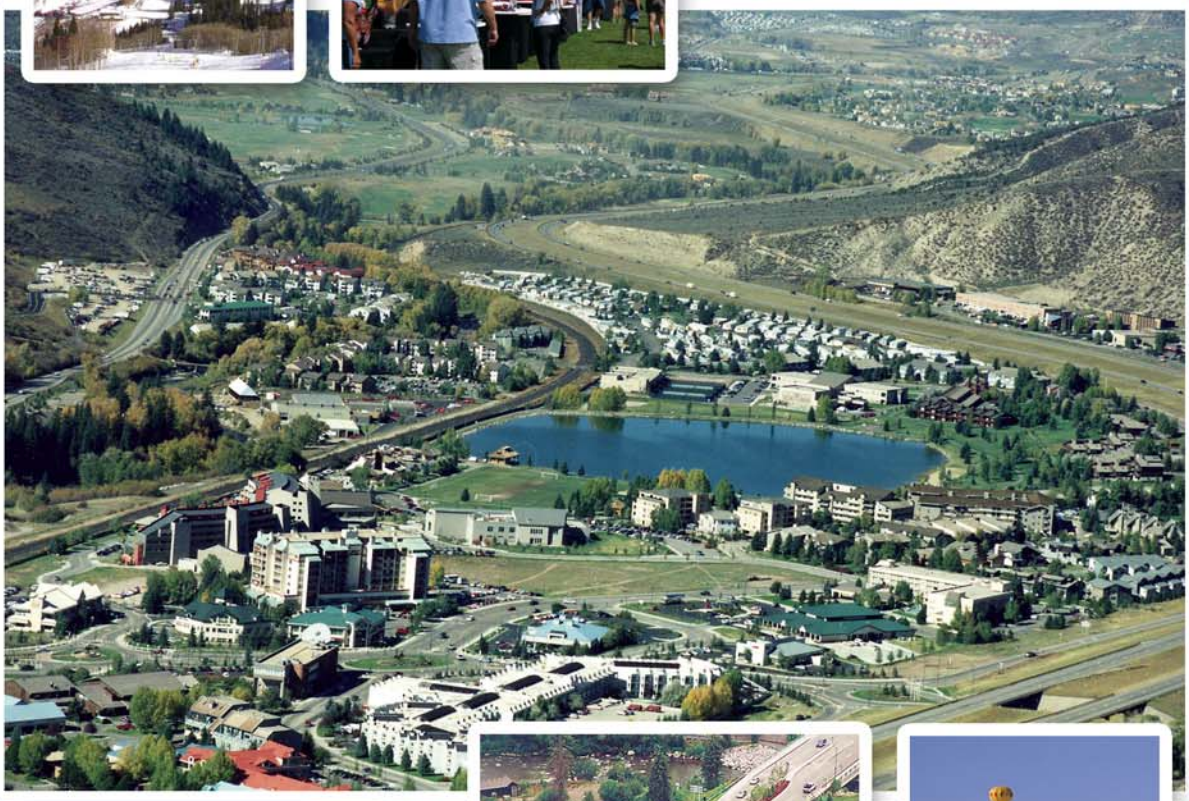
Town of Avon
Comprehensive Transportation Plan

October 2009



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TOWN OF AVON

COMPREHENSIVE TRANSPORTATION PLAN

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TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY ---------- i

CHAPTER 1. ROADWAY SYSTEM ----------1-1

1.1 EXISTING CONDITIONS ----------1-1
1.1.1 Roadways ----------1-1
1.1.2 Traffic Volumes and Operations ----------1-6
1.2 FUTURE CONDITIONS ---------- 1-12
1.2.1 Land Use ---------- 1-12
1.2.2 Traffic Volume Projections ---------- 1-13
1.2.3 Future Traffic Operational Results ---------- 1-17
1.2.4 Roadway Improvement Requirements ---------- 1-23
1.2.5 Traffic Impact Evaluations ---------- 1-24
1.3 TRAFFIC CALMING AND SAFETY ---------- 1-30
1.3.1 Alternatives ---------- 1-30
1.3.2 Application ---------- 1-30
1.3.3 Sight Distance ---------- 1-31
1.4 TOWN STANDARDS ---------- 1-32
1.4.1 Roadways ---------- 1-32
1.4.2 Transportation Impact Study Guidelines ---------- 1-39

CHAPTER 2. BICYCLE AND PEDESTRIAN SYSTEM ----------2-1

2.1 EXISTING CONDITIONS ----------2-1
2.1.1 Regional Trails System ----------2-1
2.1.2 Recreational Trails ----------2-1
2.1.3 Local Bicycle/Pedestrian Connection ----------2-3
2.2 FUTURE CONDITIONS ----------2-6
2.2.1 Regional and Recreational Trails Planning ----------2-6
2.2.2 Local Bicycle/Pedestrian Connections ----------2-7
2.2.3 Potential Grade Separated Pedestrian Solutions ----------2-8

CHAPTER 3. TRANSIT SYSTEM ----------3-1

3.1 EXISTING SERVICES ----------3-1
3.1.1 Town of Avon Shuttle ----------3-1
3.1.2 Wal-Mart and Buffalo Ridge Demonstration Service ---------- 3-15
3.1.3 ECO Transit Routes ---------- 3-16
3.1.4 Stops and Stop Amenities ---------- 3-18
3.1.5 Fleet and Facilities ---------- 3-21
3.1.6 Budget and Funding ---------- 3-22

TABLE OF CONTENTS

Page

3.2 FUTURE CONDITIONS ---------- 3-27
3.2.1 Planned Development ---------- 3-27
3.2.2 Transit Demand ---------- 3-27
3.2.3 Alternatives ---------- 3-32
3.2.4 Bus Stop Improvements ---------- 3-40
3.2.5 Maintenance/Operations ---------- 3-40
3.2.6 Capital and Operating Costs ---------- 3-40
3.2.7 Funding Options ---------- 3-43

CHAPTER 4. SUMMARY AND RECOMMENDATIONS ---------- 4-1

APPENDICES (UNDER SEPARATE COVER)

APPENDIX A TRAFFIC COUNTS

APPENDIX B EXISTING LOS ANALYSES

APPENDIX C FUTURE LOS ANALYSES

APPENDIX D BUS STOP GUIDELINES

APPENDIX E APPROVED STREET PLANTINGS

LIST OF FIGURES

		Page
Figure 1.1	Roadway System	1-2
Figure 1.2	Existing Summer Traffic Volumes	1-7
Figure 1.3	Existing Winter Traffic Volumes	1-8
Figure 1.4	Existing Summer Level of Service	1-9
Figure 1.5	Existing Winter Level of Service	1-10
Figure 1.6	Future Summer Traffic Volumes	1-18
Figure 1.7	Future Winter Traffic Volumes	1-19
Figure 1.8	Future Summer Level of Service	1-20
Figure 1.9	Future Winter Level of Service	1-21
Figure 1.10	Arterial Cross-Section	1-33
Figure 1.11	Collector – Urban Cross-Section	1-34
Figure 1.12	Collector – Rural Cross-Section	1-35
Figure 1.13	Local – Rural Cross-Section	1-36
Figure 1.14	Local – Rural Cross-Section	1-37
Figure 1.15	Transit and Alternate Mode Subareas	1-42
Figure 1.16	Non-Motorized LOS Criteria	1-49
Figure 2.1	Existing Trail System	2-2
Figure 2.2	Sidewalk Discontinuity – East Beaver Creek Boulevard	2-4
Figure 2.3	Areas of Existing Sidewalk Deficiency	2-5
Figure 2.4	I-70 Crossing Near Metcalf Road	2-9
Figure 2.5	Railroad Pedestrian Crossing at Stonebridge Drive	2-11
Figure 2.6	Future Grade Separated Solutions: US 6/Eagle River/UPRR	2-13
Figure 3.1	Existing Local and Regional Bus Routes	3-2
Figure 3.2	Winter Boardings by Hour by Route	3-6
Figure 3.3	Summer Town Route	3-7
Figure 3.4.	Ridership by Stop – Winter and Summer	3-9
Figure 3.5	Summer Boardings by Hour and Route	3-10
Figure 3.6	Avon Transit Ridership by Route by Month	3-11

LIST OF FIGURES (Continued)

Page

Figure 3.7 2008 Beaver Creek Shuttle Boardings by Month ---------- 3-12
Figure 3.8 Avon Transit Service Hours by Route ---------- 3-13
Figure 3.9 2008 Beaver Creek Shuttle Service Hours ---------- 3-14
Figure 3.10 Historic Cost per Service Hour for Town Routes ---------- 3-25
Figure 3.11 Cost of Transit Service per Passenger ---------- 3-26
Figure 3.12 Planned Roadway and High Speed Rail ---------- 3-28
Figure 3.13 Town of Avon Transit Subareas ---------- 3-30
Figure 3.14 Increase in Ridership as Town Builds Out ---------- 3-31
Figure 3.15 Near -Term Transit Plan ---------- 3-36
Figure 3.16 Areas Served by Avon Transit at Buildout ---------- 3-39
Figure 3.17 Suggested Stops ---------- 3-41
Figure 4.1 Recommended Roadway Improvements ---------- 4-2
Figure 4.2 Recommended Non-Motorized Improvements ---------- 4-4
Figure 4.3 Recommended Transit Improvements ---------- 4-5

LIST OF TABLES

Table ES-1 Improvement Cost Summary ---------- ii
Table 1.1 Land Use Summary ---------- 1-12
Table 1.2 Mode Split ---------- 1-13
Table 1.3 Summer Season Trip Generation ---------- 1-14
Table 1.4 Winter Season Trip Generation ---------- 1-16
Table 1.5 Intersection Levels of Service ---------- 1-22
Table 1.6 Roadway Levels of Service ---------- 1-23
Table 1.7 East Town Center Summer Trip Generation ---------- 1-24
Table 1.8 East Town Center Winter Trip Generation ---------- 1-25
Table 1.9 East Town Center Total Future Travel Demand ---------- 1-25
Table 1.10 West Town Center Summer Trip Generation ---------- 1-26
Table 1.11 West Town Center Winter Trip Generation ---------- 1-27
Table 1.12 West Town Center Total Future Travel Demand ---------- 1-27

LIST OF TABLES (Continued)

		Page
Table 1.13	Village at Avon Summer Trip Generation	1-28
Table 1.14	Village at Avon Winter Trip Generation	1-28
Table 1.15	Village at Avon Total Future Travel Demand	1-28
Table 1.16	Transit Ridership as a Percentage of Vehicle Trips	1-41
Table 1.17	Target Levels of Service by Pedestrian Facility Type	1-44
Table 1.18	LOS Criteria Definitions	1-46
Table 1.19	Pedestrian Street Crossing LOS	1-47
Table 1.20	Bicycle LOS Definitions	1-48
Table 2.1	Recreational Trails Capital Improvement Projects	2-6
Table 3.1	2007/2008 Avon Winter Route Hours and Frequency of Service	3-3
Table 3.2	2008/2009 Avon Winter Route Hours and Frequency of Service	3-3
Table 3.3	Ridership by Stop February 18, 2008	3-5
Table 3.4	Summer Route Hours and Frequency of Service	3-7
Table 3.5	Ridership by Stop July 26, 2008	3-8
Table 3.6	2008 Boardings per Hour by Month	3-14
Table 3.7	Potential Increase in 2008 Peak Winter Day Ridership	3-15
Table 3.8	ECO Transit Routes, Frequencies and Fares	3-17
Table 3.9	Transit Stop Amenities	3-21
Table 3.10	Fleet Roster	3-22
Table 3.11	Productivity by Service Type	3-24
Table 3.12	Mode Share Estimates	3-29
Table 3.13	New Avon Transit Demand at Buildout (Average Winter Day)	3-29
Table 3.14	Town of Avon Annual Ridership Projections at Buildout	3-31
Table 3.15	Operating Costs and Service Hour Estimate	3-42
Table 3.16	Fleet Costs	3-42
Table 4.1	Improvement Prioritization and Preliminary Cost Opinions	4-6

EXECUTIVE SUMMARY

The Town of Avon, located in the central mountains of Colorado, has experienced rapid growth in recent years. As the gateway to the Beaver Creek Resort, Avon provides a focal point for housing, lodging and services. With abundant year-round recreational opportunities throughout the area, Avon has become an increasingly desirable place to live, work, and visit. Like many communities along the Interstate 70 mountain corridor, increasing travel demand in Avon has accompanied the regional growth in both residential and commercial development.

Planned re-development of the Avon Town Center, along with anticipated new development in the Village at Avon, will also place increasing pressure on the Town's existing transportation system. As traffic volumes grow, so too will the demand for alternative transportation modes. To maintain the quality of life in this mountain community, an integrated approach to planning for future roadway improvements, transit service enhancements, and bicycle/pedestrian facilities is required.

Previous transportation planning efforts include the following reports:

- AVON TRANSPORTATION PLAN, Felsburg Holt & Ullevig, December 1991.
- TOWN OF AVON TRANSPORTATION PLAN UPDATE, MK Centennial, November 1996.
- US 6 AND I-70 G CORRIDOR FEASIBILITY STUDY, Felsburg Holt & Ullevig, PBS & J, March 2004.

These previous efforts have focused primarily on vehicular traffic, with only minimal attention to alternative travel modes. Recognizing this shortfall, the Town adopted the 2006 Comprehensive Plan that envisions a balanced, multi-modal transportation system.

The purpose of the Comprehensive Transportation Plan is to support this vision by forecasting the potential future travel demand and its impacts on the multi-modal system in Avon. Existing and future deficiencies have been identified for roadways, bicycle/pedestrian facilities, and the transit system. Improvement alternatives for each mode have been developed to ensure adequate capacity through the projected year 2035. It is the Town's goal to encourage the use of alternative transportation modes, such as walking, biking, and riding transit, by providing safe, inviting paths, walkways, and convenient bus service. A higher priority is placed on the safety and quality of the experience for pedestrians and bicyclists, with secondary consideration for roadway capacity improvements for vehicular traffic.

The transit component has been structured such that it may serve as a stand-alone "Strategic Transit Plan" to assist the Town in pursuing funding options. In addition, Roadway Standards and Traffic Impact Study guidelines have been developed to assist the Town in addressing the multi-modal transportation impacts of new developments.

Preliminary opinions of probable capital construction costs were developed for the roadway and pedestrian improvements. For the transit element, annual operating costs for three alternative service plans were prepared. The improvements, and potential estimated costs, are summarized as follows:

- **Roadways**. In general, the existing and planned roadway system in Avon will accommodate the projected future traffic volumes. However, US 6 would require widening to four through-lanes at a preliminary opinion of probable cost of $34.5 million.
- **Bicycle/Pedestrian Facilities**. Improvements include sidewalk construction, recreational trail enhancements and construction, and alternative pedestrian grade-separated solutions for I-70, Avon Road, and the UPRR. The range of potential costs for these improvements is $3.85 million to $7.22 million, depending on alternatives.
- **Transit**. Proposed service plans includes costs associated with enhanced service on existing routes, new routes, ridership increases, transit stops and shelters, fleet additions, and maintenance. The Near Term plan would have an annual operating cost of about $2.0 million. The range of annual operating costs in the Long Term future is between $4.3 million and $4.9 million per year.

The following summarizes the above costs:

Table ES-1 Improvement Cost Summary

Mode	Description	Cost (Millions)
Roadway	US 6, widen to 4 lanes	$34.5
	Swift Gulch/Nottingham Roundabout	$1.0
	Beaver Creek Boulevard Streetscape and Lane Reductions	$0.75
Non-Motorized	Sidewalk Construction	$1.43
	Recreational Trails	$0.77
	I-70 pedestrian crossing at Metcalf Road	$0.97 to $2.2
	Pedestrian Solution for Avon Road	$0.51 to $1.8
	RR Pedestrian Crossing at Eaglebend	$1.4 to $2.2
	I-70 Pedestrian Crossing from Buffalo Ridge	$2.0
	Metcalf Road Bike Lanes	$0.5
	Pedestrian Connection under US 6, over River	$1.5
	Nottingham Road/Buck Creek Connection	$0.05
	West Beaver Creek Boulevard/Nottingham Park Connection	$0.05
Transit	Near Term (annual operating cost)	$2.0
	Long Term (annual operating cost)	$3.4 to $5.3

CHAPTER 1. ROADWAY SYSTEM

1.1 EXISTING CONDITIONS

1.1.1 Roadways

The Town of Avon is situated along Interstate 70 between Vail and Edwards. US 6, which parallels the freeway, provides local access as well as secondary east-west regional connection within the Vail Valley. Avon Road provides primary access to the freeway, linking I-70 with US 6. Secondary interstate access is available at Post Boulevard, located east of Avon Road within the Village at Avon. Between I-70 and US 6, the Eagle River and the Union Pacific Railroad Tennessee Pass line (now inactive), constrain the ability to expand the existing roadway system.

The existing roadway system within Avon is depicted on **Figure 1.1**. A field inventory was conducted to establish existing physical characteristics for primary roadways within the Town.

Primary Arterials

I-70. Providing primary east-west regional connection through Colorado, this four-lane freeway bisects the Town of Avon. Interchange accesses are provided at Avon Road and Post Boulevard. East of Avon, I-70 is posted at 65 miles per hour (MPH). To the west, the speed limit is posted 75 MPH.

US 6. This arterial state highway consists of a basic two-lane cross section with auxiliary turn lanes at major intersections and access points. Shoulders are generally paved with a minimum width of 2 feet. The posted speed limit varies between 35 and 45 miles MPH, with a 25 MPH school zone within Eagle-Vail. Adjacent land uses include both residential and commercial uses.

Avon Road. This arterial Town road consists of a basic four-lane urban cross section between I-70 and US 6, with some auxiliary laneage at major intersections. Traffic control is accomplished through roundabouts at major intersections. Shoulders have been replaced with curb and gutter, and a sidewalk is provided along both side of the roadway. The posted speed limit on Avon Road is 25 MPH. Adjacent land uses are generally lodging or commercial.

Roads North of I-70

Nottingham Road. An extension of Avon Road, this collector roadway trends north and west from the I-70 interchange. The cross-section is generally two- lane, with no bike lanes, and the shoulders vary from unpaved to paved with a maximum width of two feet. There is a parallel, paved separate bike/pedestrian trail along the south side of Nottingham Road. The posted speed limit is 30 MPH. The adjacent land uses are high-density residential and commercial uses with numerous accesses.

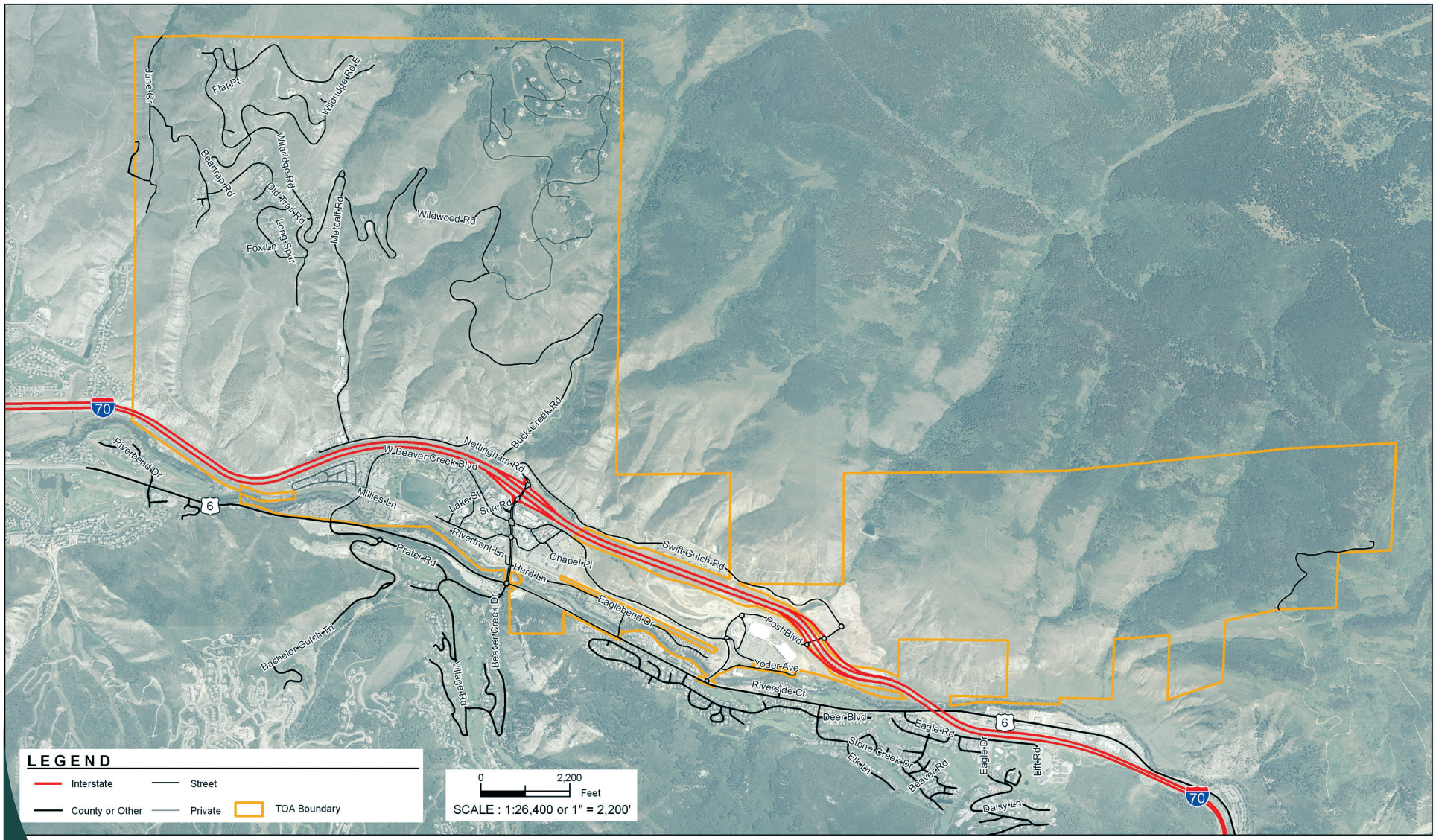


Figure 1.1
Roadway System

FELSBURG HOLT & ULLEVIG

NORTH

Metcalf Road. This two-lane collector facility trends north from Nottingham Road into mountainous terrain. There are no bike lanes, and the shoulders are unpaved with a maximum width of two feet. The posted speed limit is 35 MPH with 25 MPH posted through the commercial area. The adjacent land uses transition from commercial uses on the south to multi-family residential housing.

Wildridge Road. This two-lane local road is an extension of Metcalf Road, winding through low-density residential housing on the mountainside above the Avon core area. A paved bicycle/pedestrian lane has recently been added to Wildridge Road, beginning at the Old Trail Road intersection. This lane varies from six to eight feet in width and is denoted with channelizing lines, pedestrian symbol pavement markings, and rumble strips. The speed limit is posted 25 MPH.

Wildwood Road. Branching east from Metcalf Road, this two-lane local road follows steep grades and sharp curves. There are no marked bike lanes, and the shoulders vary between paved and unpaved, up to two feet in width. The posted speed limit is 25 MPH. The adjacent land uses are primarily residential.

Buck Creek Road. This two-lane collector extends north from Nottingham Road, trending west and north into low-density residential neighborhoods. Buck Creek Road connects with Wildwood Road, providing an alternative to Metcalf Road as a means of access for residential uses to the west. There are no marked bike lanes, and the shoulders vary between paved and unpaved, with a maximum width of two feet. The speed limit is posted 30 MPH.

Swift Gulch Road. Running along the north side of I-70 from Nottingham Road east to Post Boulevard, this two-lane collector roadway serves multi-family uses as well as Town of Avon municipal facilities. The shoulder widths vary between two and four feet (paved), and there is a parallel paved pedestrian/bike trail along much of Swift Gulch Road. The posted speed limit changes from 25 MPH at the east end to 30 MPH at the west end.

Roads East of Avon Road

East Beaver Creek Boulevard. This collector roadway extends east from Avon Road to Post Boulevard. Immediately east of Avon Road, the cross-section transitions from five lanes to two plus a center left-turn lane. The existing land uses consist of lodging and commercial within the core area. Although sidewalks are present along both sides within the core area, they are discontinuous in places. The posted speed limit on this section is 25 MPH. East of Beaver Creek Place, the roadway narrows to two-lanes with a posted speed limit of 30 MPH to Post Boulevard. Although there are no marked bike lanes, there are paved shoulders of between 4 and 6 feet in width along both sides of the roadway. This is a temporary alignment, pending adjacent development within the Village at Avon. Adjacent land uses east of Chapel Place include a day-skier lot for overflow parking, a community recycling center, rodeo grounds, and a commercial snow storage site.

Post Boulevard. This four-lane divided arterial road extends south from Swift Gulch Road to US 6 and has an interchange with I-70. Roundabouts at intersections provide traffic control. Curb and gutter, and attached sidewalks are provided along both side of the roadway. The posted speed limit on Post Boulevard is 30 MPH, changing to 35 MPH at the north end. Adjacent land uses are primarily commercial (Home Depot, Wal-Mart).

Yoder Avenue. Trending east from Post Boulevard, this collector roadway has a basic two-lane cross-section with center left-turn lane striping. An attached sidewalk is provided along the south side of Yoder Avenue. The posted speed limit is 25 MPH. Adjacent land uses include commercial (Home Depot, Wal-Mart) and a public charter school (Stone Creek School). The school is an interim use pending development by the Public Works Department.

Fawcett Road. This collector extends between Post Boulevard and Yoder Avenue, serving adjacent commercial uses. Fawcett Road has a two-lane cross-section with left-turn lanes at accesses. Curb, gutter, and sidewalk is generally provided along both sides of the roadway. There are no marked bike lanes and no speed limit signing.

Benchmark Road. Extending east from Avon Road to Beaver Creek Place, this urban local/collector roadway has a basic two-lane cross-section. Benchmark Road serves lodging and commercial land uses, and has some on-street angle parking. Curb, gutter, and sidewalk is provided along both sides; however, the sidewalks are discontinuous in places. There is no speed limit signing.

Beaver Creek Place. This urban local/collector roadway forms a loop, connecting at both ends to East Beaver Creek Boulevard. With a basic two-lane cross-section, Beaver Creek Place serves lodging and commercial land uses. Curb, gutter, and sidewalk is provided along both sides with some discontinuity of the sidewalks. There is no speed limit signing.

Chapel Place. This urban local roadway has a basic two-lane cross-section, extending between Beaver Creek Place and East Beaver Creek Boulevard, serving commercial land uses. Curb and gutter is provided adjacent to development; paved shoulders with a maximum width of two feet are provided adjacent to undeveloped properties. Some sidewalk is provided adjacent to development, but it is discontinuous in places. There are no marked bike lanes. The speed limit is posted 25 MPH.

Hurd Lane/Eaglebend Drive. Paralleling the Eagle River between US 6 and the UPRR line, this two-lane local roadway provides access to Avon Road for some commercial, but primarily residential, land uses. There are no shoulders, but a paved bicycle/pedestrian path is provided between Avon Road and Stonebridge Drive. The speed limit is posted 25 MPH.

Stonebridge Drive. This short, two-lane local connects Eaglebend Drive to US 6 via a bridge over the Eagle River. Stonebridge Drive provides an alternative means of access to US 6 for residential uses along Eaglebend Drive. There are no shoulders; an attached sidewalk is provided along the west side between US 6 and the bridge. The speed limit is posted 25 MPH.

Roads West of Avon Road

West Beaver Creek Boulevard. This collector roadway extends west from Avon Road, trending south to intersect with US 6 at Prater Road. Immediately west of Avon Road, the cross-section is basically five lanes including auxiliary turn lanes. West of Lake Street, the cross-section transitions to two lanes. South of the Eagle River bridge, and approaching US 6, the roadway widens to provide a center left-turn lane. Sidewalks are present along both sides in various places but are discontinuous. A bike lane has been striped along the south side of West Beaver Creek Boulevard for much of its length. Adjacent land uses include lodging and commercial development between Avon Road and Lake Street, transitioning to primarily residential uses, with commercial development at the intersection with US 6. The posted speed limit is 25 MPH, except through a school zone, where it is posted 20 MPH. The intersection of US 6/West Beaver Creek Boulevard/Prater Road is signalized; this is the only signalized intersection in Avon.

Benchmark Road. Extending west from Avon Road, this two-lane collector provides access for commercial and lodging developments, as well as the Town of Avon municipal offices, transit station, and Nottingham Park. A branch of Benchmark Road extends north to connect with West Beaver Creek Boulevard, serving the library, lodging, and commercial uses. A transit station is situated on the south side of Benchmark Road. There are sidewalks present along both sides of Benchmark Road east of the Transit Center; to the west, the sidewalk continues on the north side only. There are no bike lanes present. The posted speed limit is 25 MPH, with 15 MPH posted adjacent to the transit station.

Lake Street. This two-lane local road winds through municipal and commercial land uses along the east side of Nottingham Park between Benchmark Road and West Beaver Creek Boulevard. There are no marked bike lanes. Sidewalks are provided along both sides of the roadway. On-street angle parking is present along much of Lake Street. The speed limit is posted 20 MPH. Two transit stops are located along Lake Street (one with a shelter).

Riverfront Lane. Running parallel to and along the north side of the Eagle River, this two-lane local roadway provides access to Avon Road for ongoing lodging and commercial development. An at-grade crossing of the railroad provides connection to Lake Street north of the railroad tracks. The cross-section includes curb, gutter, and an attached sidewalk along the south side. A pedestrian connection to the Avon Transit Center is provided via Lettuce Shed Lane. The speed limit is posted 25 MPH.

The above descriptions of roadway physical characteristics comprise the primary existing roadway system in Avon; there are other minor roads that serve local access needs. It can be seen, however, that Avon roadways range from two-lane rural configurations to multi-lane urban streets. Within these two types of roadways (rural and urban), there is little consistency or continuity in the physical characteristics, particularly in the treatment of bicycle/pedestrian facilities and speed limits.

1.1.2 Traffic Volumes and Operations

AM and PM Peak hour traffic counts were collected at all study intersections on July 28th, 2008 (traffic count data is included in **Appendix A**). This date coincides with the Town of Avon's annual traffic counting program, when 24-hour counts along key roadway segments are conducted. The morning counts were collected from 7:00 AM to 9:00 AM and the afternoon counts were collected from 4:00 PM to 6:00 PM. The peak hours were determined to be 8:00 AM to 9:00 AM and 4:15 PM to 5:15 PM.

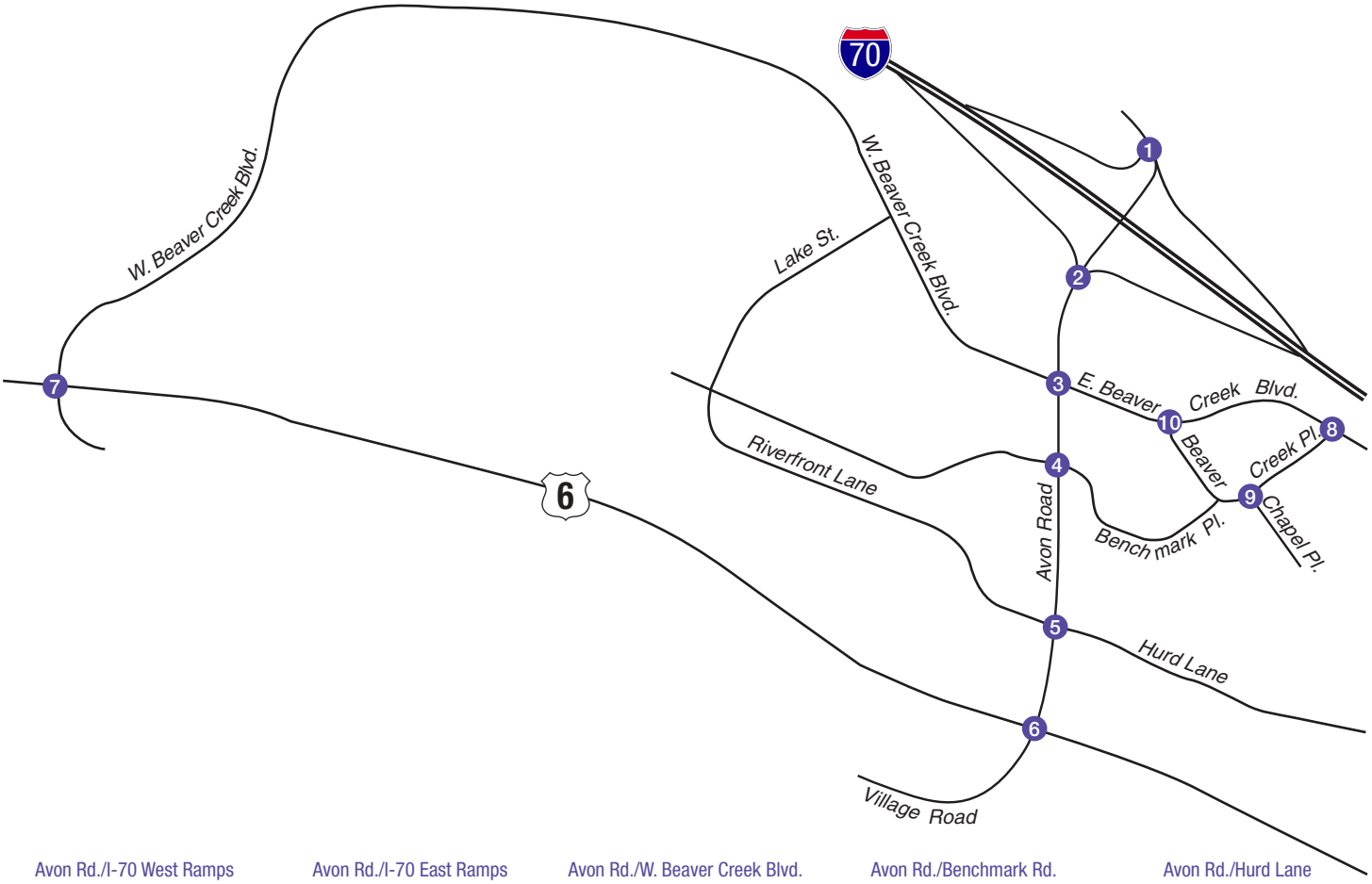
Peak hour traffic counts were also conducted during February 2009 at key intersections; these counts formed the basis for an analysis of peak winter ski season conditions. The existing traffic volumes are summarized on **Figure 1.2** (summer) and **Figure 1.3** (winter). These traffic counts were used as the basis for intersection and roadway level of service analyses.

Level of Service (LOS) is a qualitative measure of traffic operational conditions based on roadway capacity and motorist delay. The 2000 HIGHWAY CAPACITY MANUAL defines six levels of service, ranging from A to F, with LOS A representing the best possible operating conditions and LOS F representing over-capacity, or congested conditions. Per current Town of Avon standards, C is the lowest acceptable LOS for peak hour roadway operations and D is the lowest LOS for peak hour intersection operations. LOS analyses were completed for both summer and winter peak hour conditions at all intersections. Roadway level of service analyses were also completed for Avon Road between US 6 and I-70 Westbound Ramps and for US 6 between West Beaver Creek Boulevard and Avon Road.

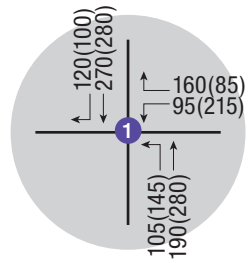
Of the ten study intersections, five are multi-lane roundabouts, one is a signalized intersection, and four are stop-controlled intersections. All roundabouts were analyzed using Sidra Intersection software. All other study intersections were analyzed using Synchro 7 software. Level of service worksheets are included in **Appendix B**.

The existing lane geometries and levels of service can be seen on **Figures 1.4** and **1.5** for summer and winter conditions. During the summer, all roundabouts currently operate at LOS A during both peak hours. The signalized intersection at US 6/West Beaver Creek Boulevard (Prater Road) currently operates at LOS C during both peak hours. All movements at all stop-controlled intersections operate at LOS C or better during both peak hours.

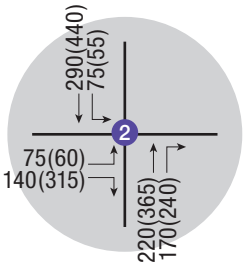
For the peak winter ski season conditions it was determined that, all roundabouts would operate at LOS A or B during both peak hours, although some periods of congestion may be experienced due to fluctuations in traffic flow. The winter roundabout analyses included adjustment factors to account for reduced capacity due to snowy conditions. Winter operations at the US 6/West Beaver Creek Boulevard (Prater Road) intersection are currently at LOS C during both peak hours. All movements at the stop-controlled intersections operate at LOS B or better during both peak hours.



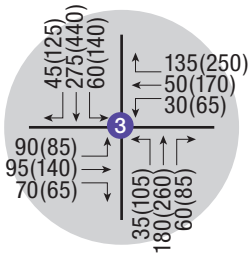
Avon Rd./I-70 West Ramps



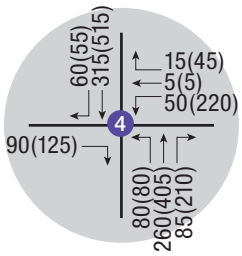
Avon Rd./I-70 East Ramps



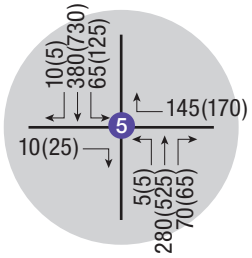
Avon Rd./W. Beaver Creek Blvd.



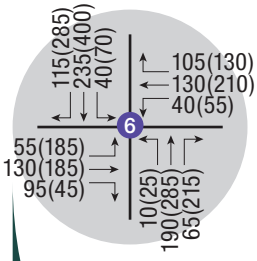
Avon Rd./Benchmark Rd.



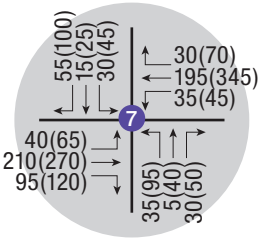
Avon Rd./Hurd Lane



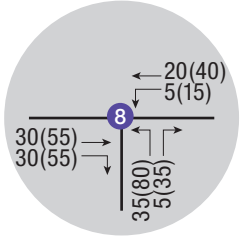
Avon Rd./US 6



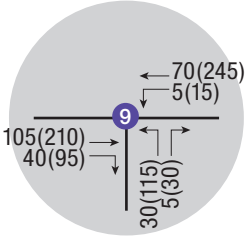
W. Beaver Creek Blvd./US 6



E. Beaver Creek Blvd./ Beaver Creek Pl.



Benchmark Rd./Chapel Pl.



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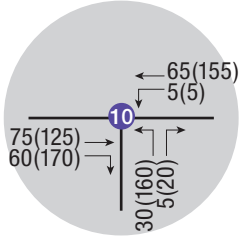


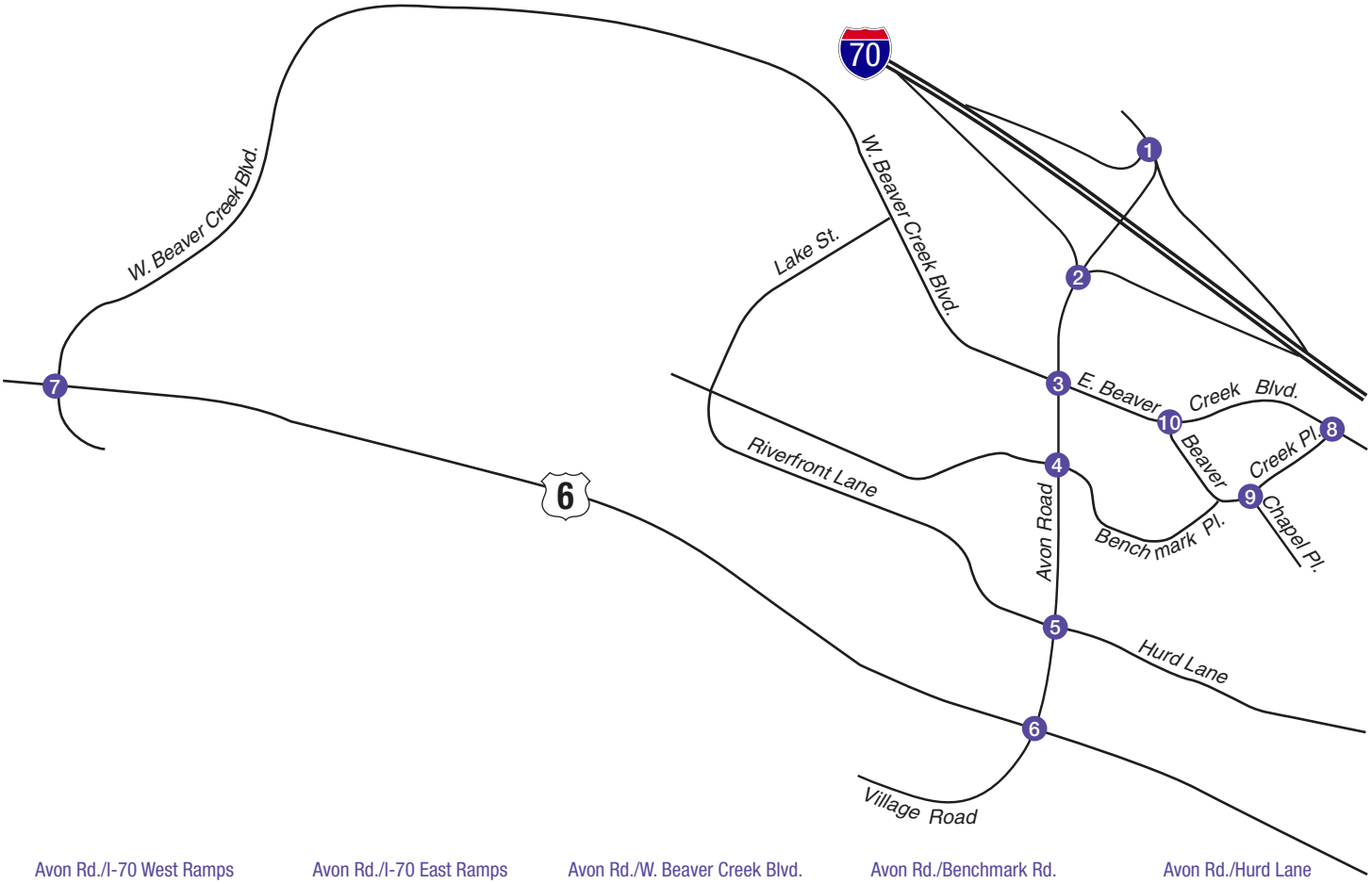
LEGEND

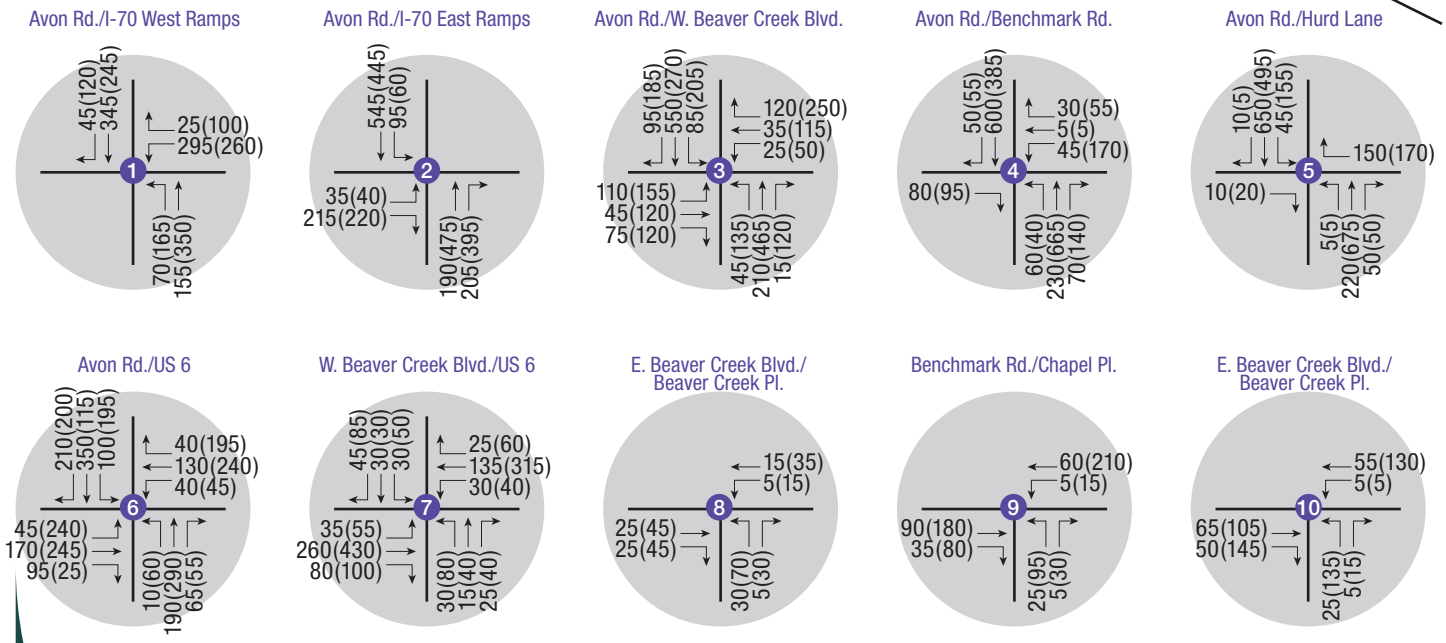
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

Figure 1.2
Existing Summer Traffic Volumes

FELSBURG HOLT & ULLEVIG

NORTH





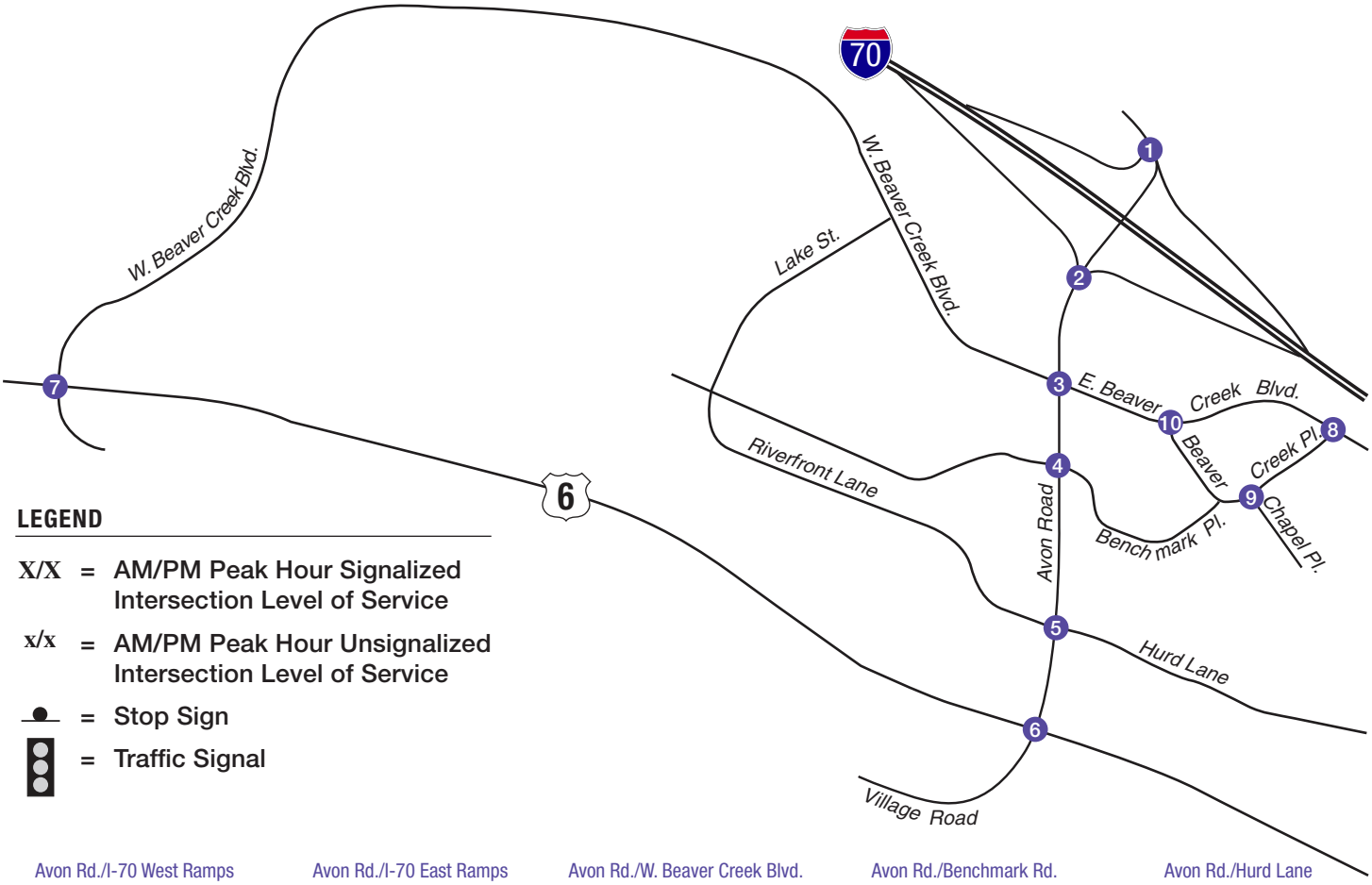
LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

Figure 1.3
Existing Winter Traffic Volumes

FELSBURG HOLT & ULLEVIG

NORTH



LEGEND

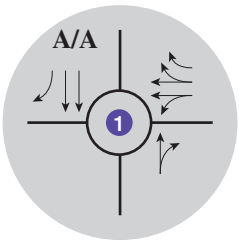
X/X = AM/PM Peak Hour Signalized Intersection Level of Service

x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service

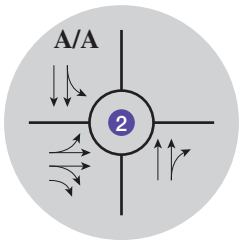
● = Stop Sign

▮ = Traffic Signal

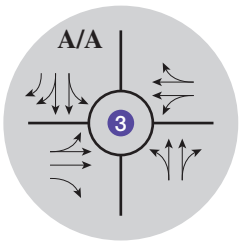
Avon Rd./I-70 West Ramps



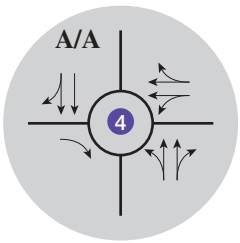
Avon Rd./I-70 East Ramps



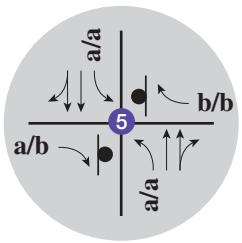
Avon Rd./W. Beaver Creek Blvd.



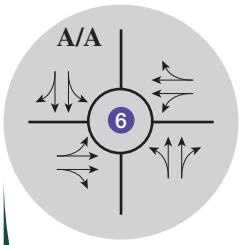
Avon Rd./Benchmark Rd.



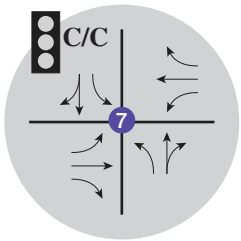
Avon Rd./Hurd Lane



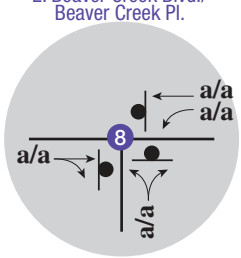
Avon Rd./US 6



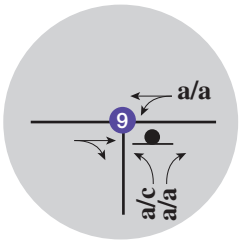
W. Beaver Creek Blvd./US 6



E. Beaver Creek Blvd./ Beaver Creek Pl.



Benchmark Rd./Chapel Pl.



E. Beaver Creek Blvd./ Beaver Creek Pl.

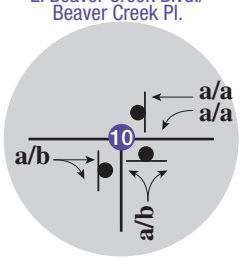


Figure 1.4
Existing Summer Level of Service

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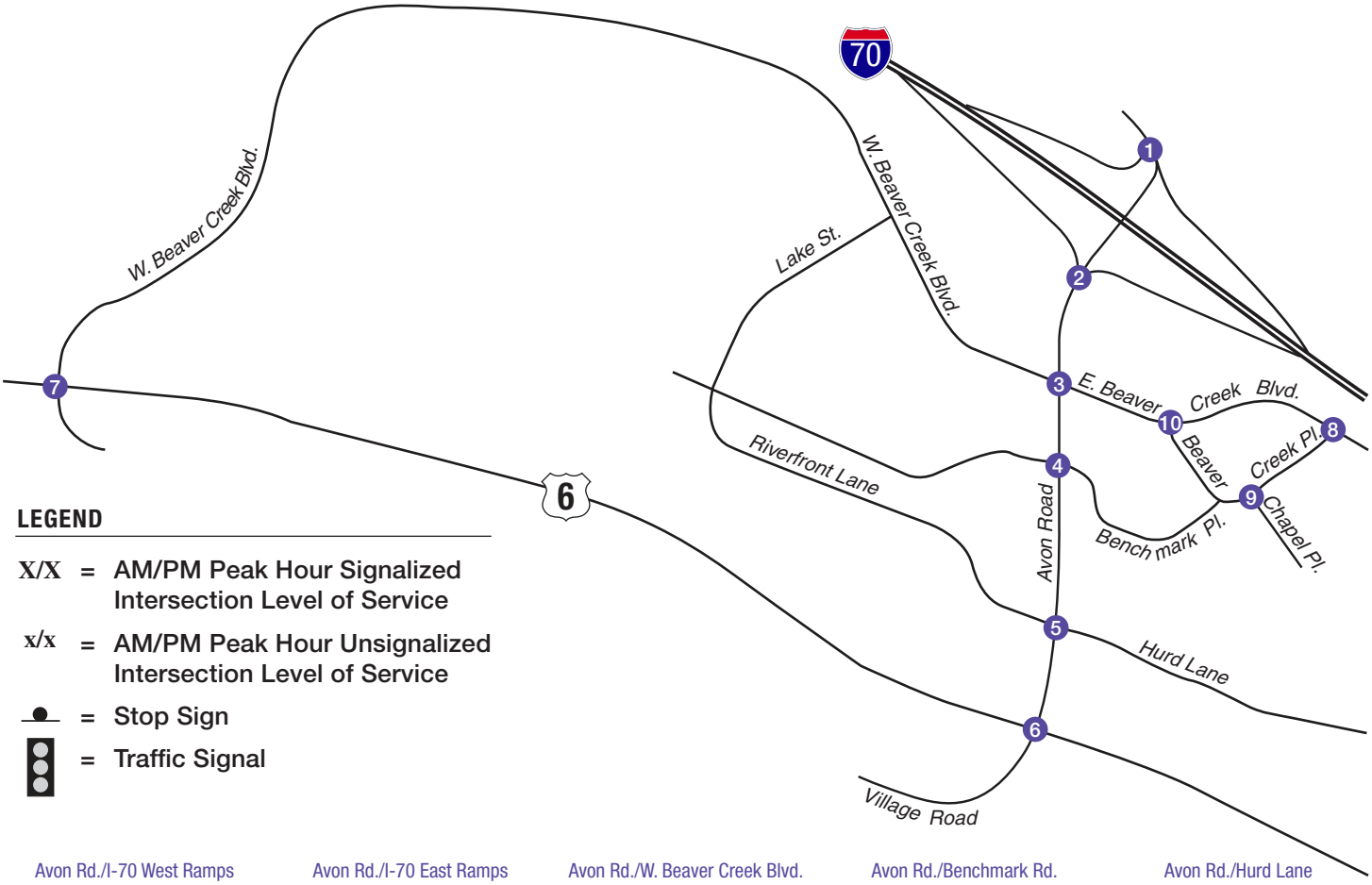


LEGEND

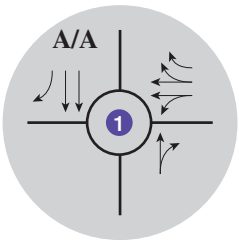
X/X = AM/PM Peak Hour Signalized Intersection Level of Service

x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service

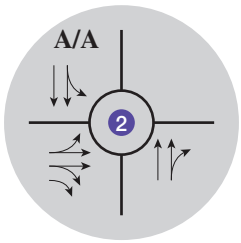
● = Stop Sign

▮ = Traffic Signal

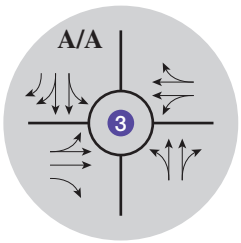
Avon Rd./I-70 West Ramps



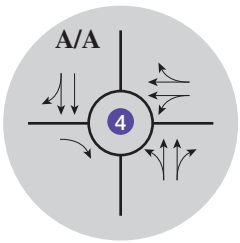
Avon Rd./I-70 East Ramps



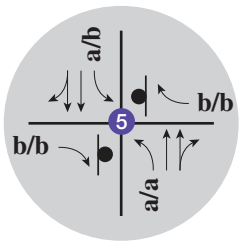
Avon Rd./W. Beaver Creek Blvd.



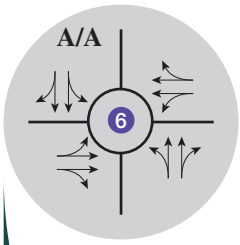
Avon Rd./Benchmark Rd.



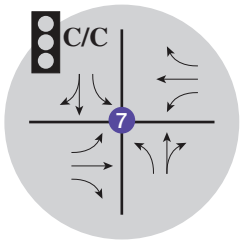
Avon Rd./Hurd Lane



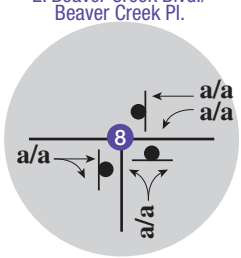
Avon Rd./US 6



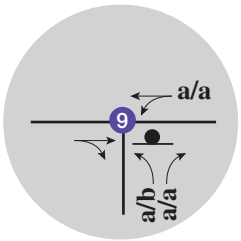
W. Beaver Creek Blvd./US 6



E. Beaver Creek Blvd./ Beaver Creek Pl.



Benchmark Rd./Chapel Pl.



E. Beaver Creek Blvd./ Beaver Creek Pl.

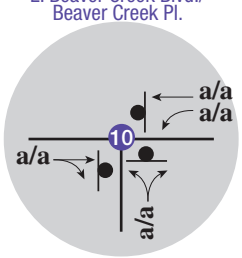


Figure 1.5
Existing Winter Level of Service

FELSBURG HOLT & ULLEVIG

NORTH

Roadway segment LOS analyses were also conducted along Avon Road and US 6 for both summer and winter conditions. The roadway segments were analyzed based on criteria contained in the Highway Capacity Manual (TRB, 2000, Chapter 15). Travel time delays were calculated using a combination of approach delays extracted from the Synchro output for signalized and stop-controlled intersections and NCHRP Report 572 for roundabouts. It was found that both Avon Road and US 6 currently operate at LOS B during both summer and winter seasons within the study area. These results were then cross-checked with computerized simulations of roadway traffic operations using SIM Traffic; the simulation output compared very well with the calculated LOS results.

1.2 FUTURE CONDITIONS

1.2.1 Land Use

Potential future land use increases include the redevelopment of East Town Center and West Town Center, as well as the completion of the Village at Avon, Riverfront, Wildridge, Buck Creek, Swift Gulch, Benchmark at Beaver Creek and the Folson Annex. These developments would result in a total net increase of 4,837 residential units, 140,000 square feet of office space, 250,000 square feet of retail space, and 4,700 square feet of industrial use based on land use projections provided by the Town. The existing, net increase, and total land use for each sub-area are summarized in **Table 1.1**. East Town Center, West Town Center and the Village at Avon will consist of residential, office and retail land uses. Riverfront will consist of residential and retail land uses, while the remaining four developments will consist only of residences.

Table 1.1 Land Use Summary

Development	Land Uses		
	Existing	Net Increase	Total
East Town Center			
Residential	390 DU	540 DU	930 DU
Office	87 KSF	25 KSF	112 KSF
Retail	253 KSF	25 KSF	278 KSF
West Town Center			
Residential	155 DU	538 DU	693 DU
Office	75 KSF	15 KSF	90 KSF
Retail	50 KSF	70 KSF	120 KSF
The Village at Avon			
Residential	244 DU	2156 DU	2400 DU
Office	40 KSF	100 KSF	140 KSF
Retail	353 KSF	155 KSF	508 KSF
Riverfront			
Residential	181 DU	275 DU	456 DU
Retail	31 KSF	0 KSF	31 KSF
Wildridge/Mountain Star			
Residential	681 DU	270 DU	951 DU
Swift Gulch			
Residential	0 DU	36 DU	36 DU
Industrial	28 KSF	47 KSF	75 KSF
Buck Creek			
Residential	0 DU	42 DU	42 DU
Public Use	0	N/A	N/A
Folson Annex			
Residential	0 DU	65 DU	65 DU
Benchmark at Beaver Creek			
Residential	2105 DU	915 DU	3020 DU

1.2.2 Traffic Volume Projections

Future traffic volume projections for roadways within the Town of Avon were developed based on year 2035 background increases due to regional growth, potential new development within the Town, and planned redevelopment of existing land uses. Reduction factors were applied to account for transit use based on current ridership levels.

The first step was to estimate the potential increase in traffic volumes to account for background growth, which is the growth in traffic associated with regional development outside of Avon. Because any traffic using the Avon interchange on I-70 would likely be oriented to or from land uses within the Town, only through-traffic traveling along US 6 would be expected to increase due to background growth. Therefore, through-volumes on US 6 were increased using CDOT growth factors and referencing recent traffic projections from the Eagle County traffic model. To account for future potential development of the Bear Lots at Beaver Creek, traffic volumes at Prater Road were increased by a factor of 1.5.

Once background traffic growth was accounted for, the next step was to calculate the volume of traffic generated by proposed developments in the area. As previously described, the developments included in the trip generation analysis are: Wildridge, Wildwood, Buck Creek, Swift Gulch, the Folson Annex, East Town Center, West Town Center, Riverfront, and the Village at Avon. Based on the net increase in land uses for each development, ITE Trip Generation (ITE Trip Generation, 7th Edition, 2008) rates for the various land uses were applied to determine the total net increase in traffic.

The total number of vehicle trips attributed to the new development was reduced to account for several factors such as transit, carpool and pedestrian trips, internal trips between various land uses and seasonal variation in land use occupancy. **Table 1.2** summarizes the breakdown used for mode split. The Core Area was defined as East and West Town Center, Riverfront and Eaglebend. Mountain Rural includes Wildridge, Wildwood, Buck Creek, Swift Gulch and the residential portion of the Village at Avon. All other developments were considered to be in the town peripheral for these purposes. As shown, the assignment of trips to different modes of transportation was also dependent on the type of development in addition to its location.

Table 1.2 Mode Split

Land Use	Core Area			Outer Core			Mountain Rural		
	Auto	Bus	TDM [1]	Auto	Bus	TDM	Auto	Bus	TDM
Residential	85%	11%	4%	91%	5%	4%	95%	1%	4%
Retail	90%	6%	4%	95%	1%	4%	96%	0%	4%
Office	93%	3%	4%	95%	1%	4%	96%	0%	4%

[1] Travel Demand Management (TDM) consists of programs and strategies to reduce single-occupancy vehicle trips, including carpooling, flexible work hours, work-from-home, bicycle programs or other strategies.

After the mode split reduction was applied, the remaining vehicle trips were again reduced to account for internal trips between various land uses. Trips made between different developments were assigned to the roadway network, however trips between different land uses within the same development (i.e.: residential-to-retail trips within West Town Center) were not. The overall internal trip percentage for the entire study area was 7 percent.

The final step in forecasting future traffic volumes was adjusting traffic volumes to account for seasonal variation. It was estimated that during the Winter (peak) season, all land uses would operate at 100 percent occupancy, and therefore no reduction to the trip generation was made. Based on existing counts, however, it was determined that overall Summer traffic volumes in Town were approximately 85 percent of winter traffic volumes. Therefore, the total net increase in traffic during the Summer season was forecasted to be 15 percent less than that of the Winter season.

Table 1.3 summarizes the resultant trip generation estimates for summer and **Table 1.4** summaries the winter trip generation estimates.

Table 1.3 Summer Season Trip Generation

Land Use Type	Size Increase	Units	AM Total	AM In	AM Out	PM Total	PM In	PM Out	Daily
East Town Center									
Condo/Townhouse	540	DU	172	32	139	203	130	73	2,266
Retail	25,000	SF	19	11	8	71	35	36	822
Office	25,000	SF	31	27	4	29	5	25	218
Sub-Total			*221*	*71*	*151*	*303*	*170*	*133*	*3,306*
West Town Center									
Condo/Townhouse	538	DU	171	32	139	202	129	73	2,258
Retail	70,000	SF	11	7	4	43	20	22	493
Office	15,000	SF	86	76	10	82	14	68	609
Sub-Total			*268*	*115*	*153*	*327*	*164*	*163*	*3,361*
Village at Avon									
Condo/Townhouse	2,063	DU	734	139	593	866	555	312	9,679
Single Family	93	DU	56	14	42	76	48	27	718
Retail	155,000	SF	125	77	48	467	229	238	5,375
Office	100,000	SF	125	107	15	118	20	98	870
Sub-Total			*1,040*	*338*	*699*	*1,527*	*852*	*675*	*16,642*
Riverfront									
Condo/Townhouse	275	DU	88	17	71	104	66	37	1,154
Sub-Total			*88*	*17*	*71*	*104*	*66*	*37*	*1,154*
Swift Gulch									
Condo/Townhouse	36	DU	13	3	10	15	9	6	169
Industrial	47,000	SF	59	52	8	56	9	47	417
Sub-Total			*71*	*54*	*18*	*71*	*19*	*53*	*587*

Land Use Type	Size Increase	Units	AM Total	AM In	AM Out	PM Total	PM In	PM Out	Daily
Buck Creek									
Condo/Townhouse	42	DU	14	3	12	18	11	7	199
Public Use	N/A	SF	66	58	8	60	10	49	427
Sub-Total			*81*	*60*	*20*	*77*	*21*	*56*	*626*
Folson Annex									
Condo/Townhouse	65	DU	22	4	18	26	17	9	291
Sub-Total			*22*	*4*	*18*	*26*	*17*	*9*	*291*
Benchmark at Beaver Creek									
Condo/Townhouse	915	DU	326	62	264	384	247	138	4,293
Sub-Total			*326*	*62*	*264*	*384*	*247*	*138*	*4,293*
Wildridge									
Condo/Townhouse	8	DU	3	1	3	3	3	1	37
Single Family	262	DU	159	41	118	214	137	77	2,025
Sub-Total			*162*	*42*	*121*	*218*	*139*	*77*	*2,062*
Total New Development									
Condo/Townhouse	4,482	DU	1,542	293	1,248	1,822	1,167	655	20,346
Single Family	355	DU	215	55	160	290	185	104	2,743
Retail	195,000	SF	155	94	60	581	284	296	6,690
Office	195,000	SF	241	210	30	230	39	190	1,697
Industrial/Commercial		SF	125	110	15	116	20	96	844
Total			*2,278*	*762*	*1,513*	*3,038*	*1,695*	*1,341*	*32,320*

Table 1.4 Winter Season Trip Generation

Land Use Type	Size Increase	Units	AM Total	AM In	AM Out	PM Total	PM In	PM Out	Daily
East Town Center									
Condo/Townhouse	540	DU	202	38	164	239	153	86	2,666
Retail	25,000	SF	22	13	9	84	41	42	967
Office	25,000	SF	36	32	5	34	6	29	256
Sub-Total			*260*	*83*	*178*	*357*	*200*	*157*	*3,889*
West Town Center									
Condo/Townhouse	538	DU	201	38	163	238	152	86	2,657
Retail	70,000	SF	13	8	5	50	24	26	580
Office	15,000	SF	101	89	12	97	17	80	717
Sub-Total			*315*	*135*	*180*	*385*	*193*	*192*	*3,954*
Village at Avon									
Condo/Townhouse	2,063	DU	863	164	698	1,019	653	367	11,387
Single Family	93	DU	66	17	49	89	57	32	845
Retail	155,000	SF	147	90	57	549	269	280	6,323
Office	100,000	SF	147	126	18	139	23	115	1,024
Sub-Total			*1,223*	*397*	*822*	*1,796*	*1,002*	*794*	*19,579*
Riverfront									
Condo/Townhouse	275	DU	103	20	83	122	78	43	1,358
Sub-Total			*103*	*20*	*83*	*122*	*78*	*43*	*1,358*
Swift Gulch									
Condo/Townhouse	36	DU	15	3	12	18	11	7	199
Industrial	47,000	SF	69	61	9	66	11	55	491
Sub-Total			*84*	*64*	*21*	*84*	*22*	*62*	*690*
Buck Creek									
Condo/Townhouse	42	DU	17	3	14	21	13	8	234
Public Use	N/A	SF	78	68	9	70	12	58	502
Sub-Total			*95*	*71*	*23*	*91*	*25*	*66*	*736*
Folson Annex									
Condo/Townhouse	65	DU	26	5	21	31	20	11	342
Sub-Total			*26*	*5*	*21*	*31*	*20*	*11*	*342*
Benchmark at Beaver Creek									
Condo/Townhouse	915	DU	383	73	310	452	290	162	5,050
Sub-Total			*383*	*73*	*310*	*452*	*290*	*162*	*5,050*
Wildridge									
Condo/Townhouse	8	DU	4	1	3	4	3	1	44
Single Family	262	DU	187	48	139	252	161	90	2,382
Sub-Total			*191*	*49*	*142*	*256*	*164*	*91*	*2,426*

Land Use Type	Size Increase	Units	AM Total	AM In	AM Out	PM Total	PM In	PM Out	Daily
Total New Development									
Condo/Townhouse	4,482	DU	1,814	345	1,468	2,144	1,373	771	23,937
Single Family	355	DU	253	65	188	341	218	122	3,227
Retail	250,000	SF	182	111	71	683	334	348	7,870
Office	140,000	SF	284	247	35	270	46	224	1,997
Industrial/Commercial	47,000	SF	147	129	18	136	23	113	993
Total			*2,680*	*897*	*1,780*	*3,574*	*1,994*	*1,578*	*38,024*

Trip generation for each land use was then assigned to the roadway network based on existing traffic patterns and engineering judgment. It has been estimated that of the external trips (travelling to or from destinations outside of Avon), 35 percent would travel to/from the west on I-70, 55 percent would travel to/from the east on I-70. The remaining 10 percent of external trips were assigned to US 6, based on projected congestion levels on this roadway.

The resulting peak hour traffic volumes for the Winter and Summer seasons are shown on **Figure 1.6** and **Figure 1.7**, respectively.

1.2.3 Future Traffic Operational Results

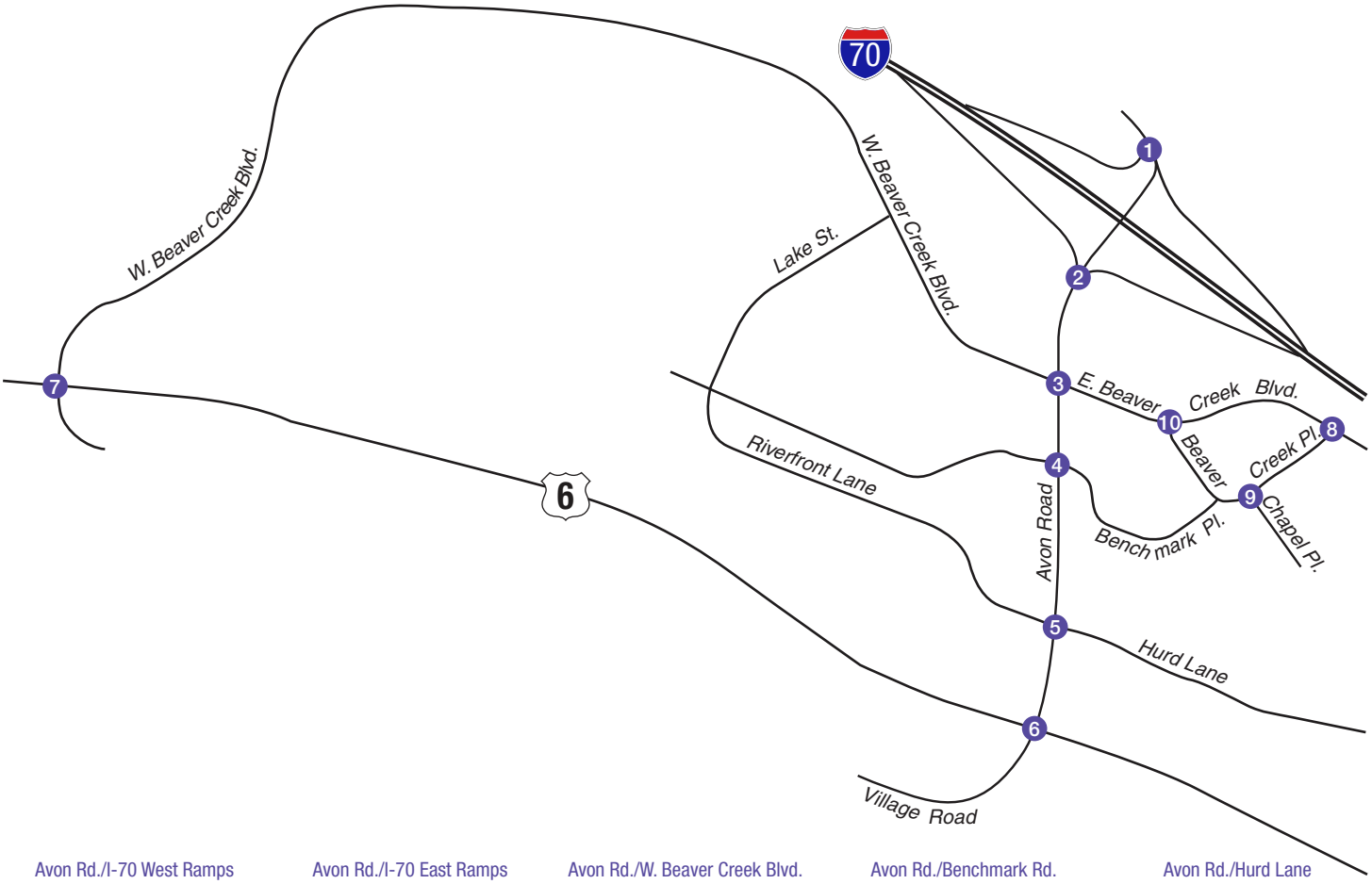
Operational analyses were completed to determine the expected levels of service at all study intersections under future traffic volumes. Level of Service (LOS) is a qualitative measure of traffic operational conditions based on roadway capacity and motorist delay. The 2000 HIGHWAY CAPACITY MANUAL defines six levels of service, ranging from A to F, with LOS A representing the best possible operating conditions and LOS F representing over-capacity, or congested conditions. Per current Town of Avon standards, C is the lowest acceptable LOS for peak hour roadway operations and D is the lowest LOS for peak hour intersection operations.

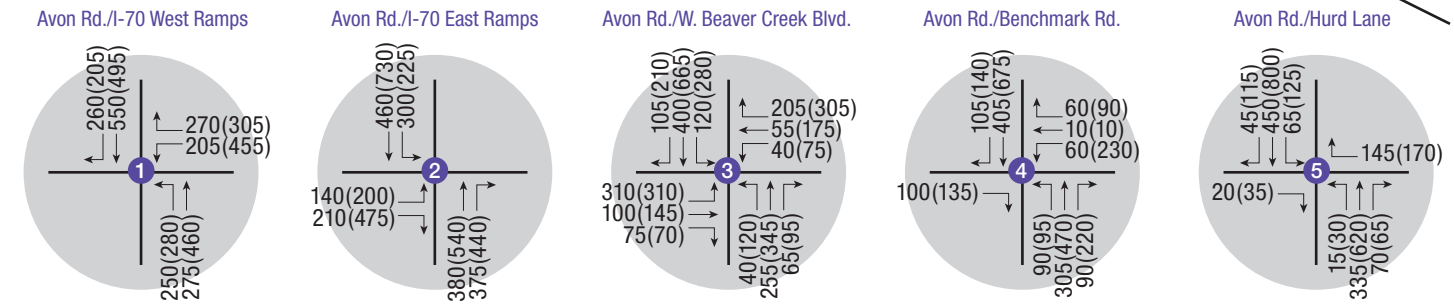
LOS analyses were completed for both summer and winter peak hour conditions at all intersections. Roadway level of service analyses were also completed for Avon Road between US 6 and I-70 Westbound Ramps and for US 6 between West Beaver Creek Boulevard and Avon Road. **Appendix C** contains LOS worksheets for future conditions.

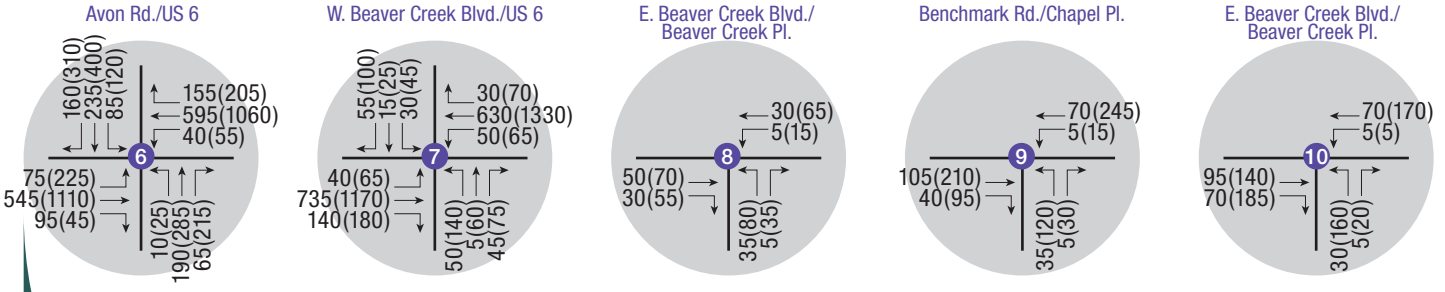
Of the ten study intersections, five are multi-lane roundabouts, one is a signalized intersection, and four are stop-controlled intersections. All roundabouts were analyzed using Sidra Intersection software. All other study intersections were analyzed using Synchro 7 software. Level of service worksheets are included in **Appendix B**.

The future lane geometries and levels of service can be seen on **Figures 1.8** and **1.9** for summer and winter conditions. **Table1.4** also summarizes the level of service results for all intersections. Because of a significant increase in background traffic expected along US 6, the analyses assume that US 6 would be widened to four lanes through Avon.

During the summer, all roundabouts are expected to operate at LOS A during both peak hours with the exception of the Avon Road/US 6 intersection which is expected to operate at LOS F







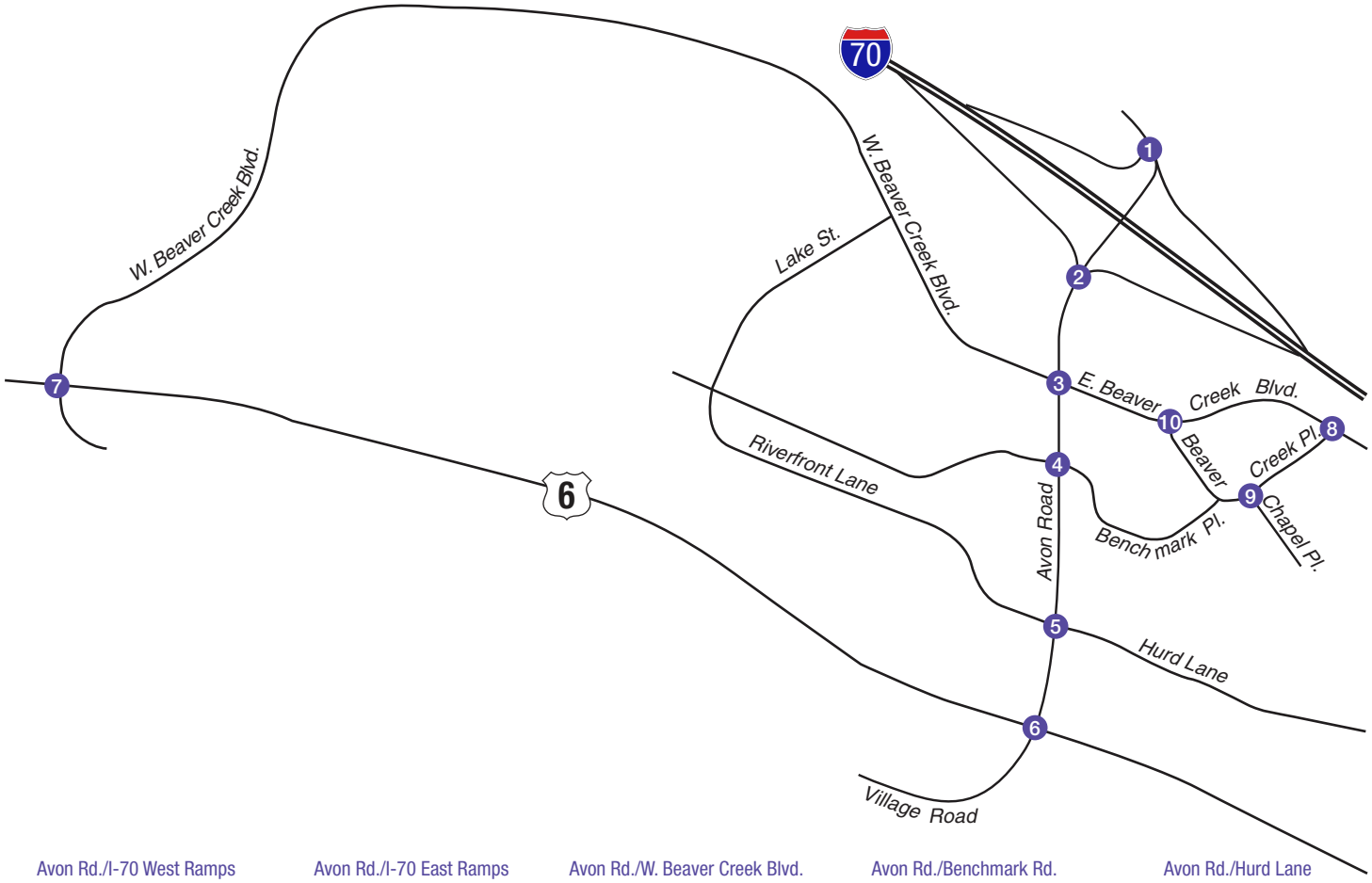
LEGEND

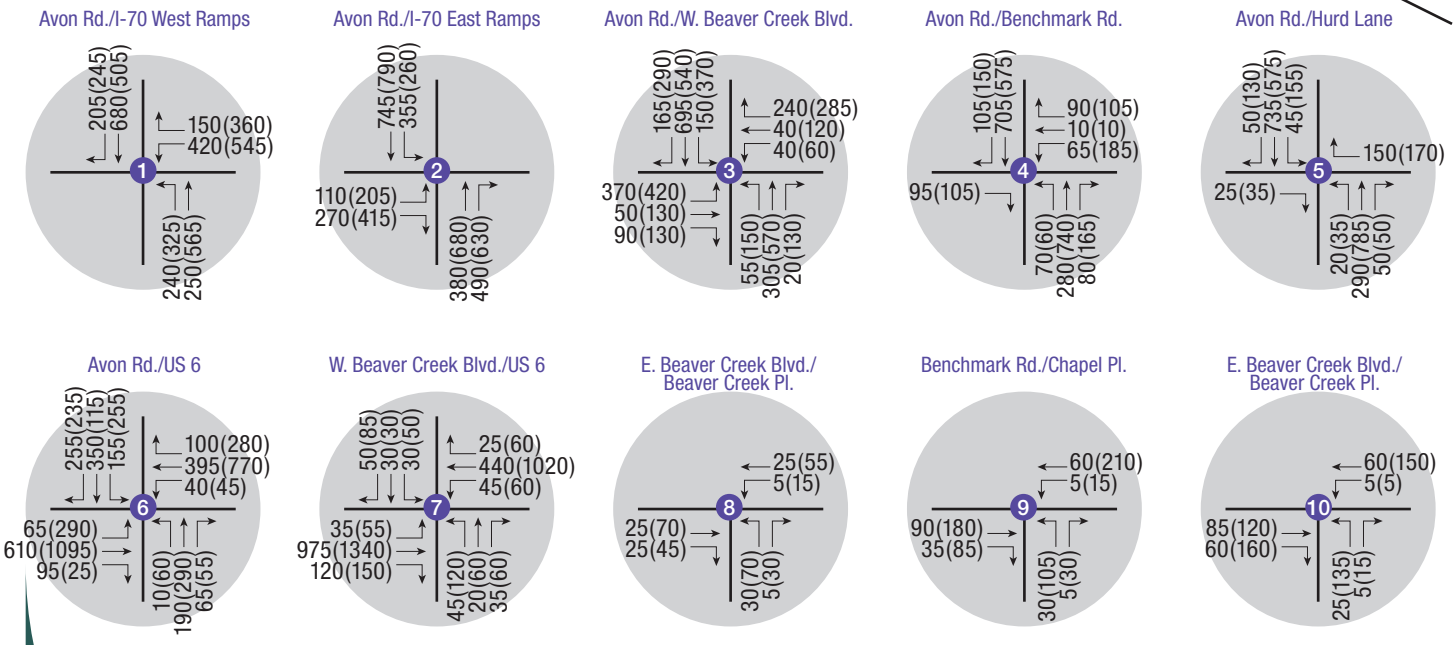
XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

Figure 1.6
Future Summer Traffic Volumes

FELSBURG HOLT & ULLEVIG

NORTH





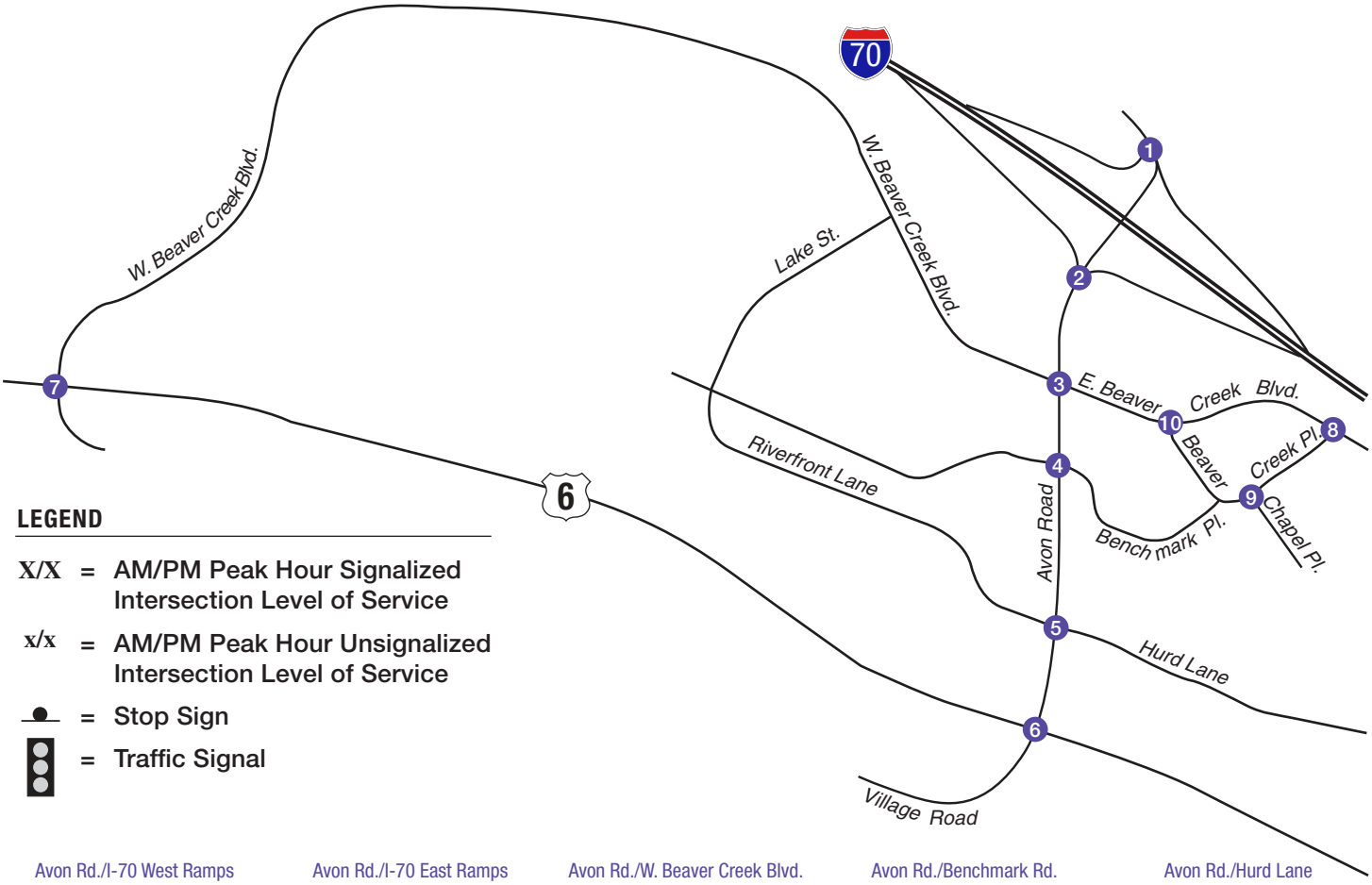
LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

Figure 1.7
Future Winter Traffic Volumes

FELSBURG HOLT & ULLEVIG

NORTH



LEGEND

X/X = AM/PM Peak Hour Signalized Intersection Level of Service

x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service

● = Stop Sign

▮ = Traffic Signal

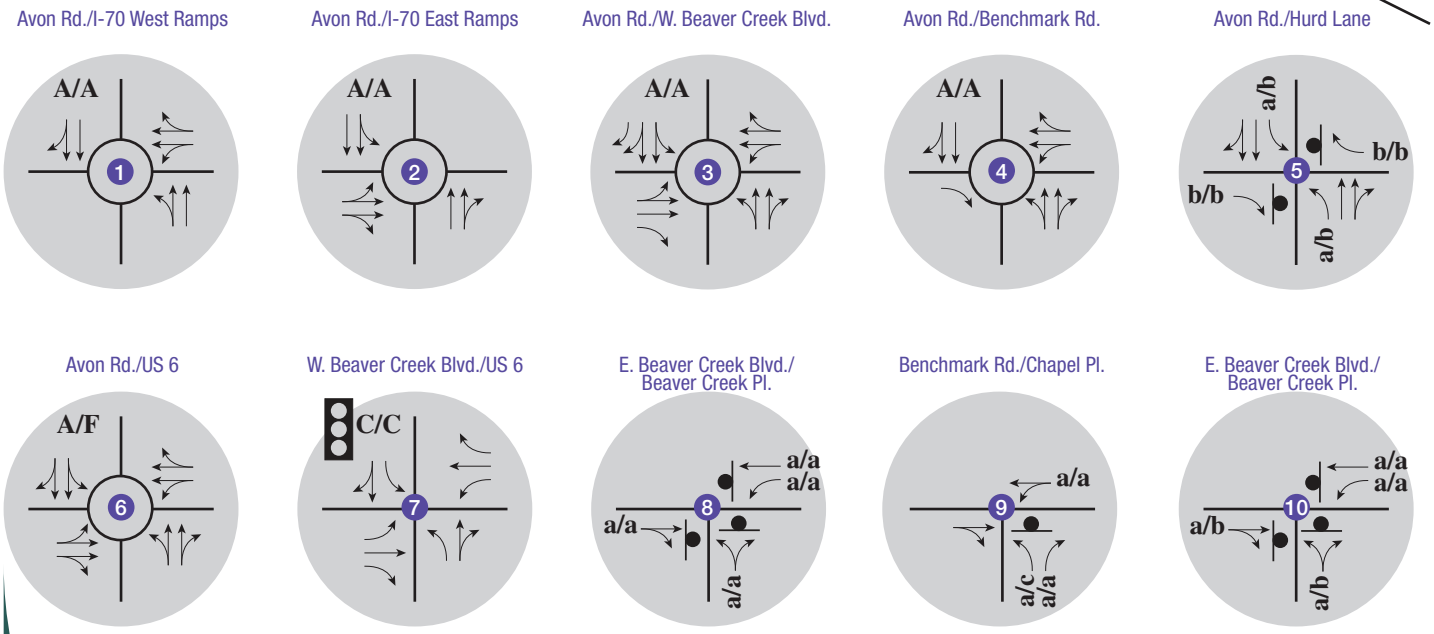


Figure 1.8
Future Summer Level of Service

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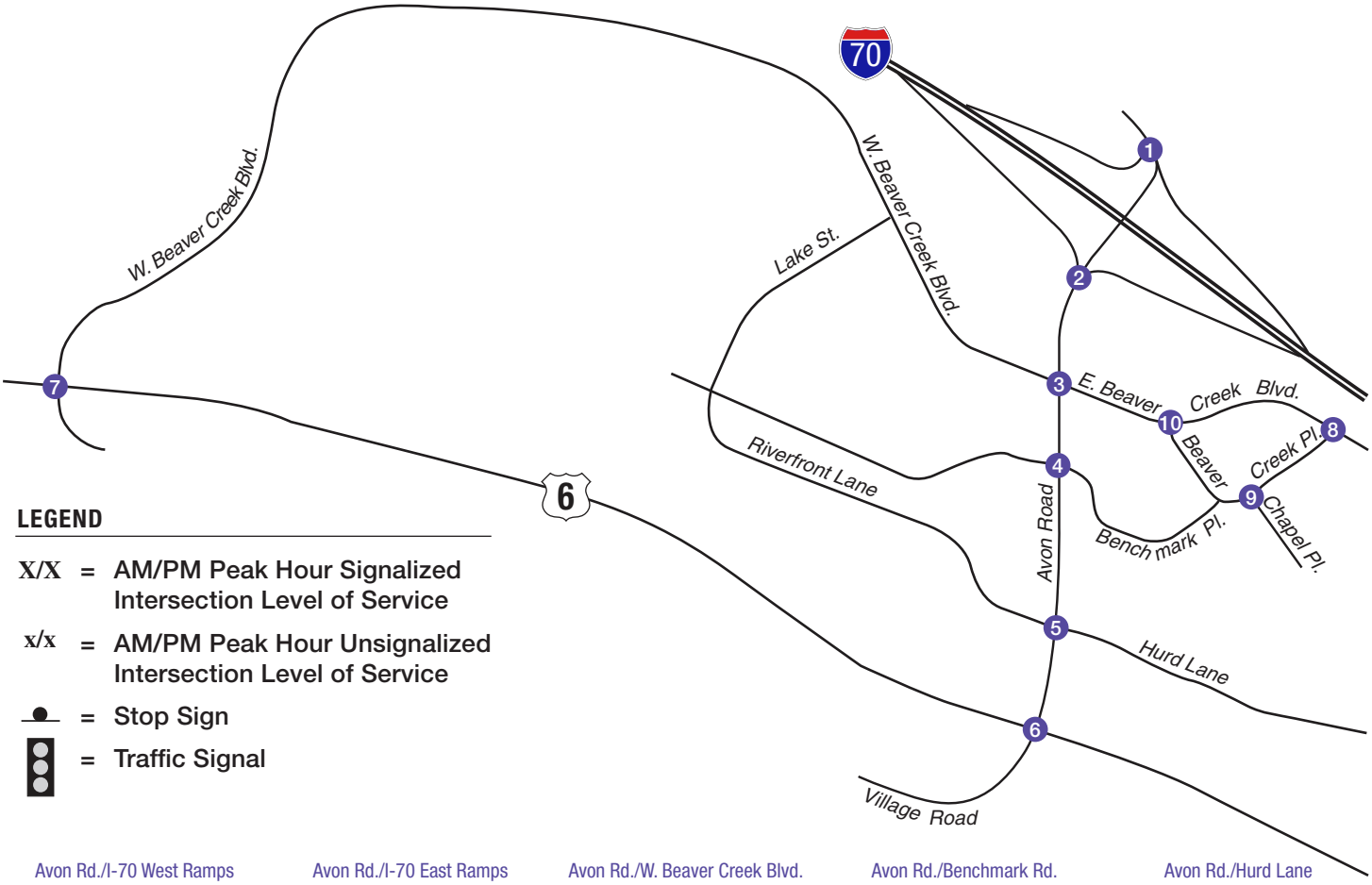
NORTH



LEGEND

X/X = AM/PM Peak Hour Signalized Intersection Level of Service

x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service

● = Stop Sign

= Traffic Signal

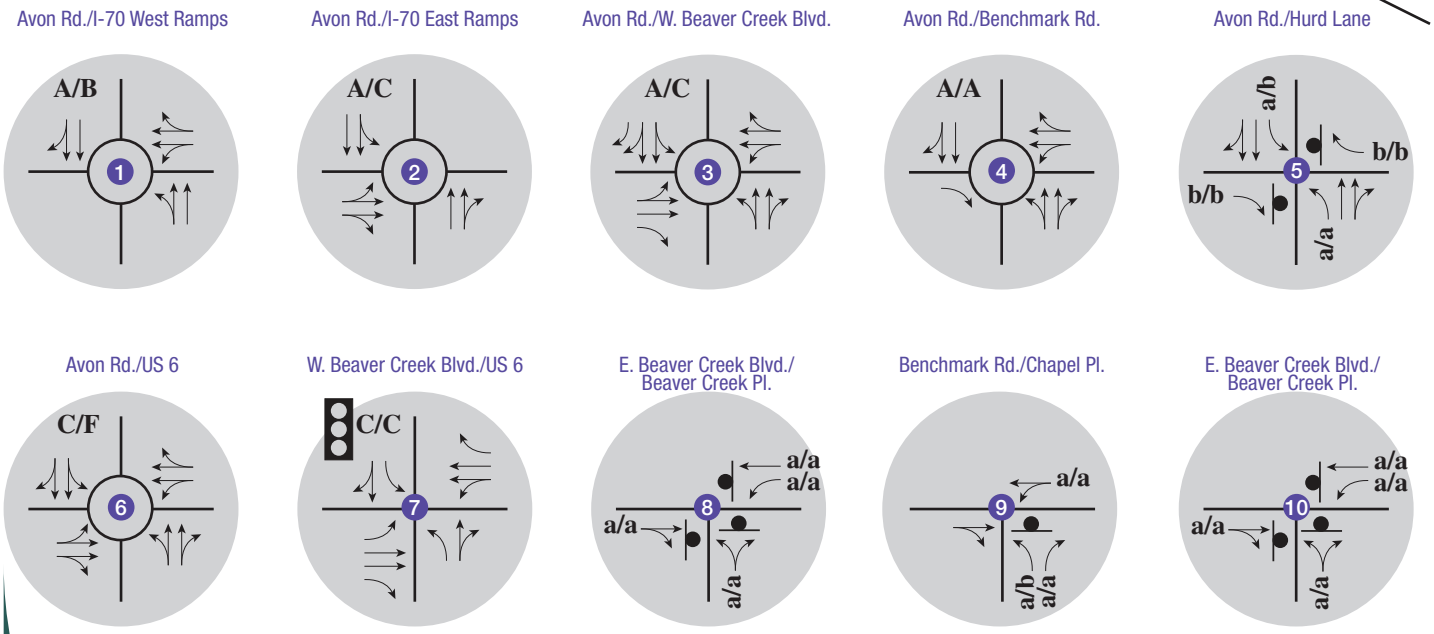


Figure 1.9
Future Winter Level of Service

FELSBURG HOLT & ULLEVIG

NORTH

during the PM peak hour. The signalized intersection at US 6/West Beaver Creek Boulevard (Prater Road) is expected to operate at LOS C during both peak hours. All movements at all stop-controlled intersections are expected to operate at LOS C or better during both peak hours.

For the forecasted winter conditions, all roundabouts are expected to operate at LOS C or better during both peak hours with the exception of the Avon Road/US 6 intersection which is expected to have PM peak hour operations at LOS F. The winter roundabout analyses included adjustment factors to account for reduced capacity due to snowy conditions. Winter operations at the US 6/West Beaver Creek Boulevard (Prater Road) intersection are expected to be at LOS C during both peak hours. All movements at all stop-controlled intersections are expected to operate at LOS B or better during both peak hours.

Roadway segment LOS analyses were also conducted along Avon Road and US 6 for both summer and winter future conditions. The roadway segments were analyzed based on criteria contained in the Highway Capacity Manual (TRB, 2000, Chapter 15). Travel time delays were calculated using a combination of approach delays extracted from the Synchro output for signalized and stop-controlled intersections and NCHRP Report 572 for roundabouts. During the Summer Season, Avon Road is expected to operate at LOS B during the AM Peak hour and LOS C during the PM peak hour. In the Winter season, it is expected to operate at LOS C during the AM peak hour. The southbound direction is also expected to operate at LOS C during the PM peak hour, but northbound is expected to operate at LOS D. US 6 is expected to operate at LOS B during the AM peak hour in the Summer season and LOS F during the PM peak hour. In the Winter season, the westbound direction is expected to operate at LOS B during the AM peak hour and LOS F in the PM peak hour. The eastbound direction is expected to operate at LOS F during both peak hours in the Winter season. These results were then cross-checked with computerized simulations of roadway traffic operations using SIM Traffic; the simulation output compared very well with the calculated LOS results.

Table 1.5 Intersection Levels of Service

Intersection		Level of Service[1]			
		Summer		Winter	
		AM	PM	AM	PM
1	Avon Rd & WB I-70	A	A	A	B
2	Avon Rd & EB I-70	A	A	A	B
3	Avon Rd & Beaver Creek Blvd	A	A	A	C
4	Avon Rd & Benchmark Rd	A	A	A	A
5	Avon Rd & Hurd Ln	B	b	b	b
6	Avon Rd & US 6	A	F	C	F
7	US 6 & Beaver Creek Blvd	C	C	C	C
8	E. Beaver Creek Blvd & Beaver Creek Pl	A	a	a	a
9	Benchmark Rd & Chapel Pl	A	c	a	b
10	E. Beaver Creek Blvd & Beaver Creek Pl	A	b	a	a

[1] *Lowercase letters indicate stop-controlled intersections; only worst movement LOS reported*

Table 1.6 Roadway Levels of Service

Arterial	Direction	Level of Service			
		Summer		Winter	
		AM	PM	AM	PM
Avon Road	Northbound	B	C	C	D
	Southbound	B	C	C	C
US 6	Eastbound	B	F	F	F
	Westbound	B	F	B	F

1.2.4 Roadway Improvement Requirements

In general, the existing roadway system within Avon has sufficient reserve capacity to accommodate the projected increases in traffic volumes. Previous planning efforts in Avon have identified a future roundabout at the intersection of Swift Gulch and Nottingham Roads. A separate analysis of this intersection relative to build out conditions at Wildridge, Mountain Star, and Buck Creek indicate that this improvement would be required to maintain acceptable operational conditions. An approximate preliminary cost opinion for this improvement is $1.5 million.

An analysis of the Benchmark Road/Beaver Creek Place intersection was also conducted. Future conditions at this intersection were found to be acceptable, at LOS C or better during peak times (both summer and winter seasons). However, due to the configuration of this intersection, and its close proximity to the Beaver Creek Place/Chapel Place intersection, some operational issues are currently experienced. As future redevelopment occurs, street system modifications are expected, including the future extension of Main Street through East Town Center. As the street system in this area evolves, consideration should be given to potential roadway realignment to consolidate the two intersections into one, subject to potential redevelopment.

The LOS analyses also examined the potential to reduce the three-lane approaches on Beaver Creek Boulevard at the roundabout with Avon Road. It was determined that traffic operations would remain at LOS A during both peak hours in the summer and during the winter AM peak hour. During the winter PM peak hour, the LOS would drop to D (still acceptable). Based on this, there would be an opportunity to reduce the amount of existing pavement on both eastbound and westbound Beaver Creek Boulevard approaching the roundabout. The additional corridor width could be used for streetscape improvements, pedestrian enhancements currently under consideration for the Main Street project in West Town Center, and traffic calming measures discussed subsequently in this report.

Traffic operations along US 6 are projected to be at congested levels during peak times in the long range future. As previously discussed, the long range future scenario assumes that this facility would be widened to four through lanes. This finding is consistent with previous traffic engineering efforts conducted in the Avon area. In order to provide acceptable operational results, additional widening, to six through lanes, would be required. Such widening to six lanes is seen as unlikely, given the existing right-of-way and topographical constraints along US 6

through Avon. Therefore, some congestion and delays would be anticipated for motorists using US 6 during peak times. Some peak hour congestion is also projected for the roundabout at US 6 and Avon Road. This congestion is due primarily to regional increases in through volumes along US 6.

Recent cost estimates prepared as a part of the Eagle County 2025 Capital Improvement Study, Phase II, Felsburg Holt & Ullevig, July 2008, show an average cost for four-lane widening along US 6 through the Avon area of approximately $14.2 million per mile. Given the approximate 2.43 miles of frontage through the Town, the estimated potential opinion of cost for this improvement would be $34.5 million.

1.2.5 Traffic Impact Evaluations

For three areas within Avon: East Town Center, West Town Center, and the Village at Avon, additional analyses were conducted to determine what specific impacts might be expected in terms of roadway capacity and the potential to provide on-street parking. The following sections document the results.

1.2.5.1 East Town Center

The redevelopment of East Town Center is planned to include residential, retail and office land uses which will result in a net increase of 1,080 condo/townhome units, 25,250 square feet of retail space and 25,250 square feet of office space. East Town Center will have access to Avon Road via East Beaver Creek Boulevard and Benchmark Road. Potential internal circulation alternatives have been considered, including an extension of Main Street to serve primarily the retail uses. East Beaver Creek Boulevard would remain as the primary collector connection between Avon Road and Post Boulevard, although the location of the roadway would likely shift with development of the Village at Avon.

Trip Generation

Tables 1.7 and 1.8 summarize the trip generation estimates for the net increase in land use for the Summer and Winter seasons. As shown, East Town Center will generate approximately 6,560 additional daily trips in the Winter and 5,580 additional daily trips in the Summer.

Table 1.7 East Town Center Summer Trip Generation

Land Use Type	Size Increase	Units	AM Total	PM Total	Daily
Condo/Townhouse	540	DU	172	203	2,266
Retail	25,000	SF	19	71	822
Office	25,000	SF	31	29	218
ETC Total			**221**	**303**	**3,306**

Table 1.8 East Town Center Winter Trip Generation

Land Use Type	Size Increase	Units	AM Total	PM Total	Daily
Condo/Townhouse	540	DU	202	239	2,666
Retail	25,000	SF	22	84	967
Office	25,000	SF	36	34	256
ETC Total			**260**	**357**	**3,889**

Future Traffic Volumes

The above additional trips were added to the existing travel demand in East Town Center to obtain the total future traffic volumes expected to be generated once the redevelopment is complete. **Table 1.9** summarizes the total AM, PM, and daily travel demand.

Table 1.9 East Town Center Total Future Travel Demand

Season	AM Total	PM Total	Daily
Summer	643	846	11,525
Winter	753	990	13,523

Of the traffic volumes shown in the above table, approximately 70 percent are expected to use East Beaver Creek Boulevard and 30 percent are expected to use Benchmark Road to access East Town Center.

Traffic Impacts

As previously documented, the roundabouts at Avon Road / Benchmark Road and Avon Road / East Beaver Creek Boulevard are expected to operate acceptably under future traffic conditions. The three stop-controlled intersections within East Town Center are also expected to operate well with the additional traffic projections.

For the evaluation of the roadways within East Town Center, generalized daily capacities were used. Urban two-lane local roadways have a general capacity of approximately 7,500 vpd while two-lane collectors can carry up to 16,000 vpd. Based on the build-out traffic assignment for Winter (the higher of the two seasons analyzed), East Beaver Creek Boulevard is expected to carry about 10,000 vehicles per day (vpd) just east of Avon Road, with traffic volumes decreasing to the east; this estimate is well within the general daily capacity for a collector roadway.

The potential Main Street extension is expected to carry approximately 4,000 vpd just east of Avon Road. Other internal roadways, such as Beaver Creek Place and Chapel Place would experience daily volumes in the approximate range of 3,000 to 3,500 VPD each. These projected volumes would be well within the general daily capacity for urban local streets.

Parking Impacts

Applying data contained in Parking Generation, Institute of Transportation Engineers, 2004 East Town Center is expected to generate a peak period parking demand of approximately 3,515 parking spaces in a peak hour during the Winter season. Residential land uses will generate a demand of about 2,145 spaces, retail uses will require about 1,045 spaces and office uses will require about 320 spaces. Often, mixed use developments can take advantage of shared parking concepts to reduce the total parking supply need. However, due to the low amount of office space relative to residential uses, consideration of shared parking reductions have been omitted in this evaluation.

The potential to provide on-street parking can help mitigate the need for off-street parking areas and structures. However, based on studies documented in Parking, Weant and Levinson, ENO Foundation, 1990, on-street parking can reduce the roadway capacity by 15 to 30 percent, depending on the number of expected parking maneuvers during any given hour.

To estimate the impacts of on-street parking within East Town Center, the above daily capacities for local roadways were reduced by 30 percent, yielding 5,250 vpd. By comparing this reduced capacity to the build-out traffic assignments, it can be seen the internal roadways would remain under-capacity. Therefore, within East Town Center, the local roadways are candidates for on-street parking, while parking should be restricted from East Beaver Creek Boulevard, a collector facility.

1.2.5.2 West Town Center

The redevelopment of West Town Center is planned to include a mix of residential, retail and office land uses which will result in a net increase 595 condo/townhome units, 35,000 square feet of retail space and 40,000 square feet of office space. West Town Center will have access to Avon Road via West Beaver Creek Boulevard and Main Street/Benchmark Road.

Trip Generation

Tables 1.10 and 1.11 summarize the trip generation estimates for the net increase in land use for the Summer and Winter seasons. As shown, West Town Center will generate approximately 4,700 additional daily trips in the Winter and 4,000 additional daily trips in the Summer.

Table 1.10 West Town Center Summer Trip Generation

Land Use Type	Size Increase	Units	AM Total	PM Total	Daily
Condo/Townhouse	538	DU	171	202	2,258
Retail	70,000	SF	11	43	493
Office	15,000	SF	86	82	609
WTC Total			**268**	**327**	**3,361**

Table 1.11 West Town Center Winter Trip Generation

Land Use Type	Size Increase	Units	AM Total	PM Total	Daily
Condo/Townhouse	538	DU	201	238	2,657
Retail	70,000	SF	13	50	580
Office	15,000	SF	101	97	717
WTC Total			**315**	**385**	**3,954**

Future Traffic Volumes

The estimated total future traffic volumes expected to be generated by the completed West Town Center are presented in **Table 1.12**.

Table 1.12 West Town Center Total Future Travel Demand

Season	AM Total	PM Total	Daily
Summer	623	826	12,166
Winter	733	973	14,254

Of the traffic volumes shown in **Table 1.12**, approximately 80 percent are expected to use West Beaver Creek Boulevard and 20 percent are expected to use Main Street/Benchmark Road to access West Town Center.

Traffic Impacts

The above described generalized daily capacities of approximately 7,500 vpd for local streets and 16,000 vpd for collectors were applied to this evaluation. Based on the build-out traffic assignment for Winter conditions, West Beaver Creek Boulevard is expected to carry 11,900 vpd just west of Avon Road, with traffic volumes decreasing to the west. Main Street/Benchmark Road is expected to carry 3,100 vpd just west of Avon Road. Other internal local connections would carry less than 2,000 vpd. Based on these projections, the adjacent roadways would have sufficient reserve capacity to accommodate the future travel demand within West Town Center.

Parking Impacts

West Town Center is expected to generate a parking demand of approximately 1,525 parking spaces during the peak season. Residential land uses would require about 1,100 spaces, retail uses would require about 300 spaces, and office uses would require about 125 spaces.

On-street parking may also be a consideration to help reduce the off-street parking supply in West Town Center. Based on the above daily capacities, reduced by 30 percent for on-street parking, all local streets within West Town Center will have sufficient reserve capacity to serve the projected traffic volumes.

1.2.5.3 Village at Avon

Current planning for the Village at Avon includes a mix of residential, retail and office development which will result in a net increase 2,063 condo/townhome units, 93 single family units, 125,000 square feet of retail space, and 178,000 square feet of office space. Access to the Village at Avon will be provided via a collector roadway replacement for East Beaver Creek Boulevard and Post Boulevard.

Trip Generation

Tables 1.13 and 1.14 summarize the Summer and Winter trip generation estimates. As indicated, the Village at Avon will generate approximately 19,150 additional daily trips in the Winter and 16,280 additional daily trips in the Summer.

Table 1.13 Village at Avon Summer Trip Generation

Land Use Type	Size Increase	Units	AM Total	PM Total	Daily
Condo/Townhouse	2,063	DU	734	866	9,679
Single Family	93	DU	56	76	718
Retail	155,000	SF	125	467	5,375
Office	100,000	SF	125	118	870
Village Total			**1,040**	**1,527**	**16,642**

Table 1.14 Village at Avon Winter Trip Generation

Land Use Type	Size Increase	Units	AM Total	PM Total	Daily
Condo/Townhouse	2,063	DU	863	1,019	11,387
Single Family	93	DU	66	89	845
Retail	155,000	SF	147	549	6,323
Office	100,000	SF	147	139	1,024
Village Total			**1,223**	**1,796**	**19,579**

Future Traffic Volumes

The estimated total future traffic volumes expected to be generated on completion of the Village at Avon are presented in **Table 1.15**.

Table 1.15 Village at Avon Total Future Travel Demand

Season	AM Total	PM Total	Daily
Summer	1,376	2,250	25,160
Winter	1,613	2,649	29,524

Traffic Impacts

Of the traffic volumes shown in **Table 1.15**, the majority is expected to use Post Boulevard with about 20 percent using East Beaver Creek Boulevard (or the collector facility that will replace it on completion of the development). This projected volume is well within the general daily capacity identified for collectors. Other internal roadways could carry between 1,000 and 2,000 vpd, consistent with a local street classification.

Parking Impacts

The Village at Avon is expected to generate a peak parking demand of approximately 4,155 parking spaces during the Winter season. Residential land uses would generate a demand of 3,180 spaces, retail uses would require 470 spaces and office uses would require 505 spaces.

On-street parking may also be a consideration to help reduce the off-street parking supply in the Village at Avon. Based on the above daily capacities, reduced by 30 percent for on-street parking, all local streets within the Village would have sufficient reserve capacity to serve the projected traffic volumes. As previously mentioned, an existing overflow lot for day-skiers exists along East Beaver Creek Boulevard. This parking capacity for overflow experienced on peak ski days is temporary pending development of the Village at Avon. It is the Town's policy not to provide parking for the ski area; rather, day-skier parking is the responsibility of Beaver Creek Resort.

1.3 TRAFFIC CALMING AND SAFETY

Traffic calming is a range of physical measures intended to reduce traffic volumes, lower vehicle speeds, improve safety for all roadway users, and enhance the pedestrian experience. Traffic calming measures fall into two general categories:

- **Volume Control**. This category addresses cut-through traffic by diverting traffic from neighborhood streets onto higher classification roadways which have greater traffic carrying capacity. Typical methods include roadway closures, median barriers, and roadway alignment shifts.
- **Speed Reduction**. Physical measures to force lower speeds include horizontal deflection or narrowing devices (traffic circles, neckdowns, center islands, or chicanes), and vertical deflection devices (speed humps or tables, raised crosswalks, or textured pavements).

Speed and volume reductions can also be achieved through roadway signing and other traffic control devices, such as flashing beacons and radar speed feedback signs.

1.3.1 Alternatives

In mountain communities such as Avon, the range of appropriate traffic calming devices is limited by winter maintenance requirements. Speed humps, raised crosswalks, chicanes (lateral jogs in the roadway) can interfere with snow plow operations. Therefore, it is suggested that traffic calming in Avon be restricted to textured or patterned pavement, raised center median islands, and roadway signing.

It is recommended that traffic calming in Avon be applied on local or collector status roadways only. The decision to install any traffic calming device should be based on a demonstrated need and a consensus among adjacent land owners. Maintenance and snow removal issues should be considered. Because traffic calming can have a negative impact on emergency response times, input from emergency response providers should also be considered.

1.3.2 Application

The intersection of Sun Road and West Beaver Creek Boulevard experiences a concentration of pedestrian activity. Planning efforts for West Town Center contemplate a pedestrian connection or extension of Sun Road to the future Main Street, which would attract additional pedestrian movements. In addition to sidewalk improvements discussed in subsequent sections, traffic calming along West Beaver Creek Boulevard approaching Sun Road would help improve pedestrian safety. Suggested measures include:

- Pedestrian crosswalk on West Beaver Creek Boulevard just northwest of the Sun Road intersection. This crosswalk could consist of textured/patterned pavement to give motorists a visual as well as tactile signal to slow down.

- Pedestrian refuge islands within the crosswalk. By reducing the number of lanes and narrowing the existing lanes on West Beaver Creek Boulevard, a raised center island could be installed to split the crossing into two stages.
- Pedestrian warning signs and flashing beacons approaching the crosswalk. These signs would alert motorists in advance of the crosswalk. The flashing beacons could be solar powered and set to flash during peak times.
- Streetscape improvements along West Beaver Creek Boulevard. Landscaping and street furniture would enhance the pedestrian interest and experiences in this area. Similar road narrowing along East Beaver Creek Boulevard would improve the pedestrian environment and allow for streetscape enhancements and potential traffic calming measures.

Prior to the installation of the above devices, consideration should be given to snow removal impacts, adjacent land owner's needs, and emergency response concerns.

1.3.3 Sight Distance

Sight distance is the length of roadway ahead that is visible to motorists, pedestrians, and bicyclists. Sufficient sight distance must be provided in order for roadway users to make safe decisions and avoid collisions with other users or objects. Sight distance is influenced by vehicle speeds, horizontal and vertical curvature, roadside vegetation or other obstructions. There are two types of sight distance which affect the safety of a roadway:

- **Stopping Sight Distance**. This is the distance required for a driver to see, react to, and stop prior to reaching a stationary object in its path.
- **Entering Sight Distance**. Someone entering a roadway from an access or side street needs to see in either direction for a sufficient distance to judge safe gaps in traffic through which to maneuver.

Procedures for determining appropriate sight distances for design are specified in A POLICY ON GEOMETRICDESIGN OF HIGHWAYS AND STREETS, 5th Edition, American Association of State Highway and Transportation Officials (AASHTO), 2004. With ongoing development and redevelopment, modifications to the roadway system should incorporate AASHTO sight distance policy in their design.

At existing locations where sight distance has been found to contribute to hazardous conditions, efforts should be made to remove roadside obstructions, trim vegetation, or modify landscaping to improve sight distance. Where roadway curvature or topographical constraints make sight distance improvements infeasible, roadway signing or other traffic control measures should be considered.

1.4 TOWN STANDARDS

1.4.1 Roadways

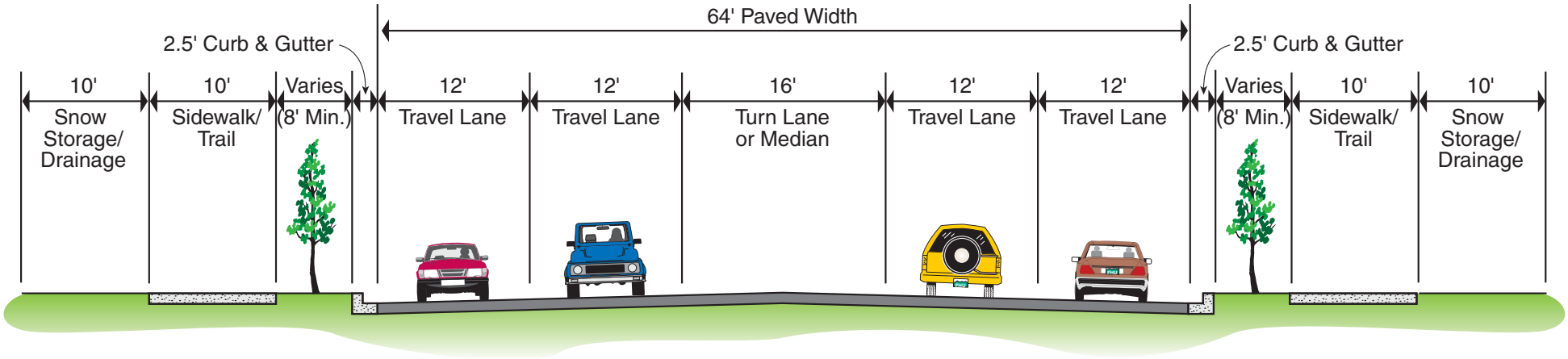
A functional classification hierarchy of streets is commonly used to define the traffic carrying function of various roadways. The two primary roadway functions are mobility and accessibility. These two functions compete; thus, roads intended to serve mobility needs (such as arterials) have necessarily fewer accesses than local streets, where mobility is of less concern than access to adjacent properties.

Avon has adopted three classification categories representing varying degrees of service with respect to these two functions. The three classifications, from highest to lowest, include Arterial Streets, Collector Streets, and Local Streets. Further, the Local and Collector Streets are defined by their setting as either Urban or Rural.

Arterial Roads provide the motorist with the highest level of mobility, and access to adjacent land uses are a minor consideration. Traffic volumes tend to greater along arterial roads, and vehicle speeds are higher. Arterial roads also have a significant amount of continuity and connectivity within a given region and often serve long distance trips. **Figure 1.10** shows the typical arterial cross-section for Avon. Shown are multiple travel lanes for through traffic as well as an area for a center left turn lane or raised median. Provision for on-street parking is in conflict with the mobility function of arterials and is, therefore not recommended. Pedestrian and bicyclist are accommodated via a 10-foot walk/trail detached from the roadway. The detachment provides for a more comfortable environment for the pedestrian/bicyclist to travel, and it provides an area for snow storage during the winter.

Collector Roads provide more of a balance between mobility and access. Traffic volumes, vehicular speeds, and continuity are all moderate in comparison to arterial roads. Served trips are typically made within a community or are traveling between local streets and arterial streets. **Figures 1.11** and **1.12** show the collector cross sections for Urban and Rural areas, respectively. The collector street section includes two travel lanes for through traffic. The urban version also includes bike lanes, curb and gutter, a center left turn lane (or raised median), and detached sidewalk. Again, the detached walk allows for snow storage and a comfortable environment for the pedestrian. The rural section includes a center turn lane only were needed, and no curb and gutter would be included as all surface drainage would be discharged into a roadside ditch. To ensure mobility on collectors, on-street parking is not recommended.

Local Roads are intended to primarily provide access to adjacent properties. Traffic volumes, speeds and continuity are usually quite low for local road facilities. Travelers along local roads almost always originate or are destined to an adjacent land use. **Figures 1.13** and **1.14** show the local cross sections for Urban and Rural areas, respectively. Both have two travel lanes for through traffic, but the urban section also includes curb, a tree lawn, and detached sidewalks. Where needed, additional width could be added accommodate on-street parking (either parallel or angle parking). The rural section includes two-foot shoulders and all surface drainage would discharge to the side of the road. A bike lane may be added to the rural road cross-section where deemed necessary.



Arterial

Figure 1.10
Arterial Cross-Section

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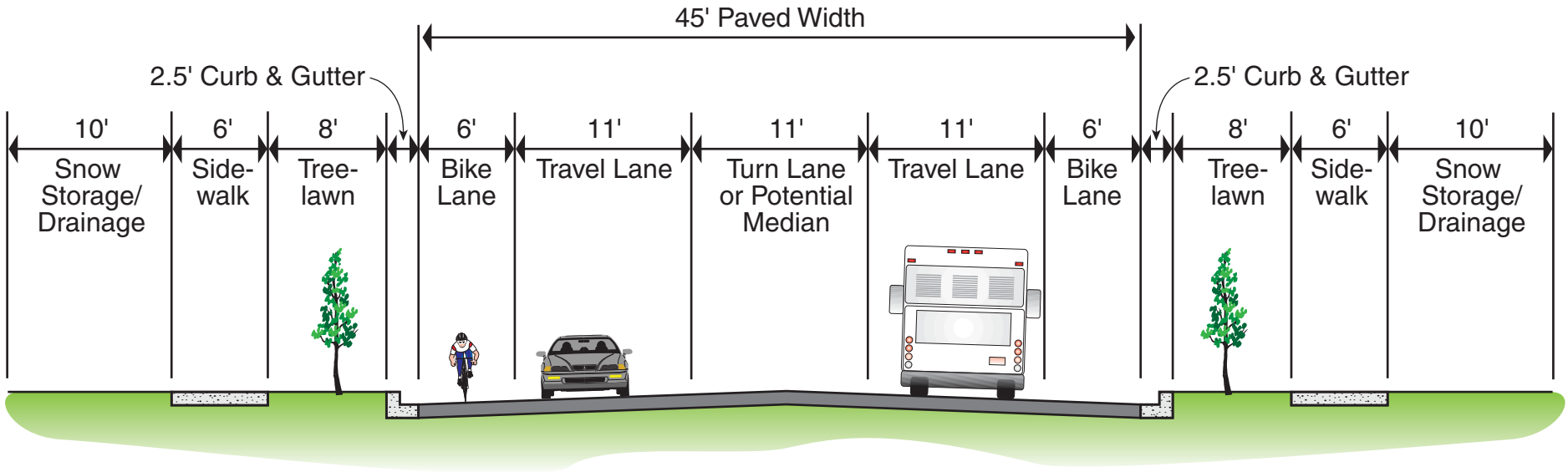

Collector - Urban

Figure 1.11
Collector - Urban Cross-Section

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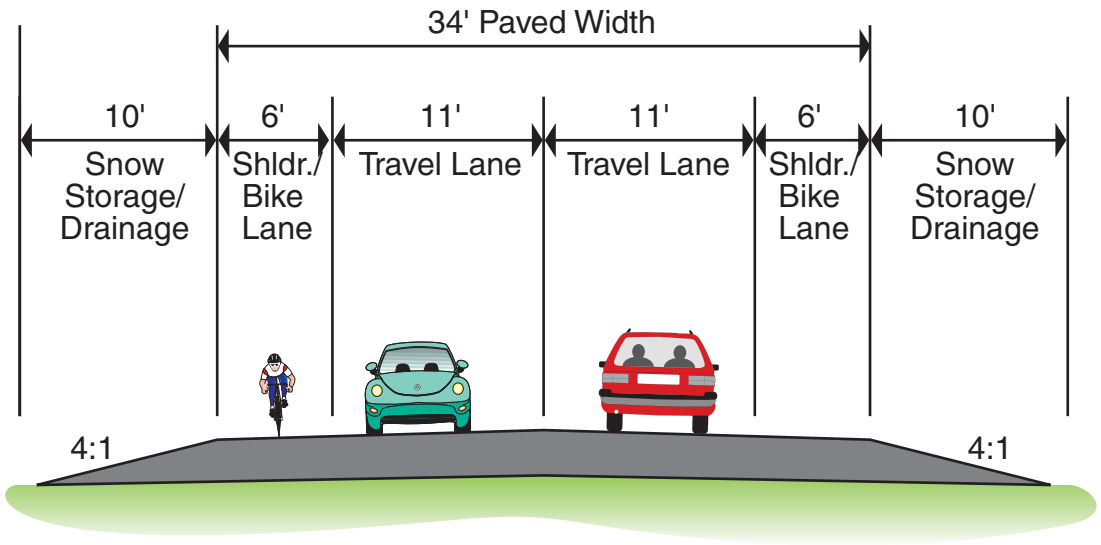
NORTH



NOTE: Additional width may be required to accomodate turn lanes at intersections

Collector - Rural

Figure 1.12
Collector - Rural Cross-Section

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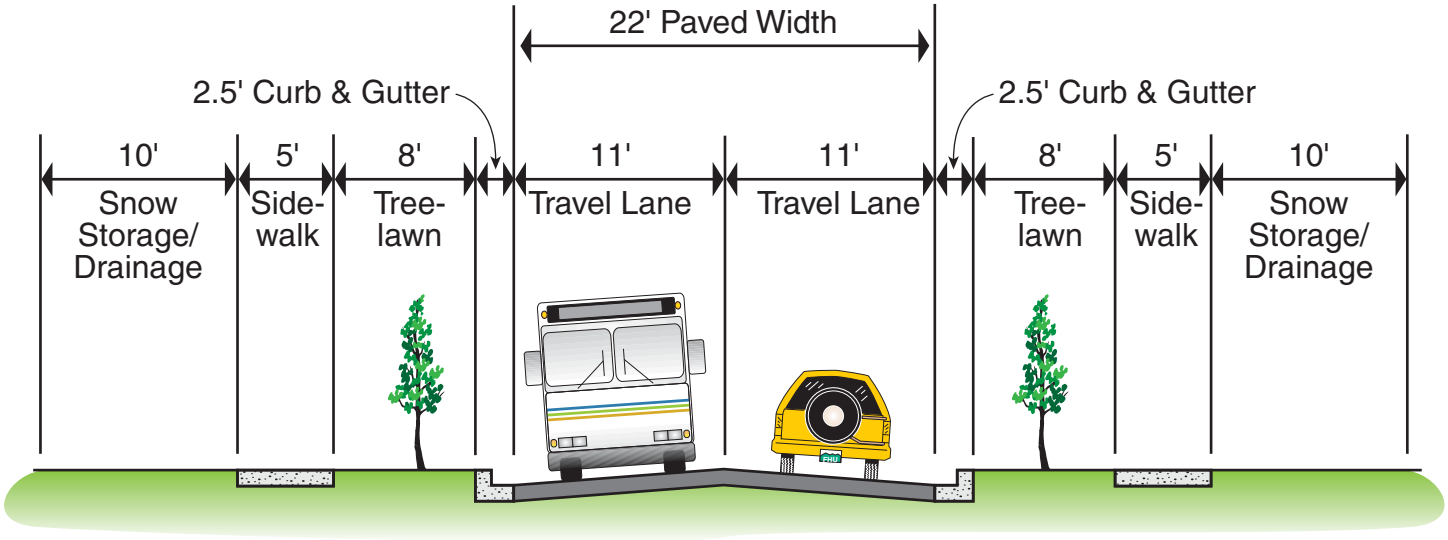

NOTE: Additional width may be required to accomodate turn lanes at intersections or on-street parking

Local - Urban

Figure 1.13
Local - Urban Cross-Section

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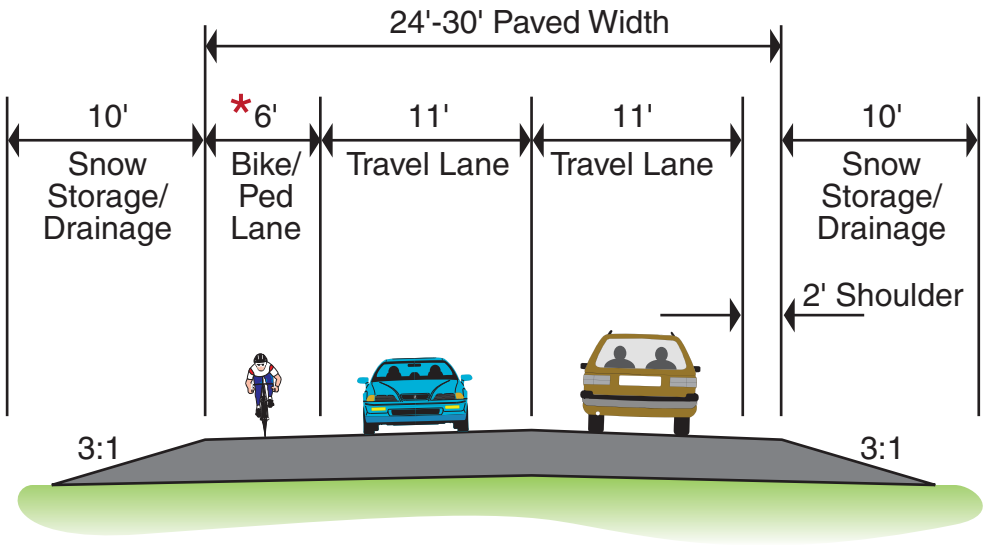

*NOTE: Where Required

Local - Rural

Figure 1.14
Local - Rural Cross-Section

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Street Plantings are intended to beautify the streetscape without resulting in adverse consequences to driver safety or excessive added maintenance duties. Care must be taken to select and locate plants in such a way that branches do not stick out into traffic or block site distance. Plant species that have shallow aggressive roots can damage sidewalks and road asphalt. Snow plowing activities can stress some species beyond their tolerance. Water demands for irrigation are also a consideration. For these reasons, the Town has created a pre-approved list of street plantings (see **Appendix E**). Developers are encouraged to follow the guidance in this list and to identify any other landscaping proposals upon plan review. It may be possible to reduce set back requirements via use of a root barrier or other site-specific adaptation.

Snow Storage and Drainage is needed adjacent to all roads, sidewalks and paved trails. This area is typically about ten feet in depth on either side of a road to accommodate the extent of snow occurring in Avon. Snow storage and drainage along the frontage is for use by Public Works to maintain the public rights-of-way.

1.4.2 Transportation Impact Study Guidelines

1.4.2.1 Purpose

Transportation Impact Studies (TIS) are needed to appropriately address the transportation related impacts of new development, redevelopment, plan amendments, or zoning modifications within the Town of Avon. The TIS identifies whether the existing transportation system can operate at acceptable levels with the proposed development, or if improvement measures are needed to mitigate the impacts. The owner/developer is responsible for contracting a transportation consultant to conduct the TIS, and is also responsible for providing any required impact mitigation measures identified in the TIS. The Town shall review each TIS for approval or rejection relative to criteria specified herein.

The purpose of this section is to provide guidance to developers and their consultants for TIS preparation. The required content and format will ease the review process by ensuring a consistent approach in the identification of multi-modal travel projections, impacts, and mitigation measures.

1.4.2.2 Requirement for Transportation Impact Studies

A TIS shall be required for any proposed development that will generate 200 or more daily vehicle trips during an average weekday. The trip generation potential of the proposed project shall be estimated using the data and methodology contained in the latest edition of TRIP GENERATION, Institute of Transportation Engineers (currently the 8th Edition). As a general reference, developments of the following sizes, or larger, would typically require a TIS:

- Residential, Single Family Detached – 20 units
- Residential, Multi-Family, Condominium– 35 units
- Residential, Multi-Family, Apartment – 30 units
- Hotel/Lodging – 25 rooms
- Office – 18,000 square feet
- Retail – 4,600 square feet
- Industrial – 28,000 square feet

For developments that are not projected to exceed the 200 daily vehicle trip generation threshold, the submittal of a letter, describing the project and documenting its trip generation potential, will be required. The letter shall be prepared and sealed by a licensed professional engineer. In any case, a TIS may be still required due to site-specific conditions, as determined by the Town.

For developments where access to a Colorado State Highway is requested, the requirements of Section 2.3(5) of the STATE HIGHWAY ACCESS CODE may also apply. Applicants are advised to contact the Region 3 Access Manager, Colorado Department of Transportation, for additional details regarding access to State Highways.

A new TIS may be required for developments when a previously prepared TIS is more than two years old, or when proposed land uses or densities have changed. In these cases, the Town will make the determination whether a complete new TIS is required or if an addendum letter will suffice.

1.4.2.3 Transportation Impact Study Format and Required Elements

Applicants, or their transportation consultants, are encouraged to discuss their projects with the Town prior to starting the TIS to establish study area boundaries, directional distribution, nearby potential developments that might affect background conditions, or critical issues to be addressed. In some cases, the particular type of development may have a greater seasonal impact, such as development related to winter recreation; thus, appropriate seasonal considerations maybe required. While specific TIS requirements may vary site to site, all studies should incorporate the following elements:

1. Description of Proposed Development and Study Area Boundaries

   A description of the development site, including size, current zoning or land uses, and general terrain features shall be provided. The general location of the site within the Town shall be identified relative to the adjacent roadway system. A conceptual site plan, showing the location, type, and quantity of proposed land uses, as well as access to adjacent roadways shall be provided. The study area shall be defined.

2. Existing Conditions

   A discussion of the existing roadways within the study area shall be provided, addressing functional classification, number of lanes, speed limits, and intersection geometrics and traffic control. The locations of transit routes and nearby bus stops shall be identified. Pedestrian and bicycle facilities, such as sidewalks, designated bike lanes, and regional trails, shall be described.

   Existing traffic data shall be compiled or collected on roadways and at key intersections within the study area. These data may include recent 24-hour traffic counts conducted by the Town, CDOT data, or traffic counts provided by the applicant. Sufficient data shall be provided to conduct an analysis of existing traffic operational conditions within the study area for both AM and PM peak hour conditions.

   Level of Service (LOS) analyses shall be conducted based on the latest edition of the HIGHWAY CAPACITY MANUAL (currently HCM2000) to establish existing operational conditions and to identify any existing geometric or traffic control deficiencies. Acceptable operations within the Town of Avon are LOS C for peak hour roadway operations and LOS D for peak hour intersection operations. These LOS threshold standards account for the increased delay that is anticipated at intersections due to traffic control devices.

3. Site Trip Generation

A trip generation analysis of the proposed site uses shall be conducted per Institute of Transportation Engineers (ITE) methodology. The trip generation analysis shall consider the daily, AM and PM peak hours for a typical weekday. Pass-by traffic and internal trip reductions may be applied where applicable using ITE data; however, any reductions for pass-by or internal trips must be appropriately documented.

When the proposed development involves a rezoning of the site, the TIS shall include a trip generation comparison to demonstrate the difference between the existing and proposed zoning. The trip generation comparison shall be based on the maximum allowable uses under each zoning criteria.

4. Mode Split

An evaluation of the potential use of alternate travel modes such as transit, carpooling or biking associated with the proposed development shall be included in the TIS. Analyses documented in the Town of Avon Comprehensive Transportation Plan, indicate that the use of alternate modes varies by type of land use and proximity to the Town core area. The following table provides factors to be applied to the trip generation estimates to quantify trips by alternate mode for each general land use type. The area type can be determined from the map depicted on **Figure 1-15.**

Table 1.16 Transit Ridership as a Percentage of Vehicle Trips

Land Use	Percent Transit Trips for Area Type		
	Town Core	Outer Core	Mountain Rural
Residential	11.0	5.4	1.0
Hotel/Lodging	6.0	3.2	1.0
Office	10.0	5.0	1.0
Retail	11.0	5.4	1.0
Industrial	7.0	3.4	1.0

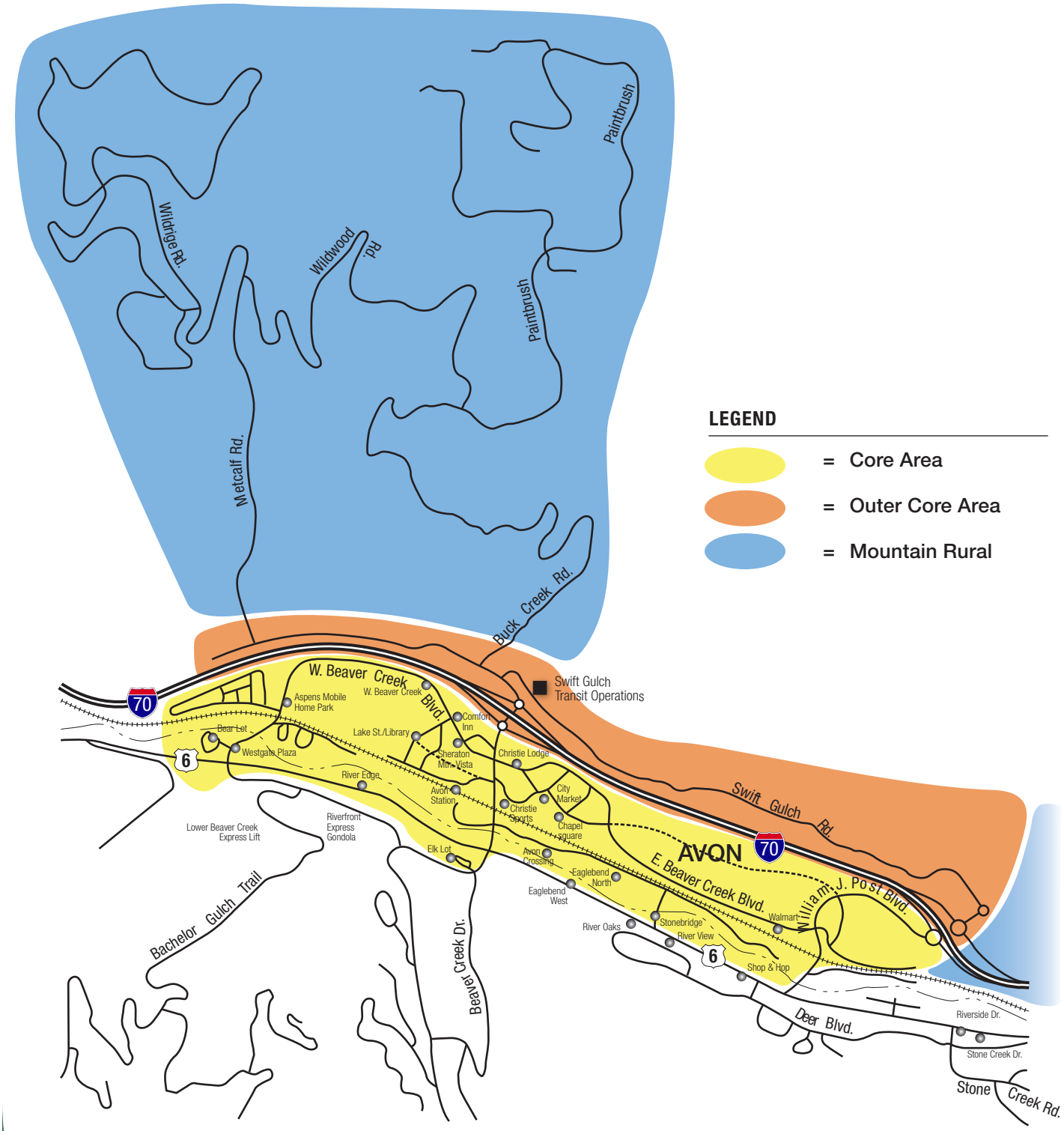

Figure 1.15
Town of Avon
Transit and Alternate Mode Subareas

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The above factors provide the transit mode split as a percentage of the overall vehicle trip generation. Thus, the vehicle trip generation estimates, and the resultant traffic assignment, is reduced.

To estimate the number of transit trips, the resultant transit split is converted into person trips by multiplying by 2.4. This calculation will quantify the expected impact to transit facilities.

5. Trip Distribution

The resultant site generated vehicular traffic volumes shall be assigned to the adjacent roadway network based on the proximity of the site to nearby activity centers, regional transportation facilities, or on directional distribution assumptions previously established with the Town. The resultant site generated traffic assignment shall include the daily, AM and PM peak hour traffic volumes.

6. Future Conditions

The TIS shall evaluate both short term future and long range future conditions. The short term future shall be based on the anticipated completion date of the proposed project, while the long range future corresponds to an approximate 20 year planning horizon. Interim future scenarios may be appropriate for larger, phased developments, as determined by the Town.

Background traffic volumes, representing traffic unrelated to site development, shall be developed based on traffic forecasts contained in the Comprehensive Transportation Plan, CDOT growth factors, or as established through discussions with the Town. Total traffic volumes consist of background traffic plus the site generated traffic volumes.

Level of Service analyses shall be conducted for the following future conditions:

- Short Term Background
- Short Term Background plus Site
- Long Term Background
- Long Term Background plus Site

Any interim scenarios shall also be similarly analyzed.

7. Recommendations

The TIS shall recommend traffic engineering measures to mitigate any operational impacts identified in the analyses and maintain acceptable LOS on the adjacent roadways and intersections. Potential improvements may include:

- Roadway widening for additional lanes, such as right- or left-turn lanes
- Traffic control, such as a STOP sign, roundabout, or traffic signal
- Access modifications, such as relocation or restricted turns
- Other engineering improvements

Where impacts to transit operations or pedestrian facilities are anticipated, the TIS shall also provide recommendations for multi-modal improvements. These may include:

- Transit improvements, such as bus stops, bus shelters, bus pull-out lanes, or route modifications
- Pedestrian improvements, such as sidewalks or access to trails
- Bicycle improvements, such as paths, trails, or designated bike lanes
-

Non-Motorized LOS Criteria – Pedestrian

The Pedestrian LOS is evaluated according to prevailing or forecasted conditions within a ¼ mile radius from the proposed development site. Destinations within this area where LOS applies may include:

- Recreational sites.
- Residential areas with concentrations of at least 20 dwelling units within 5 acres.
- Institutional sites.
- Office buildings greater than 25,000 square feet.
- Commercial sites greater than 15,000 square feet.
- Industrial sites greater than 50,000 square feet.

Pedestrian LOS is based upon the area types depicted on **Table 1.17**. The following tables provide LOS target levels for pedestrian facilities as determined by Pedestrian LOS criteria.

Table 1.17 Target Levels of Service by Pedestrian Facility Type

Facility Type	Directness	Continuity	Street Crossings	Visual Interest Amenities	Security
Core Area	A	A	B	A	A
Outer Core	B	B	C	B	B
Mountain Rural	B	A	C	B	B

Pedestrian Street Crossing Criteria

- 3 or fewer lanes to cross
- 4 or fewer lanes to cross
- 6 or fewer lanes to cross
- Raised median at least 6' wide with low planting features or curb bulb outs
- Well marked crosswalks
- Good lighting levels
- Standard curb ramps
- Amenities, signing, sidewalk and roadway character strongly suggest the presence of pedestrian crossing
- Drivers and pedestrians have unobstructed view of each other

Table 1.18 LOS Criteria Definitions

	A	B	C	D	E	F
Directness	Excellent and direct connectivity through full utilization or urban space, streets, transit, activity centers with clear linear visual statements. (AM Ratio <1.2)	Good and direct connectivity with clear linear and visual connection to transit facilities, streets, and activities. (AM Ratio 1.2 to 1.6)	Minimum acceptable directness and connectivity standard. Perceptions and urban space become less coherent with the beginning of discomfort with visual clarity and lack of linearity. (AM Ratio 1.6 to 2.0)	Increase lack of directness, connectivity and linearity with incoherent and confusing direction and visual connection to pedestrian destinations. (AM Ratio 2.0 to 2.4)	Poor directness and connectivity. Pedestrians perception of a linear connection to desired destination falters and serves only the person with no other choice. (AM Ratio 2.4 to 3.0)	No directness or connectivity. Total pedestrian disorientation, no linearity and confusing. (AM Ratio >3.0)
Continuity	Pedestrian sidewalk appears as a single entity with a major activity area or public open space	Continuous stretches of sidewalks which are physically separated by a landscaped parkway.	Continuous stretches of sidewalks which may have variable widths, with and without landscaped parkways.	Pedestrian corridors are not well connected with several breaches in the pedestrian network.	Significant breaks in continuity.	Complete breakdown in pedestrian traffic flow as each pedestrian selects a different network exists.
Visual Interest and Amenity	Visual appealing and compatible with local architecture. Generous sidewalk width, active building frontages, pedestrian lighting, street trees and quality street furniture.	Generous sidewalks, visual clarity, some street furniture and landscaping, no blank street walls.	Functionally operational with less importance to visual interest or amenity.	Design ignores pedestrian with negative mental image.	Comfort and convenience non-existent, design has overlooked needs of users.	Total discomfort and intimidation.

	A	B	C	D	E	F
Security	Sense of security enhanced by presence of other people using sidewalks and overlooking them from adjacent buildings. Good lighting and clear sight lines.	Good lighting levels and unobstructed lines of sight.	Unobstructed lines or sight.	Sidewalk configuration and parked cars may inhibit vigilance from the street.	Major breaches in pedestrian visibility from street, adjacent lane uses and activities	Streetscape is pedestrian intolerant.

Table 1.19 Pedestrian Street Crossing LOS

	A	B	C	D	E	F
Roundabout Crossing*	All criteria met	Missing 2 criteria	Missing 4 criteria	Missing 5 criteria	Missing 7 criteria	Missing 9 criteria
Unsignalized Crossing (Major Street)**	All criteria met	Missing 2 criteria	Missing 3 criteria	Missing 4 criteria	Missing 5 criteria	Missing 6 criteria
Unsignalized Crossing (Minor Street)**	All criteria met	Missing 1 criteria	Missing 2 criteria	Missing 3 criteria	Missing 4 criteria	Missing 5 criteria
Mid Block (Major Street Crossing)	All criteria met	Missing 2 criteria	Missing 3 criteria	Missing 2 criteria	Missing 5 criteria	Missing 6 criteria

* Pedestrian LOS at a roundabout will go up one level of service with colored or textured crosswalks.

** Unsignalized crossing at intersection of major street (minor arterial to major arterial) and minor street (local and collector)

Non-Motorized LOS Criteria – Pedestrian

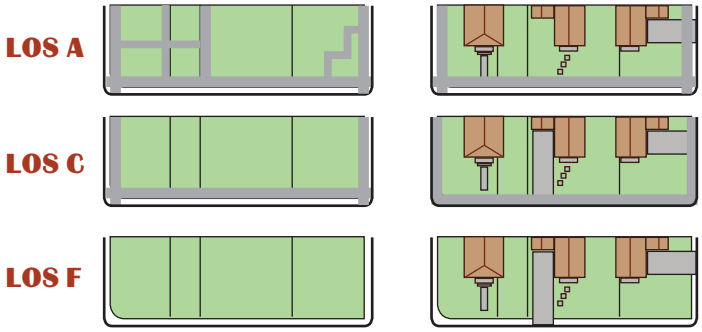
Bicycle LOS would be based upon connectivity to either on-street bike lanes or off-street facilities (Shared Use Paths), as well as street crossing safety according to the LOS Criteria listed in **Table 1.20**. The proposed project must be directly connected to all priority designations located within ¼ mile of any edge of the project boundaries as shown in the figure below. Priority destinations include:

- Public school sites, both future and existing, as specified by the school district.
- Recreational and park sites.
- Commercial sites greater than 15,000 square feet.
- Major employment centers

Table 1.20 Bicycle LOS Definitions

LOS	Connectivity	Street Crossing Safety
A	Directly connected to more than one north-south or east-west existing facility; one of which is an on-street and one of which is an off-street facility.	Grade separated crossings of major arterial streets. Clearly striped crossings of all other streets.
B	Directly connected to one north-south and east-west on-street of off-street facility.	Crossings at roundabouts. Clearly striped and signed crossings of all streets.
C	Directly connected to one north-south or east-west on-street or off-street facility.	All crossings of streets are clearly signed and striped.
D	Indirectly connected to a north-south or east-west on-street or off-street facility via a low volume local street within a quarter mile.	Striping of bike lanes not defined at intersections.
E	Indirectly connected to a north-south or east-west on-street or off-street facility via a low volume local street within a mile.	Crossings are not clearly marked at intersections. Locations of crossings are at unexpected locations.
F	No direct or indirect connections to north-south or east-west corridors.	Obstructed views at crossings.

Figure 1.16 provides graphic examples of non-motorized LOS measures.

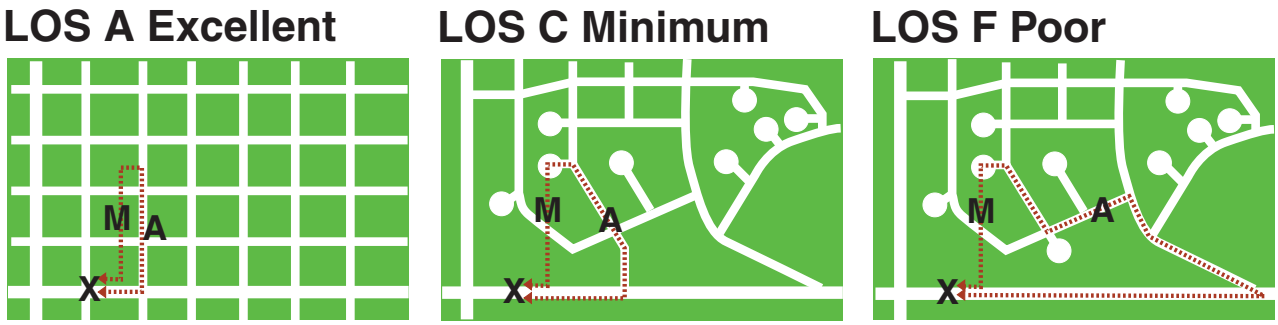


Continuity

(Measurement of the completeness of the sidewalk system)

LOS "A" is achieved when the pedestrian sidewalk appears as a single entity with a major activity area or public open space.

Examples of Pedestrian LOS Continuity

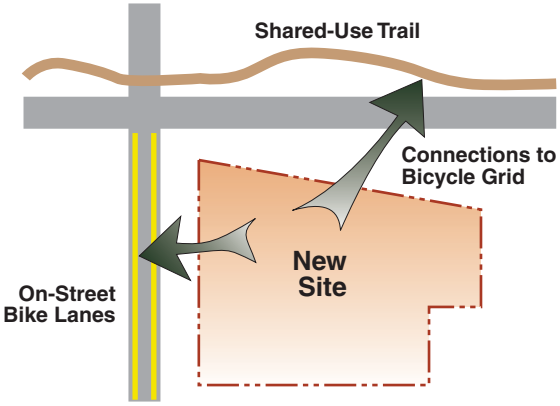


A = Actual Distance to Walk
M = Measured Distance to Walk
X = Destination

Directness

The directness LOS measure is based on a ratio of the actual distance from the trip origin to trip destination divided by the minimum distance (as the crow flies) between those two points.

Examples of Pedestrian LOS Directness



Bicycle Connectivity

Figure 1.16
Non-Motorized LOS Criteria

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For larger commercial developments, the TIS may also include recommendations for Transportation Demand Management (TDM), including:

- Flexible work hours
- Telecommuting
- Employee programs to encourage car pooling or transit use

In cases where TDM strategies are included as a part of a development proposal, the Town may offer incentives such as reduced roadway improvement contributions, tax incentives, or other considerations. As a part of approval, on-going monitoring and documentation of TDM program continuity by the developer would be a requirement for the continuation of such incentives.

The TIS shall be prepared by or under the supervision of a registered Professional Engineer. The completed report shall be signed and sealed.