2</b>	<b>C</b>	<b>34.3</b>	<b>C</b>					<b>45.5</b>	<b>D</b>	<b>52.3</b>	<b>D</b>	<b>45.3</b>	<b>D</b>	<b>53.4</b>	<b>D</b>				
Eastbound Left	36.4	D	11.2	B	36.4	D	13.6	B			31.3	C	11.8	B	31.3	C	13.8	B					41.1	D	15.7	B	41.1	D	19.5	B				
Eastbound Through-Right	5.9	A	33.1	C	6.1	A	34.7	C																										
Eastbound Through											4.1	A	41.2	D	4.2	A	44.3	D					4.6	A	74.8	E	4.7	A	75.0	E				
Eastbound Right											2.1	A	2.7	A	2.1	A	2.7	A					2.1	A	2.2	A	2.1	A	2.0	A				
Westbound Left	6.0	A	8.9	A	6.0	A	9.0	A			5.3	A	10.5	B	5.3	A	10.5	B					4.4	A	9.4	A	4.4	A	9.4	A				
Westbound Through-Right	59.3	E	14.8	B	59.6	E	16.4	B																										
Westbound Through											44.4	D	17.7	B	44.6	D	19.1	B					69.0	E	18.6	B	69.3	E	21.1	C				
Westbound Right											5.6	A	7.9	A	5.6	A	7.9	A					4.7	A	6.8	A	4.7	A	6.9	A				
Northbound Left-Through-Right	36.1	D	44.9	D	36.1	D	45.3	D																										
Northbound Left											41.5	D	45.5	D	41.5	D	45.5	D					42.1	D	48.5	D	42.1	D	49.5	D				
Northbound Through-Right											39.3	D	45.0	D	39.3	D	45.0	D					39.3	D	47.7	D	39.3	D	48.6	D				
Southbound Left-Through	41.2	D	56.2	E	41.6	D	57.7	E																										
Southbound Left											54.2	D	60.0	E	55.1	E	60.6	E					58.1	E	84.9	F	59.7	E	100.3	F				
Southbound Through											0.0	A	0.0	A	0.0	A	0.0	A					0.0	A	0.0	A	0.0	A	0.0	A				
Southbound Right	35.3	D	44.8	D	35.3	D	45.2	D			39.9	D	45.8	D	39.9	D	44.7	D					39.9	D	48.7	D	39.9	D	49.6	D				

(a) Delay represented in average seconds per vehicle.  
 Stop Sign Control Delay LOS Criteria: LOS A = 0-10, LOS B = 10.1-15, LOS C = 15.1-25, LOS D = 25.1-35, LOS E = 35.1-50, LOS F > 50.1;  
 Signal Control Delay LOS Criteria: LOS A = 0-10, LOS B = 10.1-20, LOS C = 20.1-35, LOS D = 35.1-55, LOS E = 55.1-80, LOS F > 80.1.

(1) This "Existing + Site" scenario only applies if CDOT delays construction of improvements to Arapahoe. They currently anticipate construction during 2011 and 2012.

Table 2

6400 Arapahoe - Phase I/II & III Trip Generation Estimates



Site User and Use Type:	Daily Trips			Weekday AM Peak Hour Trips			Weekday PM Peak Hour Trips			Weekday Peak Hour of Site Use Trips			Saturday Peak Hour			
	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total	
<b>CHaRM Vision</b>																
Employment																
Employees	6															
Employee Trips		9	9	18	2	0	2	0	2	2	2	2	4	2	2	4
Customers / Visitors / Drop Off Patrons																
Customers Per Day	300															
Customer Trips		300	300	600	0	0	0	0	0	0	45	45	90	55	55	110
Trucks																
Truck Fleet (all types)	1															
Site Owned Truck Trips		2	2	4	0	0	0	0	0	0	1	1	2	1	1	2
Service Truck Trips		4	4	8	0	0	0	0	0	0	1	1	2	0	0	0
Traffic Subtotal:		315	315	630	2	0	2	0	2	2	49	49	98	58	58	116
<b>Eco-Cycle Vision</b>																
Employment																
Employees	17															
Employee Trips		25	25	50	17	0	17	0	17	17	6	6	12	6	6	12
Customers / Visitors / Drop Off Patrons																
Visitors	7															
Visitor Trips		7	7	14	0	0	0	0	0	0	7	7	14	7	7	14
Trucks																
Truck Fleet (all types)	11															
Site Owned Truck Trips		22	22	44	0	0	0	0	0	0	4	4	8	4	4	8
Service Truck Trips																
Traffic Subtotal:		54	54	108	17	0	17	0	17	17	17	17	34	17	17	34
<b>ReSource Vision</b>																
Employment																
Employees	9															
Employee Trips		12	12	24	9	0	9	0	9	9	3	3	6	3	3	6
Customers / Visitors / Drop Off Patrons																
Customers Per Day	140															
Customer Trips		140	140	280	0	0	0	20	30	50	35	35	70	35	35	70
Trucks																
Truck Fleet (all types)	2															
Site Owned Truck Trips		5	5	10	0	0	0	0	0	0	2	2	4	2	2	4
Service Truck Trips		3	3	6	1	1	2	1	1	2	1	1	2	0	0	0
Traffic Subtotal:		160	160	320	10	1	11	21	40	61	41	41	82	40	40	80
<b>Total Phase I/II Trips</b>		<b>529</b>	<b>529</b>	<b>1058</b>	<b>29</b>	<b>1</b>	<b>30</b>	<b>21</b>	<b>59</b>	<b>80</b>	<b>107</b>	<b>107</b>	<b>214</b>	<b>115</b>	<b>115</b>	<b>230</b>
<b>Total Phase III Trips<sup>(4)</sup></b>		<b>688</b>	<b>688</b>	<b>1376</b>	<b>38</b>	<b>1</b>	<b>39</b>	<b>27</b>	<b>77</b>	<b>104</b>	<b>139</b>	<b>139</b>	<b>278</b>	<b>150</b>	<b>150</b>	<b>300</b>

Notes:

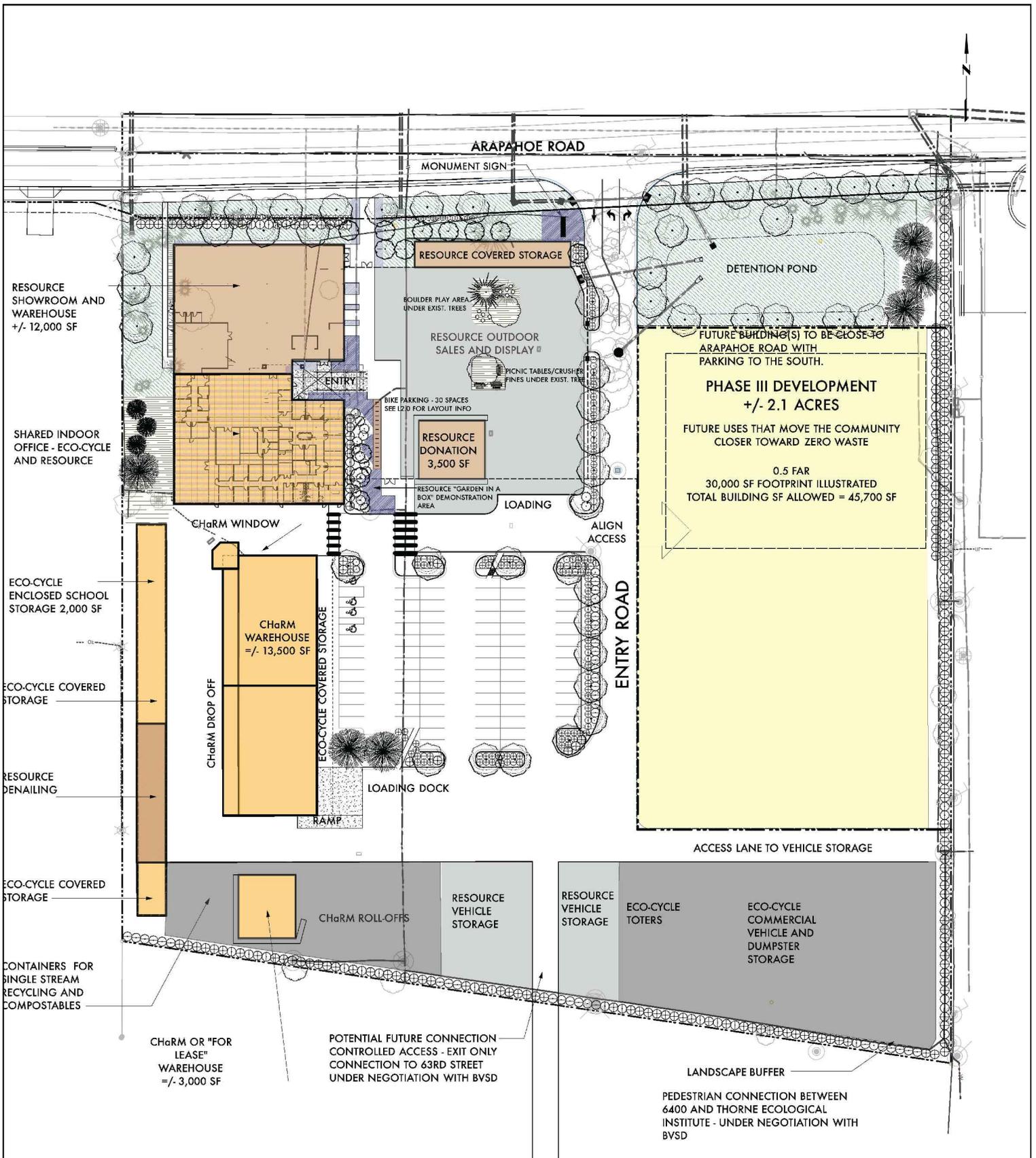
1. CHaRM is only open to the public between 9:00 AM and 4:00 PM. Truck traffic typically occurs outside of the weekday peak hours.
2. ReSource is only open to the public between 9:00 AM and 5:00 PM. Most truck trips occur outside of the weekday peak hours.
3. Trip generation estimates based on detailed conversations with existing facility operators.
4. It is anticipated that Phase III will increase the site's trip generation by approximately 30%. This is based on the available land area and the goal of serving similar waste reduction type uses.

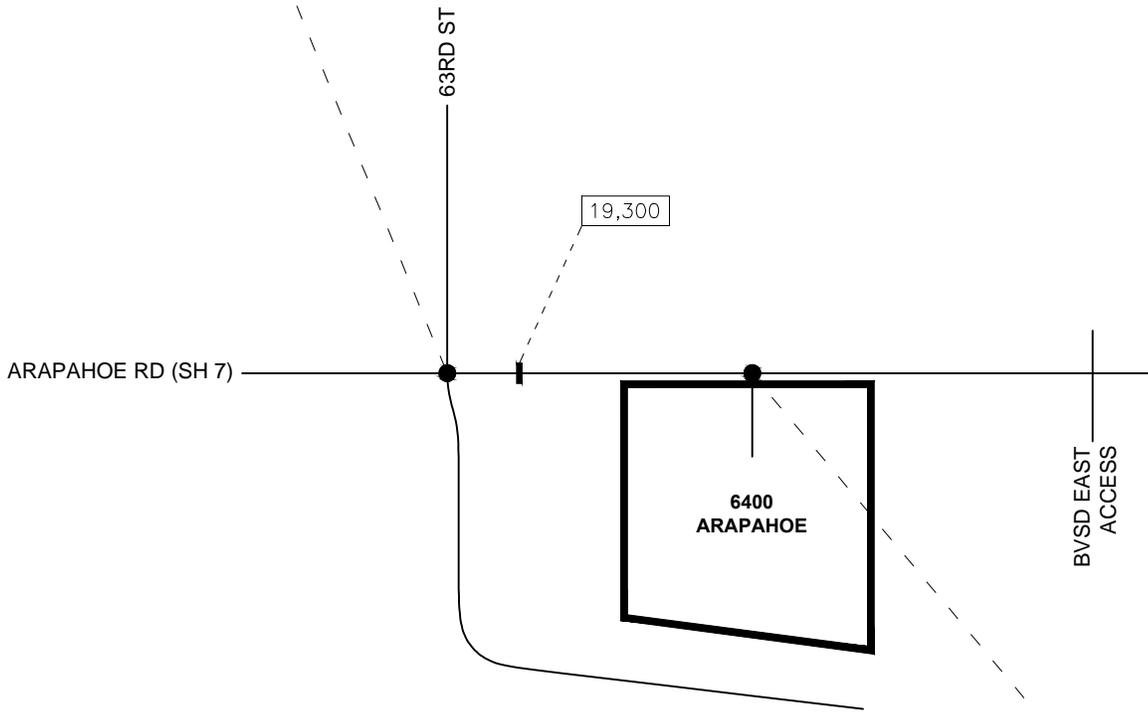
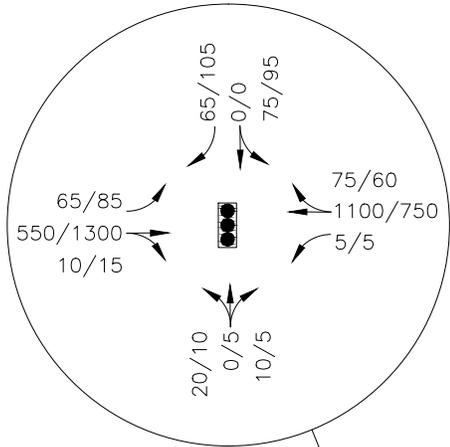


**FOX HIGGINS**  
TRANSPORTATION GROUP

6400 ARAPAHOE  
VICINITY MAP

FH Project #	10005	Original Scale	1"=800'	Date	2/18/11	Drawn by	SGT	Figure #	1
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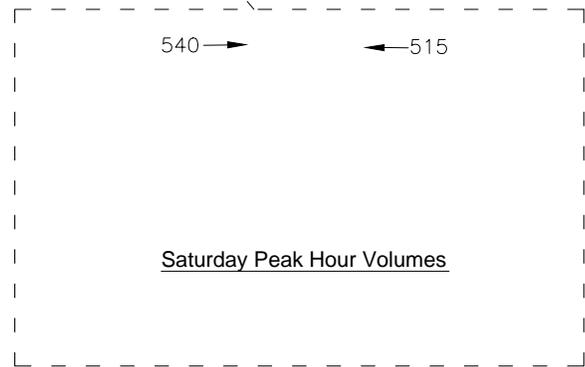




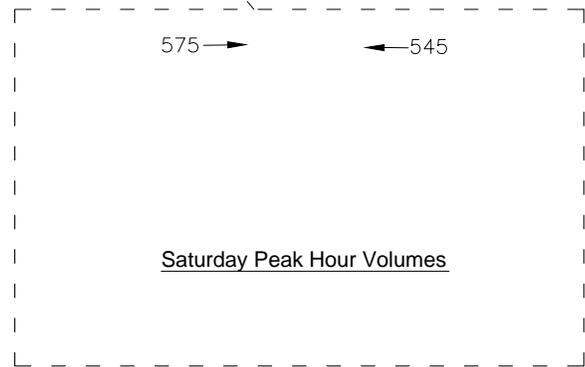
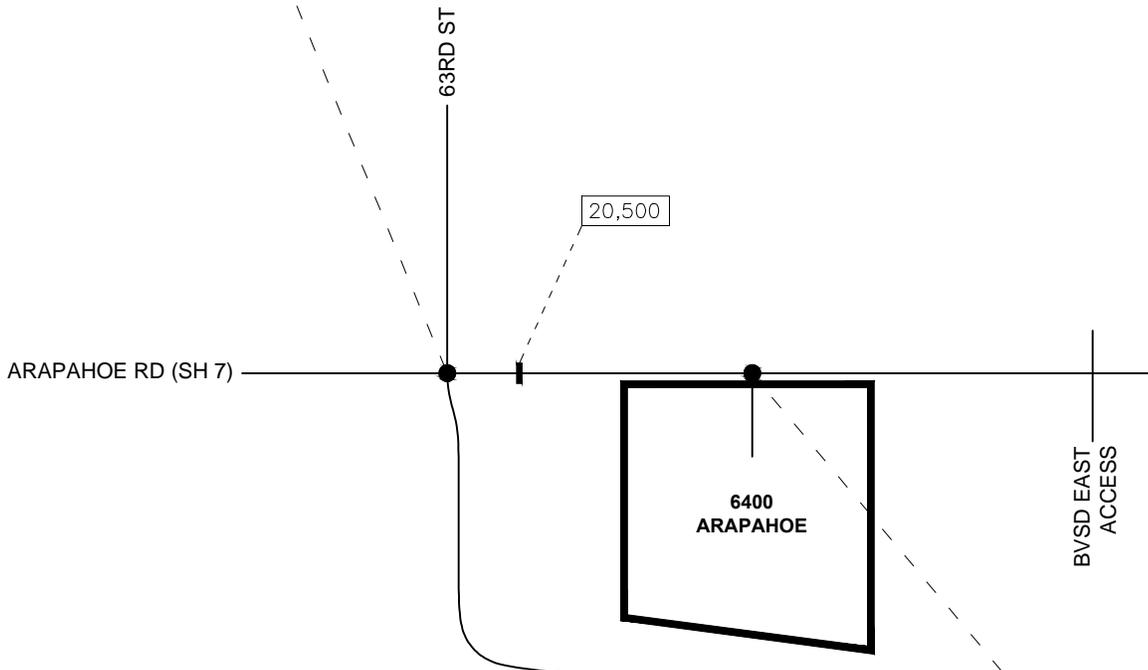
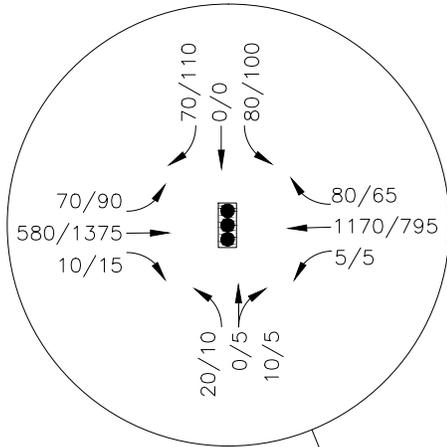
**KEY**

XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume

*Data Source: SH 7 Cherryvale Rd to 75th St.  
 Environmental Assessment and more recent area  
 traffic data*



6400 ARAPAHOE  
 EXISTING TRAFFIC VOLUMES



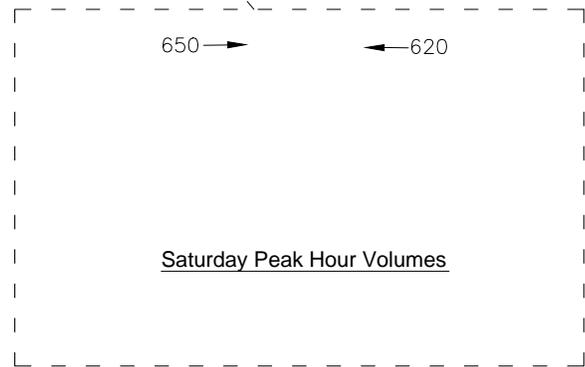
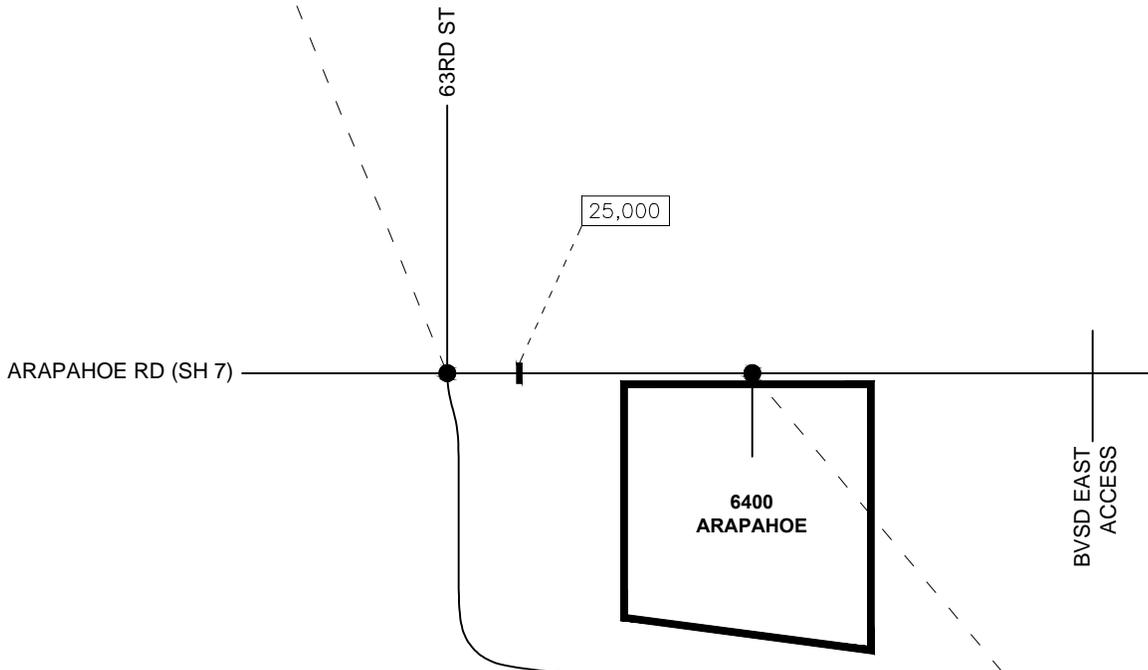
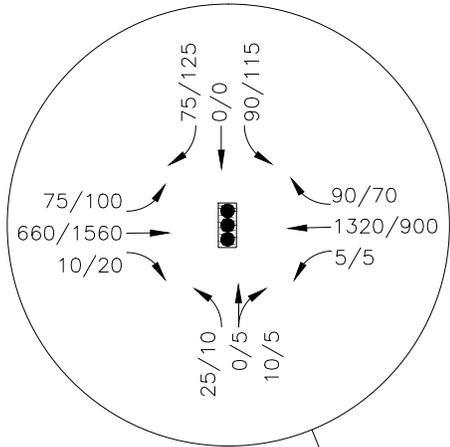
**KEY**

XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume



6400 ARAPAHOE

**YEAR 2015 BACKGROUND TRAFFIC VOLUMES**



**KEY**

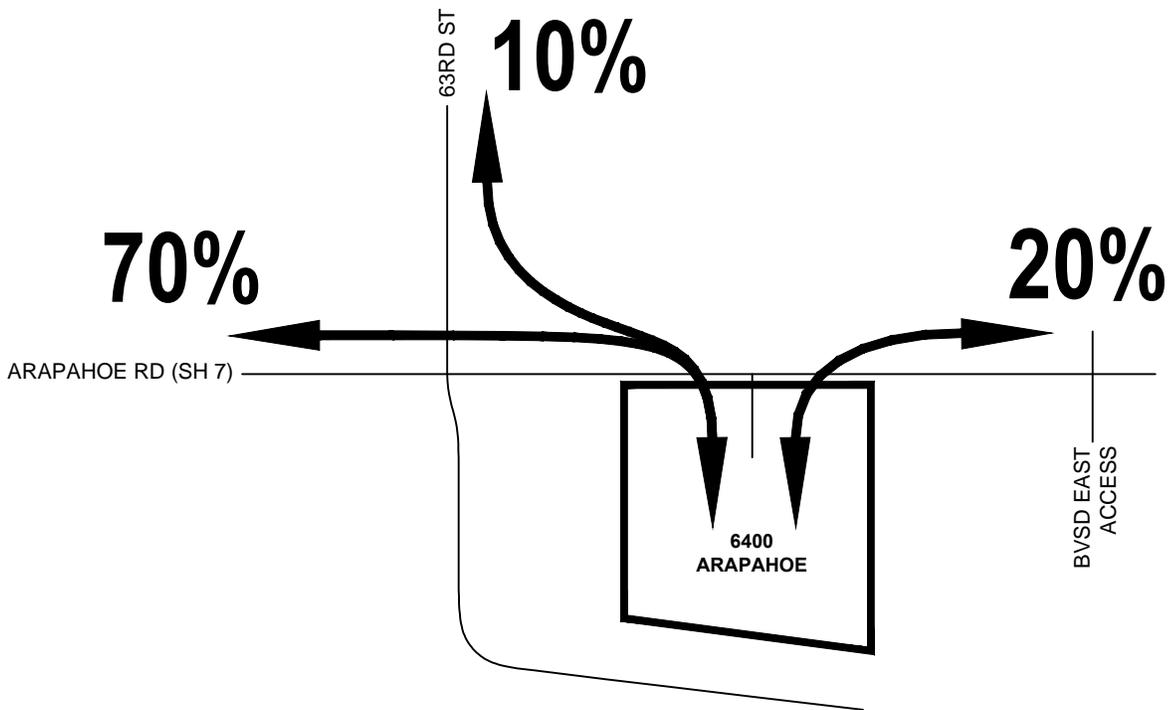
XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume

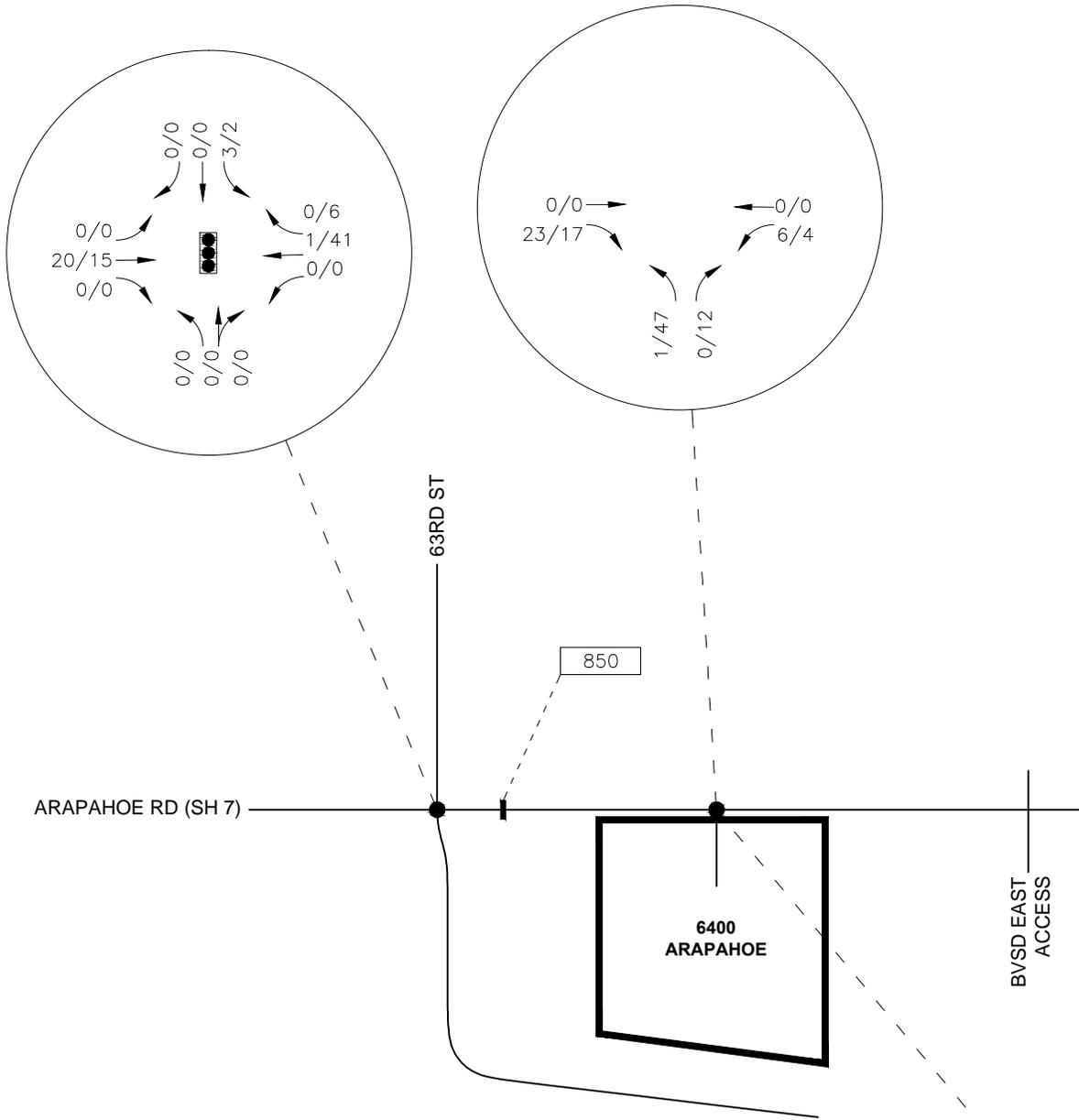


6400 ARAPAHOE

**YEAR 2030 BACKGROUND TRAFFIC VOLUMES**

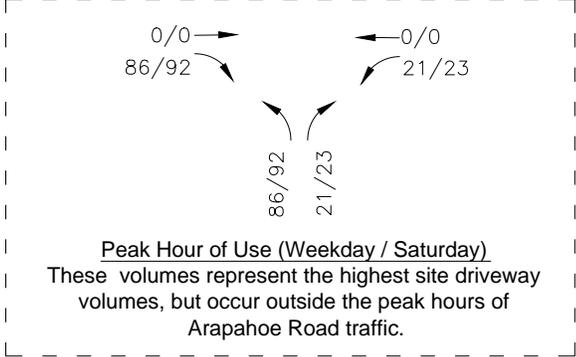
FH Project #	10005	Original Scale	Date	2/18/11	Drawn by	SGT	Figure #	5
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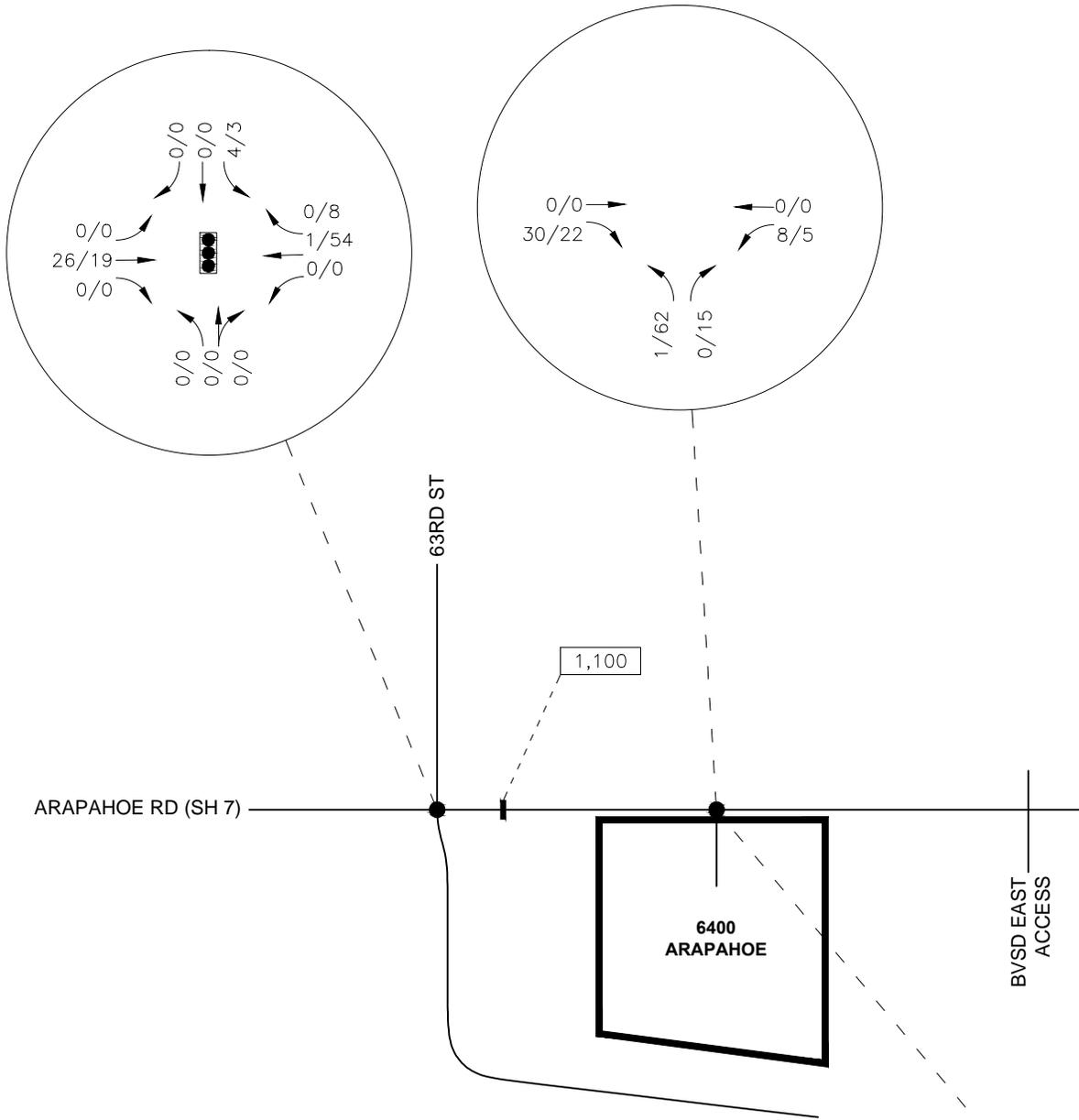
**KEY**

XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume



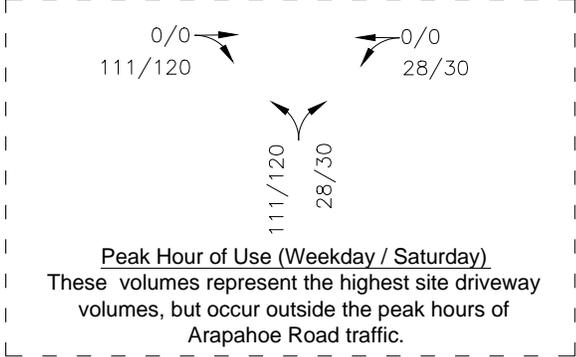
6400 ARAPAHOE  
 SITE-GENERATED TRAFFIC VOLUMES - PHASE I / II

FH Project #	10005	Original Scale	Date	2/18/11	Drawn by	SGT	Figure #	7
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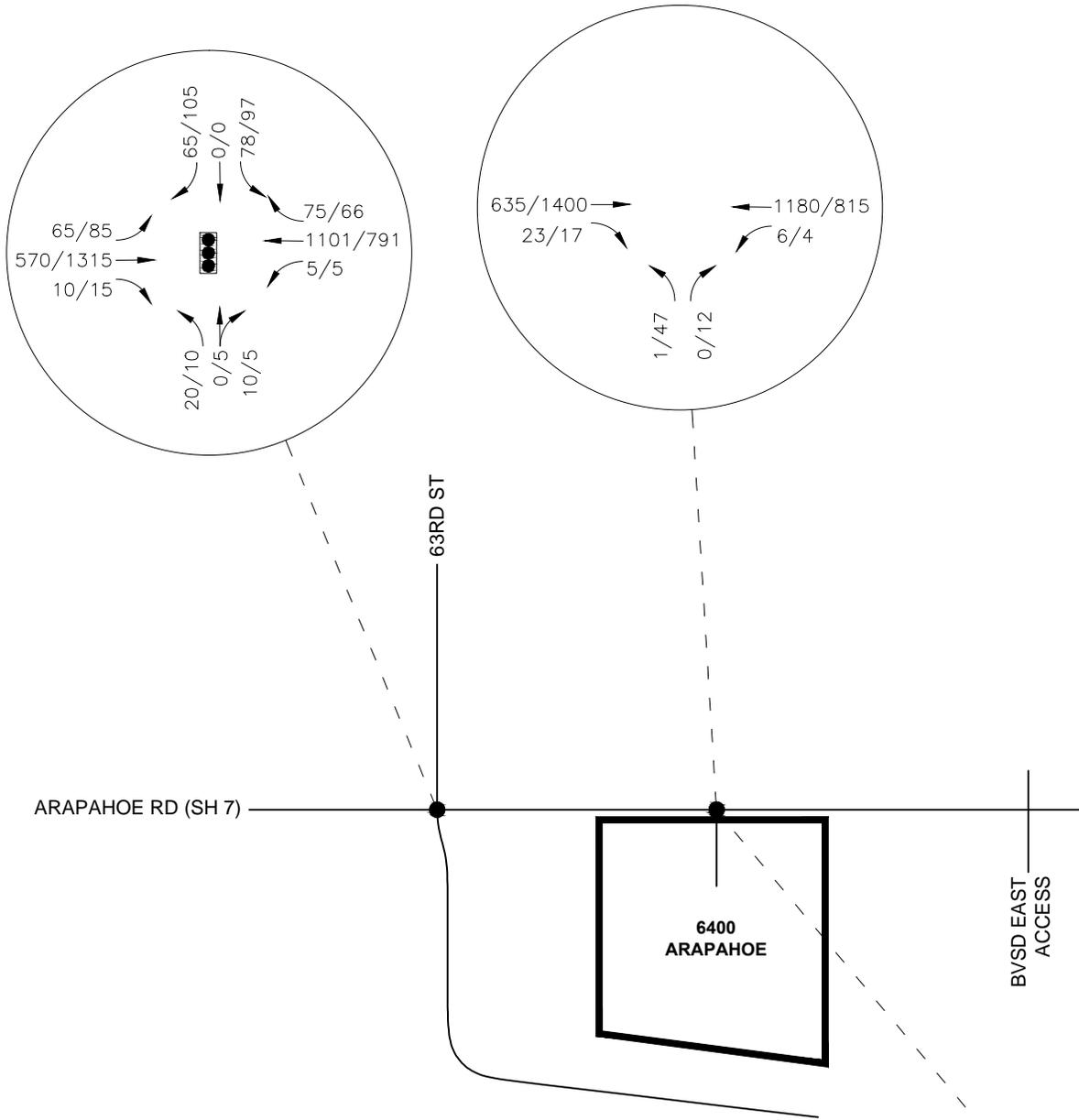
**KEY**

XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume



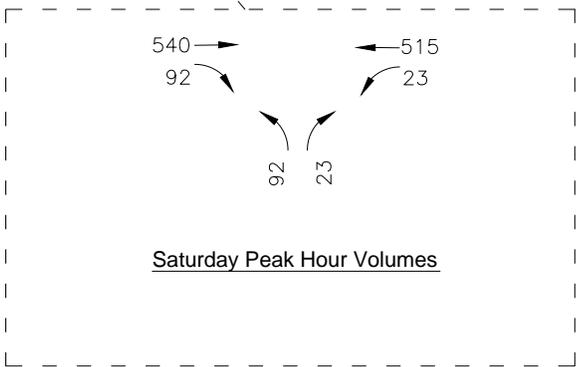
6400 ARAPAHOE  
 SITE-GENERATED TRAFFIC VOLUMES - PHASE III

FH Project #	10005	Original Scale	Date	2/18/11	Drawn by	SGT	Figure #	8
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**KEY**

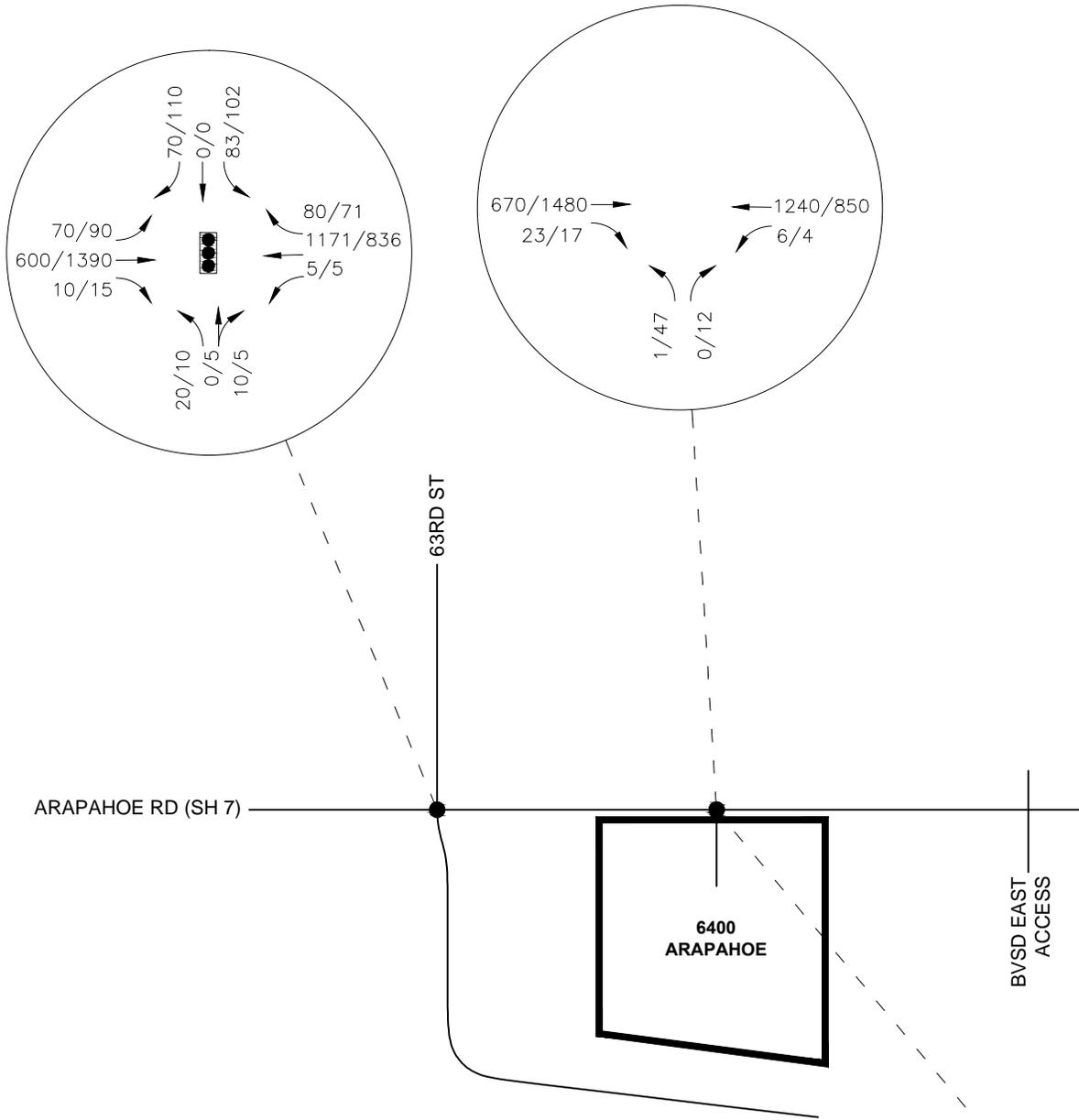
XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume



6400 ARAPAHOE

**EXISTING + SITE-GENERATED TRAFFIC VOLUMES (PHASE I/II)**

FH Project #	10005	Original Scale	Date	2/18/11	Drawn by	SGT	Figure #	9
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ARAPAHOE RD (SH 7)

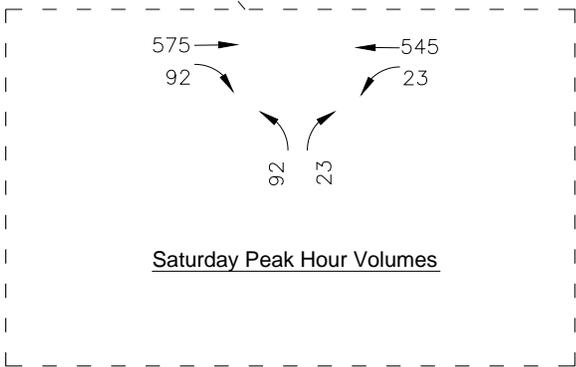
63RD ST

6400 ARAPAHOE

BVSD EAST ACCESS

**KEY**

XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume



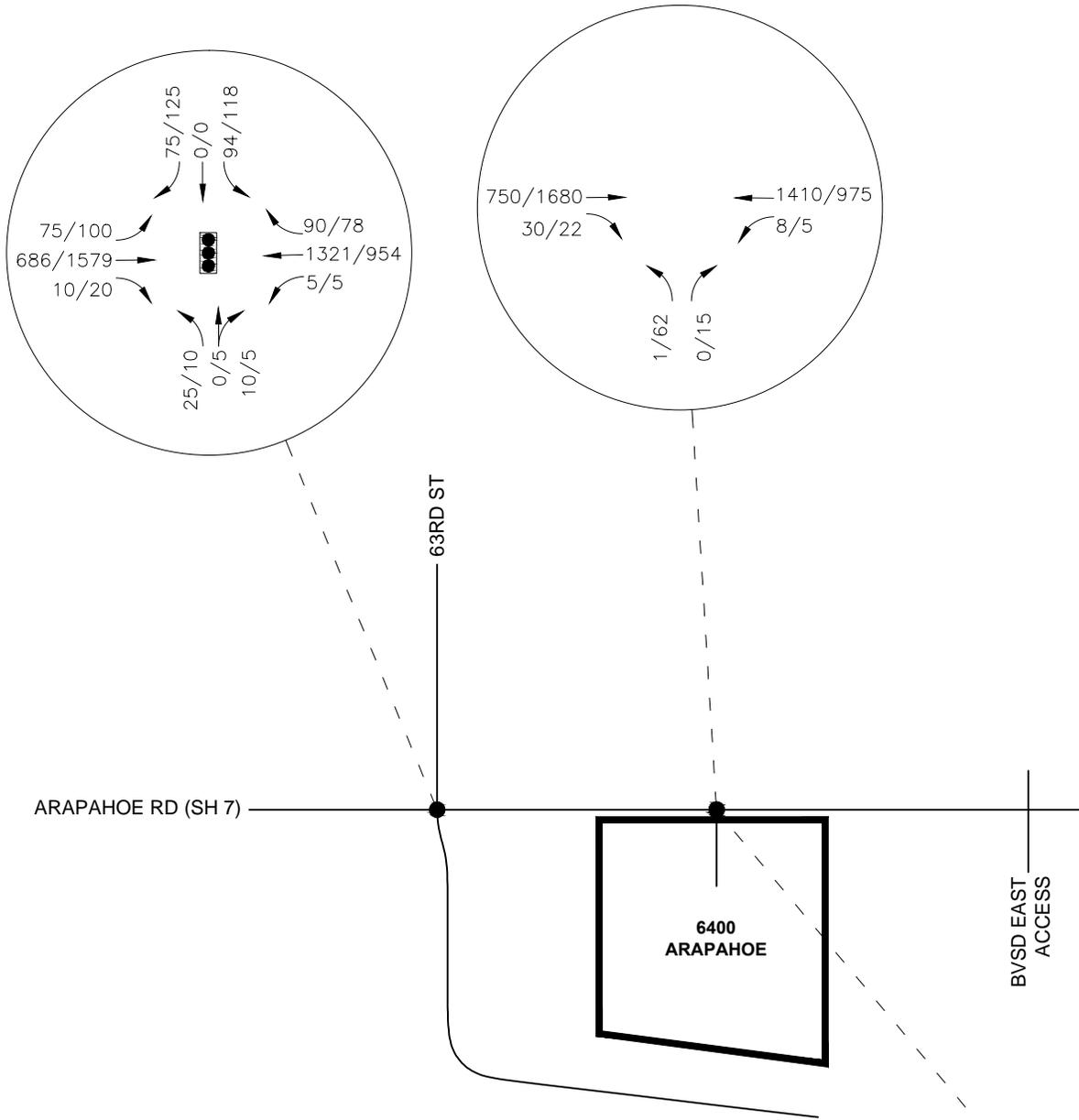
Saturday Peak Hour Volumes



6400 ARAPAHOE

2015 + SITE-GENERATED TRAFFIC VOLUMES (PHASE I/II)

FH Project #	10005	Original Scale	Date	2/18/11	Drawn by	SGT	Figure #	10
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**KEY**

XXX / XXX = Weekday AM / PM Peak Hour Volume  
 [XX,XXX] = Weekday Average Daily Traffic Volume



6400 ARAPAHOE

**2030 + SITE-GENERATED TRAFFIC VOLUMES (PHASE III)**

FH Project #	10005	Original Scale	Date	2/18/11	Drawn by	SGT	Figure #	11
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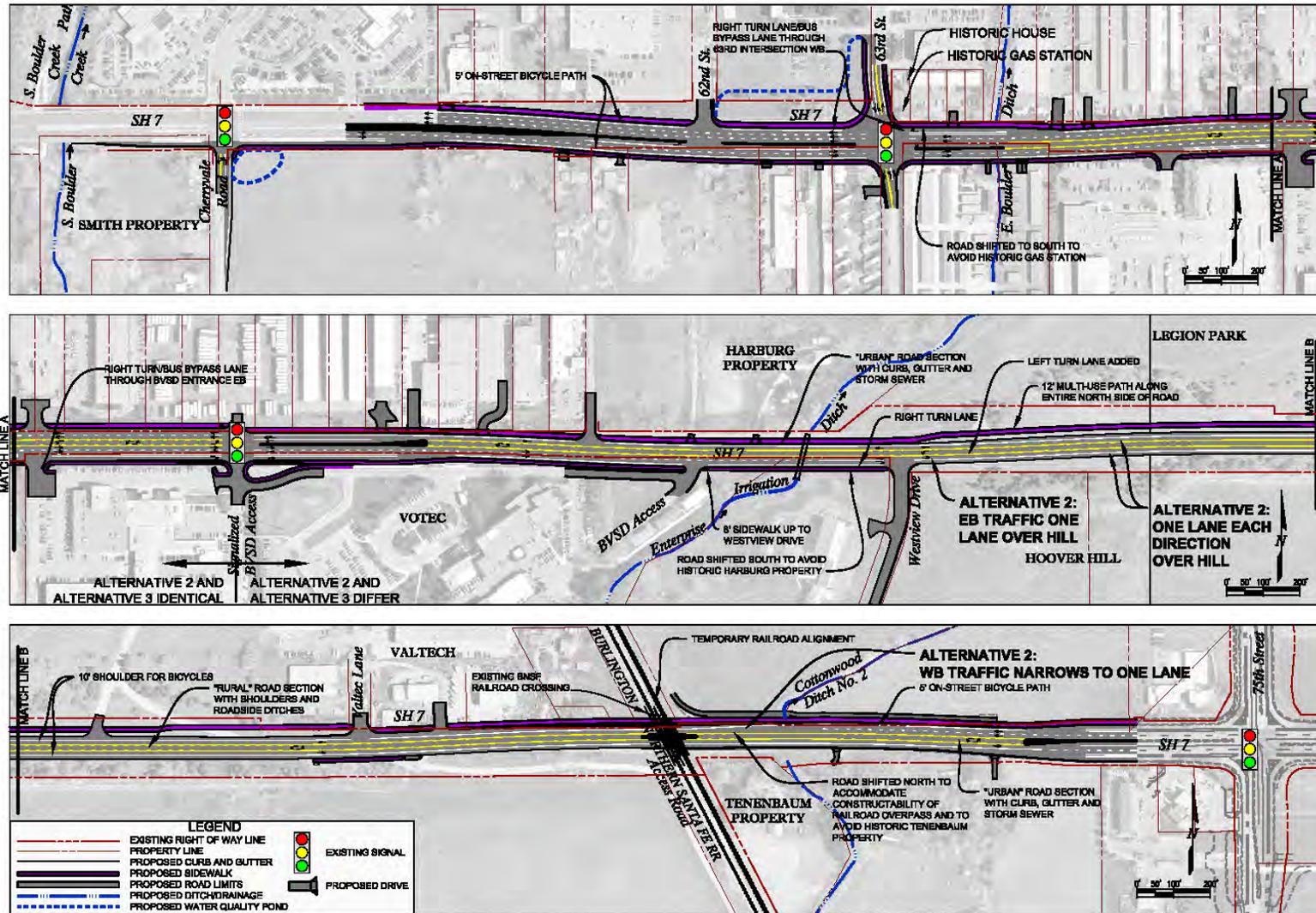
***APPENDIX***

SH 7 Cherryvale Road to 75<sup>th</sup> Street Environmental Assessment Information

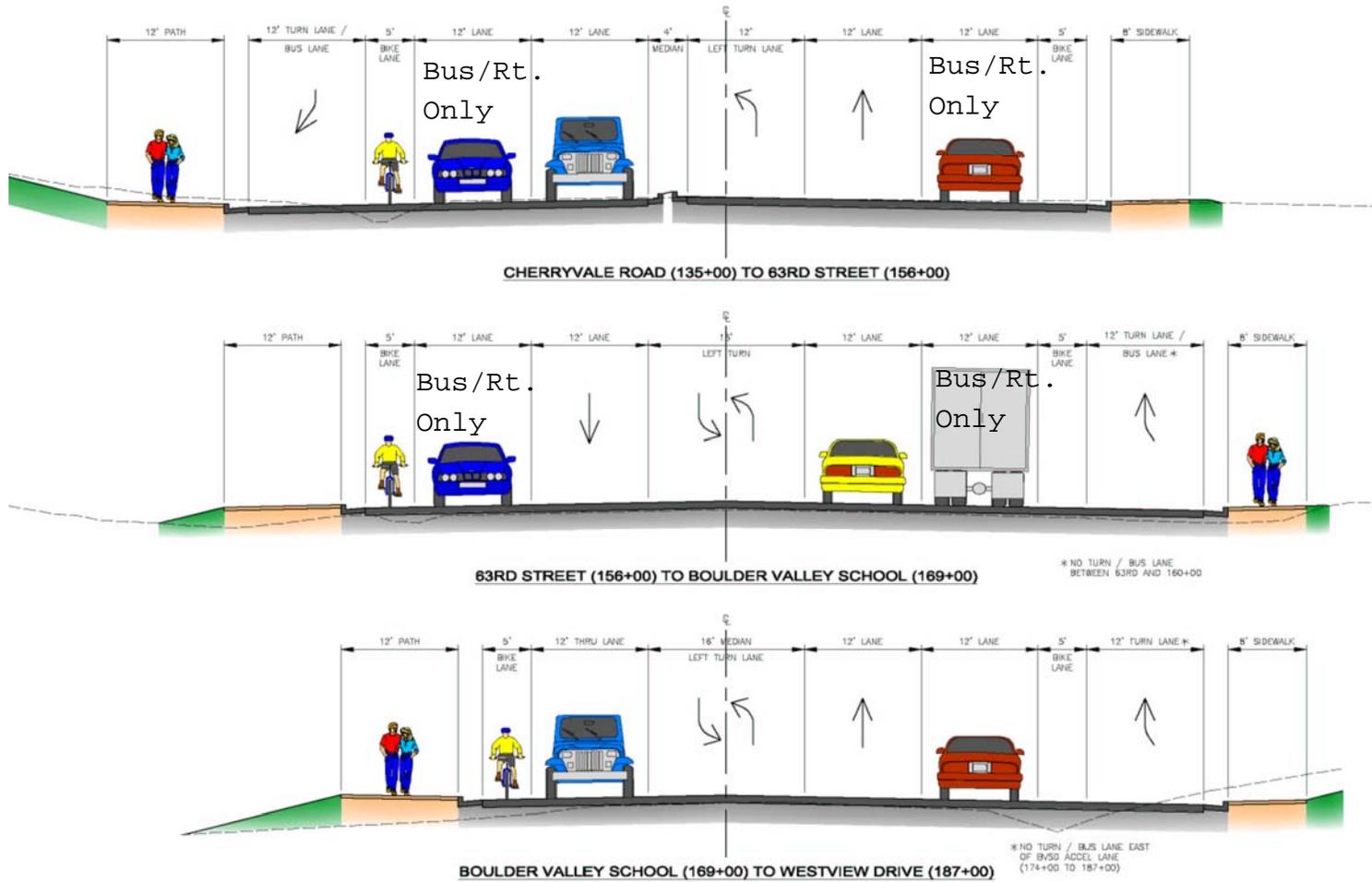
Level of Service Definitions

Level of Service calculation sheets

**Figure 2-3**  
**Preferred Alternative – Plan View**



**Figure 1-4**  
**Preferred Alternative Typical Sections**



## LEVEL OF SERVICE DEFINITIONS

In rating roadway and intersection operating conditions with existing or future traffic volumes, “Levels of Service” (LOS) A through F are used, with LOS A indicating very good operation and LOS F indicating poor operation. Levels of service at signalized and unsignalized intersections are closely associated with vehicle delays experienced in seconds per vehicle. More complete level of service definitions and delay data for signal and stop sign controlled intersections are contained in the following table for reference.

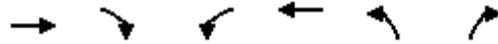
Level of Service Rating	Delay in seconds per vehicle (a)		Definition
	Signalized	Unsignalized	
A	0.0 to 10.0	0.0 to 10.0	Low vehicular traffic volumes; primarily free flow operations. Density is low and vehicles can freely maneuver within the traffic stream. Drivers are able to maintain their desired speeds with little or no delay.
B	10.1 to 20.0	10.1 to 15.0	Stable vehicular traffic volume flow with potential for some restriction of operating speeds due to traffic conditions. Vehicle maneuvering is only slightly restricted. The stopped delays are not bothersome and drivers are not subject to appreciable tension.
C	20.1 to 35.0	15.1 to 25.0	Stable traffic operations, however the ability for vehicles to maneuver is more restricted by the increase in traffic volumes. Relatively satisfactory operating speeds prevail, but adverse signal coordination or longer vehicle queues cause delays along the corridor.
D	35.1 to 55.0	25.1 to 35.0	Approaching unstable vehicular traffic flow where small increases in volume could cause substantial delays. Most drivers are restricted in ability to maneuver and selection of travel speeds due to congestion. Driver comfort and convenience are low, but tolerable.
E	55.1 to 80.0	35.1 to 50.0	Traffic operations characterized by significant approach delays and average travel speeds of one-half to one-third the free flow speed. Vehicular flow is unstable and there is potential for stoppages of brief duration. High signal density, extensive vehicle queuing, or corridor signal progression/timing are the typical causes of vehicle delays at signalized corridors.
F	> 80.0	> 50.0	Forced vehicular traffic flow and operations with high approach delays at critical intersections. Vehicle speeds are reduced substantially and stoppages may occur for short or long periods of time because of downstream congestion.

(a) Delay ranges based on 2000 Highway Capacity Manual criteria.

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	→
Volume (veh/h)	635	23	6	1180	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	690	25	7	1283	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	760			904		
pX, platoon unblocked						
vC, conflicting volume			715		1998	703
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			715		1998	703
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	100
cM capacity (veh/h)			885		65	438

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	715	1289	2
Volume Left	0	7	1
Volume Right	25	0	1
cSH	1700	885	131
Volume to Capacity	0.42	0.01	0.02
Queue Length 95th (ft)	0	1	1
Control Delay (s)	0.0	0.3	37.1
Lane LOS		A	E
Approach Delay (s)	0.0	0.3	37.1
Approach LOS			E

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		76.9%	ICU Level of Service D
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔	↔	↔
Volume (veh/h)	1400	17	6	815	47	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1522	18	7	886	51	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	760			904		
pX, platoon unblocked						
vC, conflicting volume			1540		2430	1531
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1540		2430	1531
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		0	91
cM capacity (veh/h)			431		35	144

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	1540	892	64
Volume Left	0	7	51
Volume Right	18	0	13
cSH	1700	431	42
Volume to Capacity	0.91	0.02	1.52
Queue Length 95th (ft)	0	1	162
Control Delay (s)	0.0	0.5	475.3
Lane LOS		A	F
Approach Delay (s)	0.0	0.5	475.3
Approach LOS			F

Intersection Summary			
Average Delay		12.4	
Intersection Capacity Utilization		84.7%	ICU Level of Service E
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→			←	←	→
Volume (veh/h)	540	92	23	515	92	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	587	100	25	560	100	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	760			904		
pX, platoon unblocked						
vC, conflicting volume			687		1247	637
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			687		1247	637
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		46	95
cM capacity (veh/h)			907		186	477

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	687	585	125
Volume Left	0	25	100
Volume Right	100	0	25
cSH	1700	907	233
Volume to Capacity	0.40	0.03	0.54
Queue Length 95th (ft)	0	2	72
Control Delay (s)	0.0	0.7	38.4
Lane LOS		A	E
Approach Delay (s)	0.0	0.7	38.4
Approach LOS			E

Intersection Summary			
Average Delay		3.7	
Intersection Capacity Utilization		57.6%	ICU Level of Service
Analysis Period (min)		15	B

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

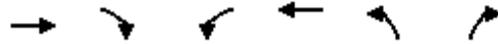
2/16/2011

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↖	↗
Volume (veh/h)	670	23	6	1240	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	728	25	7	1348	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	TWLTL		TWLTL			
Median storage veh	2		2			
Upstream signal (ft)	760		904			
pX, platoon unblocked						
vC, conflicting volume			753	2089		728
vC1, stage 1 conf vol					728	
vC2, stage 2 conf vol					1361	
vCu, unblocked vol			753	2089		728
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2	3.5		3.3
p0 queue free %			99	99		100
cM capacity (veh/h)			857	211		423
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	728	25	7	1348	2	
Volume Left	0	0	7	0	1	
Volume Right	0	25	0	0	1	
cSH	1700	1700	857	1700	422	
Volume to Capacity	0.43	0.01	0.01	0.79	0.01	
Queue Length 95th (ft)	0	0	1	0	0	
Control Delay (s)	0.0	0.0	9.2	0.0	17.8	
Lane LOS			A	C		
Approach Delay (s)	0.0	0.0		17.8		
Approach LOS			C			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			75.3%	ICU Level of Service		D
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	1480	17	4	850	47	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1609	18	4	924	51	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	TWLTL		TWLTL			
Median storage (veh)	2		2			
Upstream signal (ft)	760		904			
pX, platoon unblocked						
vC, conflicting volume			1627		2541	1609
vC1, stage 1 conf vol					1609	
vC2, stage 2 conf vol					933	
vCu, unblocked vol			1627		2541	1609
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			99		68	90
cM capacity (veh/h)			399		159	129

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1609	18	4	924	64
Volume Left	0	0	4	0	51
Volume Right	0	18	0	0	13
cSH	1700	1700	399	1700	200
Volume to Capacity	0.95	0.01	0.01	0.54	0.32
Queue Length 95th (ft)	0	0	1	0	33
Control Delay (s)	0.0	0.0	14.1	0.0	37.6
Lane LOS			B	E	
Approach Delay (s)	0.0		0.1		37.6
Approach LOS					E

Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			87.9%	ICU Level of Service	E	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↖	↗
Volume (veh/h)	575	92	23	545	92	23
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	625	100	25	592	100	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	TWLTL		TWLTL			
Median storage (veh)	2		2			
Upstream signal (ft)	760		904			
pX, platoon unblocked						
vC, conflicting volume			725		1267	625
vC1, stage 1 conf vol					625	
vC2, stage 2 conf vol					642	
vCu, unblocked vol			725		1267	625
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			97		75	95
cM capacity (veh/h)			878		398	485
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	625	100	25	592	125	
Volume Left	0	0	25	0	100	
Volume Right	0	100	0	0	25	
cSH	1700	1700	878	1700	497	
Volume to Capacity	0.37	0.06	0.03	0.35	0.25	
Queue Length 95th (ft)	0	0	2	0	25	
Control Delay (s)	0.0	0.0	9.2	0.0	16.2	
Lane LOS			A			C
Approach Delay (s)	0.0		0.4		16.2	
Approach LOS						C
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization			42.0%	ICU Level of Service	A	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

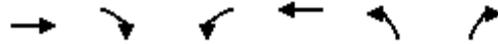
2/16/2011

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↖	↗
Volume (veh/h)	750	30	8	1410	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	815	33	9	1533	1	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	TWLTL		TWLTL			
Median storage (veh)	2		2			
Upstream signal (ft)	760		904			
pX, platoon unblocked						
vC, conflicting volume			848	2365		815
vC1, stage 1 conf vol			815			
vC2, stage 2 conf vol			1550			
vCu, unblocked vol			848	2365		815
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)			5.4			
tF (s)			2.2	3.5		3.3
p0 queue free %			99	99		100
cM capacity (veh/h)			790	172		377
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	815	33	9	1533	2	
Volume Left	0	0	9	0	1	
Volume Right	0	33	0	0	1	
cSH	1700	1700	790	1700	343	
Volume to Capacity	0.48	0.02	0.01	0.90	0.01	
Queue Length 95th (ft)	0	0	1	0	0	
Control Delay (s)	0.0	0.0	9.6	0.0	20.3	
Lane LOS			A	C		
Approach Delay (s)	0.0	0.1		20.3		
Approach LOS			C			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			84.2%	ICU Level of Service		E
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↘	↗
Volume (veh/h)	1680	22	5	975	62	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1826	24	5	1060	67	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	TWLTL		TWLTL			
Median storage (veh)	2		2			
Upstream signal (ft)	760		904			
pX, platoon unblocked						
vC, conflicting volume			1850		2897	1826
vC1, stage 1 conf vol					1826	
vC2, stage 2 conf vol					1071	
vCu, unblocked vol			1850		2897	1826
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			98		46	83
cM capacity (veh/h)			327		125	96

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1826	24	5	1060	84
Volume Left	0	0	5	0	67
Volume Right	0	24	0	0	16
cSH	1700	1700	327	1700	155
Volume to Capacity	1.07	0.01	0.02	0.62	0.54
Queue Length 95th (ft)	0	0	1	0	68
Control Delay (s)	0.0	0.0	16.2	0.0	61.0
Lane LOS			C	F	
Approach Delay (s)	0.0		0.1		61.0
Approach LOS					F

Intersection Summary					
Average Delay			1.7		
Intersection Capacity Utilization			98.5%	ICU Level of Service	F
Analysis Period (min)			15		

# HCM Unsignalized Intersection Capacity Analysis

## 1: Arapahoe Rd & Site Access

2/16/2011



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	650	120	30	620	120	30
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	707	130	33	674	130	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type	TWLTL		TWLTL			
Median storage (veh)	2		2			
Upstream signal (ft)	760		904			
pX, platoon unblocked						
vC, conflicting volume			837	1446		707
vC1, stage 1 conf vol			707			
vC2, stage 2 conf vol			739			
vCu, unblocked vol			837	1446		707
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)			5.4			
tF (s)			2.2	3.5		3.3
p0 queue free %			96	63		93
cM capacity (veh/h)			797	351		436

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	707	130	33	674	163
Volume Left	0	0	33	0	130
Volume Right	0	130	0	0	33
cSH	1700	1700	797	1700	439
Volume to Capacity	0.42	0.08	0.04	0.40	0.37
Queue Length 95th (ft)	0	0	3	0	42
Control Delay (s)	0.0	0.0	9.7	0.0	19.7
Lane LOS	A			C	
Approach Delay (s)	0.0	0.4		19.7	
Approach LOS					C

Intersection Summary					
Average Delay			2.1		
Intersection Capacity Utilization	47.5%		ICU Level of Service		A
Analysis Period (min)	15				

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd St

3/2/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	550	10	5	1100	75	20	0	10	75	0	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.99			0.95			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.95	1.00
Satd. Flow (prot)	1770	1858		1770	1845			1722			1770	1583
Flt Permitted	0.06	1.00		0.43	1.00			0.82			0.74	1.00
Satd. Flow (perm)	106	1858		809	1845			1451			1370	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	598	11	5	1196	82	22	0	11	82	0	71
RTOR Reduction (vph)	0	1	0	0	2	0	0	9	0	0	0	59
Lane Group Flow (vph)	71	608	0	5	1276	0	0	24	0	0	82	12
Turn Type	pm+pt			Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	74.3	74.3		65.5	65.5			16.7			16.7	16.7
Effective Green, g (s)	74.3	74.3		65.5	65.5			16.7			16.7	16.7
Actuated g/C Ratio	0.74	0.74		0.66	0.66			0.17			0.17	0.17
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Grp Cap (vph)	150	1380		530	1208			242			229	264
v/s Ratio Prot	0.02	c0.33			c0.69							
v/s Ratio Perm	0.33			0.01				0.02			c0.06	0.01
v/c Ratio	0.47	0.44		0.01	1.06			0.10			0.36	0.04
Uniform Delay, d1	26.1	4.9		6.0	17.2			35.3			36.9	35.0
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	10.3	1.0		0.0	42.0			0.8			4.3	0.3
Delay (s)	36.4	5.9		6.0	59.3			36.1			41.2	35.3
Level of Service	D	A		A	E			D			D	D
Approach Delay (s)		9.1			59.1			36.1			38.5	
Approach LOS		A			E			D			D	

### Intersection Summary

HCM Average Control Delay	41.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	81.0%	ICU Level of Service	D
Analysis Period (min)	15		

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# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd St

2/16/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	1300	15	5	750	60	10	5	5	95	0	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.99			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.95	1.00
Satd. Flow (prot)	1770	1860		1770	1842			1757			1770	1583
Flt Permitted	0.19	1.00		0.05	1.00			0.86			0.74	1.00
Satd. Flow (perm)	363	1860		91	1842			1557			1385	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	1413	16	5	815	65	11	5	5	103	0	114
RTOR Reduction (vph)	0	0	0	0	3	0	0	4	0	0	0	97
Lane Group Flow (vph)	92	1429	0	5	877	0	0	17	0	0	103	17
Turn Type	pm+pt			Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	93.5	93.5		81.9	81.9			17.5			17.5	17.5
Effective Green, g (s)	93.5	93.5		81.9	81.9			17.5			17.5	17.5
Actuated g/C Ratio	0.78	0.78		0.68	0.68			0.15			0.15	0.15
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Grp Cap (vph)	366	1449		62	1257			227			202	231
v/s Ratio Prot	0.01	c0.77			0.48							
v/s Ratio Perm	0.18			0.05				0.01			c0.07	0.01
v/c Ratio	0.25	0.99		0.08	0.70			0.07			0.51	0.07
Uniform Delay, d1	9.6	12.6		6.4	11.6			44.3			47.3	44.2
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	1.6	20.5		2.5	3.2			0.6			8.9	0.6
Delay (s)	11.2	33.1		8.9	14.8			44.9			56.2	44.8
Level of Service	B	C		A	B			D			E	D
Approach Delay (s)		31.8			14.8			44.9			50.2	
Approach LOS		C			B			D			D	

### Intersection Summary

HCM Average Control Delay	27.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd St

3/2/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	570	10	5	1101	75	20	0	10	78	0	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.99			0.95			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.95	1.00
Satd. Flow (prot)	1770	1858		1770	1845			1722			1770	1583
Flt Permitted	0.06	1.00		0.42	1.00			0.81			0.74	1.00
Satd. Flow (perm)	106	1858		785	1845			1448			1370	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	620	11	5	1197	82	22	0	11	85	0	71
RTOR Reduction (vph)	0	1	0	0	2	0	0	9	0	0	0	59
Lane Group Flow (vph)	71	630	0	5	1277	0	0	24	0	0	85	12
Turn Type	pm+pt			Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	74.3	74.3		65.5	65.5			16.7			16.7	16.7
Effective Green, g (s)	74.3	74.3		65.5	65.5			16.7			16.7	16.7
Actuated g/C Ratio	0.74	0.74		0.66	0.66			0.17			0.17	0.17
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Grp Cap (vph)	150	1380		514	1208			242			229	264
v/s Ratio Prot	0.02	c0.34			c0.69							
v/s Ratio Perm	0.33			0.01				0.02			c0.06	0.01
v/c Ratio	0.47	0.46		0.01	1.06			0.10			0.37	0.04
Uniform Delay, d1	26.1	5.0		6.0	17.2			35.3			37.0	35.0
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	10.3	1.1		0.0	42.3			0.8			4.6	0.3
Delay (s)	36.4	6.1		6.0	59.6			36.1			41.6	35.3
Level of Service	D	A		A	E			D			D	D
Approach Delay (s)		9.2			59.3			36.1			38.7	
Approach LOS		A			E			D			D	

### Intersection Summary

HCM Average Control Delay	41.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd St

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1315	15	5	791	66	10	5	5	97	0	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.99			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.95	1.00
Satd. Flow (prot)	1770	1860		1770	1841			1757			1770	1583
Flt Permitted	0.17	1.00		0.05	1.00			0.86			0.74	1.00
Satd. Flow (perm)	312	1860		91	1841			1553			1385	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	1429	16	5	860	72	11	5	5	105	0	114
RTOR Reduction (vph)	0	0	0	0	3	0	0	4	0	0	0	98
Lane Group Flow (vph)	98	1445	0	5	929	0	0	17	0	0	105	16
Turn Type	pm+pt			Perm			Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	93.9	93.9		81.6	81.6			17.1			17.1	17.1
Effective Green, g (s)	93.9	93.9		81.6	81.6			17.1			17.1	17.1
Actuated g/C Ratio	0.78	0.78		0.68	0.68			0.14			0.14	0.14
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	4.5
Lane Grp Cap (vph)	339	1455		62	1252			221			197	226
v/s Ratio Prot	0.02	c0.78			0.50							
v/s Ratio Perm	0.21			0.05				0.01			c0.08	0.01
v/c Ratio	0.29	0.99		0.08	0.74			0.08			0.53	0.07
Uniform Delay, d1	11.5	12.7		6.5	12.4			44.6			47.7	44.6
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	2.1	22.0		2.5	4.0			0.7			10.0	0.6
Delay (s)	13.6	34.7		9.0	16.4			45.3			57.7	45.2
Level of Service	B	C		A	B			D			E	D
Approach Delay (s)		33.3			16.4			45.3			51.2	
Approach LOS		C			B			D			D	

### Intersection Summary

HCM Average Control Delay	29.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↑	↗	↖	↑	↗	↖	↗		↖	↑	↗
Volume (vph)	70	580	10	5	1170	80	20	0	10	80	0	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1583		1770		1583
Flt Permitted	0.06	1.00	1.00	0.43	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	103	1863	1583	793	1863	1583	1410	1583		1398		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	630	11	5	1272	87	22	0	11	87	0	76
RTOR Reduction (vph)	0	0	2	0	0	22	0	10	0	0	0	67
Lane Group Flow (vph)	76	630	9	5	1272	65	22	1	0	87	0	9
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	79.5	79.5	79.5	67.5	67.5	67.5	11.5	11.5		11.5		11.5
Effective Green, g (s)	79.5	79.5	79.5	67.5	67.5	67.5	11.5	11.5		11.5		11.5
Actuated g/C Ratio	0.80	0.80	0.80	0.68	0.68	0.68	0.12	0.12		0.12		0.12
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	207	1481	1258	535	1258	1069	162	182		161		182
v/s Ratio Prot	0.03	c0.34			c0.68			0.00				
v/s Ratio Perm	0.26		0.01	0.01		0.04	0.02			c0.06		0.01
v/c Ratio	0.37	0.43	0.01	0.01	1.01	0.06	0.14	0.01		0.54		0.05
Uniform Delay, d1	26.3	3.2	2.1	5.3	16.2	5.5	39.8	39.2		41.8		39.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	5.0	0.9	0.0	0.0	28.1	0.1	1.7	0.1		12.4		0.5
Delay (s)	31.3	4.1	2.1	5.3	44.4	5.6	41.5	39.3		54.2		39.9
Level of Service	C	A	A	A	D	A	D	D		D		D
Approach Delay (s)		6.9			41.8			40.8			47.5	
Approach LOS		A			D			D			D	

## Intersection Summary

HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1375	15	5	795	65	10	5	5	100	0	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1723		1770		1583
Flt Permitted	0.18	1.00	1.00	0.05	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	333	1863	1583	96	1863	1583	1410	1723		1399		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	1495	16	5	864	71	11	5	5	109	0	120
RTOR Reduction (vph)	0	0	3	0	0	22	0	4	0	0	0	104
Lane Group Flow (vph)	98	1495	13	5	864	49	11	6	0	109	0	17
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	94.5	94.5	94.5	77.5	77.5	77.5	16.5	16.5		16.5		16.5
Effective Green, g (s)	94.5	94.5	94.5	77.5	77.5	77.5	16.5	16.5		16.5		16.5
Actuated g/C Ratio	0.79	0.79	0.79	0.65	0.65	0.65	0.14	0.14		0.14		0.14
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	412	1467	1247	62	1203	1022	194	237		192		218
v/s Ratio Prot	0.02	c0.80			0.46			0.00				
v/s Ratio Perm	0.16		0.01	0.05		0.03	0.01			c0.08		0.01
v/c Ratio	0.24	1.02	0.01	0.08	0.72	0.05	0.06	0.02		0.57		0.08
Uniform Delay, d1	10.4	12.8	2.7	7.9	14.0	7.8	45.0	44.8		48.4		45.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	1.4	28.4	0.0	2.5	3.7	0.1	0.6	0.2		11.6		0.7
Delay (s)	11.8	41.2	2.7	10.5	17.7	7.9	45.5	45.0		60.0		45.8
Level of Service	B	D	A	B	B	A	D	D		E		D
Approach Delay (s)		39.0			17.0			45.3			52.6	
Approach LOS		D			B			D			D	

### Intersection Summary

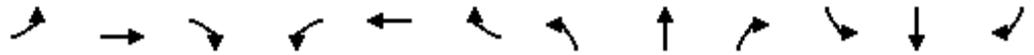
HCM Average Control Delay	32.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	94.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

3/2/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	600	10	5	1171	80	20	0	10	83	0	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1583		1770		1583
Flt Permitted	0.06	1.00	1.00	0.42	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	103	1863	1583	777	1863	1583	1410	1583		1398		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	652	11	5	1273	87	22	0	11	90	0	76
RTOR Reduction (vph)	0	0	2	0	0	22	0	10	0	0	0	67
Lane Group Flow (vph)	76	652	9	5	1273	65	22	1	0	90	0	9
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	79.5	79.5	79.5	67.5	67.5	67.5	11.5	11.5		11.5		11.5
Effective Green, g (s)	79.5	79.5	79.5	67.5	67.5	67.5	11.5	11.5		11.5		11.5
Actuated g/C Ratio	0.80	0.80	0.80	0.68	0.68	0.68	0.12	0.12		0.12		0.12
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	207	1481	1258	524	1258	1069	162	182		161		182
v/s Ratio Prot	0.03	c0.35			c0.68			0.00				
v/s Ratio Perm	0.26		0.01	0.01		0.04	0.02			c0.06		0.01
v/c Ratio	0.37	0.44	0.01	0.01	1.01	0.06	0.14	0.01		0.56		0.05
Uniform Delay, d1	26.3	3.2	2.1	5.3	16.2	5.5	39.8	39.2		41.9		39.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	5.0	1.0	0.0	0.0	28.3	0.1	1.7	0.1		13.3		0.5
Delay (s)	31.3	4.2	2.1	5.3	44.6	5.6	41.5	39.3		55.1		39.9
Level of Service	C	A	A	A	D	A	D	D		E		D
Approach Delay (s)		6.9			42.0			40.8			48.1	
Approach LOS		A			D			D			D	

### Intersection Summary

HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1390	15	5	836	71	10	5	5	102	0	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1723		1770		1583
Flt Permitted	0.15	1.00	1.00	0.05	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	288	1863	1583	96	1863	1583	1410	1723		1399		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	1511	16	5	909	77	11	5	5	111	0	11
RTOR Reduction (vph)	0	0	3	0	0	27	0	4	0	0	0	9
Lane Group Flow (vph)	98	1511	13	5	909	50	11	6	0	111	0	2
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	94.5	94.5	94.5	77.5	77.5	77.5	16.5	16.5		16.5		16.5
Effective Green, g (s)	94.5	94.5	94.5	77.5	77.5	77.5	16.5	16.5		16.5		16.5
Actuated g/C Ratio	0.79	0.79	0.79	0.65	0.65	0.65	0.14	0.14		0.14		0.14
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	381	1467	1247	62	1203	1022	194	237		192		218
v/s Ratio Prot	0.03	c0.81			0.49			0.00				
v/s Ratio Perm	0.18		0.01	0.05		0.03	0.01			c0.08		0.00
v/c Ratio	0.26	1.03	0.01	0.08	0.76	0.05	0.06	0.02		0.58		0.01
Uniform Delay, d1	12.2	12.8	2.7	7.9	14.7	7.8	45.0	44.8		48.5		44.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	1.6	31.5	0.0	2.5	4.4	0.1	0.6	0.2		12.1		0.1
Delay (s)	13.8	44.3	2.7	10.5	19.1	7.9	45.5	45.0		60.6		44.7
Level of Service	B	D	A	B	B	A	D	D		E		D
Approach Delay (s)		42.0			18.2			45.3			59.1	
Approach LOS		D			B			D			E	

### Intersection Summary

HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗		↖	↗	↘
Volume (vph)	75	660	10	5	1320	90	25	0	10	90	0	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1583		1770		1583
Flt Permitted	0.05	1.00	1.00	0.39	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	99	1863	1583	731	1863	1583	1410	1583		1398		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	717	11	5	1435	98	27	0	11	98	0	82
RTOR Reduction (vph)	0	0	2	0	0	22	0	10	0	0	0	73
Lane Group Flow (vph)	82	717	9	5	1435	76	27	1	0	98	0	9
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	79.5	79.5	79.5	70.5	70.5	70.5	11.5	11.5		11.5		11.5
Effective Green, g (s)	79.5	79.5	79.5	70.5	70.5	70.5	11.5	11.5		11.5		11.5
Actuated g/C Ratio	0.80	0.80	0.80	0.70	0.70	0.70	0.12	0.12		0.12		0.12
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	154	1481	1258	515	1313	1116	162	182		161		182
v/s Ratio Prot	0.02	c0.38			c0.77			0.00				
v/s Ratio Perm	0.40		0.01	0.01		0.05	0.02			c0.07		0.01
v/c Ratio	0.53	0.48	0.01	0.01	1.09	0.07	0.17	0.01		0.61		0.05
Uniform Delay, d1	28.6	3.4	2.1	4.4	14.8	4.6	39.9	39.2		42.1		39.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	12.6	1.1	0.0	0.0	54.2	0.1	2.2	0.1		15.9		0.5
Delay (s)	41.1	4.6	2.1	4.4	69.0	4.7	42.1	39.3		58.1		39.9
Level of Service	D	A	A	A	E	A	D	D		E		D
Approach Delay (s)		8.2			64.7			41.3			49.8	
Approach LOS		A			E			D			D	

### Intersection Summary

HCM Average Control Delay	45.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1560	20	5	900	70	10	5	5	115	0	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1723		1770		1583
Flt Permitted	0.14	1.00	1.00	0.05	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	256	1863	1583	93	1863	1583	1410	1723		1399		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1696	22	5	978	76	11	5	5	125	0	136
RTOR Reduction (vph)	0	0	4	0	0	21	0	4	0	0	0	121
Lane Group Flow (vph)	109	1696	18	5	978	55	11	6	0	125	0	15
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	97.5	97.5	97.5	80.5	80.5	80.5	13.5	13.5		13.5		13.5
Effective Green, g (s)	97.5	97.5	97.5	80.5	80.5	80.5	13.5	13.5		13.5		13.5
Actuated g/C Ratio	0.81	0.81	0.81	0.67	0.67	0.67	0.11	0.11		0.11		0.11
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	366	1514	1286	62	1250	1062	159	194		157		178
v/s Ratio Prot	0.03	c0.91			0.53			0.00				
v/s Ratio Perm	0.21		0.01	0.05		0.03	0.01			c0.09		0.01
v/c Ratio	0.30	1.12	0.01	0.08	0.78	0.05	0.07	0.03		0.80		0.09
Uniform Delay, d1	13.6	11.2	2.1	6.9	13.7	6.7	47.6	47.4		51.9		47.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	2.1	63.5	0.0	2.5	4.9	0.1	0.8	0.3		32.9		0.9
Delay (s)	15.7	74.8	2.2	9.4	18.6	6.8	48.5	47.7		84.9		48.7
Level of Service	B	E	A	A	B	A	D	D		F		D
Approach Delay (s)		70.4			17.7			48.1			66.0	
Approach LOS		E			B			D			E	

### Intersection Summary

HCM Average Control Delay	52.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	103.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	686	10	5	1321	90	25	0	10	94	0	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1583		1770		1583
Flt Permitted	0.05	1.00	1.00	0.38	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	99	1863	1583	702	1863	1583	1410	1583		1398		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	746	11	5	1436	98	27	0	11	102	0	82
RTOR Reduction (vph)	0	0	2	0	0	22	0	10	0	0	0	73
Lane Group Flow (vph)	82	746	9	5	1436	76	27	1	0	102	0	9
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	79.5	79.5	79.5	70.5	70.5	70.5	11.5	11.5		11.5		11.5
Effective Green, g (s)	79.5	79.5	79.5	70.5	70.5	70.5	11.5	11.5		11.5		11.5
Actuated g/C Ratio	0.80	0.80	0.80	0.70	0.70	0.70	0.12	0.12		0.12		0.12
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	154	1481	1258	495	1313	1116	162	182		161		182
v/s Ratio Prot	0.02	c0.40			c0.77			0.00				
v/s Ratio Perm	0.40		0.01	0.01		0.05	0.02			c0.07		0.01
v/c Ratio	0.53	0.50	0.01	0.01	1.09	0.07	0.17	0.01		0.63		0.05
Uniform Delay, d1	28.6	3.5	2.1	4.4	14.8	4.6	39.9	39.2		42.2		39.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	12.6	1.2	0.0	0.0	54.5	0.1	2.2	0.1		17.5		0.5
Delay (s)	41.1	4.7	2.1	4.4	69.3	4.7	42.1	39.3		59.7		39.9
Level of Service	D	A	A	A	E	A	D	D		E		D
Approach Delay (s)		8.3			65.0			41.3			50.9	
Approach LOS		A			E			D			D	

### Intersection Summary

HCM Average Control Delay	45.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 2: Arapahoe Rd & 63rd

2/17/2011



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗		↖	↗	↘
Volume (vph)	100	1579	20	5	954	78	10	5	5	118	0	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00		0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95		1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1723		1770		1583
Flt Permitted	0.11	1.00	1.00	0.05	1.00	1.00	0.76	1.00		0.75		1.00
Satd. Flow (perm)	200	1863	1583	93	1863	1583	1410	1723		1399		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1716	22	5	1037	85	11	5	5	128	0	136
RTOR Reduction (vph)	0	0	3	0	0	22	0	4	0	0	0	122
Lane Group Flow (vph)	109	1716	19	5	1037	63	11	6	0	128	0	14
Turn Type	pm+pt		Perm	Perm		Perm	Perm			Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2			6		6
Actuated Green, G (s)	98.5	98.5	98.5	80.5	80.5	80.5	12.5	12.5		12.5		12.5
Effective Green, g (s)	98.5	98.5	98.5	80.5	80.5	80.5	12.5	12.5		12.5		12.5
Actuated g/C Ratio	0.82	0.82	0.82	0.67	0.67	0.67	0.10	0.10		0.10		0.10
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5		4.5
Lane Grp Cap (vph)	341	1529	1299	62	1250	1062	147	179		146		165
v/s Ratio Prot	0.04	c0.92			0.56			0.00				
v/s Ratio Perm	0.23		0.01	0.05		0.04	0.01			c0.09		0.01
v/c Ratio	0.32	1.12	0.01	0.08	0.83	0.06	0.07	0.03		0.88		0.09
Uniform Delay, d1	17.1	10.8	1.9	6.9	14.7	6.8	48.5	48.3		53.0		48.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00
Incremental Delay, d2	2.5	64.3	0.0	2.5	6.5	0.1	1.0	0.3		47.3		1.0
Delay (s)	19.5	75.0	2.0	9.4	21.1	6.9	49.5	48.6		100.3		49.6
Level of Service	B	E	A	A	C	A	D	D		F		D
Approach Delay (s)		70.9			20.0			49.1			74.2	
Approach LOS		E			B			D			E	

### Intersection Summary

HCM Average Control Delay	53.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group