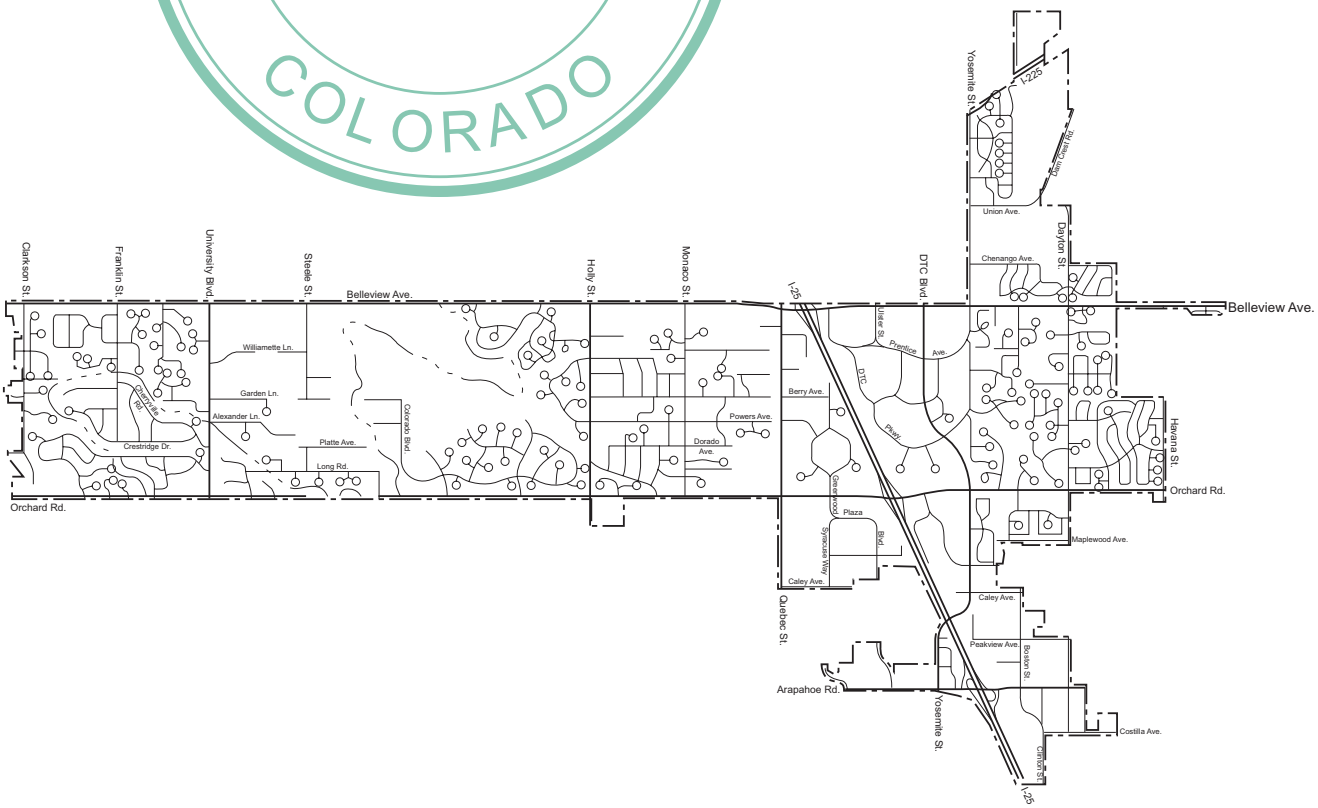
Greenwood Village Transportation Plan



December 1998

GREENWOOD VILLAGE TRANSPORTATION PLAN

Prepared for:

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Adopted: January 25, 1999

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EXECUTIVE SUMMARY

PLANNING PROCESS

In response to continuing development, increasing traffic congestion, and concerns about traffic impacts on Greenwood Village neighborhoods, the City of Greenwood Village has undertaken development of a village-wide transportation plan. The plan encompasses all travel modes, including automobile, bus, passenger rail, bicycle and pedestrian transportation. The planning process has been conducted with an extensive neighborhood-level public involvement program, aimed at developing recommendations for improving mobility and reducing transportation impacts in neighborhoods throughout the Village.

A wide range of transportation issues was identified and explored through technical evaluations, discussions with City Council, Village commissions, staff members, and village-wide public workshops. Individual neighborhood issues and concerns were blended together to reflect a village-wide perspective, fitting individual neighborhood transportation issues and recommendations into a system that works for all neighborhoods in the Village.

The plan also incorporates consideration of the Village's transportation system as it fits into overall Denver regional transportation planning. The regional perspective was incorporated by reviewing plans and coordinating with regional agencies and neighboring jurisdictions. Specifically, the Village's transportation plan reflects agreements that resulted from the 1997 Mediation Agreement developed by Greenwood Village, Arapahoe County and the City of Aurora.

TRANSPORTATION GOALS

The planning process has resulted in the formulation of five transportation goals that have guided the development of the Greenwood Village Transportation Plan:

1. Define a practical roadway classification system to include five street levels (as shown on Figure S-6):

    - Regional Level - The principal roadway system which is designed to carry high volumes of traffic and longer trips, including roads designated in Denver regional transportation plans as freeways, major regional arterials, and principal arterials.

    - City and County Level - Supporting the regional roadway network is a network of city and county level streets that are not designed to carry traffic volumes as great as regional facilities, but which are intended to serve a significant mobility function. Commercial streets that are not regional facilities are included in this category.

- Inter-Neighborhood - Often referred to as collector streets, inter-neighborhood streets connect local neighborhood streets with the city and county and regional systems. While these streets serve a mobility function for adjacent neighborhoods, the function of these streets needs to be balanced with impacts that high traffic volumes and speeds on them may create for adjacent neighborhoods.

- Direct Local - These are local streets that are configured in such a way that they may tend to attract significant volumes of through traffic.

- Indirect Local - Local streets that lack direct continuity, thus do not create concerns over attraction of through traffic.

2. Work with regional agencies and neighboring jurisdictions to maintain and improve the ability of the regional transportation network to accommodate regional mobility needs of area workers, residents and visitors.

3. Provide convenient and safe multi-modal access for the Village's residential neighborhoods, public facilities and commercial areas.

4. Use traffic calming and impact mitigation techniques to minimize the negative impacts of traffic on residential neighborhoods and maintain the Village's quality of life. Identify and implement appropriate techniques directed at inter-neighborhood, direct local and indirect local streets.

5. Encourage development patterns that minimize vehicle trip generation, including mixed use development, transit oriented development and pedestrian/bicycle friendly neighborhoods and developments.

TRANSPORTATION ISSUES AND CONCERNS

A series of meetings was held to present results of a transportation conditions survey and to solicit comments on good and bad aspects of the existing transportation system and on possible transportation improvements that should be evaluated in the transportation planning process. One public meeting was held in each of five Planning Areas. In addition, similar project initiation meetings were held with City Council, the Planning and Zoning Commission, the Parks, Recreation and Trails Commission, Village department heads, Public Works Department staff members, and a representative of the Denver Technological Center. Problems and concerns of eight general types were identified:

- Access deficiencies from neighborhoods and local streets;
- Traffic impacts on neighborhood streets;
- Need for improved bicycle and pedestrian facilities;
- Need to improve Greenwood Village collector and arterial streets that are needed for local mobility;
- Intersection operational and safety problems;
- Need to improve major arterial and regional roadways;

- Need for improved transit service; and
- Need for a better mix of land uses, control of growth, and alternative mode incentives.

A menu of potential solutions was developed to address each of these concerns. Solutions include improvements and policies that have been implemented in the Village, as well as some measures that have not been implemented in Greenwood Village but may be applicable in particular situations. It is important to note that while many of these improvements can be implemented by Greenwood Village, many others would be expected to have regional or state implementing agencies or be cooperative efforts with neighboring jurisdictions.

TRANSPORTATION PLAN

Plan elements are organized around five transportation systems:

- Regional Transportation System
- City/County Level Transportation System
- Neighborhood Level Transportation System
- Transit System
- Bicycle and Pedestrian System

Regional Transportation System

The functioning of the regional transportation system in and around Greenwood Village is vital to provide mobility for existing residents and commercial uses and to support the additional development that is expected. Equally important, the regional transportation system needs to have adequate capacity to accommodate regional traffic movements. Without an adequate regional transportation system, there is an increased tendency for regional traffic to divert from the regional system to the local Greenwood Village street network in order to avoid congestion. It is clear that the capacity of the regional transportation system in the southeast part of the metropolitan area has not kept pace with development and growth in travel demand. The highest priority recommended regional improvements are within the I-25 corridor.

Figure S-1 depicts the regional transportation system in and around Greenwood Village, with proposed system improvements shown in two categories. Improvements that are included in adopted regional and inter-jurisdictional plans are shown in yellow, while additional improvements included in Greenwood Village's Transportation Plan are shown in green.

City and County Level System

Supporting the regional roadway system is a network of city and county level streets that are not designed to carry the high traffic volumes of principal arterials, but which are intended to serve a significant mobility function. It is preferable for traffic to use these city level mobility routes rather than more minor, residentially oriented streets. Alternative improvements have been identified and evaluated to facilitate travel on these roadways by improving safety and reducing congestion. Figure S-2 summarizes the recommended city and county level transportation system and improvements. Included are operational improvements on several principal arterials and city/county level roadways throughout the Village.

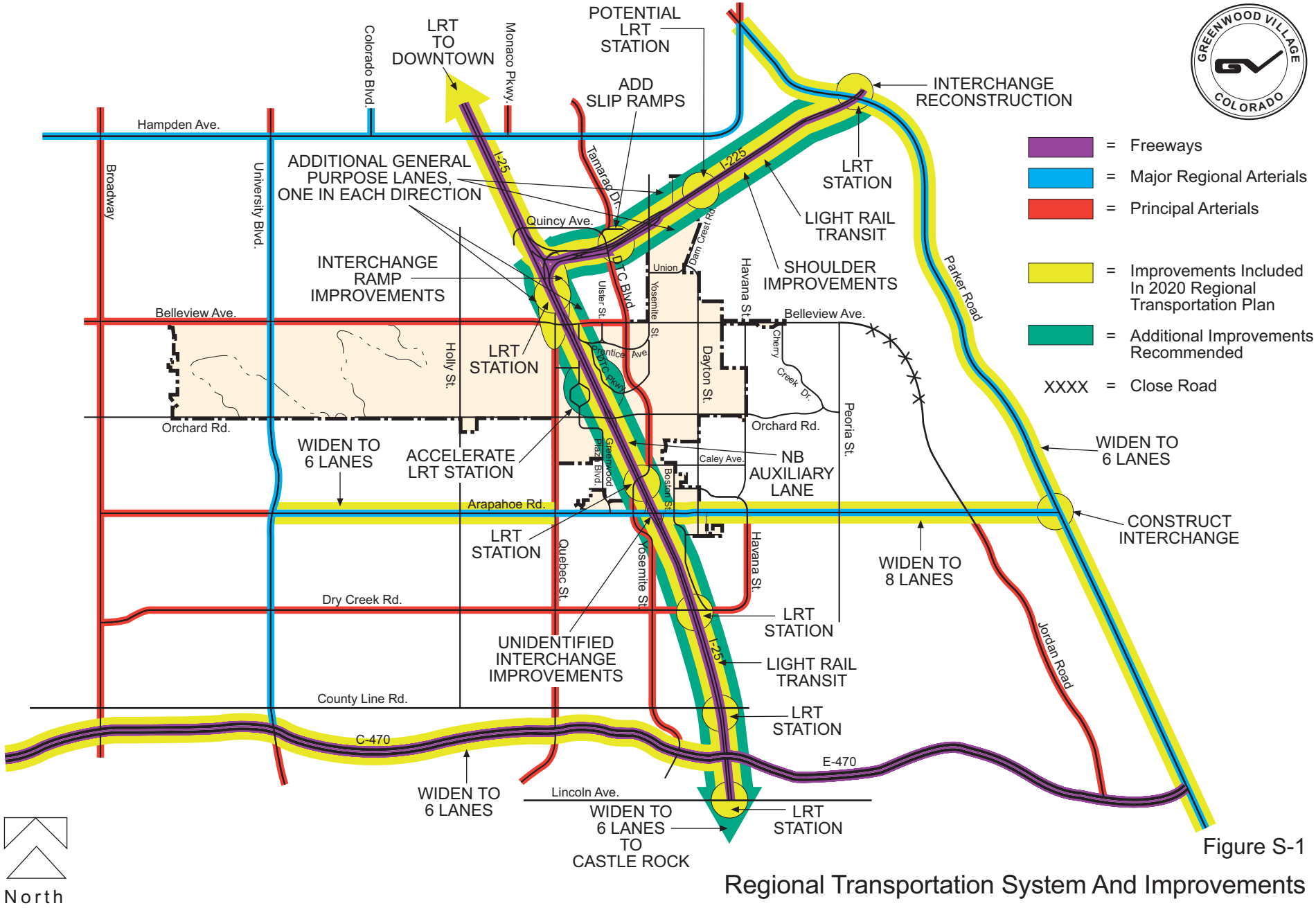

Figure S-1

Regional Transportation System And Improvements

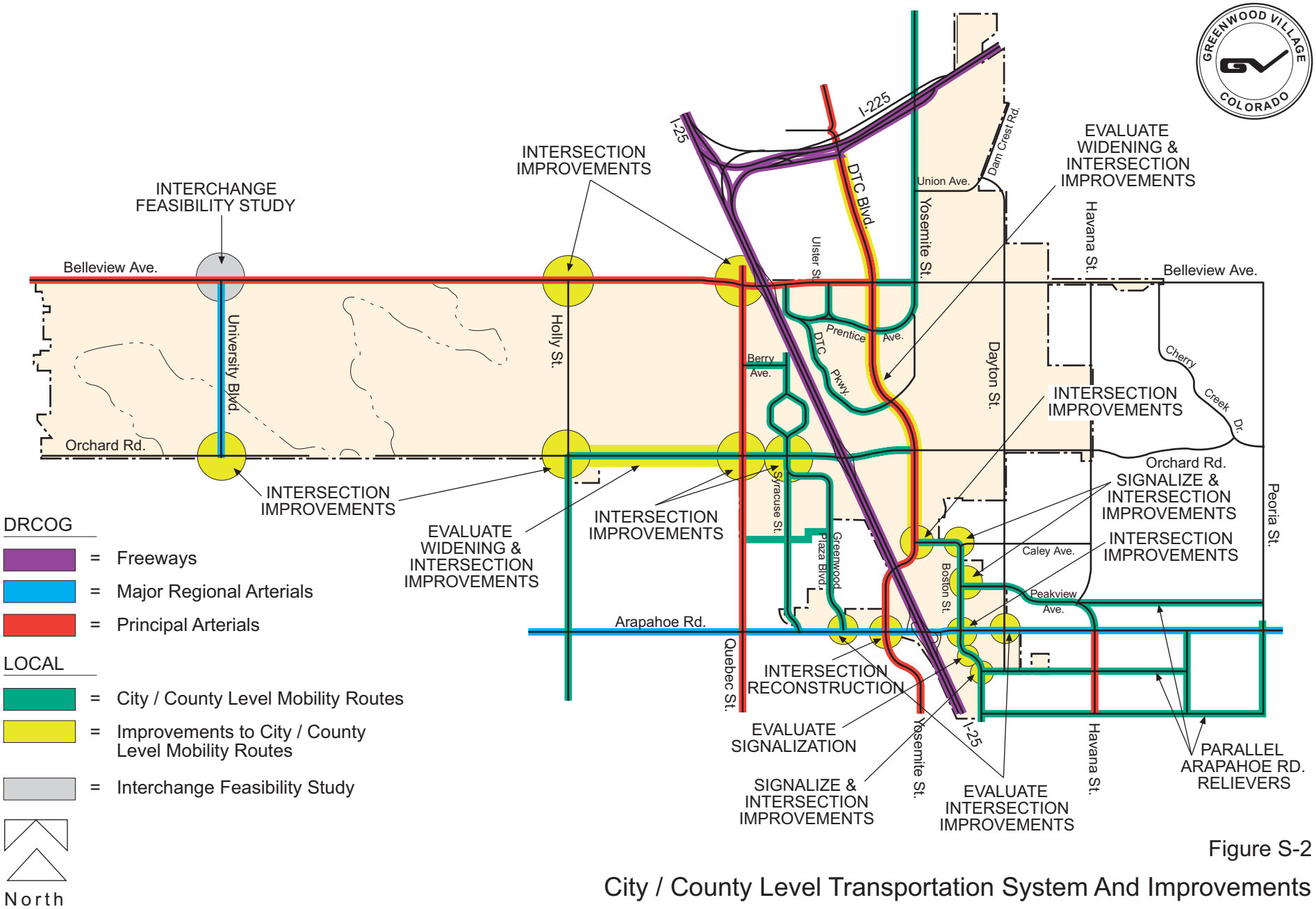

Figure S-2

City / County Level Transportation System And Improvements

Roadway widening projects on parts of Orchard Road and Yosemite Street/DTC Boulevard have been identified as potential improvements. Due to the wide range of opinions, determination of the desired treatment of these corridors will require extensive evaluation and public discussion.

Neighborhood Level Transportation System

The final roadway layer in the Greenwood Village roadway network is the neighborhood level street system. These streets, including inter-neighborhood streets and both direct and indirect local streets, are intended to provide access between neighborhoods and the city/regional transportation network, as well as circulation within neighborhoods. Issues and improvement recommendations at the neighborhood level are generally of three types:

- Traffic calming,
- Access enhancements, and
- Spot operational improvements

Figure S-3 shows the neighborhood level transportation system and improvement recommendations.

Transit System

Figure S-4 shows the existing Regional Transportation District (RTD) bus service in and around Greenwood Village, as well as major planned and recommended transit system improvements. The two most significant planned transit investments are light rail in the I-25 and I-225 corridors and a circulator bus around Greenwood Village. Inclusion of the proposed Orchard Road light rail station in the initial rail development phase is urged by Greenwood Village. Also recommended are bus service improvement concepts that were raised during the public involvement process and should be coordinated with RTD planners.

Bicycle and Pedestrian System

Support has been expressed for implementation of the several bicycle and pedestrian improvements that are included in the Village's Capital Improvement Program (CIP), as well as for additional bicycle and pedestrian improvements. These projects are shown on Figure S-5.

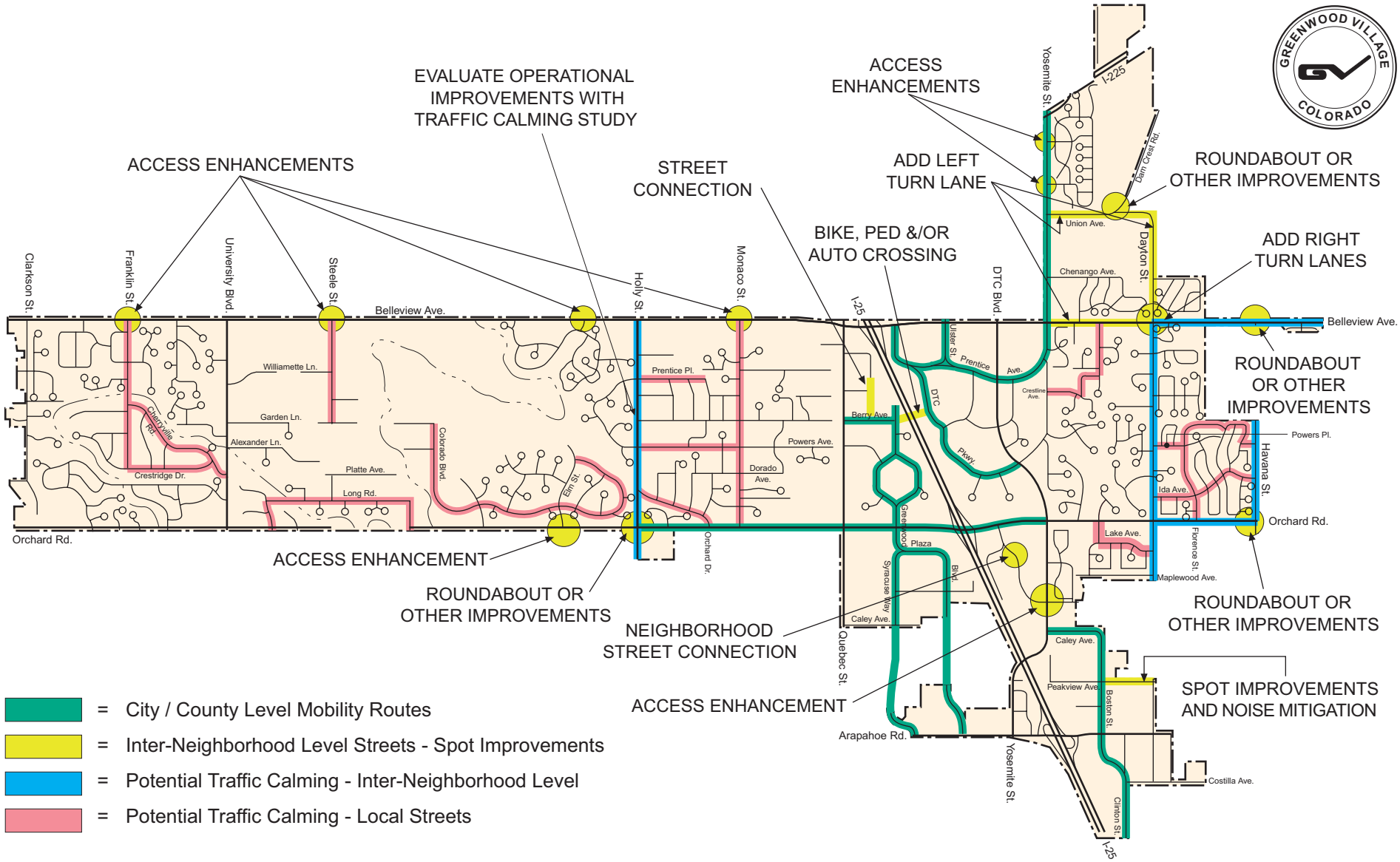

Figure S-3

Neighborhood Level Transportation System And Improvements

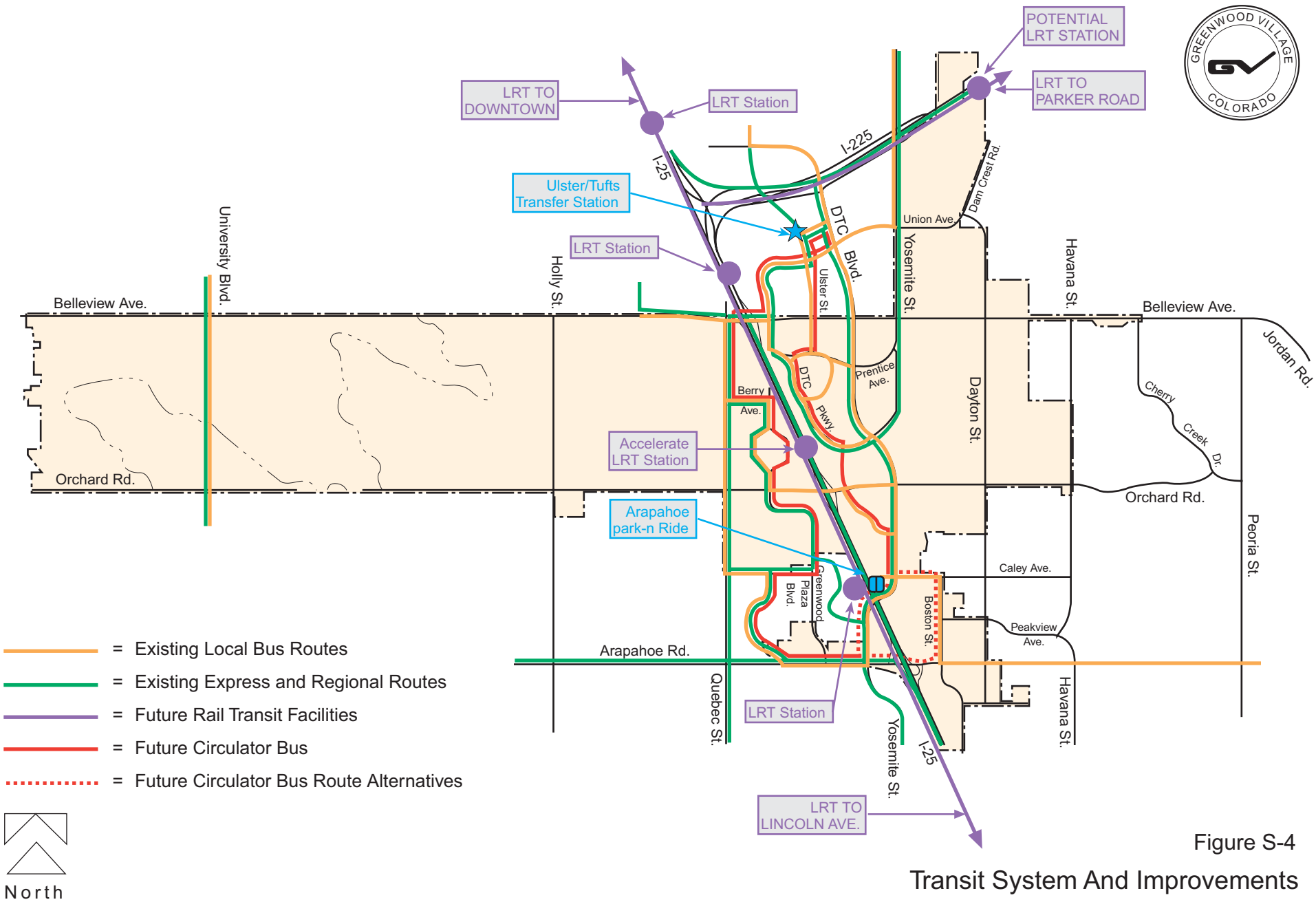

Figure S-4

Transit System And Improvements

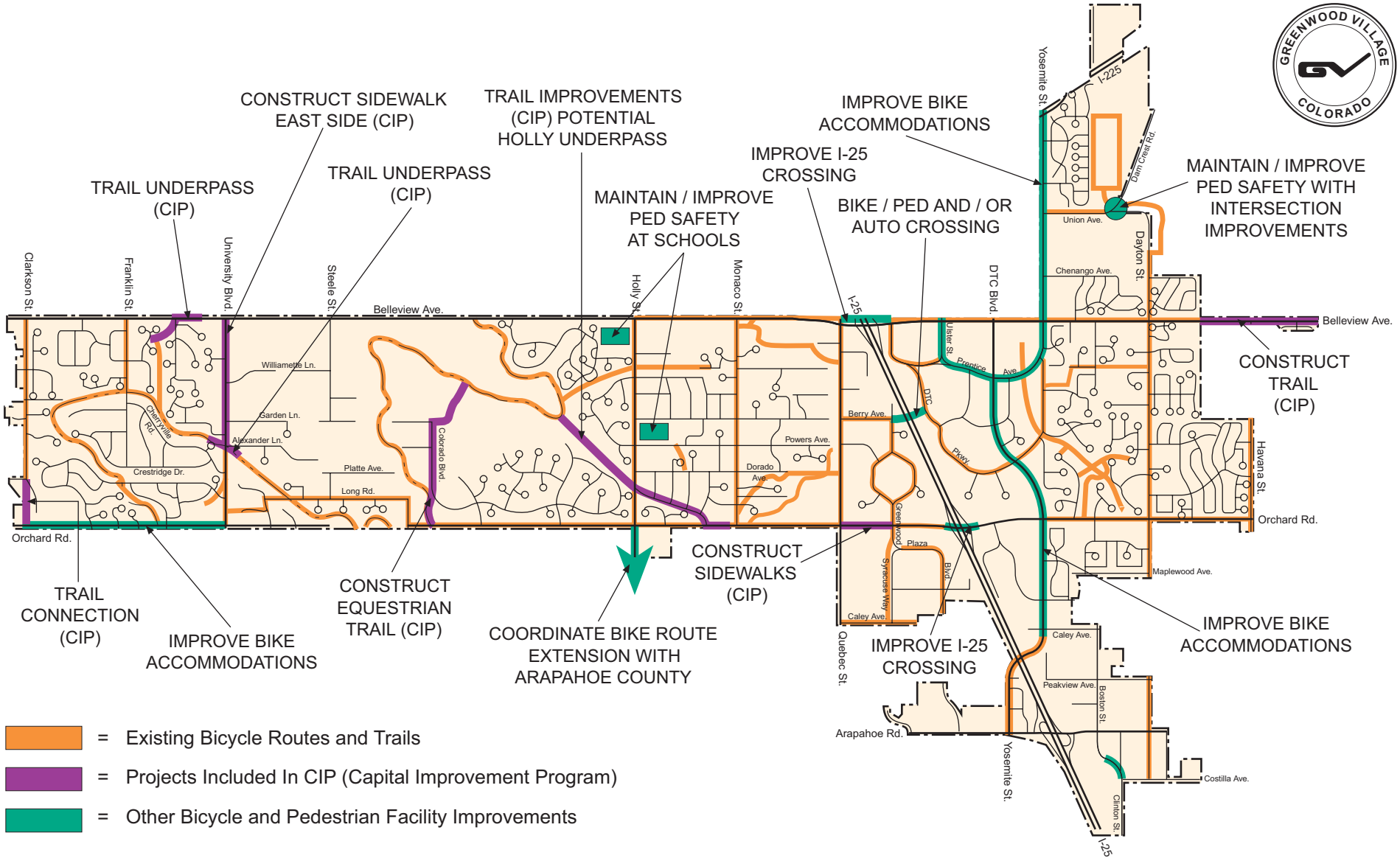

Figure S-5

Bicycle and Pedestrian System And Improvements

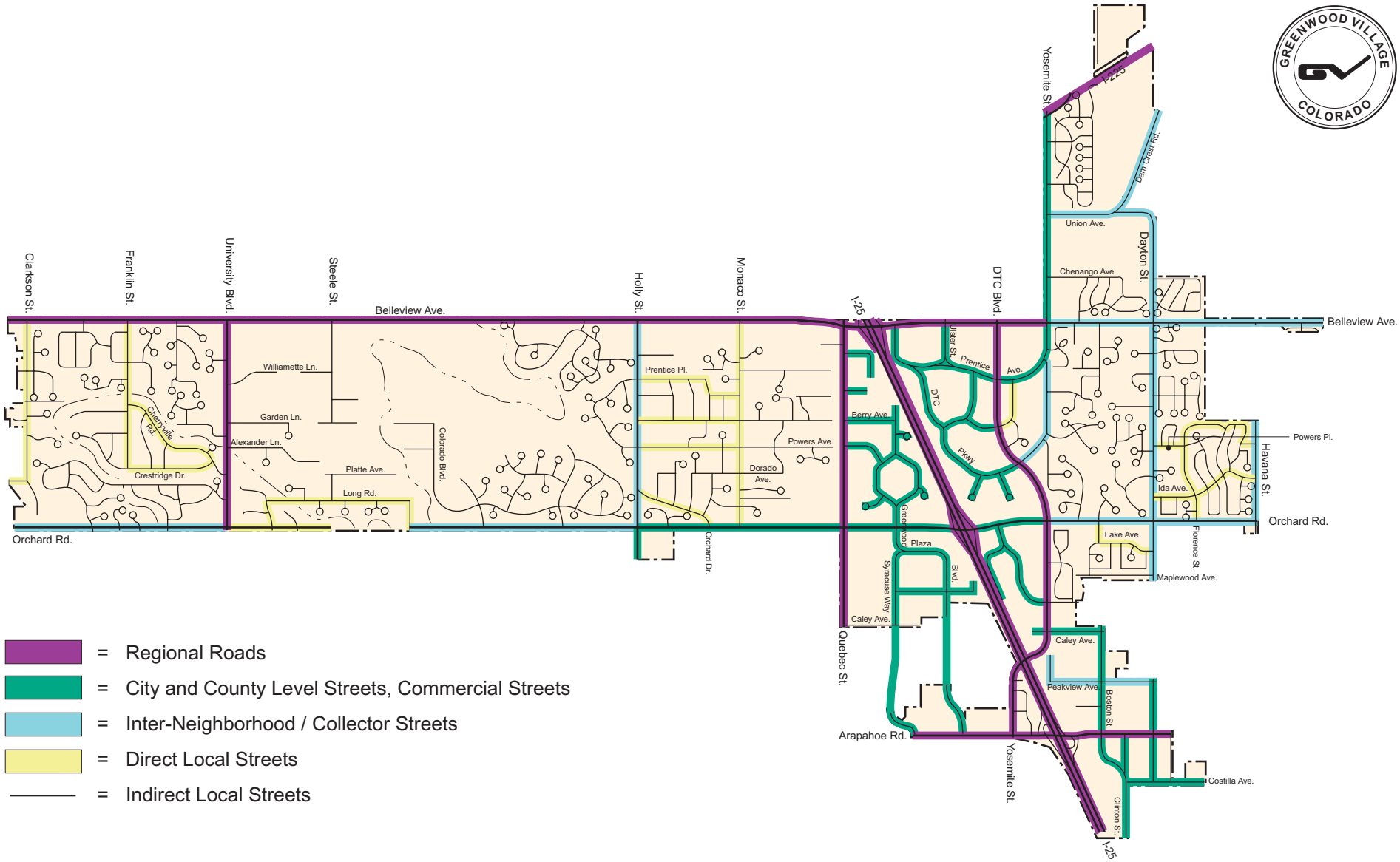

Figure S-6

Functional Classification of Streets

I. INTRODUCTION

PLANNING PROCESS

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The public involvement framework included meetings focused on five different Planning Areas established within the Village (shown on Figure 1). Through these Planning Area meetings, as well as meetings and correspondence with individual property owners, business representatives and residents, hundreds of different transportation issues, concerns, and suggested improvements at the neighborhood level were assembled.

This wide range of transportation issues was explored through technical evaluations and discussions with City Council, Village commissions, staff members, and village-wide public workshops. Individual neighborhood issues and concerns were blended together to reflect a village-wide perspective, fitting individual neighborhood transportation issues and recommendations into a system that works for all neighborhoods in the Village.

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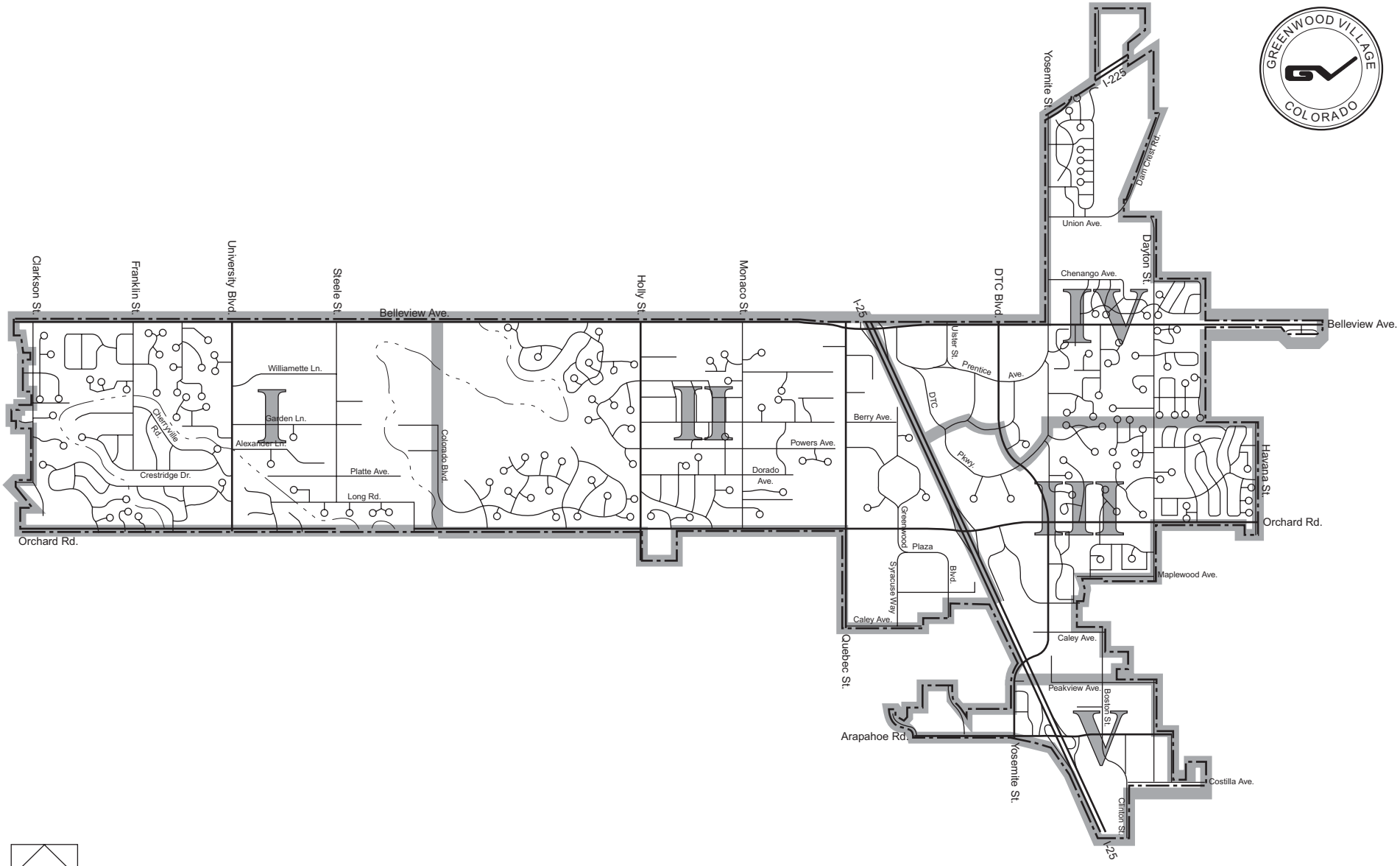

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Figure 1

Planning Areas

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II. TRANSPORTATION SYSTEM DESCRIPTION

ROADWAY NETWORK

Figure 2 shows existing land uses in Greenwood Village and the existing roadway network that serves those land uses. The Denver Technological Center and Greenwood Plaza office complexes surround I-25 in the center of the Village. On the south, the Arapahoe Road corridor is commercially developed, with a mix of retail, restaurant, and hotel uses. Other parts of the Village are primarily residential neighborhoods. Residential development is predominantly low to medium density single family, with some newer multi-family complexes being developed on the periphery of the Village's office development.

Residential neighborhoods are largely served by a suburban pattern of curvilinear streets and cul-de-sacs. The Denver Technological Center and Greenwood Plaza office complexes are served by a curvilinear network of roadways, while the southeastern commercial area is served by more of a grid system of streets.

Figure 3 shows the major street network in Greenwood Village and its surrounding area. Examination of the major street network reveals that the basic mile-grid of arterial streets that is typical in the Denver metro area and in other metro areas throughout the western United States, is present in the vicinity of Greenwood Village. However, there are several significant interruptions in this arterial grid system. Orchard Road has been de-emphasized through residential parts of the Village, including a discontinuity between University Boulevard and Holly Street. There is no through street on the Colorado Boulevard alignment through Greenwood Village, and Holly Street has been de-emphasized due to its residential character. In the eastern part of the Village, Belleview Avenue and Orchard Road have both been de-emphasized due to their residential and recreational character. East of Greenwood Village, the presence of the Cherry Creek State Recreational Area and policy of Greenwood Village have prevented the extension of Belleview Avenue or Orchard Road as arterial streets connecting with Parker Road.

VOLUME/CAPACITY

Figure 3 shows weekday daily volumes on these streets based on counts collected by Greenwood Village in 1997, as well as 1995 and 1996 data collected by the Colorado Department of Transportation (CDOT) and Arapahoe County. I-25 passes through the central commercial part of the Village, carrying more than 200,000 vehicles per day (vpd) north of Belleview Avenue, diminishing to 140,000 vpd south of Arapahoe Road. I-225 carries approximately 115,000 vpd in the vicinity of Greenwood Village.

On arterial streets, the highest volumes of traffic are found on Belleview Avenue (west and immediately east of I-25), Arapahoe Road, and University Boulevard, with daily volumes ranging from 30,000 to more than 50,000. The missing principal arterial segments discussed above tend to place additional pressure on these principal arterial routes that are continuous through the Village and vicinity.

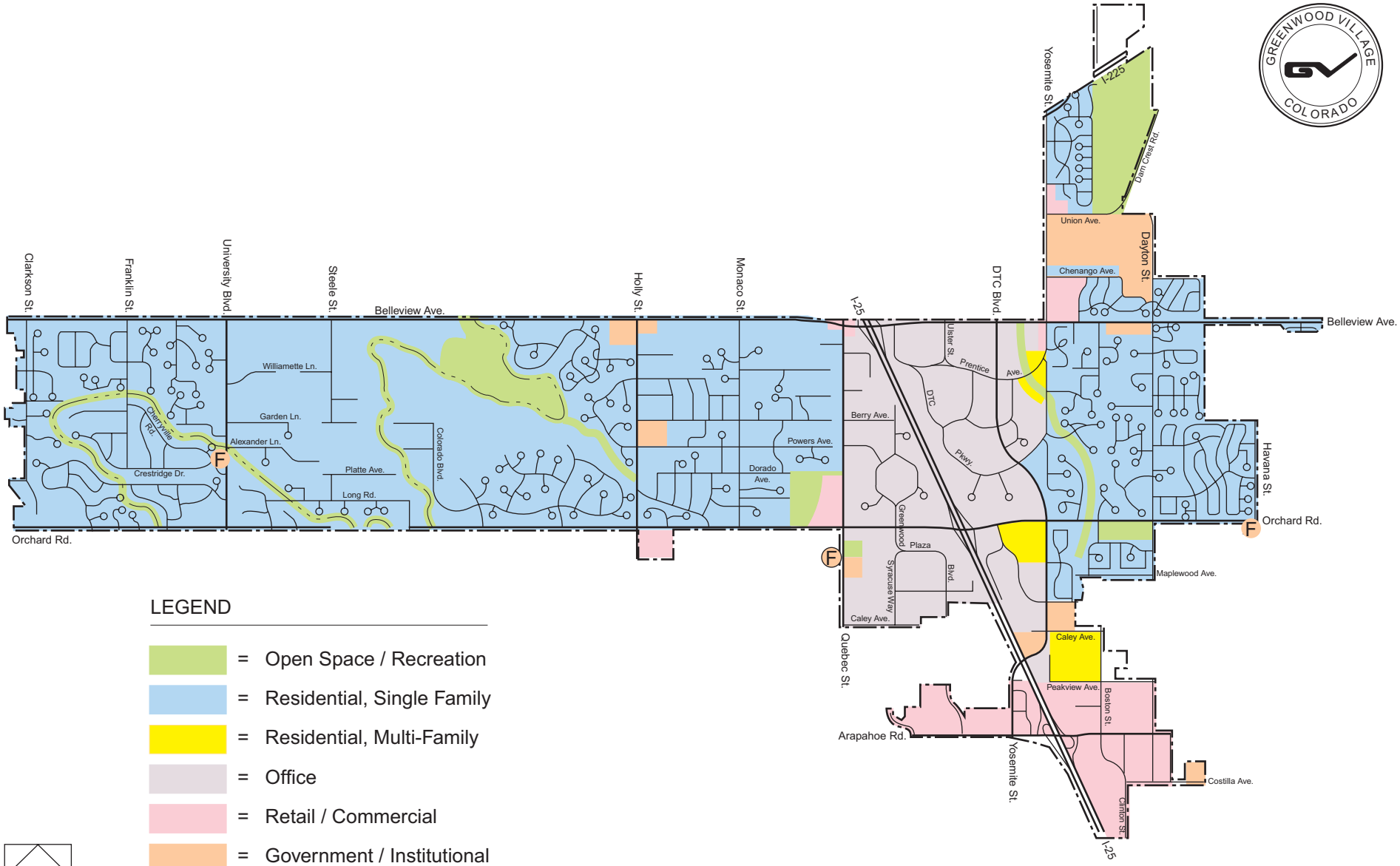


Figure 2

Existing Street Network and Predominant Land Uses

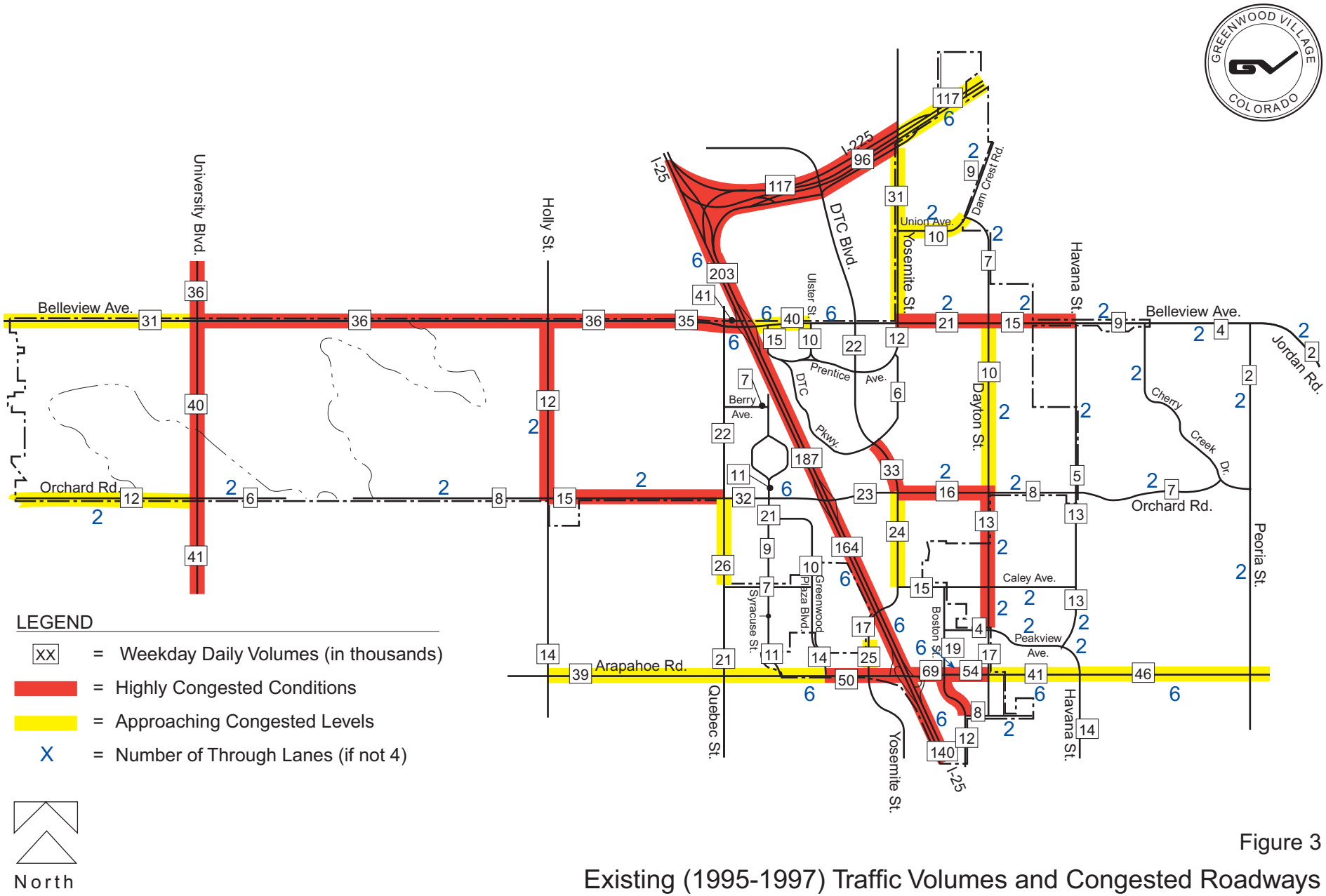


Figure 3

Existing (1995-1997) Traffic Volumes and Congested Roadways

Figure 3 highlights roadway segments that are currently operating with highly congested conditions or conditions approaching congested levels. Table 1 provides typical volume thresholds that can be applied to streets of various classifications to measure congestion. Based on the Denver Regional Council of Governments (DRCOG) functional classification system, I-25 and I-225 are classified as freeways; Arapahoe Road, Belleview Avenue west of Yosemite Street, Orchard Road between Quebec Street and Yosemite Street, University Boulevard, Quebec Street, and the Yosemite Street/DTC Boulevard corridor are classified as principal arterials; and all other streets are classified as minor arterials or collector streets.

Table 1
Typical Congestion Thresholds

Roadway Type	Daily Volume Threshold Per Lane	
	Highly Congested	Approaching Congestion
Freeway	20,000	16,000
Principal Arterial	8,000	6,000
Minor Arterial/Collector	6,000	5,000

Table 2 shows the roadway segments that currently have volumes creating high levels of congestion.

Table 2
Roadway Segments with High Levels of Congestion

Roadway	Highly Congested Segment
I-25	Throughout the Village
I-225	I-25 to Yosemite
Belleview Avenue	University to I-25
Belleview Avenue	Yosemite to Havana
Orchard Road	Holly to Quebec
Orchard Road	Yosemite to Dayton
Arapahoe Road	Greenwood Plaza Blvd. to Dayton
Holly Street	Orchard to Belleview
University Blvd.	Throughout the Village
DTC Blvd.	Orchard to DTC Pkwy.
Clinton Street	Arapahoe to Costilla
Dayton Street	Orchard to Peakview

This analysis shows that all of the freeways and principal arterials currently have volumes exceeding capacity in one or more segment. In addition, volumes exceed capacity on several two-lane minor arterial or collector streets, including Belleview Avenue in the eastern part of the Village, Orchard Road both east and west of the commercial Village center, Holly Street, and segments of Dayton and Clinton Streets.

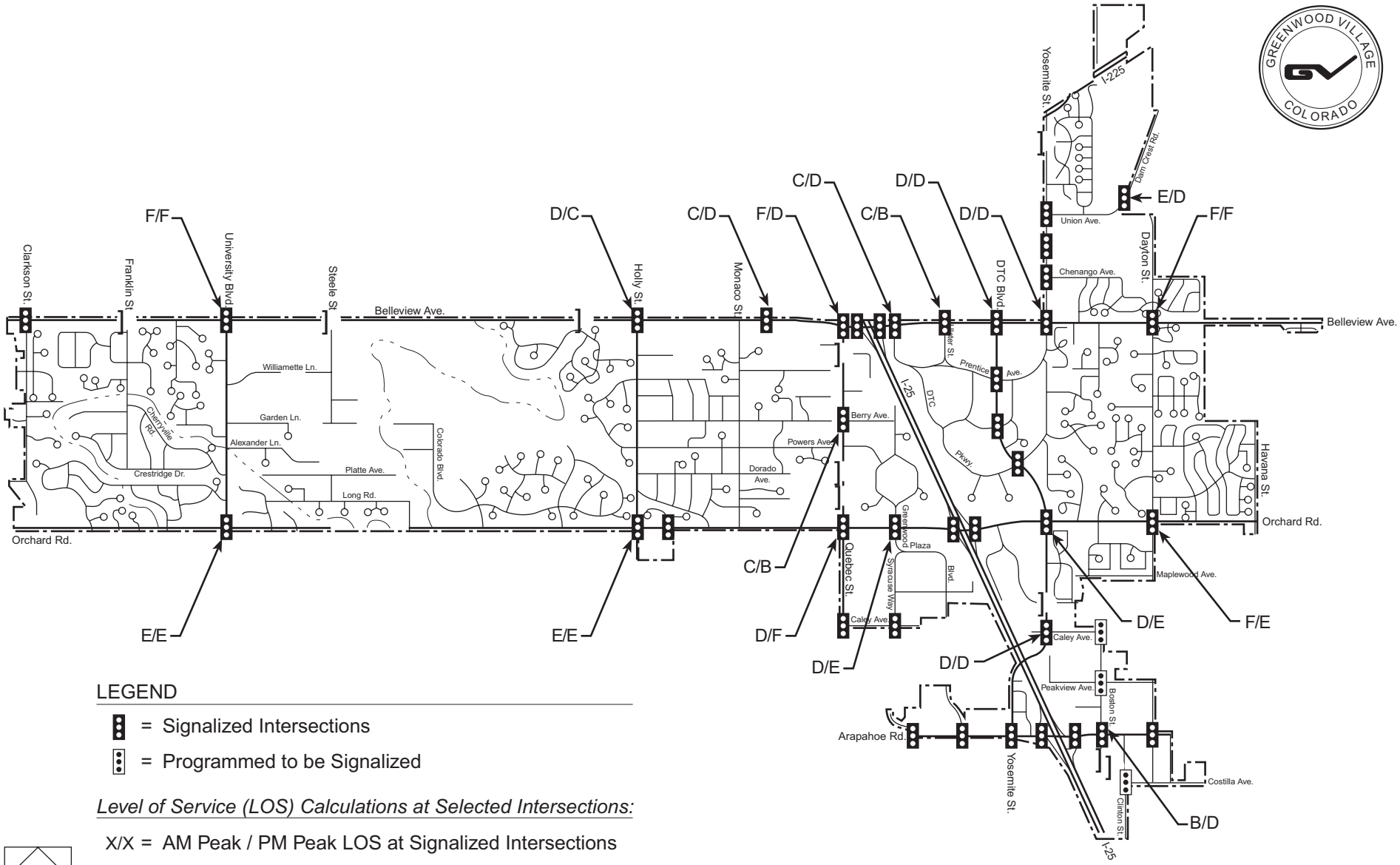
Volumes that do not exceed but are near street capacities are also found on segments of I-225, Union Avenue, Belleview Avenue, Orchard Road, Arapahoe Road, Holly Street, Quebec Street, Yosemite Street, and Dayton Street.

INTERSECTION OPERATIONS

Key intersections were evaluated to determine congestion levels during peak periods. Peak hour turning traffic volume data were collected at selected locations within the past two to three years. Based on this volume data and existing traffic control and lane configurations, intersection level of service (LOS) was determined at each location. LOS is a qualitative assessment of the level of congestion at intersections, based on the average amount of delay experienced by drivers passing through the intersection. LOS is measured on an A to F scale, with LOS A referring to minimal delays and low levels of congestion, and LOS F referring to intersections with high levels of congestion. Detailed LOS definitions are provided in the Appendix.

LOS D or better is generally considered to be desirable for peak period conditions, while LOS E is currently the regional planning design standard. LOS F conditions, with average delays of more than one minute, are typically indicative of traffic demands in excess of intersection capacity. Intersection LOS for key Greenwood Village signalized intersections are shown on Figure 4. LOS E or F conditions for the AM or PM peak hour are found at the following signalized intersections:

- Belleview/University
- Belleview/Quebec
- Belleview/Dayton
- Orchard/University
- Orchard/Holly
- Orchard/Quebec
- Orchard/Greenwood Plaza Boulevard
- Orchard/Yosemite
- Orchard/Dayton
- Union/Dayton/Cherry Creek Dam Road



LEGEND

= Signalized Intersections

= Programmed to be Signalized

Level of Service (LOS) Calculations at Selected Intersections:

X/X = AM Peak / PM Peak LOS at Signalized Intersections

] = LOS F for Vehicles entering Major Street at Unsignalized Intersection during Peak Hours

North

Figure 4

Existing (1995-1997) Signalized Intersection Level of Service

In addition to the configuration of individual intersections, signal timing along arterial corridors also influences travel times, delays and convenience. A signal timing optimization project has recently been completed along Belleview Avenue from Quebec Street to Yosemite Street. Similar projects are programmed for segments of Arapahoe Road, Orchard Road, and Yosemite/DTC Boulevard.

LOS for selected unsignalized intersections was also calculated. Since each of the hundreds of unsignalized intersections in the Village could not be evaluated, intersections were selected that have had significant side street delays identified through past studies or planning processes. LOS at unsignalized intersections is measured separately for different movements, since delays vary widely. Drivers making left turns and movements across from the side street generally experience the longest delays, since they must wait for all other movements to clear.

LOS F for left-turning or crossing movements from side streets are indicated on Figure 4 as having "Excessive Delays at STOP-Controlled Intersections. Such locations exist on Belleview Avenue in the western part of the Village; along Quebec Street; along Clinton Street south of Arapahoe Road; and along Yosemite Street, both south of Orchard Road and north of Belleview Avenue.

CONSEQUENCES OF CONGESTION

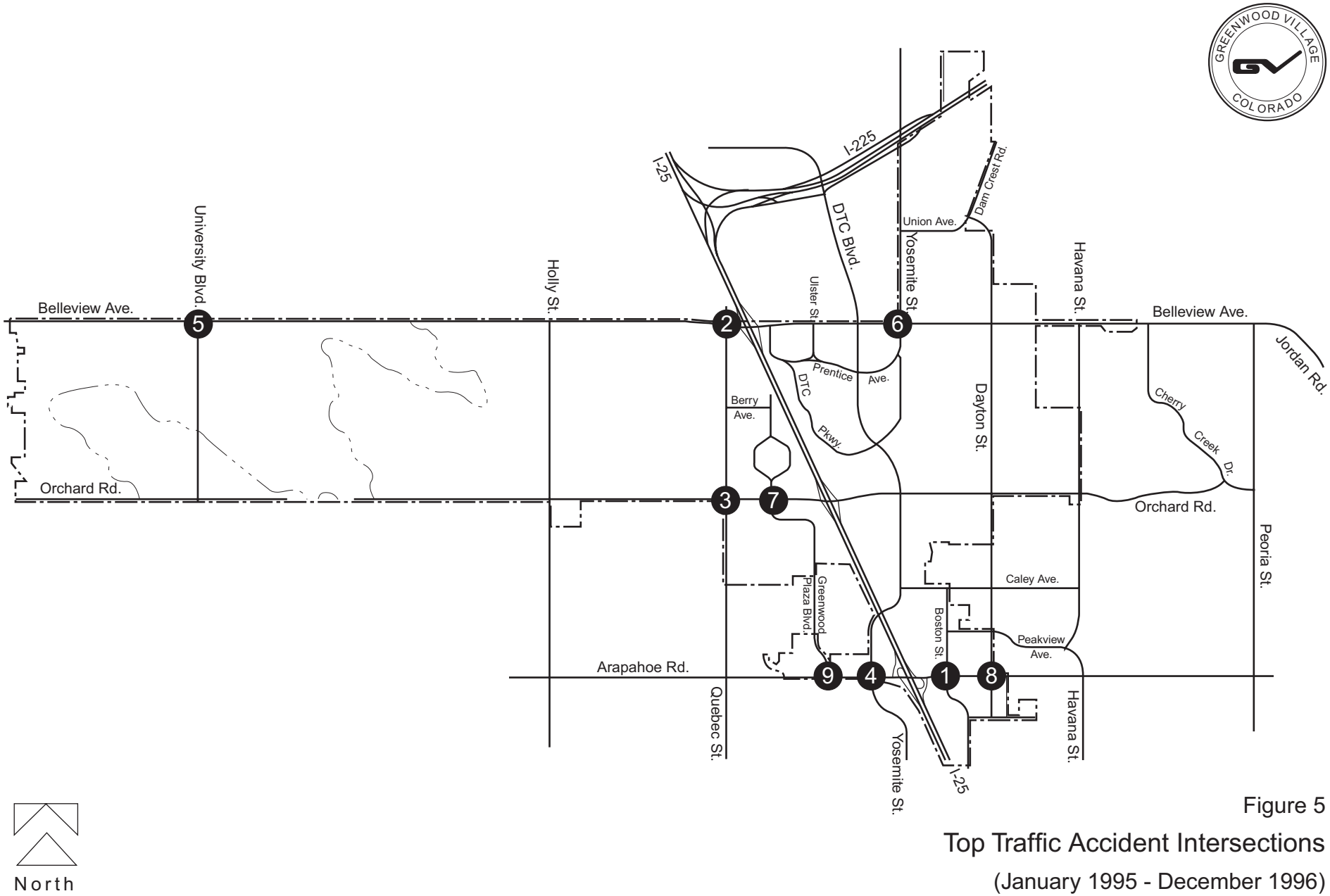
The congested conditions on the Greenwood Village roadway system that are discussed above have a number of consequences for Village residents, employees, and visitors. First, high levels of congestion lead to increased travel times and reduced levels of mobility. Second, the ability to access the arterial street system from local neighborhood streets may be diminished. Third, drivers may divert from congested arterial streets and use local neighborhood streets instead, creating increased neighborhood traffic impacts.

ACCIDENT HISTORY

Traffic accident histories in Greenwood Village during 1995 and 1996 were compiled by the Police Department to determine the intersections in the Village with the high number of accidents. The nine highest accident intersections are shown on Figure 5, with the numbers of accidents shown on Table 3. The Arapahoe/Boston/Clinton intersection ranked number one in the Village during both 1995 and 1996, with 113 accidents for the two-year period, nearly 50% higher than the number at any other intersection in the Village.

Table 3
High Accident Locations - 1995 and 1996

Intersection	1995-1996 Number of Accidents
Arapahoe/Boston	113
Belleview/Quebec	76
Orchard/Quebec	68
Arapahoe/Yosemite	63
Belleview/University	56
Belleview/Yosemite	51
Orchard/Greenwood Plaza Blvd.	49
Arapahoe/Dayton	46
Arapahoe/Greenwood Plaza Blvd.	40



North

Figure 5

Top Traffic Accident Intersections

(January 1995 - December 1996)

Since accident data volume data were not available for all intersections in the Village, a complete ranking of accidents by rate, or accidents per vehicle, could not be made. However, a comparison of the highest accident locations with estimated volume through those intersections shows that the following five intersections rank highest in terms of accident rate:

- Orchard/Quebec
- Arapahoe/Boston
- Belleview/Quebec
- Belleview/Yosemite
- Orchard/Greenwood Plaza Boulevard

Orchard/Quebec ranks first among those in rate of accident, with the other four having similar rates as each other.

TRAFFIC GROWTH TRENDS

The Village has been conducting a traffic monitoring program for more than ten years, collecting traffic volume data at the same locations on an annual basis. Traffic volume data for 1987 or 1988 are compared with 1997 traffic counts in Table 4, and significant traffic volume trends are discussed below.

In the residential areas west of Quebec Street, Holly Street has shown the sharpest increase in traffic volumes over the past ten years. Other streets have generally had stable, or in some cases, decreasing traffic volumes.

In the Village center commercial area, some very steep growth rates have been observed, with 50% to 100% increases observed at several locations. These high traffic growth locations can be directly correlated to extensive Denver Tech Center and Greenwood Plaza office development, particularly in the 1980's.

In the eastern residential areas, traffic growth has been very sharp at some locations, particularly on eastern parts of Belleview Avenue. Traffic growth reflects residential area development, both in and east of Greenwood Village, and may also reflect changing traffic patterns as drivers access the growing Denver Tech Center area under increasing congestion conditions on some routes. Chenango Avenue is one example of significantly reduced traffic, owing to its closure at Dayton Street.

Sharp traffic increases in the newer southern portion of the Village have reflected the recent rapid development in this mixed commercial area and the surrounding residential areas.

Table 4
Traffic Volume Growth

Street	Location	1987 or 1988 Daily Traffic Volumes	1997 Daily Traffic Volumes
Residential Areas - West of Quebec St.			
Clarkson St.	South of Sunset Ct.	3,200	2,700
Franklin St.	South of Belleview Ave.	2,000	1,300
Orchard Rd.	East of Franklin St.	12,300	11,900
Orchard Rd.	East of Clayton St.	5,600	5,800
Orchard Rd.	East of Colorado Blvd.	8,300	8,200
Orchard Rd.	East of Holly St.	12,600	14,700
Long Rd.	at Highline Canal	6,000	5,900
Holly St.	North of Powers Ave.	8,100	12,400
Monaco St.	North of Powers Ave.	2,200	1,800
Commercial Areas - Village Center			
Quebec St.	South of Berry Ave.	14,800	21,600
Quebec St.	North of Caley Ave.	17,500	26,000
Berry Ave.	East of Quebec St.	5,800	7,100
Caley Ave.	East of Quebec St.	6,900	6,500
Orchard Rd.	East of Quebec St.	23,100	31,700
Orchard Rd.	West of DTC Blvd.	15,700	22,600
Greenwood Plaza Blvd.	North of Orchard Rd.	6,800	10,600
Greenwood Plaza Blvd.	South of Orchard Rd.	15,500	20,700
Syracuse Way	South of Maplewood Ave.	5,300	9,000
DTC Blvd.	South of Belleview Ave.	10,600	22,000
DTC Blvd.	North of Orchard Rd.	15,700	33,100
Belleview Ave.	East of DTC Pkwy.	25,400	39,000
DTC Pkwy.	South of Belleview Ave.	16,700	14,600

Table 4 (Continued)
Traffic Volume Growth

Street	Location	1987 or 1988 Daily Traffic Volumes	1997 Daily Traffic Volumes
Ulster St.	South of Belleview Ave.	6,000	9,600
Residential Areas - East of Yosemite St.			
Yosemite St.	South of Tufts Ave.	21,800	30,900
Yosemite St.	South of Belleview Ave.	8,500	11,800
Union Ave.	East of Yosemite St.	9,500	9,300
Chenango Ave.	East of Yosemite St.	1,900	1,200
Dayton St.	North of Chenango St.	5,600	7,000
Dayton St.	North of Poundstone Pl.	10,900	10,200
Cherry Creek Dam Rd.	North of Dayton St.	7,500	9,100
Belleview Ave.	East of Boston St.	17,500	21,300
Belleview Ave.	West of Fulton St.	6,100	15,300
Belleview Ave.	West of Cherry Creek Dr.	2,700	8,800
Orchard Rd.	East of Boston St.	8,300	16,000
Orchard Rd.	West of Havana St.	5,800	7,700
Havana St.	North of Orchard Rd.	5,000	4,800
Mixed Commercial Areas - South of Orchard Rd.			
Yosemite St.	South of Orchard Rd.	14,600	23,600
Yosemite St.	North of Arapahoe Rd.	17,300	25,400
Caley Ave.	East of Yosemite St.	6,900	14,600
Peakview Ave.	East of Boston St.	1,700	3,700
Boston St.	North of Arapahoe Rd.	4,700	18,800
Dayton St.	North of Arapahoe Rd.	14,900	16,500
Clinton St.	South of Arapahoe Rd.	13,600	26,200
Clinton St.	North of Easter Ave.	6,800	12,300
Costilla Ave.	East of Clinton St.	4,400	8,400

TRIP GENERATION

Estimates were derived for the number of vehicle trips that are generated to and from land uses in Greenwood Village. Trips to and from residential areas and commercial areas were estimated in different ways.

To estimate trips generated by residential development in the Village, traffic counts were collected at seven selected locations where it was possible to isolate parts of neighborhoods with limited routes in and out. Of the six of these neighborhoods with detached single family residents, the average number of trips was 16 per home per day. This trip generation rate is considerably higher than the ten trip per home national average that is published in the primary national source used to estimate trip generation, the *Trip Generation Manual* published by the Institute of Transportation Engineers. Higher rates in Greenwood Village reflect housing type and demographic factors including higher income levels, larger homes, and the relative lack of retail and service opportunities within easy walking distance.

The seventh count location was the Timber Creek apartment complex just east of the Denver Tech Center. An average of approximately six vehicle trips per dwelling unit was calculated for this development. Trip generation rates are commonly much lower for multi-family developments than for single family homes (particularly larger, higher income homes) due to the different demographics, household sizes, and walking accessibility associated with multi-family development. In the case of Timber Creek and other apartment complexes surrounding the Denver Tech Center, trip generation rates per leased unit are also lower since some units are leased by businesses and not occupied at all times.

The current number of single family and apartment dwelling units was estimated for each of the five planning areas established for the study. Estimates are based on Village staff estimates, Denver Regional Council of Governments (DRCOG) data, and inspection of aerial photographs. Table 5 shows the resulting numbers of dwelling units and vehicle trips generated by Greenwood Village residences in each planning area. It is estimated that the Village's 4,700 residences generate 59,000 vehicle trips per day.

Table 5
Greenwood Village Residential Trip Generation

Planning Area	Number of Dwelling Units		Daily Vehicle Trips Generated
	Single Family	Multi-Family	
1	671	0	10,700
2	755	0	12,100
3	823	508	16,200
4	844	1,100	20,100
5	0	0	0
Village Total	3,093	1,608	59,100

The numbers of trips generated by the Village's three major commercial districts were estimated using employment and trip generation estimates prepared by DRCOG for its regional modeling. These estimates are shown in Table 6.

Table 6
Greenwood Village Major Commercial Area Vehicle Trip Generation

Commercial Area	Approximate Daily Vehicle Trips Generated
Denver Tech Center	82,000
Greenwood Plaza	35,000
Arapahoe Road Corridor	25,000

Figure 6 shows a compilation of these trip generation estimates by Planning Area, with trip estimates from small commercial areas also included. In total 212,000 daily vehicle trips are estimated to be generated by land uses within Greenwood Village. Approximately 28% of these trips are generated by residential neighborhoods while approximately 72% are generated by office or commercial development.

VEHICLE OCCUPANCY

Vehicle occupancy is a measure of the average number of persons in vehicles at certain locations. DRCOG surveys of seven Denver Tech Center area streets, presented in the Southeast Multimodal Transportation Evaluation, show average vehicle occupancy of 1.08 in 1994, down from 1.14 in 1983. This low vehicle occupancy rate indicates a low rate of ridesharing among Denver Tech Center commuters.

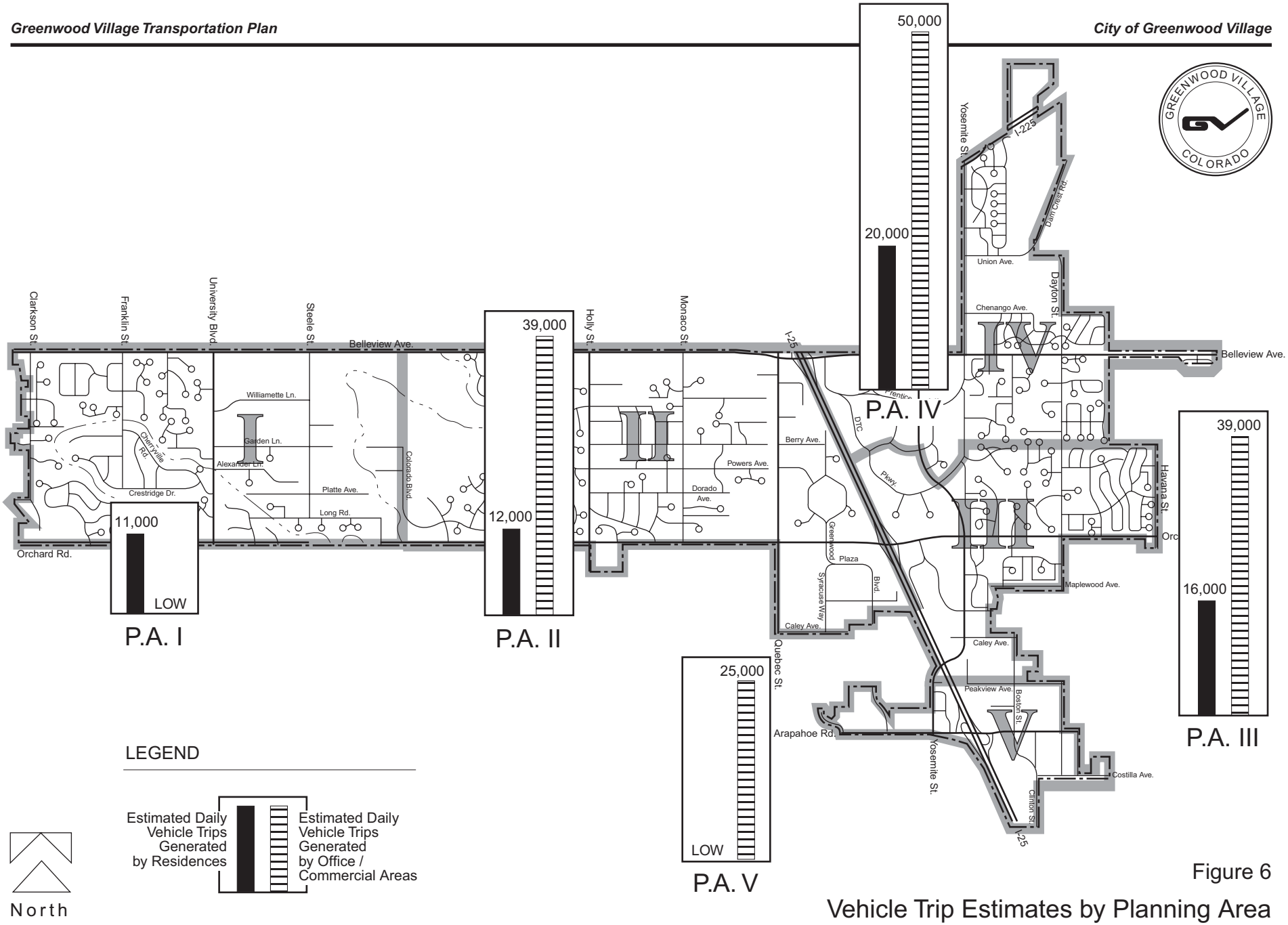


Figure 6

Vehicle Trip Estimates by Planning Area

TRANSIT SERVICE

Greenwood Village is currently served by the Regional Transportation District (RTD) with 19 bus routes, including six local routes, eight express routes, four regional routes, and a SkyRide route. Table 7 summarizes the characteristics of these 19 routes. Local bus routes, along with bus stops and shelters, are shown on Figure 7. Express, regional and SkyRide routes are shown on Figure 8. The 362 space Arapahoe Park-n-Ride is located at Caley/Yosemite and the Ulster/Tufts transfer station is located on Ulster Street just north of Greenwood Village.

Table 7
Bus Routes

Route #	Type	North/West Terminus	South/East Terminus	Principal GWV Street(s)	Buses per Weekday
24	Local	North Denver	Southglenn Mall	University	60
27	Local	SW Plaza	Tech Center	DTC Blvd.	49
66	Local	Tech Center	Parker	DTC Blvd/Pkwy	47
105	Local	Stapleton	Southglenn Mall	Greenwood Plaza/ Quebec	67
121	Local	Stapleton	Arapahoe P&R	Yosemite/DTC Blvd.	47
473	Local	Tech Center	Meridian	Quebec	22
24x	Express	Denver CBD	Highlands Ranch	University	15
77x	Express	Denver CBD	Dry Creek Rd.	University	6
6x	Express	Arvada	Arapahoe/ Yosemite	Greenwood Plaza/ Yosemite	8
25x	Express	Denver CBD	Inverness	I-25/Belleview	39
66x	Express	Denver CBD	Southglenn Mall	Yosemite/I-25	6
78x	Express	Denver CBD	Highlands Ranch	Yosemite/I-25	9
85x	Express	Denver CBD	Douglas Co.	Yosemite/I-25	14
89x	Express	Broadway LRT	Tech Center	Yosemite	14
D	Regional	Boulder	Arapahoe P&R	Yosemite/DTC Blvd.	12
T	Regional	Boulder	Arapahoe/ Yosemite	Greenwood Plaza/ Yosemite	10
U	Regional	Jefferson Co.	Park Meadows	Syracuse	6
W	Regional	120th/I-25	Meridian	Yosemite	7
AT	SkyRide	Littleton	DIA	Yosemite/DTC Pkwy.	33

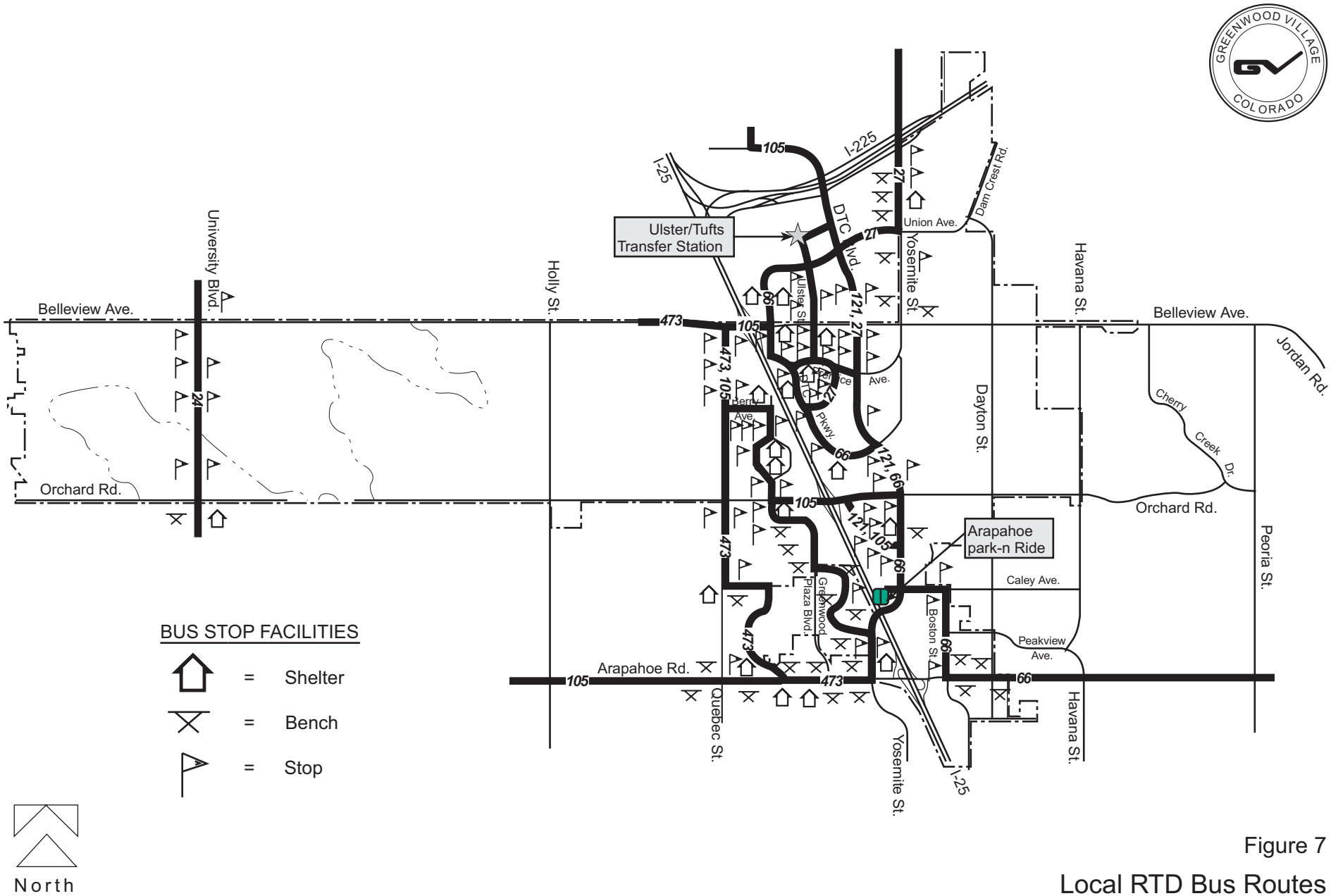


Figure 7

Local RTD Bus Routes

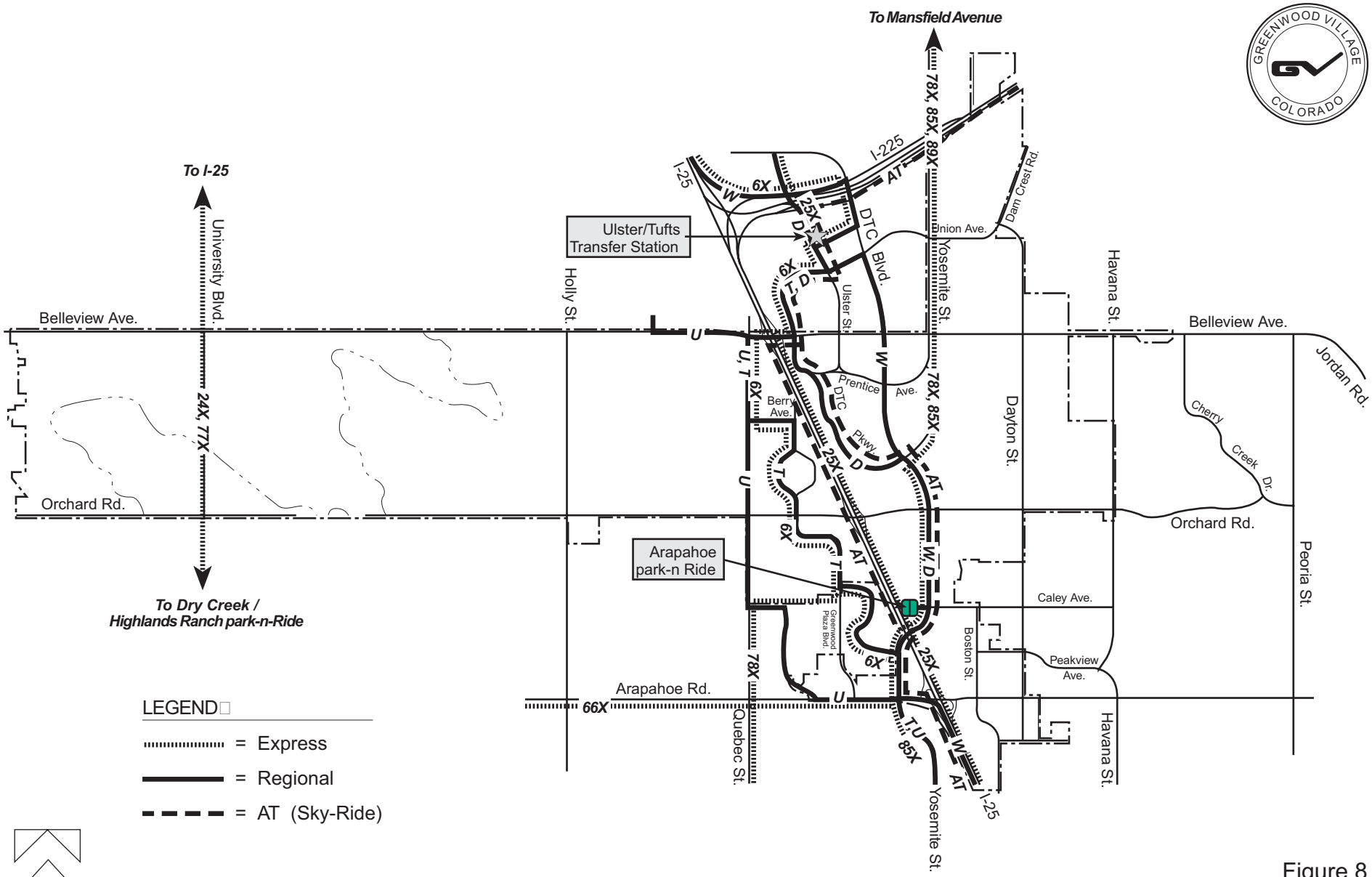


Figure 8

RTD Express and Regional Bus Routes

Examination of the existing RTD transit service shows that the majority of routes serve the Denver Tech Center and Greenwood Plaza office complexes, with many allowing transfers to other routes at the Ulster/Tufts transfer station or the Arapahoe Park-n-Ride. According to the 1995 *Southeast Multi-Modal Transportation Evaluation*, daily bus boardings at the Union /Tufts transfer station are approximately 500 and daily boardings at the Arapahoe Park-n-Ride are approximately 350. Much of the area's bus service is focused on downtown Denver or the Stapleton redevelopment site to the north.

The 1996 *Greenwood Village Transit Circulator Feasibility Study* estimates current ridership to the Village center office area at 1,200 riders per day, or between one and two percent of area employees. This low percent ridership can be attributed largely to two factors. First, free parking is available to nearly all area employees. Second, buses operate in mixed traffic and, with the exception of I-25 on-ramp bus bypasses, receive no time advantage over automobiles during congested conditions.

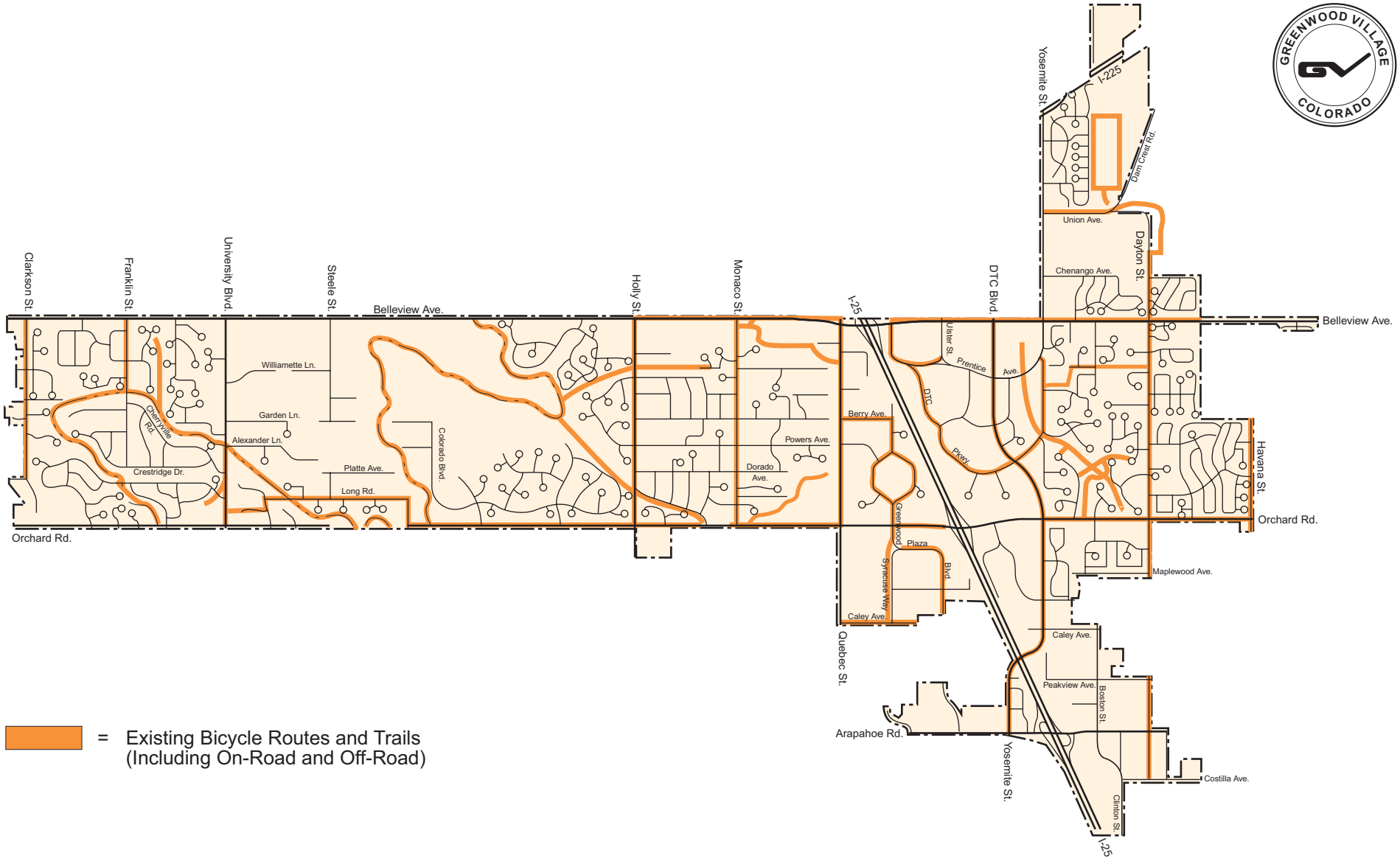
Data provided by the 1990 Census Transportation Planning Package (CTPP), Bureau of Transportation Studies, 1994, shows that 2% of Greenwood Village residents travel to work by transit and 8% travel to work by carpool.

BICYCLE ROUTES

Figure 9 shows bicycle facilities in Greenwood Village that are designated by DRCOG as part of the regional bicycle system in the 1994 *Pedestrian and Bicycle Element of the Regional Transportation Plan* or designated by the Village. Facilities include the unpaved Highline Canal trail and a combination of on-street and off-street routes along portions of Union Avenue, Belleview Avenue, Orchard Road, Clarkson Street, Monaco Street, Yosemite Street, and Dayton Street. Different routes having varying quality with respect to width, continuity and treatment at intersections.

TRAFFIC CALMING MEASURES

Traffic calming refers to a number of measures aimed at reducing speeds, volumes, and impacts of traffic passing through neighborhood streets. The Village has incorporated such measures at a number of locations, shown on Figure 10. Median islands have been implemented on Clarkson Street, and on Belleview Avenue in the eastern part of the Village. Speed control dips have been installed on Long Road in the area of Orchard Road's discontinuity. Pavement sections have been narrowed on segments of Orchard Road in both the eastern and western parts of the Village. In addition, all way STOP sign control has been incorporated at a number of locations throughout the Village. Additional traffic calming measures are currently being designed on Monaco Street; have been proposed on Cherryville Road, Crestridge Drive and Franklin Street; and have also been considered on Holly Street and the eastern portion of Belleview Avenue.

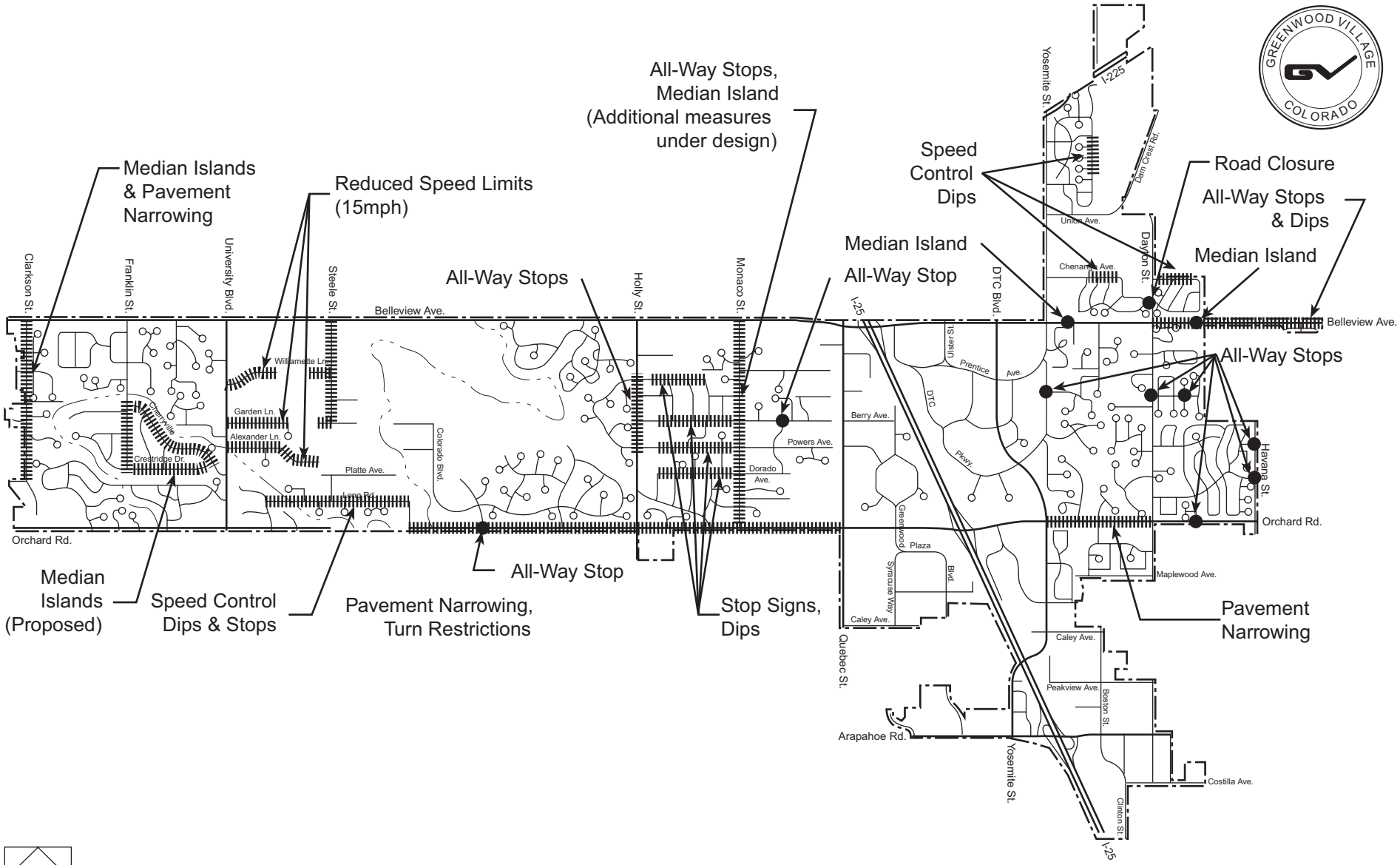


= Existing Bicycle Routes and Trails (Including On-Road and Off-Road)

North

Figure 9

Existing Bicycle Facilities



North

Figure 10

Existing Traffic Calming Measures

REGIONAL CONTEXT

Figure 11 shows Greenwood Village's regional setting in the southern part of the Denver metropolitan area. The south I-25 employment corridor passes through the center of the Village, extending from the Denver portion of the Denver Tech Center in the north to Meridian and other office developments south of C-470/E-470. Employment in this corridor is currently more than 100,000, joining downtown Denver as the two largest employment centers in the region. The south I-25 employment corridor relies upon I-25 to a great extent for its access. Increasingly severe congestion on I-25 has become an increasing concern as employment in the corridor continues to grow.

West of I-25, Greenwood Village is surrounded by predominantly low and medium density residential areas in all directions, including Cherry Hills Village to the north, Englewood to the northwest, Littleton to the west, and unincorporated Arapahoe County to the south. While those areas to the north of Greenwood Village are largely built out, areas to the south are undergoing more rapid growth. Particularly sharp growth is occurring in areas of Douglas County farther to the south, particularly in Highlands Ranch. Major commercial centers surrounding the western part of Greenwood Village include the Broadway commercial corridor through Englewood and Littleton, the Southglenn Mall and surrounding University Boulevard commercial corridor, and the Park Meadows Mall area near I-25/County Line Road.

East of I-25, Greenwood Village is surrounded by unincorporated portions of Arapahoe County and the Cherry Creek State Recreation Area. Centennial Airport and surrounding commercial development is found immediately south of the Village, with several large tracts of land currently undeveloped. Immediately to the east of Greenwood Village are single family residential neighborhoods in Arapahoe County. North and east of Greenwood Village and the adjacent residential neighborhoods is the Cherry Creek State Recreation Area. Farther east, northeast, and southeast are growing residential parts of the City of Aurora, Arapahoe County, and Douglas County.

TRAFFIC FORECASTS

Long-range traffic forecasts were prepared using a simplified regional forecasting model created by DRCOG for use by its member jurisdictions for planning exercises. Preliminary DRCOG year 2020 population and employment projections for the region that have been developed as part of DRCOG's ongoing 2020 Metro Vision Plan refinement process have been used as input to these preliminary traffic forecasts. Household and employment growth forecast are summarized in Table 8. Since DRCOG forecasts are prepared using a zone system which includes zones that are partially in the Village, Table 8 incorporates estimates of data within Village boundaries. Forecasts show an 87% increase in households and a 25% increase in employment from 1995 to 2020.

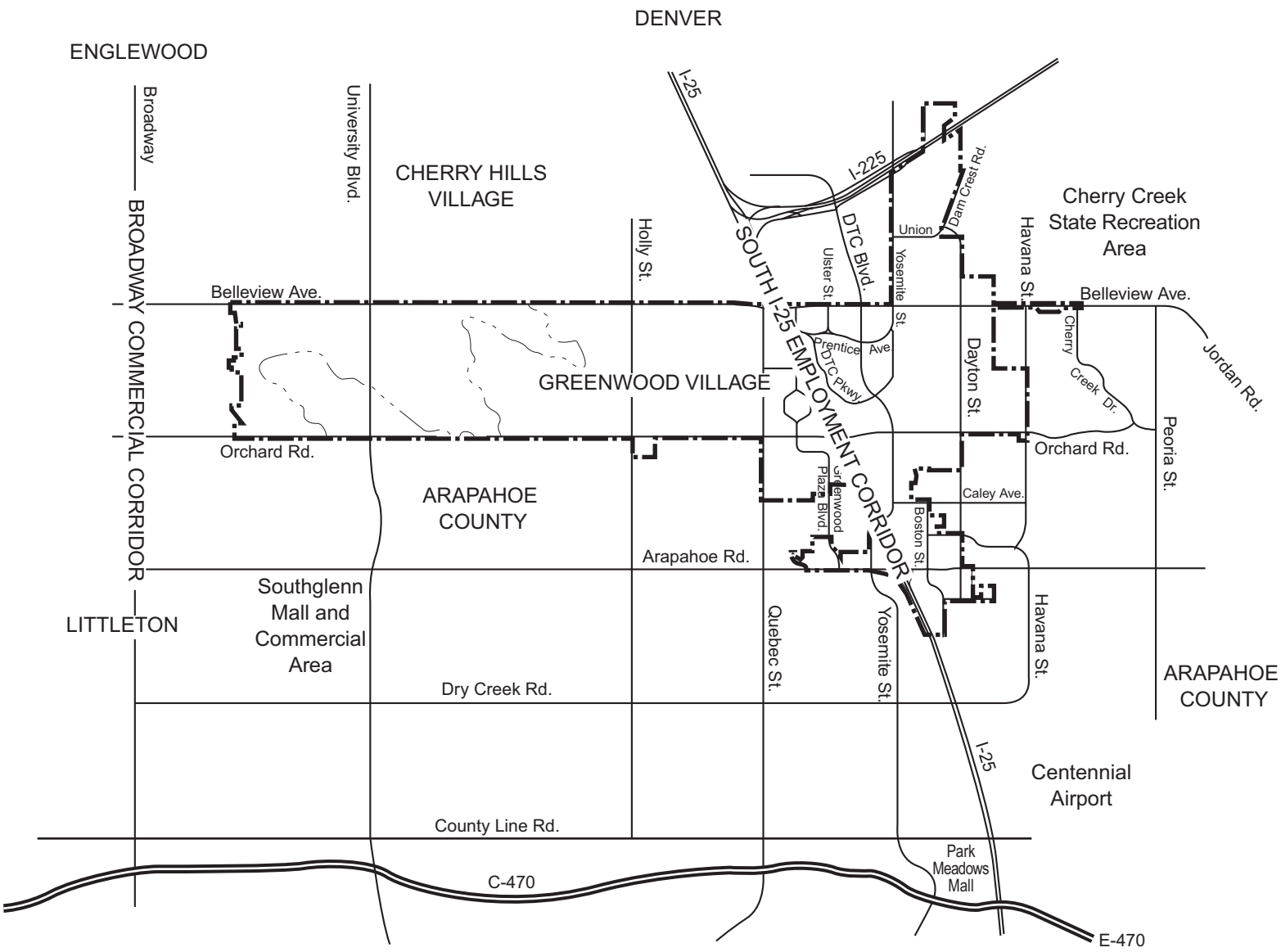


Figure 11

Regional Context

Table 8
DRCOG Preliminary Greenwood Village Household and Employment Growth Forecasts

Area	Households		Employment	
	1995	2020	1995	2020
West of Quebec Street	1,163	2,668	1,386	2,815
Greenwood Plaza and Denver Tech Center	265	1,192	30,082	37,044
Arapahoe Road Corridor (South of Peakview Avenue)	261	383	4,007	4,581
East of Yosemite and North of Arapahoe Road	1,730	2,144	1,996	2,303
Total	3,419	6,387 (+87%)	37,471	46,743 (+25%)

A preliminary 2020 street network that was also developed as part of DRCOG's 2020 Metro Vision Plan refinement process was used as a basis for this forecasting model. Significant roadway capacity increases incorporated in the 2020 network are on parts of I-25 and Arapahoe Road. Network coding was adjusted as needed to better reflect the Greenwood Village roadway system. The regional model assumes planned transit improvements, and projects vehicle trips accordingly. Raw forecasts output from the model were adjusted based on actual traffic counts and a 1995 calibration model. Year 2020 forecasts for I-25 were taken from Southeast Corridor Major Investment Study forecasting. Figure 12 shows the resulting year 2020 daily traffic forecasts.

Comparing existing traffic volumes to 2020 forecasts shows that only small increases are projected on several street segments that pass through built-out areas of the Village and are currently carrying traffic volumes near the street's capacity. Examples of such low-growth streets include University Boulevard, western parts of Belleview Avenue, and western parts of Orchard Road.

More significant growth in the range of 10% to 40% between 1995 and 2020, is projected on other major roadways that are already near capacity, including I-25, I-225 and Arapahoe Road. This suggests that much of the travel demand generated by area development will be added to already congested routes. For this growth in travel to occur, there will need to be some combination of roadway capacity improvements, increased use of alternative modes, a spreading of peak demand periods, or use of alternative roadways.

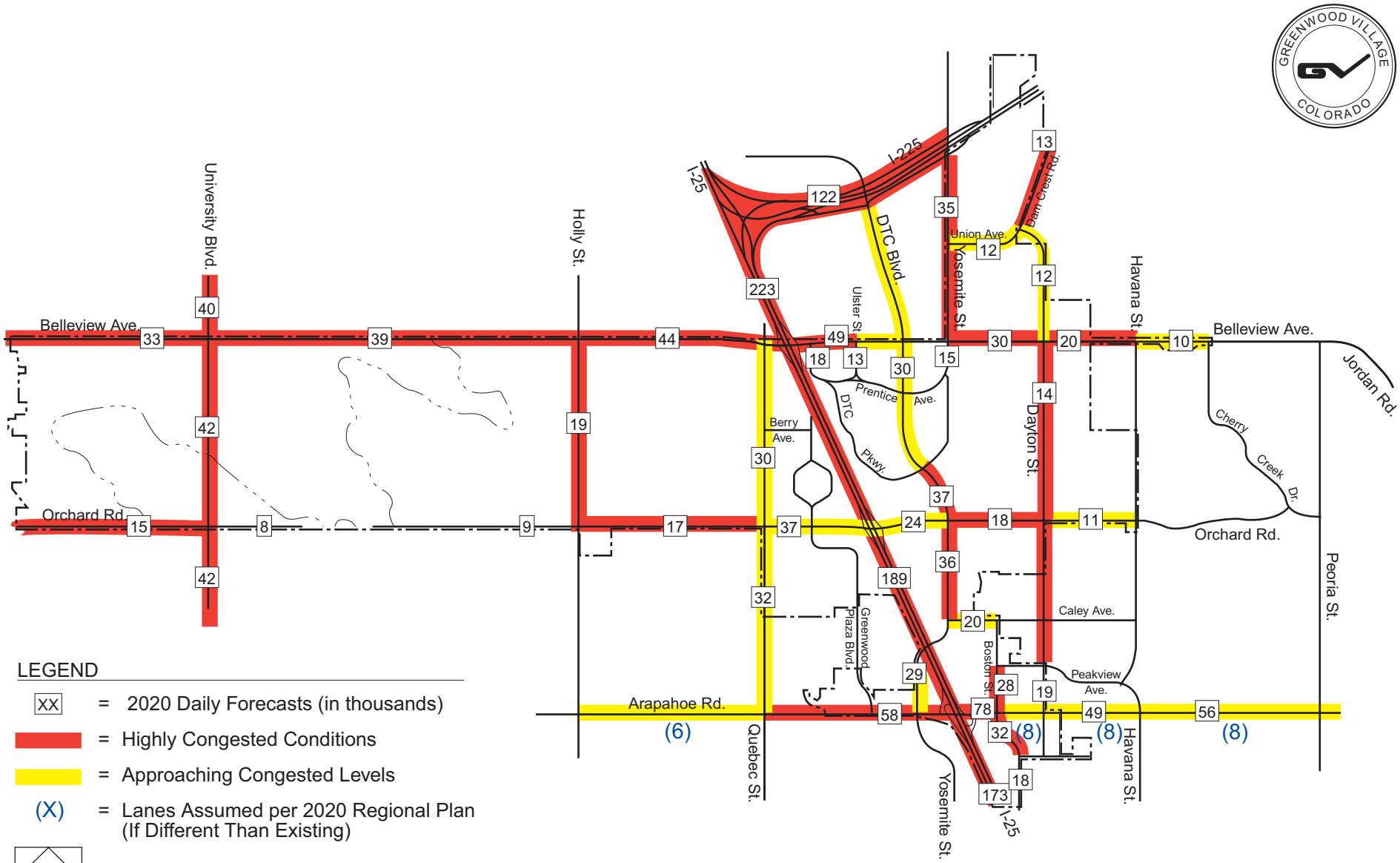


Figure 12

2020 Traffic Forecasts

Projected highly congested roadways are also shown on Figure 12. In addition to streets currently exhibiting high levels of congestion, additional segments of Yosemite Street, Belleview Avenue, Orchard Road, Arapahoe Road and Dam Crest Road are forecast to have high levels of congestion without major improvements or changes in travel behavior. Parts of Arapahoe Road are forecast to have reduced levels of congestion with the DRCOG plan assumption of widening to eight lanes east of I-25 and six lanes west of Quebec Street.

All forecasts, but particularly those on the Greenwood Village minor arterial and collector level streets, should be viewed with a large measure of caution for several reasons. First, population and employment projections on which they are based cannot be predicted with a great level of certainty. Forecasts on minor arterial and collector streets in particular are dependent upon the development forecasts in surrounding zones. Furthermore, traffic volumes on minor arterial and collector streets are strongly influenced by characteristics such as congestion levels on connecting principal arterials, street improvements or closures, traffic control, and implementation of traffic calming measures.

Keeping these cautions in mind, a comparison of Figure 12 forecasts on minor arterial and collector level streets with current counts shows a wide range of growth rates projected, with some high percentage rates of growth projected on parts of Boston/Clinton Street, Caley Avenue, Dayton Street and Holly Street.

REGIONAL TRAFFIC PATTERNS

As part of the 1996 Greenwood Village Transit Circulator study, home zip codes of Denver Tech Center and Greenwood Plaza employees were surveyed using license plate numbers of parked vehicles. Figure 13 shows the results of this survey. Approximately 8% of these Greenwood Village employees also live in Greenwood Village. Employees living north of Greenwood Village account for 23% of all Greenwood Village employees. The other major concentrations of Greenwood Village employees are the south/southwest region and Aurora, accounting for 20% and 19%, respectively. 11% of the remaining Greenwood Village employees live in the south/southeast region, 10% live to the northwest and 3% live in the northeast region. Finally, 7% of all Greenwood Village employees live, or have vehicles registered, outside the Denver metropolitan area.

The 1990 Census Transportation Planning Package (CTPP), Bureau of Transportation Statistics, provides information on travel characteristics of Greenwood Village residents. Figure 14, depicts the CTPP data for work destinations of Greenwood Village residents. Approximately, 13% of Greenwood Village residents also work in Greenwood Village. Almost half, 45%, of the Greenwood Village residents work in Denver and the northern suburbs. 15% of Greenwood Village residents work in Aurora, 10% in the south/southwest region, 9% in the south/southeast region, 4% in northwest region, and 1% work in the northeast region. Finally, the remaining 3% work outside the metropolitan area.

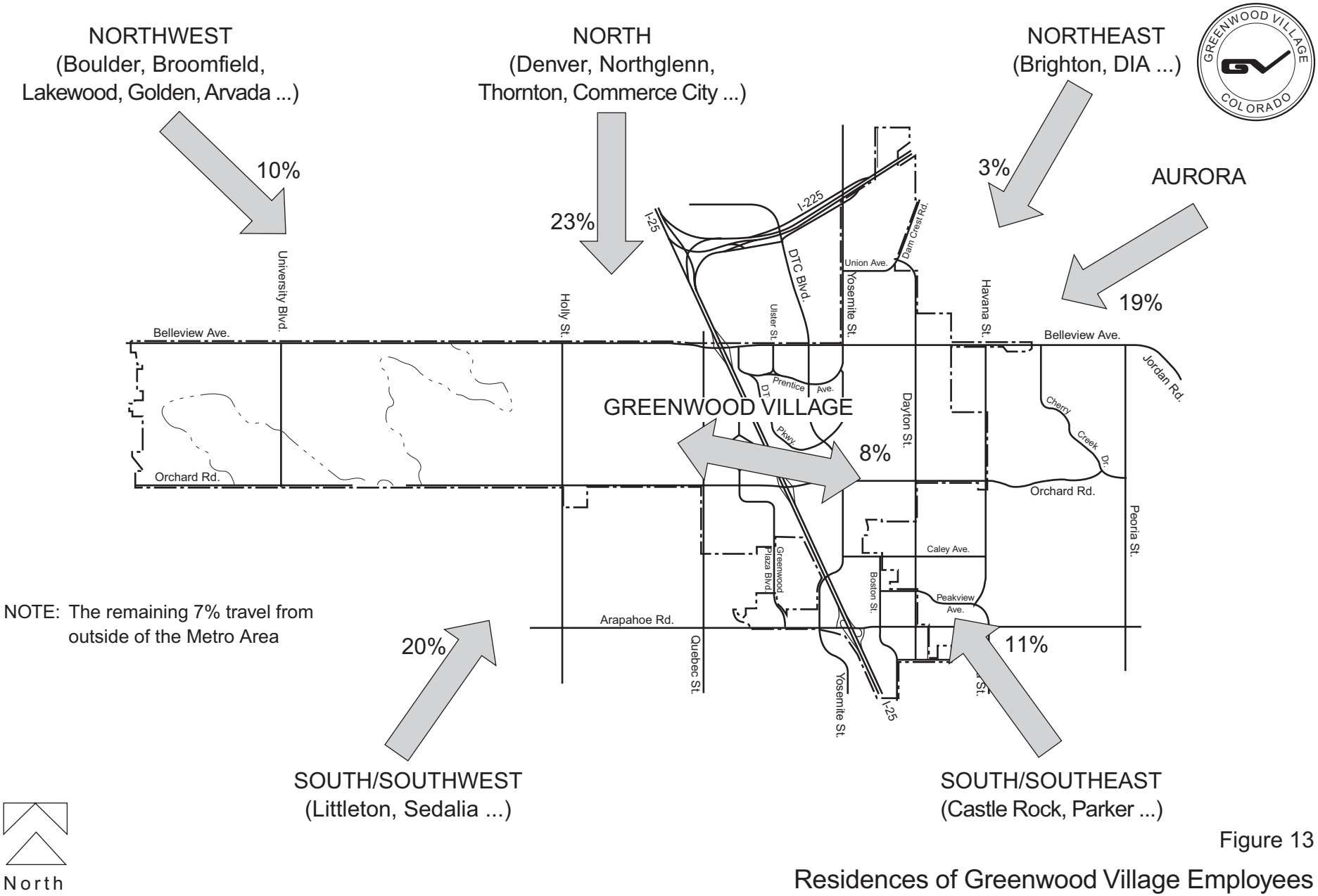


Figure 13

Residences of Greenwood Village Employees

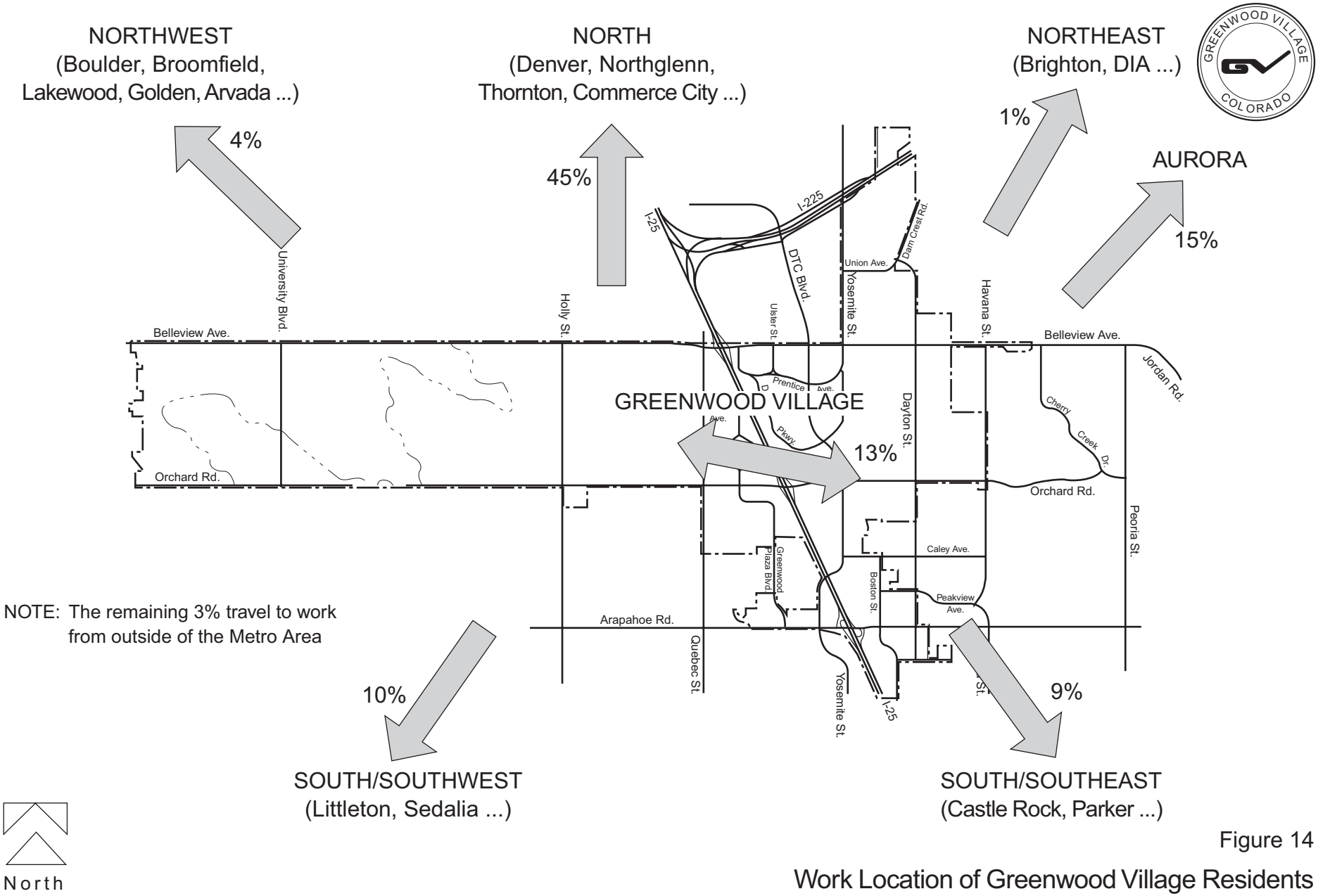


Figure 14

Work Location of Greenwood Village Residents

III. SUMMARY OF ISSUES AND IMPROVEMENT OPTIONS

A series of meetings were held to present results of the transportation conditions survey and to solicit comments on good and bad aspects of the existing transportation system and on possible transportation improvements that should be evaluated in the transportation planning process. One public meeting was held in each of the five Planning Areas. In addition, similar project initiation meetings were held with City Council, the Planning and Zoning Board, the Parks, Recreation and Trails Board, Village department heads, Public Works Department staff members, and a representative of the Denver Technological Center.

This section provides a summary of the transportation issues and concerns that have been raised through all of the meetings described above, as well as through previous planning efforts and through observations and technical evaluations that are described in the previous section.

In a number of cases a series of comments reinforce each other, while, in many cases, comments may contradict or be in conflict with one another. For example, some comments were provided that suggested widening or otherwise improving a certain street to accommodate traffic demand, while other comments suggested traffic calming to reduce traffic on the same street. For the purpose of the following summary, the full range of comments is discussed.

A menu of potential solutions was developed to address each of these concerns. Solutions include improvements and policies that have been implemented in the Village, as well as some measures that have not been implemented in Greenwood Village but may be applicable in particular situations. It is important to note that while many of these improvements can be implemented by Greenwood Village, many others would be expected to have regional or state implementing agencies or be cooperative efforts with neighboring jurisdictions.

ACCESS DEFICIENCIES FROM NEIGHBORHOODS AND LOCAL STREETS

Concerns/Issues

There is a widespread concern in the Village about difficulty in accessing the major street system from local neighborhood streets. The most common specific problem relates to making left-turns or through movements from local streets onto or across major streets at unsignalized intersections. This type of concern has been raised with regard to accessing most of the busy streets in the Village, including Belleview Avenue, Orchard Road, Holly Street, Quebec Street, Yosemite Street, Clinton Street, and Dayton Street.

Potential Solutions

Access deficiencies can be addressed through traffic control modifications including signalization or changes to Stop sign patterns; physical improvements to major roadways and intersections; or provision of alternative access.

TRAFFIC IMPACTS ON NEIGHBORHOOD STREETS

Concerns/Issues

The impact of traffic on streets that pass through or are adjacent to residential neighborhoods, schools, parks, and other sensitive land uses has been expressed as a concern in several parts of the Village. Concerns relate to volumes of traffic, speeds, pedestrian safety, noise, and dust. Some comments are specifically aimed at cut-through traffic that does not have an origin or destination in the neighborhood through which the street in question passes. Traffic impacts have been cited on more than 20 different streets, ranging from local residential streets to busy collector and minor arterial roadways.

Potential Solutions

The most common type of solution to neighborhood traffic impacts is the area of traffic calming. Traffic calming refers to a wide range of physical, regulatory, or educational measures aimed at influencing driver behavior in ways that reduce neighborhood impacts. Different measures may be appropriate for application on different street types, depending upon the role of a given street and the objectives of calming on that street. Traffic calming measures can be aimed at reducing traffic volumes, reducing travel speeds, improving driver attentiveness, or a combination of these three objectives.

Other potential solutions include improvements to regional or Village-level streets and alternative mode systems to reduce demand on neighborhood streets.

NEED FOR IMPROVED BICYCLE/PEDESTRIAN FACILITIES

Concerns/Issues

The need for improved accommodations for bicycles and pedestrians has been expressed relative to bicycle and pedestrian accessibility needs, including the need for improved east-west accommodations across the I-25 corridor, improved safety around schools, and the need to improve connections between the Village's central office complex and surrounding residential neighborhoods.

Potential Solutions

Specific bicycle and pedestrian improvements can include developing or improving existing on-street bicycle facilities, sidewalks and paths adjacent to streets, and off-street trails. Other programs may include provision of support facilities such as bicycle parking, lockers and showers at employment sites.

NEED TO IMPROVE VILLAGE COLLECTOR AND ARTERIAL STREETS

Concerns/Issues

Some comments expressed the view that Greenwood Village needs to selectively identify improvements to its collector and arterial street system to maintain an acceptable level of mobility for its residents, businesses and visitors. Also, it has been suggested that congestion on collector and arterial-level streets can lead to increased demands on local streets. Segments of the roadway system specifically identified for potential improvement include Belleview Avenue east of Yosemite Street; Orchard Road west of I-25; Orchard Road between Yosemite Street and Dayton; Holly Street; Dayton Street; and the corridor that has been referred to the "Serpentine Road" corridor, including Clinton Street, Boston Street, Caley Avenue, Yosemite Street and DTC Boulevard.

Potential Solutions

Improvements to Greenwood Village's minor arterial and collector level streets, referred to in this plan as Village-level streets, can include street extensions, additional through lanes, major intersection improvements, or signal timing improvements.

INTERSECTION OPERATIONAL/SAFETY PROBLEMS

Concerns/Issues

Intersections that exhibit particularly high levels of congestion, high accident rates, or other operational problems were identified based on technical evaluations described previously, supplemented by observations and public comments.

Potential Solutions

Solutions to operational and safety problems are commonly referred to as traffic system management (TSM). TSM projects are generally lower cost projects aimed at improving the functioning of existing facilities rather that adding new through lanes. TSM projects can include additional or modified turn lanes, traffic control modifications, signing improvements, altering lane designations, or turn restrictions.

NEED TO IMPROVE MAJOR ARTERIAL OR REGIONAL ROADWAYS

Concerns/Issues

A commonly expressed concern of all groups is that the regional/principal roadway system needs to function well to maintain mobility as growth continues in and around Greenwood Village. An efficient regional system is needed so that regional travel demands can be accommodated on facilities that are designed for them, rather than on streets with lesser ability to accommodate traffic and greater neighborhood impacts associated with them. The need for increased capacity in the I-25 corridor is widely regarded as the highest transportation priority for Greenwood Village due to its tremendous and growing demands, its severe and worsening congestion, and the spillover effects that its congestion has on facilities crossing it and parallel to it. Significant highway improvements on I-25, in addition to rapid transit, are widely viewed as being vital to Greenwood Village. Other regional/principal arterial corridors specified as being in need of improvement include Belleview Avenue, Arapahoe Road, I-225, University Boulevard, and, farther from Greenwood Village, other regional facilities such as C-470, Hampden Avenue, and Broadway.

Potential Solutions

Regional roadway improvements can include additional through lanes, auxiliary lanes, or special lane designations such as high occupancy vehicle (HOV) lanes.

NEED FOR IMPROVED TRANSIT SERVICE

Concerns/Issues

There was widespread support expressed for implementation of a rapid transit system that runs on its own right-of-way, thereby creating a travel time advantage compared with rush hour driving. Several comments were made with regard to ancillary facilities to support rapid transit, including adequate parking, convenient access to stations, and encouraging transit-oriented development surrounding stations. A circulator bus around the Greenwood Village and surrounding office development is strongly supported to transport regional transit patrons to final destinations and to allow for lunch-time and daily travel within the office district. Several other comments were received regarding improvements to the Regional Transportation District (RTD) bus service for the Village.

Potential Solutions

The proposed light rail corridor along I-25 and I-225 is strongly supported, as are adequate supporting services at stations. The proposed circulator bus around the Greenwood Village and surrounding office development is supported in the short-term, and is viewed as being vital to support light rail development in the longer term. Improvements to RTD bus service can include new routes, adjustments to existing routes, schedule expansions, and increased frequency.

NEED FOR A BETTER MIX OF LAND USES, CONTROL OF GROWTH, AND ALTERNATIVE MODE INCENTIVES

Concerns/Issues

The opinion has been expressed that the lack of a mix of land uses, with residential neighborhoods in the eastern and western parts of the Village and a large office complex in the middle, contributes to the current reliance on long automobile trips. Also, deficiencies in terms of speed, convenience, reliability, and safety can make use of alternative modes unattractive to many potential users. Some individuals feel that the only way to control the impacts of transportation is to limit growth through regulatory and land purchase policies

Potential Solutions

Improving the mix of land uses can include continued residential development surrounding the Village's central office development and targeted retail and recreational uses to support both office and residential development.

Trip reduction and alternative mode usage can be made more attractive by working with agencies and organizations, particularly the Southeast Transportation Management Organization, to implement incentives for the use of alternative travel modes and/or driving disincentives.

IV. TRANSPORTATION PLAN

To present elements of the Greenwood Village Transportation Plan in a coherent manner, plan elements are organized around five transportation systems:

- Regional Transportation System
- City/County Level Transportation System
- Neighborhood Level Transportation System
- Transit System
- Bicycle and Pedestrian System

This section of the plan provides discussions of issues within each of these facility types and levels, as well as maps depicting plan elements within each of these systems. A final section is provided discussing land use and growth issues as they relate to transportation.

In addition to the planning process that specifically was tailored to development of this plan, recommendations are also built upon the foundation of previous processes, including:

- The 1997 mediation agreement between Greenwood Village, Arapahoe County and Aurora to address transportation issues in and surrounding the eastern portion of Greenwood Village.

- Projects that have already been incorporated in the Village's current Capital Improvement Program; and

- Regional planning efforts focusing on regional facilities in and around Greenwood Village.

REGIONAL TRANSPORTATION SYSTEM

The functioning of the regional transportation system in and around Greenwood Village is vital to provide mobility for existing residents and commercial uses and to support the additional development that is expected. Equally important, the regional transportation system needs to have adequate capacity to accommodate regional traffic movements. Without an adequate regional transportation system, there is an increased tendency for regional traffic to divert from the regional system to the local Greenwood Village street network in order to avoid congestion. It is clear that the capacity of the regional transportation system in the southeast part of the metropolitan area has not kept pace with development and growth in travel demand.

Figure 15 depicts the regional transportation system in and around Greenwood Village, with proposed system improvements shown in two categories. Improvements that are included in adopted regional and inter-jurisdictional plans are shown in yellow, while additional improvements proposed for inclusion in Greenwood Village's Transportation Plan are shown in green.

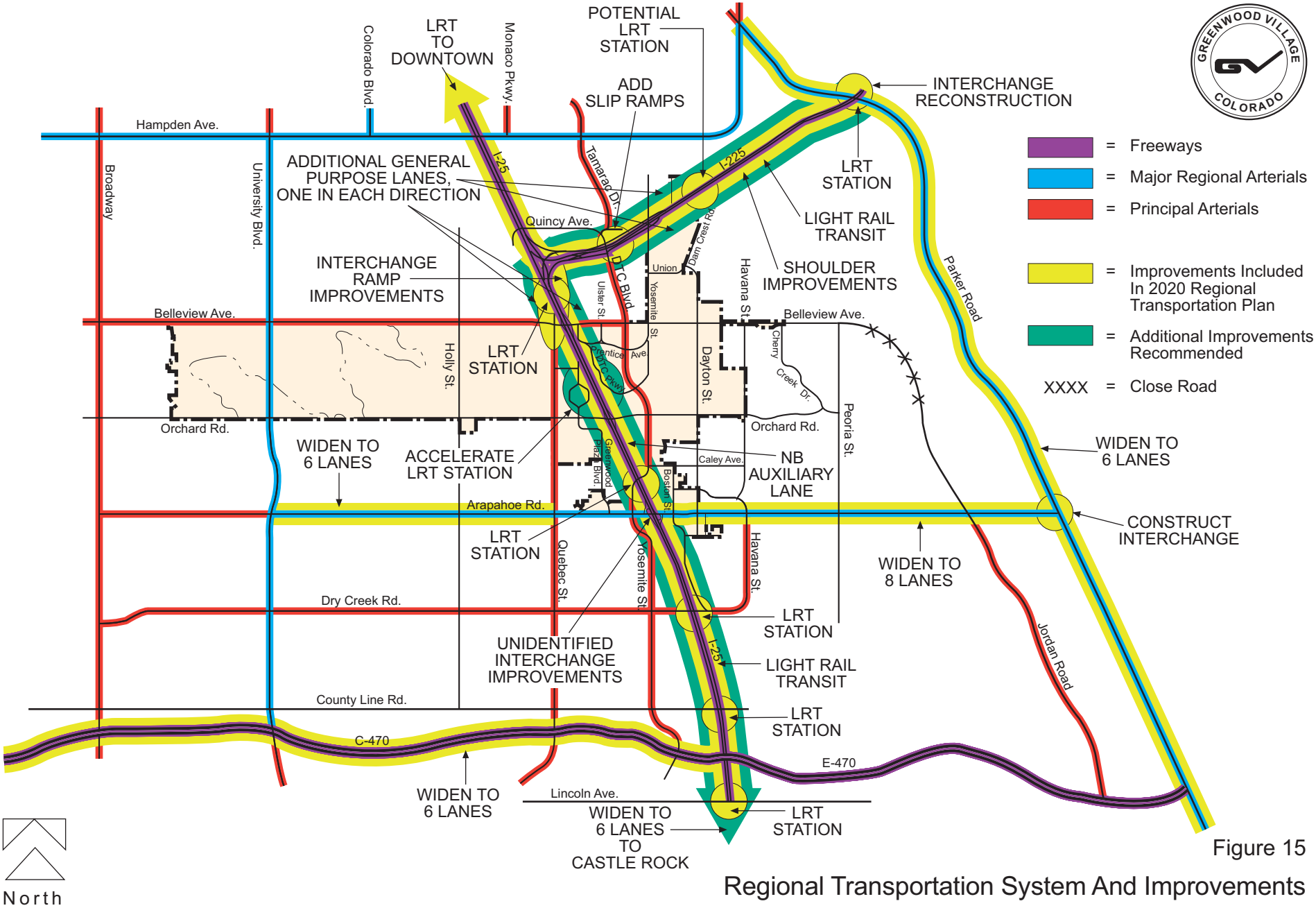


Figure 15

Regional Transportation System And Improvements

Adopted Regional and Inter-jurisdictional Plans

The Denver Regional Council of Governments (DRCOG), as the area's designated metropolitan planning organization, develops long-range regional transportation plans. The 2020 Metro Vision Plan has recently been adopted. A draft 2020 Regional Transportation Plan has been prepared by DRCOG as an element of the overall Vision Plan. This transportation plan includes a vision plan with the desired regional transportation system and a fiscally constrained plan of improvements that are affordable with estimated available transportation funding. The transportation plan is currently undergoing air quality conformity analysis. Plan refinements may be necessary for the plan to meet federal air quality conformity requirements.

DRCOG planning includes designation of functional classification for three types of regional roadways. The Freeway, Major Regional Arterial, and Principal Arterial designations shown on Figure 15 reflect the DRCOG functional classification system, defined as follows:

- Freeways - divided highways with access restricted to grade-separated interchanges. I-25, I-225, C-470, and E-470 are designated as Freeways.

- Major Regional Arterials - divided and undivided highways that permit at-grade access and crossings; however, they also provide for high traffic volumes by minimizing left-turns, side access, and cross-streets. Arapahoe Road, Parker Road, University Boulevard, and Hampden Avenue are designated by DRCOG as Major Regional Arterials.

- Principal Arterials - major streets primarily used by through-traffic, with at-grade intersections and side access permitted but regulated. Portions of Belleview Avenue, Quebec Street, and Yosemite Street/DTC Boulevard within Greenwood Village, and surrounding segments of Arapahoe Road, Dry Creek Road, Broadway, University Boulevard, Havana Street and Jordan Road are designated by DRCOG as Principal Arterials.

Major improvements to the regional transportation system that are included in the draft 2020 Regional Transportation Plan are shown in yellow on Figure 15 and are listed below. Support for all of these improvements has been included in the Greenwood Village, Arapahoe County Aurora Mediation Agreement.

- Light rail transit (LRT) along I-25 connecting from the existing central corridor in downtown Denver to Lincoln Avenue in Douglas County, and along I-225 from I-25 to Parker Road. Stations in the vicinity of Greenwood Village are planned in the I-25 corridor at I-225, Orchard Road, Arapahoe Road, Dry Creek Road, County Line Road, and Lincoln Avenue. A station is also planned at I-225/Parker Road. The I-25/Orchard Road Station is currently not included in the Year 2020 system, but is listed as a Phase II station location to be added after 2020.

- I-225/Parker Road Interchange Reconstruction, including a northbound Parker Road to westbound I-225 flyover ramp and grade-separations of Vaughn Way and Hampden Avenue at Parker Road. Funding for this project has been included in the current six year regional Transportation Improvement Program.

- I-225/DTC Boulevard Slip Ramps, to allow direct access between DTC Boulevard and I-225 to the east.

- I-25/I-225/Belleview Avenue Interchange Improvements, including enhancements for northbound Belleview Avenue on-ramp merging traffic and a barrier to prevent weaving from westbound I-225 to the I-25/Belleview off-ramp.

- I-25 Auxiliary Lane, to be constructed northbound between the Arapahoe Road on-ramp and the Orchard Road off-ramp.

- I-225 Shoulder Widening, between I-25 and Parker Road.

- Widening of Arapahoe Road, from six lanes to eight lanes between I-25 and Parker Road and from four to six lanes between Quebec Street and University Boulevard. Interchange improvements have been designated at I-25/Arapahoe to accompany Arapahoe Road widening, but specific improvements have not yet been defined. An Arapahoe Road corridor study is planned by Arapahoe County, in coordination with Greenwood Village and the Colorado Department of Transportation (CDOT), to further define Arapahoe Road improvements between Broadway and Parker Road.

- Arapahoe Road/Parker Road Interchange Construction. A feasibility study for this project has been completed.

- Widening of Parker Road, from four to six lanes between I-225 and E-470. A Parker Road corridor study is planned by Arapahoe County to further define Parker Road improvements.

- Widening of C-470, from four to six lanes between I-25 and Wadsworth Boulevard.

Additional Improvement Recommendations

Greenwood Village supports implementation of all of these regional plan elements. Additional improvements to the regional system have widespread support in Greenwood Village and are recommended to be included in the Greenwood Village Transportation Plan. These additional recommendations, shown in green on Figure 15, include:

- Acceleration of the Orchard Road LRT Station, to be included in the initial LRT construction project rather than being deferred to a long-range second phase of construction. This station would serve the heart of the Greenwood Village office district.

- Widening of I-25, to include an additional through lane in each direction on I-25, at a minimum, between C-470/E-470 and I-225. This widening would help to accommodate the demand in one of the highest demand freeway segments in the metropolitan area, which serves the southeast employment corridor as well as accommodating movements between the I-225 and C-470/E-470 beltway corridors.

- Widening of I-225, to create a full six lane section between I-25 and Parker Road, completing a consistent six lane freeway corridor from I-25 to I-70.

CITY AND COUNTY LEVEL TRANSPORTATION SYSTEM

Supporting the regional roadway system is a network of city and county level streets that are not designed to carry the high traffic volumes of principal arterials, but which are intended to serve a significant mobility function. It is preferable for traffic to use these city level mobility routes rather than more minor, residentially oriented streets. Alternative improvements have been identified and evaluated to facilitate travel on these roadways by improving safety and reducing congestion. Figure 16 summarizes the recommended city and county level transportation system and improvements. Included are operational improvements on principal arterials and city/county level roadways.

Opinions of probable costs for recommended and potential roadway projects at the city/county and neighborhood level are included in the following sections. These estimated cost ranges were prepared at planning level, based on descriptions of the recommended improvement concept, as opposed to specific designs. As such, actual implementation costs may vary significantly and wide cost ranges are provided. In some cases, more specific design work has been completed, therefore more narrow cost ranges are provided. Where available, cost estimates are drawn from previous planning performed by the consultant and others in support of Mediation Agreement and Greenwood Village Capital Improvement Program development. Cost estimates provided include cost ranges for engineering, landscaping, and right-of-way.

Potential Capacity Improvements

Three roadway widening projects are shown on Figure 16 as potential improvements that are recommended for more detailed evaluation and focused discussions with affected neighboring residents and property owners. The rationales for these recommendations are described below, followed by a summary of these recommendations in Table 9.

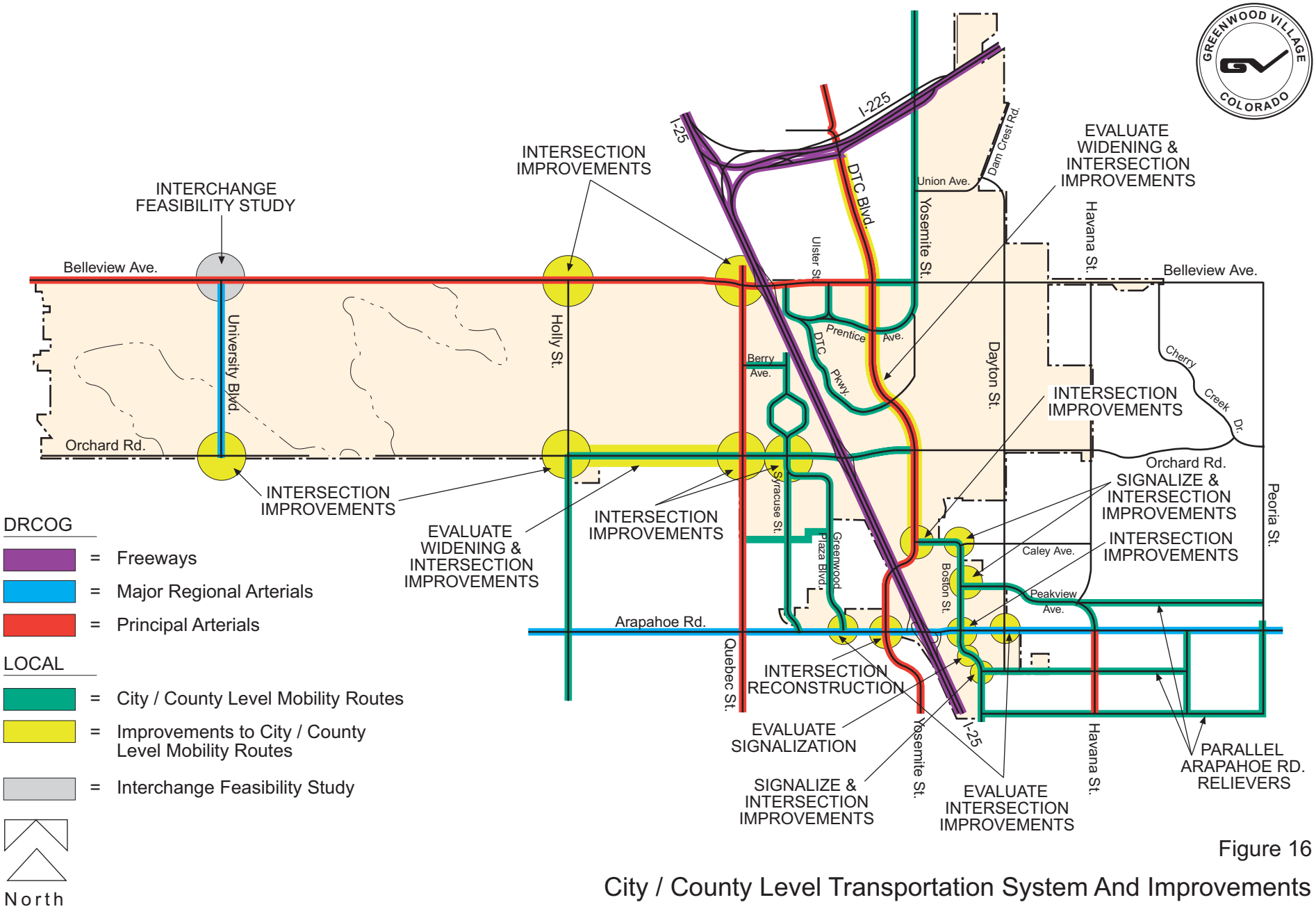


Figure 16

City / County Level Transportation System And Improvements

- Orchard Road Between Holly Street and Quebec Street - This segment of Orchard Road currently carries approximately 15,000 vehicle per day (vpd), which is a volume that translates to high levels of congestion on a two-lane roadway, particularly one without separate turn lanes. The existing four-lane Arapahoe County segment of Holly Street south of Orchard Road currently feeds into two-lane streets, including the continuation of Holly Street through Greenwood Village and Orchard Road east and west of Holly Street. Orchard Road is a four to six lane commercial street east of Quebec Street. Thus, the two-lane segment of Orchard Road between Holly Street and Quebec Street has become a capacity constraint for regional movements between residential areas to the south and office uses to the east.

  This capacity constraint has created a number of impacts:

  - The lack of capacity on Orchard Road causes many drivers to and from the south on Holly Street and from Orchard Road on the west to use the segment of Holly Street through Greenwood Village, which is residential in character and has two adjacent schools. Orchard Road congestion may also contribute to cut-through traffic on Monaco Street.

  - At the Orchard/Holly intersection, peak hour traffic demands cause high levels of congestion (level of service E during both AM and PM peaks, see level of service definitions in the Appendix). Specifically, in the AM peak the more than 800 northbound right-turning vehicles create a need for two right turn lanes, which narrows to a single lane on Orchard Road at Krameria Street. These right-turning vehicles also tend to crowd out the eastbound through vehicles at Orchard/Holly, further increasing delays for these vehicles in a single lane.

  - At the Orchard/Quebec intersection, the existing Orchard Road configuration will only accept a single westbound lane on Orchard Road. The demand on this single westbound lane is the primary cause of the high level of congestion (level of service F) experienced in the PM peak at this intersection.

  It is, therefore, proposed that potential improvements to this segment of Orchard Road be evaluated in greater detail. Potential improvements may include additional through lanes, additional turn lanes, modified traffic and access control, and noise and visual impact mitigation measures. The cost for widening of Orchard Road is estimated to be in the $2.0 million to $4.2 million range, depending upon the level of improvements that is implemented.

  Improvements to Quebec Street between Arapahoe Road and Orchard Road or Belleview Avenue should also be explored as accompanying or additional measures with the potential to provide traffic relief for Orchard Road.

- Yosemite Street/DTC Boulevard Between Caley Avenue and Belleview Avenue - Development in and around the Denver Tech Center has created increased traffic and congestion levels on this corridor, with traffic north of Orchard reaching 33,000 vehicles per day in 1997. Overall intersection delays and delays for particular turning movements are becoming high during peak hours, particularly at corridor intersections with Caley Avenue, Orchard Road, and Belleview Avenue. Demands on this corridor can be expected to increase with continued development, construction of I-225 slip ramps providing direct access to and from DTC Boulevard, and planned improvements to Boston Street/Clinton Street south of Caley Avenue.

  More detailed design work will be needed to assess the feasibility of potential improvements in different segments of the corridor. One concept that will be explored between Orchard Road and Belleview Avenue is to extend and connect the existing right-turn deceleration and acceleration lanes to form six through lanes. Additional right-turn deceleration lanes could be added as needed. The feasibility of various improvement levels in the segment of Yosemite Street between Orchard Road and Caley Avenue will need to be explored in detail in light of the right-of-way constraints in this area. The cost range for improvements that are being explored between Caley Avenue and Belleview Avenue is estimated at $6.5 million to $7.5 million.

  An extension of Caley Avenue west of Yosemite Street to connect with Willow Drive has been identified as a project for exploration. Such a connection has the potential to provide relief for Yosemite Street between Caley Avenue and Orchard Road.

- Construction/Improvement of Parallel Arapahoe Road Relievers - Development of parallel streets to accommodate some of the shorter trips north and south of Arapahoe Road east of Greenwood Village is included in the Greenwood Village/Arapahoe County/ Aurora mediation agreement. The objective of these parallel streets is to relieve some of the demands on Arapahoe Road to preserve its major regional arterial function. Reliever routes include existing and future segments of Peakview Avenue, Costilla Avenue, and Easter Avenue, as well as portions of Caley Avenue, Briarwood Avenue and Broncos Parkway farther to the east. Future improvements on the portion of Costilla Avenue within Greenwood Village should be compatible with these parallel reliever functions. The cost range for construction of these roads, which lie primarily in unincorporated Arapahoe County, is estimated at $11.1 million to $13.3 million.

Table 9
Capacity Improvements Requiring Detailed Study

Location	Recommendation	Opinion of Probable Cost Range ($1000's)
1. Orchard Rd., Holly to Quebec	Evaluate options to widen from 2-lane section to 3, 4 or 5-lane section.	$2,000 - $4,200 *
2. Yosemite/DTC Blvd., Caley to Belleview	Evaluate options to widen from existing 4 through lanes to 5 or 6 through lanes.	$6,500 - $7,500 **
3. Arapahoe Rd. Corridor, East of Boston/Clinton	Construct parallel reliever roads.	$11,100 - $13,300

* Does not include potential improvements to Quebec Street.
** Does not include potential extension of Caley Avenue to Willow Drive.

Intersection and Operational Improvements on City and Regional Level Streets

In addition to the larger scale issues discussed above, numerous operational and safety problems at particular intersections were identified through the public involvement and technical evaluation processes. Each of these issue areas was explored and improvement alternatives were developed and evaluated. Table A-2 in the Appendix describes the problems, alternative improvements and alternatives evaluations for each of these intersections, and provides a preliminary recommendation at each location. Improvement recommendations are summarized in Table 10.

Table 10
Intersection and Operational Improvement Recommendations

Location	Recommendation	Opinion of Probable Cost Range (in $1000's)
1. Belleview/University	Widen bridge to extend northbound right-turn lane. Initiate an interchange feasibility study	$75 - $ 125
2. Orchard/University	Add a southbound right-turn lane Adjust signal timing	$40 - $60
3. Orchard/Quebec	Evaluate improvements as part of a detailed evaluation of Orchard Road	Included with Orchard Improvements
4. Orchard/ Greenwood Plaza	Add EB right turn lane	$50 - $75
5. Belleview/Holly	Evaluate signal timing adjustment as part of Holly Street traffic calming study	<$25
6. Orchard/Holly	Evaluate intersection improvements or reconfiguration to roundabout as part of Orchard Road and Holly Street studies	Include standard improvements with Orchard improvements; Roundabout: $500-$700
7. Belleview/Quebec	Add an additional northbound lane and an eastbound right-turn lane	$700-$750
8. DTC Blvd/Yosemite/ Orchard	Initiate detailed evaluation of DTC Blvd/Yosemite corridor improvements	Included with DTC Blvd/ Yosemite improvements
9. Caley/Yosemite	Add a 2nd southbound left-turn lane and a 2nd westbound right turn lane	$200 - $250
10. Boston/Caley	Reconfigure to make movement between west and south legs predominant and signalize reconfigured intersection	$1,000 - $1,300
11. Boston/Peakview	Signalize with basic current configuration; Evaluate the need for an exclusive westbound right-turn lane	$150 - $200
12. Arapahoe/Clinton/ Boston	Widen intersection for a second northbound through lane, westbound left-turn lane, and southbound left-turn lane	$1,700 - $1,900
13. Clinton/Costilla	Signalize and realign intersection	Funded
14. Arapahoe/Yosemite	Reconstruct and upgrade signal installation	Funded
15. Arapahoe/Dayton	Evaluate improvements as part of planned Arapahoe Road corridor study	$800 estimated for corridor study
16. Arapahoe/ Greenwood Plaza	Evaluate improvements as part of planned Arapahoe Road corridor study	$800 estimated for corridor study

Table 10 (Continued)
Intersection and Operational Improvement Recommendations

Location	Recommendation	Opinion of Probable Cost Range (in $1000's)
17. Belleview/Yosemite	Add a westbound left-turn arrow	<$25
18. Village-Wide	Coordinate with regional and neighboring jurisdictions to develop and implement Intelligent Vehicle Highway System (IVHS) measures.	Variable

NEIGHBORHOOD LEVEL TRANSPORTATION SYSTEM

The final roadway layer in the Greenwood Village roadway network is the neighborhood level street system. These are streets that are intended to provide access between neighborhoods and the city/regional transportation network, as well as circulation within neighborhoods. Issues and preliminary improvement recommendations at the neighborhood level are generally of three types:

- Traffic calming,
- Access enhancements, and
- Spot operational improvements

Figure 17 shows the neighborhood level transportation system and preliminary improvement recommendations.

Traffic Calming

One of the most pervasive transportation concerns cited in Greenwood Village over many years, and specifically during the course of the public involvement process that is part of the development of the Greenwood Village Transportation Plan, is the impact of traffic on residential neighborhoods. Concerns include high volumes of traffic, particularly high volumes of through traffic, traffic speeds, noise, and safety concerns for pedestrians and bicyclists.

Traffic calming techniques have long been viewed by the Village as an effective response to these concerns. Traffic calming measures have been or are being implemented on a number of streets throughout the Village, with implementation decisions having been made on a case by case basis in response to a particular neighborhood concern. It is intended that the Greenwood Village Transportation Plan will further village-wide policies related to traffic calming, documenting:

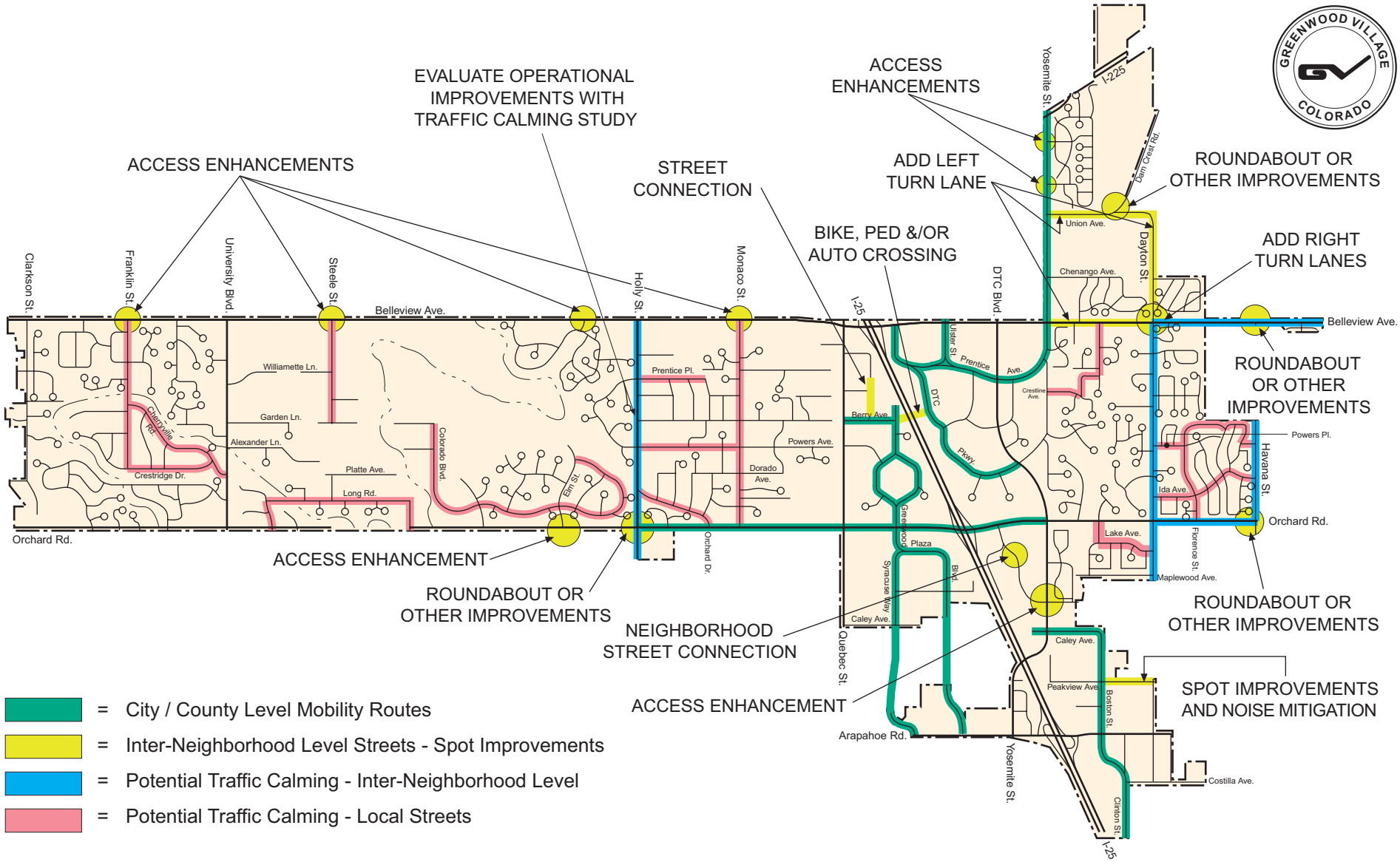


Figure 17

Neighborhood Level Transportation System And Improvements

- The objectives of traffic calming;
- The types of traffic calming measures that are viewed as being compatible with various street types; and
- Criteria to apply in deciding where traffic calming should be implemented, the relative priority for various projects, and sources of project funding.

What is Traffic Calming?

The goal for the continuing city traffic calming program is to reduce the impacts of traffic on residential neighborhoods and, in so doing, improve the livability of those neighborhoods.

Many traffic calming measures have already been implemented or are in the implementation process in the Village, as documented in Section 2. All-way stops, median islands, dips, and pavement narrowing have all been implemented in one or more locations. The Police Department has also been conducting targeted speed enforcement in neighborhoods throughout the Village. Greenwood Village's most intensive traffic calming design project has recently been completed on Monaco Street. When complete, this project will include additional islands, traffic circles, and chicanes (meandering street segments).

Candidate Street Types

There are three categories of streets for which some form of traffic calming has been suggested or could be considered. For some streets, it is intuitively clear to which category they belong. In other cases, streets may have some characteristics of more than one category or data collection may be necessary to help determine the most appropriate category. Greenwood Village streets are classified according to these categories on Figure 18.

1. Indirect Local Streets: These are local streets which do not connect directly through the Village street network, but are, rather, cul de sacs, looping streets, or follow circuitous routes between external points. By virtue of their lack of continuity, these streets do not have a high through traffic component; therefore measures aimed at reducing traffic volumes are not appropriate. For these streets, any calming measures would be most appropriately aimed at reducing traffic speeds and improving driver attentiveness to pedestrians and bicyclists.

2. Direct Local Streets: These are also local streets, but are configured in such a way that through-traffic, or traffic with neither an origin nor destination in the neighborhood, may be a significant volume and proportion of total traffic. External drivers may use these streets as a short-cut, typically to bypass a congested collector or arterial street. In these cases, calming measures that both reduce through traffic and calm the remaining traffic may be appropriate. In many cities, this category of streets forms the heart of the traffic calming program.

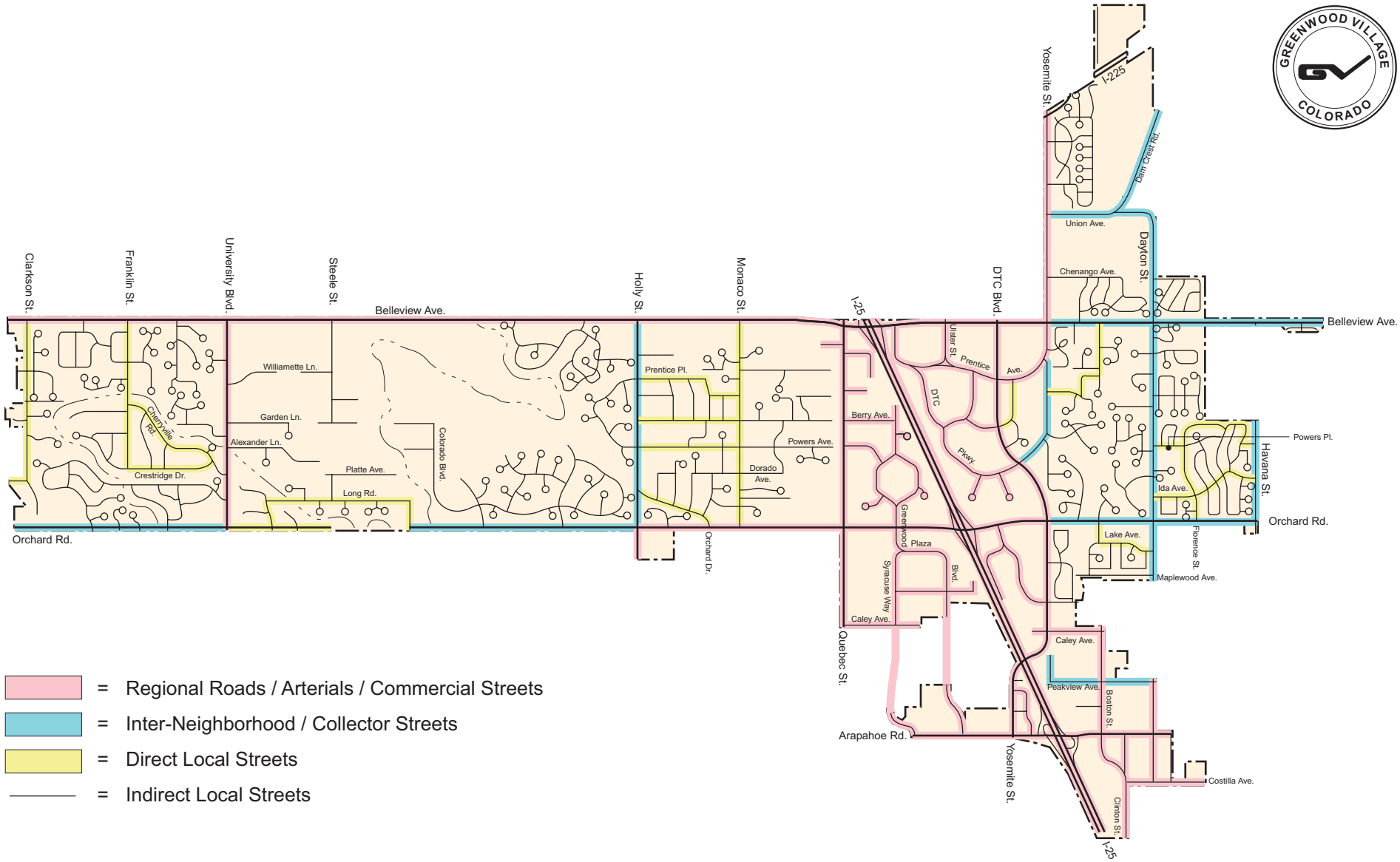


Figure 18

Traffic Calming Street Classification

3. Inter-neighborhood or Collector Streets: These are streets that are designed to carry significant volumes of traffic, connecting local neighborhood streets with the regional or city-level street system. However, residents may have complaints about the volume, speed, and other driving behavior of traffic on the street, given its residential character. This type of streets has several distinguishing characteristics relative to traffic calming compared with local streets:

   - They were designed to serve a significant mobility function in the Village;
   - They are more commonly used as bus routes and emergency service access routes;
   - They typically have no or few homes with driveways fronting directly onto the street; and
   - Traffic that would be diverted from this street due to aggressive traffic calming may be diverted to a street with a lower classification that is designed for reduced traffic and is subject to greater impacts for each vehicle that passes through.

4. Streets in the fourth category including regional facilities, arterials, and commercial streets, are not appropriate for traffic calming consideration, although traffic impacts may be mitigated by such strategies as increased speed enforcement, noise walls, landscape and streetscape amenities, detached sidewalks, and grade separations for crossing trails.

Applicability of Potential Calming Strategies

Table 11 provides a summary of the traffic calming strategies that are available. Each strategy is briefly defined then a judgement is made as to their potential applicability for each of the three street categories discussed above. Again, with the exception of enforcement and education, these techniques are not applicable to arterial and commercial streets.

Table 11
Traffic Calming Strategies and Potential Applicability

Strategy	Description	Applicability		
		Indirect Local Streets	Continuous Local Streets	Inter-Neighborhood Streets
Enforcement	Increase enforcement of speed limits and other regulations; photo enforcement	Yes	Yes	Yes
Education and Awareness	Neighborhood meetings, brochures, radar speed trailers	Yes	Yes	Yes
Reduced Speed Limits	Reduce speed limits	Yes	Yes	Yes
Advisory Signs and Markings	Cross-walk markings, lane delineations, bike lane markings, yield signs, speed or other advisory or warning signs	Yes	Yes	Yes
All-Way Stops	Place stop signs for all approaches to an intersection	No	No	Yes
Stop Sign Patterns	Change the pattern of two-way stops in a neighborhood	Yes	Yes	No
Turn Prohibitions	Prohibiting turns all day or at specific times by signing	No	No	Yes
Curb Extensions or Neckdowns	Narrowing of the street width at an intersection or mid-block by widening sidewalks or landscaped areas	Yes	Yes	Yes
Raised Crosswalks	Raise pavement at crosswalks and/or emphasize crosswalk using a different pavement color/texture	No	Yes	Yes
Median Islands	Raised median islands that narrow roadway width, create a meandering path, and reduce sight distance	No	No	Yes
Gateways	Median or roadside features at intersections to narrow street width and signal entry into a neighborhood	Yes	Yes	Yes

Table 11 (Continued)
Traffic Calming Strategy and Potential Applicability

Strategy	Description	Applicability		
		Indirect Local Streets	Continuous Local Streets	Inter-Neighborhood Streets
Speed Humps	Raised asphalt mounds designed to reduce traffic speeds	Yes	Yes	No
Speed Dips	Pavement depressions designed to reduce traffic speeds	Yes	Yes	No
Chicanes	Deviations from a straight travel path designed to reduce sight distances and traffic speed	Yes	Yes	No
Traffic Circles or Mini-Roundabouts	Small circular island placed in the center of an existing local street intersection to create indirect, slower travel paths	No	Yes	No
Roundabouts	Typically created by widening an existing intersection, roundabouts are designed to maintain or increase intersection capacity while slowing through movements	No	No	Yes
On-street Parking	Introducing on-street parking on one or both sides of a street to reduce the width of the driving surface	No	No	Yes
Barriers or Diverters	Barriers constructed diagonally or horizontally through the center of an intersection, to prevent selected movements	No	Yes	No
Street Closures	Completely closing a street at a certain point, used as a last resort if neighborhood circulation and access can be maintained.	No	Yes	No

Implementation Process

Stating potential applicability does not necessarily mean that the measure will be effective or desirable at a given location; it simply means that it may be compatible with that street type. As an example, reducing the speed limit on a collector street may not be effective at reducing actual speeds on a given street, but may still be applicable in some situations. As another example, many neighborhoods find speed humps and dips to be undesirable on their streets due to noise, aesthetic, and other considerations, yet they are listed as being potentially applicable on local streets.

The choice of traffic calming strategies at a particular location should be evaluated based on specific neighborhood characteristics such as traffic patterns, street design, adjacent property features and, perhaps most importantly, adjacent property owners and neighborhood opinions. A particular traffic calming strategy should have acceptance on three levels before it is implemented:

- There should be approval of all residents or other property owners immediately adjacent to any proposed calming device;
- There should be a general consensus in the neighborhood in which traffic calming is to be applied; and
- There should be majority support in surrounding neighborhoods and village-wide support, as expressed by an elected or appointed Village board or council.

It is recommended that Greenwood Village modify and adopt procedures for neighborhood coordination and implementation of traffic calming projects.

Access Enhancements

A widespread concern among Greenwood Village residents, businesses, and visitors is difficulty accessing the major street network from local streets and driveways. Each of the specific issue areas was explored and improvement alternatives were developed and evaluated. Table A-3 in the Appendix describes each access concern and improvement alternatives, and provides a preliminary recommendation at each location. Recommendations are summarized in Table 12.

Table 12
Access Enhancement Recommendations

Location	Recommendation	Opinion of Probable Cost Range (in $1000's)
1. Belleview at Franklin, Steele, Fairfax, and Monaco	Evaluate in detail as part of the Belleview Access Study, budgeted for 1998 in the Capital Improvements Program	Access study: $75 Improvements: <$25 to $1,000
2. Orchard at Elm	Perform traffic counts and consider implementation of an all-way Stop, particularly if Orchard is widened east of Holly	<$25
3. Holly at Greenwood Elementary and West Middle School	Consider appropriate improvements as part of planned Holly traffic calming study	Calming study: $85
4. Quebec at Progress Place	Extend Roslyn Street to Berry Avenue	$1,400 - $1,600
5. Quebec at Solarium Building	Evaluate alternative improvements as part of any Quebec/Orchard intersection improvement project	Include with Orchard/Quebec improvements
6. Quebec at Greenwood Athletic Club and Westlands Park	Construct dedicated access for Westlands Park with park expansion	Include with park expansion cost
7. Roundtree Neighborhood Access	Close access to Yosemite Street and replace with access to Willow Court	$25 - $50
8. Yosemite at Fair	Evaluate appropriate improvements as part of programmed Capital Improvements Program project	Access study: $30 Implementation: <$25 - $300
9. Orchard at Big Canon	Sign and enforce "Do Not Block Intersection" regulation on Orchard Road at Big Canon	<$25
10. Belleview at Belleview Square, Boston, Beeler	Conduct detailed design on Belleview, including a center left-turn lane, and implement selected design.	Include with Belleview improvements
11. Yosemite at Radcliff and Tufts	Monitor Yosemite operations after implementation of DTC Blvd. slip ramps; Evaluate relocation of access opposite Tufts if still needed	<$25
12. Cherry Creek Village on the Lake	Coordinate Dayton Street access improvements with Cherry Creek School District and implement	Include with Dayton Street improvements
13. Greenwood Gardens	Sign and enforce "Do Not Block Intersection" regulation on Dayton Street at Emporia Way	<$25
14. Clinton at Target, Norwest and Costilla	Finalize decision on best location for a signal and implement	$200 - $300
15. Greenwood Plaza at Commercial Access to the North	Collect traffic counts and evaluate potential improvements	<$25 - $125

Spot Improvements on Neighborhood Level Streets

Spot improvements have been suggested at certain intersections of neighborhood level streets to enhance neighborhood mobility and safety. Issues at these intersections are listed in Table A-4 along with improvement alternatives, evaluations, and recommended improvements. Recommendations are listed in Table 13.

Table 13
Neighborhood-Level Streets - Intersection and Spot Improvement Recommendations

Number/Location	Recommendation	Opinion of Probable Cost Range (in $1000's)
1. Orchard / Dayton	Explore minor turn radius improvements with Orchard traffic calming study	Include with Orchard improvements
2. Belleview / Dayton	Add eastbound and westbound right-turn lanes Adjust signalization to add an eastbound left-turn arrow Restripe to add southbound left-turn storage	$100 - $120
3. Union / Dayton / Dam Road	Initiate feasibility study for roundabout or other improvements	$500 - $700
4. Union and Dayton Along Cherry Creek Campus Perimeter	Add center left-turn lanes and modify access control	$600 - $750
5. Belleview from Yosemite to Dayton	Add a center left-turn lane and modify access control	$300 - $400

TRANSIT SYSTEM

Figure 19 shows the existing Regional Transportation District (RTD) bus service in and around Greenwood Village, as well as major planned and recommended transit system improvements. The two most significant planned transit investments, light rail in the I-25 and I-225 corridors and a circulator bus around Greenwood Village, are discussed below. Also discussed are bus service improvement concepts that were raised during the public involvement process and should be coordinated with RTD planners.

Light Rail Transit

Construction of a light rail transit (LRT) corridor extending from downtown Denver to Lincoln Avenue in the I-25 corridor and from I-25 to Parker Road in the I-225 corridor was the primary improvement recommendation of the Southeast Corridor Major Investment Study. This recommendation has been included in the 2020 Regional Transportation Plan, and has been referred to by numerous decision-makers within CDOT and RTD as the region's top rapid transit investment priority. However, with the defeat of RTD's Guide the Ride program, its funding source has not yet been identified.

The LRT corridor is planned to be constructed on the west side of I-25 and in the median of I-225. Stations in and around Greenwood Village are currently planned along I-25 at Dry Creek Road, Arapahoe Road, Union Avenue, and the Southmoor park-n-Ride, as well as an I-225 corridor station at Parker Road.

A station north of Orchard Road is currently contemplated as a long-range "Phase 2" project, but is not included in the Year 2020 recommendation of the Major Investment Study or the draft Regional Transportation Plan. The Greenwood Village Transportation Plan strongly urges the inclusion of this station in the initial LRT implementation phase. It will serve the heart of Greenwood Village's office core. With the recommended bicycle/pedestrian crossing of I-25 between Orchard Road and Belleview Avenue and the implementation of the bus circulator discussed in the next section, a station north of Orchard Road would connect passengers with dozens of office buildings via walking, bicycling, or use of the circulator bus.

It is important that adequate parking be provided at LRT stations in order to accommodate potential passengers and to minimize impacts associated with any spillover parking that would occur without adequate parking provided. Security at transit stations and park-n-Rides is an issue that was raised during the public involvement process and that RTD is encouraged to continue to address.

To maximize both the patronage of LRT and the ability of the LRT investment to shape desirable development patterns, Greenwood Village should investigate the use of regulatory and investment tools to encourage creation of mixed use transit-oriented development surrounding both the Orchard Road and Arapahoe Road stations. The presence of convenience retail and service uses and the presence of high density development in close proximity to transit stations can both be effective ways to encourage use of transit.

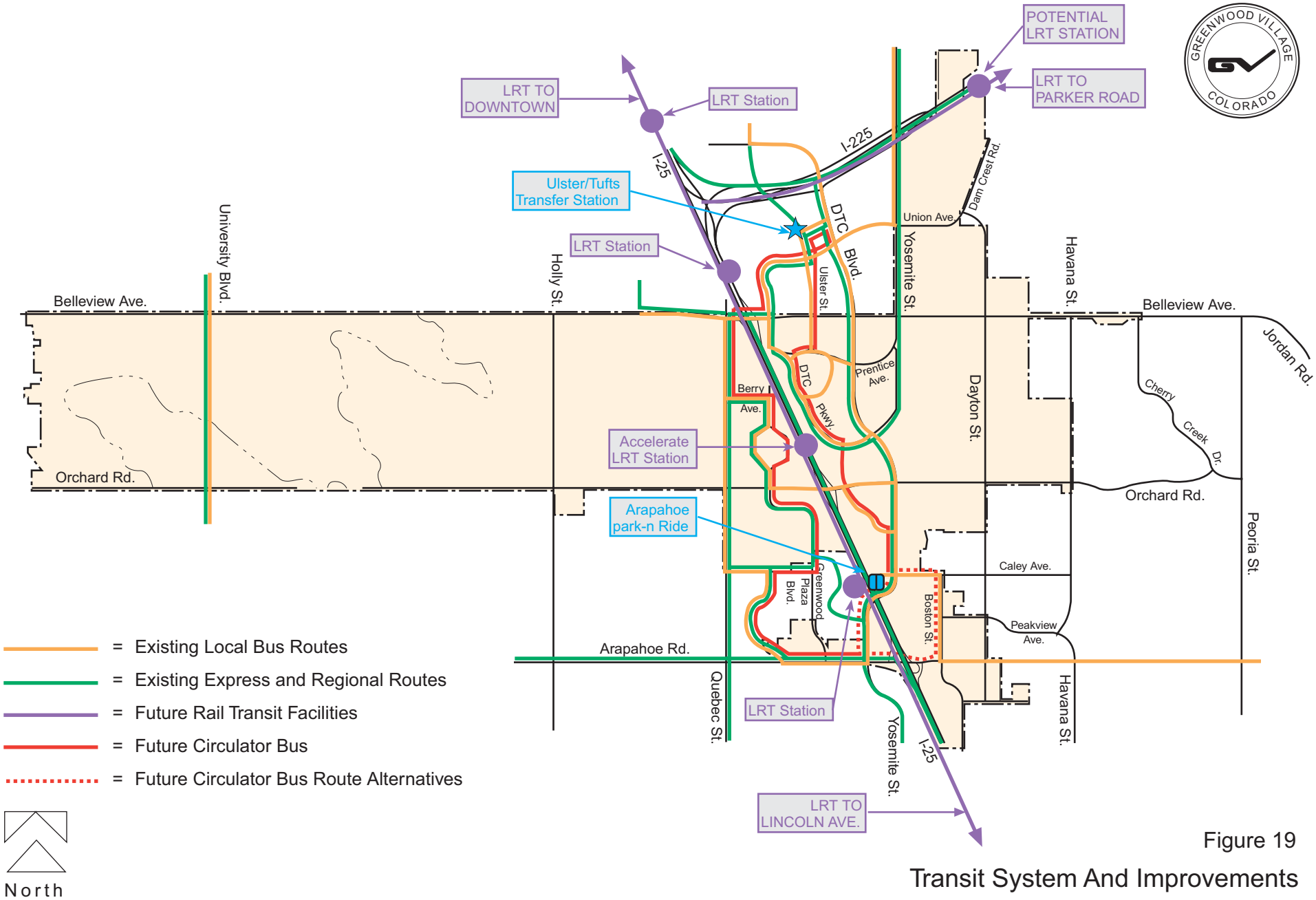


Figure 19

Transit System And Improvements

Circulator Bus

Greenwood Village has explored a joint effort with RTD to provide a circulator bus connecting the Denver Technological Center, Greenwood Plaza, and other surrounding office and retail developments with each other and with the Arapahoe park-n-RIDE and the Ulster/Tufts Transfer Station. The 1996 Greenwood Village Transit Circulator Feasibility Study suggested the circulator route shown on Figure 19, and estimated that its implementation, along with a package of other transit incentives, could more than double the existing transit ridership to the Greenwood Village and surrounding office area. The circulator was envisioned to have five-minute frequency during peak hours and 15-minute frequency during other times. Coordination with RTD to implement this circulator bus is desirable under existing conditions.

The circulator would be even more important and beneficial to support the LRT system when it is constructed. Further planning and implementation of the circulator bus can also assist in demonstrating the area's commitment to transit and aid in securing of federal assistance for LRT project funding.

Bus Service Enhancements

RTD continually works with local governments to update its service planning in an attempt to best meet their transit needs. Several comments were made in the public involvement process about the desire for improved and expanded transit service for Greenwood Village. Greenwood Village should coordinate with RTD to work towards addressing these issues:

- Expanded Hours of Service: Expand the hours of transit service to office locations to allow employees who work irregular shifts or late hours to use transit.

- Smaller Vehicles: Increase the use of smaller vehicles that are more flexible and cause less neighborhood impacts.

- Transit Incentives: Expand initiatives, in coordination with RTD, the Southeast Transportation Management Organization (SETMO), and area employers, to create incentives for use of transit.

- Improve Regional System: Greenwood Village should work with other jurisdictions to improve the regional transit system, since improved regional transit will increase the willingness of Greenwood Village residents and employees to use transit.

- Extend Route 105: Extend Bus Route 105 to Yosemite to serve the Cherry Creek High School campus.

- Service to Clinton Street: Provide service to the growing Clinton Street commercial corridor south of Arapahoe Road.

- Improve Service to Activity Centers: Provide service or make service more direct to surrounding activity centers, including Southglenn Mall, Arapahoe Community College, Auraria Campus, Park Meadows Mall, and Highlands Ranch.

- East-West Route: Improve east-west service by providing a route on Belleview Avenue connecting the center of Greenwood Village with the Broadway and Santa Fe Drive corridors.

- Service to East Neighborhoods: Explore providing bus service to Greenwood Village and Arapahoe County residential areas east of I-25.

- Ken Caryl Park-n-Ride: Coordinate with RTD on Denver Tech Center service to be provided from the Ken Caryl Park-n-Ride.

BICYCLE AND PEDESTRIAN SYSTEM

Support has been expressed for implementation of the several bicycle and pedestrian improvements that are included in the Village's Capital Improvement Program (CIP), as well as for additional bicycle and pedestrian improvements. These projects are shown on Figure 20 and discussed below.

Projects Included in CIP

The following projects are under construction or planned to be funded by the Village as part of its CIP:

- Barnard Equestrian Trail: Provide a trail along the west side of Barnard Equestrian Park connecting Orchard Road with Clarkson Street and Littleton Boulevard.

- University Underpass: Provide an underpass for the Highline Canal trail at University Boulevard.

- Belleview Underpass: Provide an underpass and trail improvements for the Dry Creek trail at Belleview Avenue.

- Colorado Boulevard Equestrian Trail: Provide a trail along Colorado Boulevard connecting Orchard Road with the Highline Canal trail.

- Orchard Road Sidewalks: Construct sidewalks along Orchard Road between Quebec Street and Greenwood Plaza Boulevard.

- Greenwood Gulch Improvements/Holly Underpass: Improve the Greenwood Gulch trail between Orchard Road and the Highline Canal, including an underpass at Holly Street.

- Belleview Trail: Provide a trail along the north side of Belleview Avenue from Fulton Street to Cherry Creek Drive.

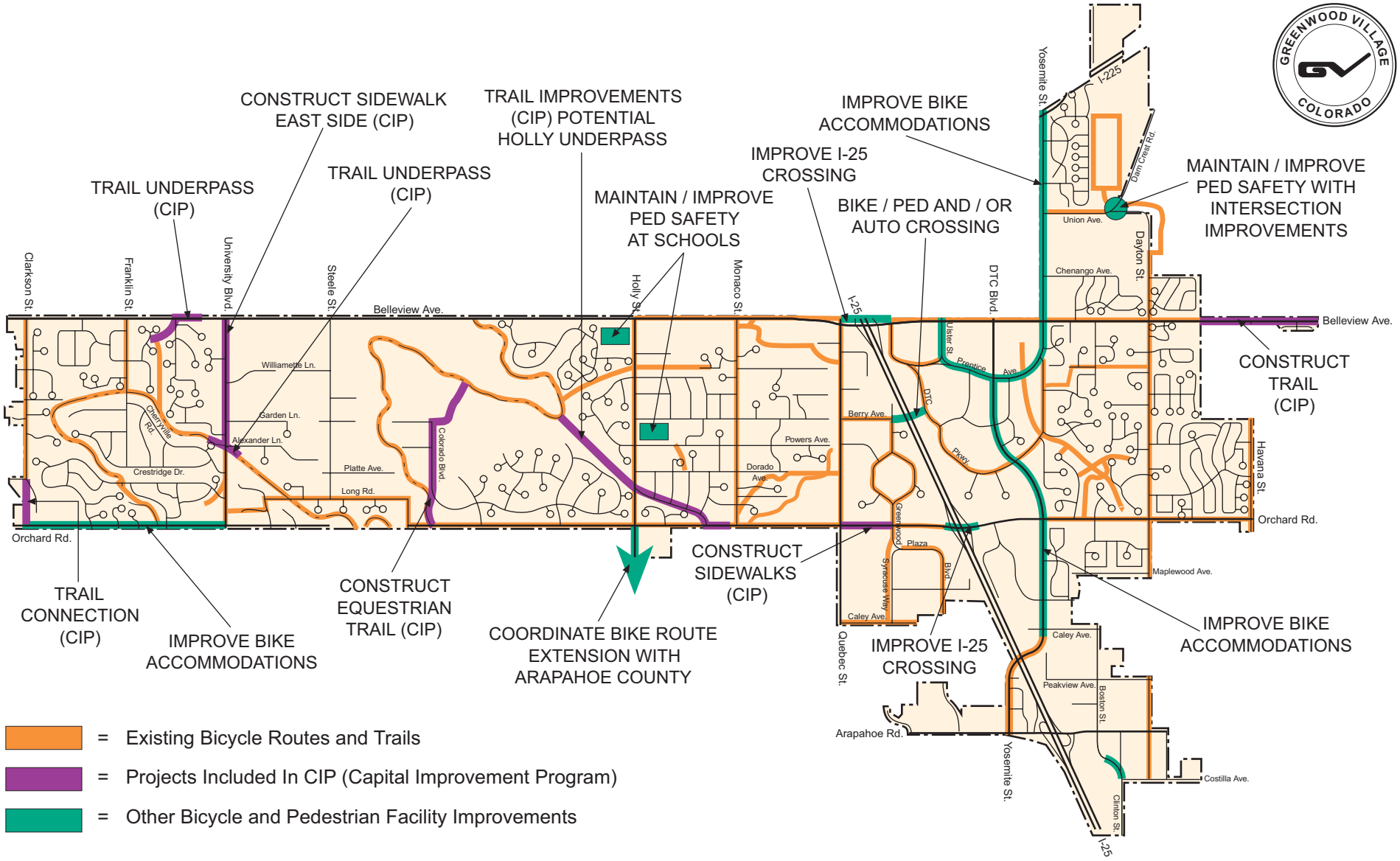


Figure 20

Bicycle and Pedestrian System And Improvements

Other Needs

Several other bicycle and pedestrian facilities are recommended for further evaluation and implementation, including:

- Bicycle Accommodations on Orchard Road: Evaluate potential on-street or off-street improvement of accommodations for bicycles on Orchard Road west of University Boulevard, extending the existing bicycle corridor along Orchard Road and Long Road east of University Boulevard. Widen the Orchard Road bridge over Greenwood Gulch to better accommodate bicycles and pedestrians.

- Pedestrian Safety Around Schools: Coordinate with the Cherry Creek School District to enhance safety for students walking to and from the Cherry Creek High School campus, West Middle School, and Greenwood Elementary School.

- Bicycle Accommodations on Yosemite Street: Coordinate with Denver to develop improvement accommodations for bicycles along Yosemite Street between Belleview Avenue and I-225, connecting the Denver Technological Center and Belleview Avenue on the south with the bicycle route along Yosemite Street north of I-225.

- Bicycle Accommodations on DTC Boulevard/Ulster Street: Evaluate potential on-street or off-street improvement of accommodations for bicycles on the Yosemite Street/DTC Boulevard/Ulster Street corridor, shown on Figure 6, to improve this DRCOG-designated Regional Bikeway Corridor.

- Clinton Sidewalks: Work with existing property owners and developers to connect sidewalks along Clinton Street between the Target Center and the developing hotel/office/restaurant area south of Costilla Avenue.

- I-25 Crossing: Construct an I-25 overpass between Belleview Avenue and Orchard Road, to connect office uses on either side and to enhance pedestrian and bicycle access to the future LRT station north of Orchard Road. Incorporate bicycle and pedestrian crossing improvements in any Belleview Avenue and Orchard Road interchange reconstruction project that is designed.

- Holly Bicycle Route Extension: Coordinate with Arapahoe County to improve accommodations for bicycles along Holly Street south of Orchard Road, as an extension of the existing Holly Street bike lanes through Greenwood Village.

- Sidewalks Serving Multi-Family Residential Development: Survey to locate any missing sidewalk segments that connect Greenwood Village center office developments with the surrounding multi-family residential developments. Consider Village funding of sidewalk improvements in advance of adjacent development to complete gaps in the sidewalk system.

LAND USE AND GROWTH

Transportation demands are a direct result of the amount, mix, and design of development in and around the Village. Several concepts related to growth and development in Greenwood Village have been raised to reduce or manage transportation demands in the Village.

- Medium to high density residential development can help internalize some of the office trips in the center of the Village and increase commuting by walking, bicycle and circulator bus. To capitalize on the existing and future multi-family residential developments, sidewalks, bike routes, and the local/circulator bus system need to effectively connect the residential and office uses. Small scale retail and service establishments near multi-family development could reduce vehicle travel generation by residential development.

- To maximize transit ridership when the planned light rail system is implemented, there should be focused land use planning surrounding transit stations. Creation of compact, mixed use development around transit stations can encourage utilization of the transit investment.

- The Village should work with SETMO, other jurisdictions, and major employers to support alternative mode incentive programs. Examples are rideshare matching services, subsidized bus passes, secure bicycle parking, locker room facilities, and telecommuting programs.

- The Village should also continue or expand alternative mode incentive programs for its own employees, including the Eco Pass which is currently offered to employees.

- One option for the Village to explore is purchasing some vacant parcels to limit new office development.

V. IMPLEMENTATION

PRIORITIZATION

The full range of plan recommendations was examined to determine which elements should have the highest priority. The highest priority projects were identified based on immediacy of need, ability to implement in the short-term, inclusion in existing plans, and inter-jurisdictional planning.

Table 14 lists recommendations that are considered to be highest priorities and should be pursued in the short-term future, within the next five years. In some cases, most notably I-25 widening and light rail transit, projects are likely to take more than five years to plan, fund, design, and construct; however, they are listed as high priorities and expeditious completion of steps toward implementation is recommended. Projects are listed in recommended order of priority within each improvement category.

Table 14
High Priority Project Recommendations

Project	Lead Agency(s)	Next Step(s)
Regional System		
1. I-25/I-225/Belleview Interchange Improvements	CDOT	Complete Southeast Corridor environmental impact statement and design
2. Northbound I-25 Auxiliary Lane, Arapahoe to Orchard	CDOT	Complete Southeast Corridor environmental impact statement and design
3. I-225/DTC Boulevard Slip Ramps	CDOT	Complete Southeast Corridor environmental impact statement and design
4. I-25 Highway Improvements	CDOT and RTD	Complete environmental impact statement
City/County Level System		
1. Clinton/Costilla Signal	Greenwood Village	Implement with identified funds
2. Arapahoe/Yosemite Intersection Reconstruction	CDOT/Greenwood Village	Implement with identified funding
3. Belleview/Quebec Intersection Improvements	Greenwood Village/CDOT	Complete design, obtain right-of-way, and secure funding for construction

Table 14 (Continued)
High Priority Project Recommendations

Project	Lead Agency(s)	Next Step(s)
4. Arapahoe/Boston/Clinton Intersection Improvements	Greenwood Village/CDOT	Complete design, obtain right-of-way, and secure funding for construction
5. Clinton/Target Center Signal	Greenwood Village/ Property Owners	Finalize location with business/property owner group
6. Yosemite/Caley Intersection Improvements	Greenwood Village	Prepare improvement design
7. Boston/Peakview and Boston/Caley Intersection Reconfiguration and Signalization	Greenwood Village	Prepare improvement and signal designs
8. Orchard Road Improvements at Quebec, Holly, and between Quebec and Holly	Greenwood Village	Initiate study process
Neighborhood Level System - Operational Improvements		
1. Dayton/Belleview Turn Lanes	Greenwood Village	Design and implement using CIP funds
2. Belleview Left-Turn Lane, Yosemite to Dayton	Greenwood Village	Design and implement using CIP funds
3. Union and Dayton Left-Turn Lanes	Greenwood Village/Cherry Creek Schools	Confirm jurisdictional issues, design and implement using CIP funds
4. Union/Dayton/Dam Road Intersection Reconstruction	Greenwood Village	Confirm jurisdictional issues and complete feasibility evaluation
5. Roslyn Street Extension	Greenwood Village	Finalize alignment, obtain right-of-way and secure funding for construction
6. Belleview Access Enhancements, West of Quebec	Greenwood Village/CDOT	Initiate study process
Neighborhood Level System - Traffic Calming		
1. Monaco Traffic Calming	Greenwood Village	Construct using CIP funding
2. Cherryville, Crestridge, and Franklin Traffic Calming	Greenwood Village	Prepare detailed design and implement

Table 14 (Continued)
High Priority Project Recommendations

Project	Lead Agency(s)	Next Step(s)
3. Holly Street Traffic Calming/Operational Enhancements	Greenwood Village	Initiate study process
4. Belleview Avenue Traffic Calming - Fulton St. to Cherry Creek Dr.	Greenwood Village	Prepare design and implement with CIP funding
5. Havana Street Traffic Calming	Greenwood Village	Prepare design and implement with CIP funding
6. Orchard Road Traffic Calming, Dayton St. to Havana St.	Greenwood Village	Prepare design and implement with CIP funding
Transit System		
1. Circulator Bus	Greenwood Village/RTD	Coordinate funding and implementation with RTD
2. Southeast Corridor Light Rail	RTD/CDOT	Complete environmental impact statement and secure funding
Bicycle and Pedestrian System		
1. Greenwood Gulch Trail Underpass at Holly	Greenwood Village	Complete project with CIP funding
2. Orchard Sidewalk, Quebec to Greenwood Plaza	Greenwood Village	Implement with 1996 CIP funding
3. Highline Trail Underpass at University	Greenwood Village	Implement with 1997 CIP funding
4. Trail Underpass at Belleview, west of University	Greenwood Village	Implement with 1997 CIP funding
5. Belleview Trail East of Fulton	Greenwood Village	Implement with 1998 CIP funding
6. I-25 Crossing Between Belleview and Orchard	Greenwood Village/CDOT	Initiate feasibility study
7. Yosemite Bicycle Improvements, North of Belleview	Greenwood Village	Initiate feasibility study
8. Clarkson Trail Connection	Greenwood Village	Implement with 2002 CIP funding

CONTINUED PLANNING

This Transportation Plan has been developed to address existing transportation conditions and conditions that are projected based on the best available forecasts for future conditions. With the dynamic development climate in and around Greenwood Village, it is likely that unanticipated changes in travel demand will take place over time. In addition, regional and local transportation system changes will influence transportation issues in ways that are not completely predictable. Therefore, it is important that Greenwood Village transportation planning be continually monitored and evaluated in light of dynamic conditions. Specifically, it is recommended that the Village:

- Continue to monitor traffic volumes at selected locations on a systematic, annual basis. In addition it is recommended that the traffic volume monitoring program be supplemented in two ways. First, count locations that are most directly affected by school-related traffic, including Holly Street at Powers Avenue, Cherry Creek Dam Road at Dayton Street, Dayton Street at Chenango Avenue, Dayton Street at Poundstone Place, and Union Avenue at Yosemite Street, be counted when school is in session in addition to continuing summer counting. Second, it is recommended that any streets on which traffic calming measures are implemented be monitored for volume and/or speed changes on an annual basis to determine the success of traffic calming measures.

- Follow up on issues discussed in this plan as requiring detailed evaluation, cooperative efforts with neighboring or regional agencies, or focused monitoring of changing conditions, beginning with the high priority projects listed in Table 13.

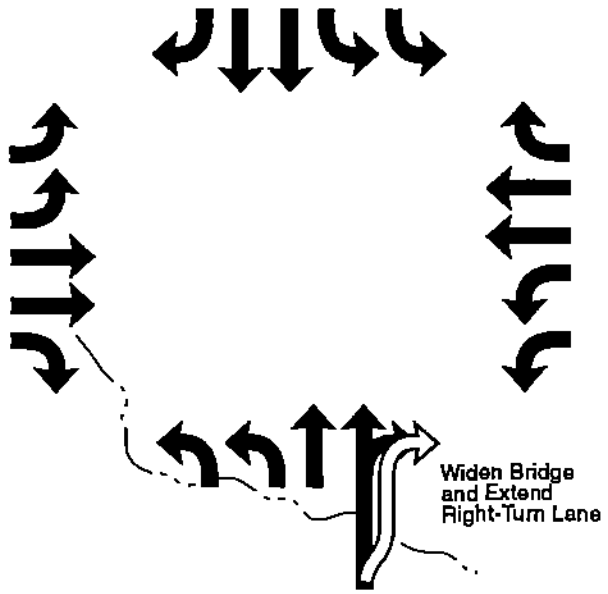
- Remain active in regional planning activities, including DRCOG's regional plan and transportation funding updates, corridor major investment and environmental impact studies, SETMO transportation advocacy and trip reduction programs, RTD transit planning activities, and CDOT planning activities.

- Prepare updates of the Greenwood Village Transportation Plan, in whole or in part, as needs warrant. In order to determine the need for updates, it is recommended that a staff member or members be assigned the responsibility of preparing for City Council review an annual summary of transportation planning status, including annual traffic monitoring results, progress toward implementation of high-priority recommendations, and status of regional and inter-jurisdictional planning efforts. These annual summaries, as well as City Council actions that relate to transportation plan updates and implementation, should be included as addenda to this Transportation Plan. It is recommended that such addenda be added to complete transportation plan copies maintained at selected locations, including the City Clerk's office, Public Works Department, and Planning Department.

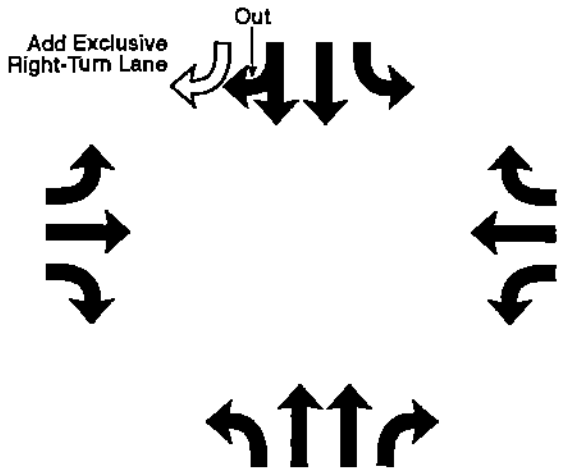
APPENDICES

APPENDIX 1
RECOMMENDED IMPROVEMENT SKETCHES

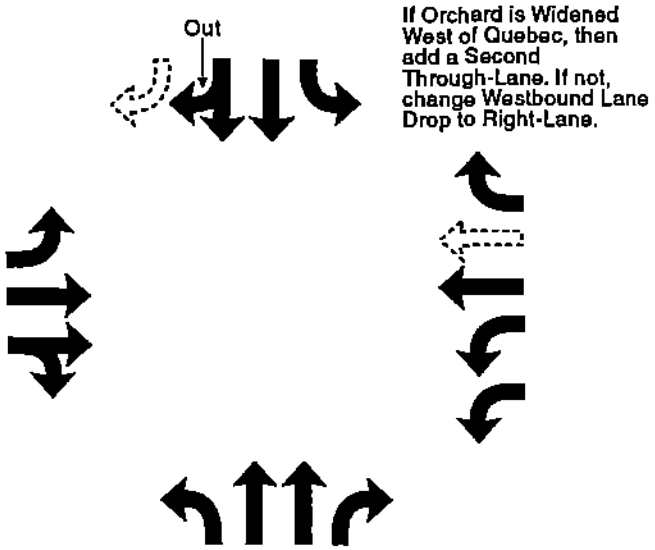
1. BELLEVIEW / UNIVERSITY



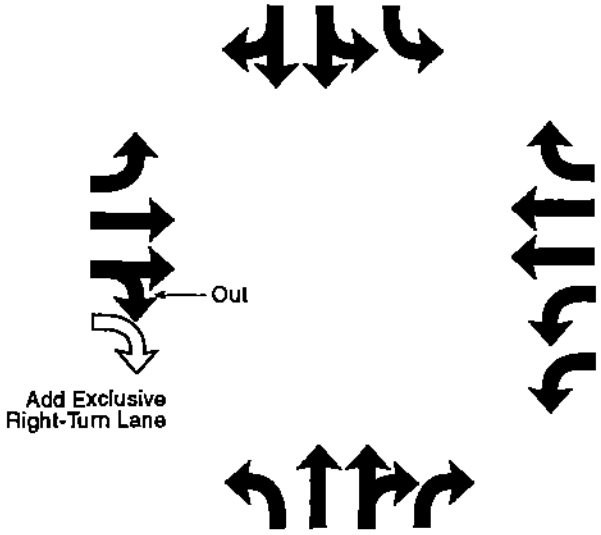
2. ORCHARD / UNIVERSITY



3. ORCHARD / QUEBEC



4. ORCHARD / GREENWOOD PLAZA



LEGEND

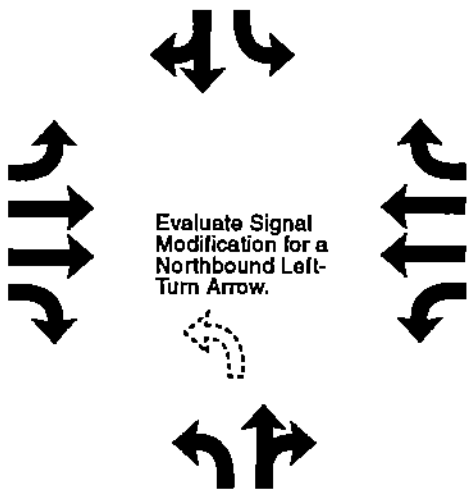
- = Existing
- = Recommended Improvements
- = Recommended for Further Evaluation

North

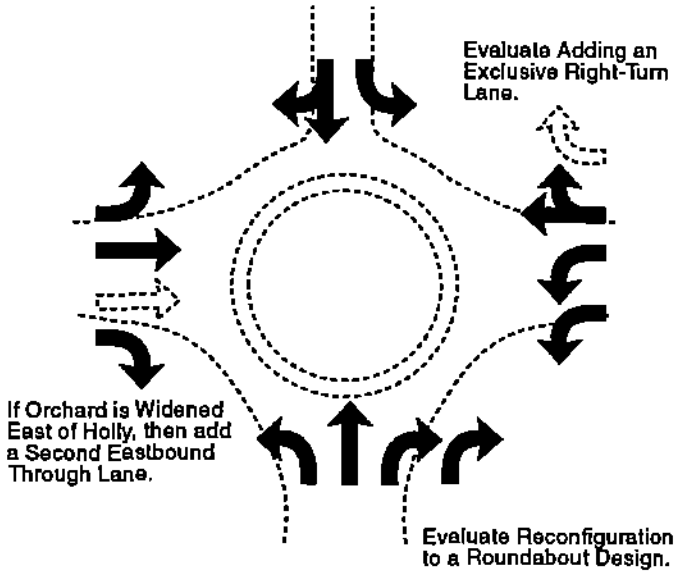
Intersection and Spot Improvement Recommendations (1-4)

Concept Sketches (Corresponding to Table 10)

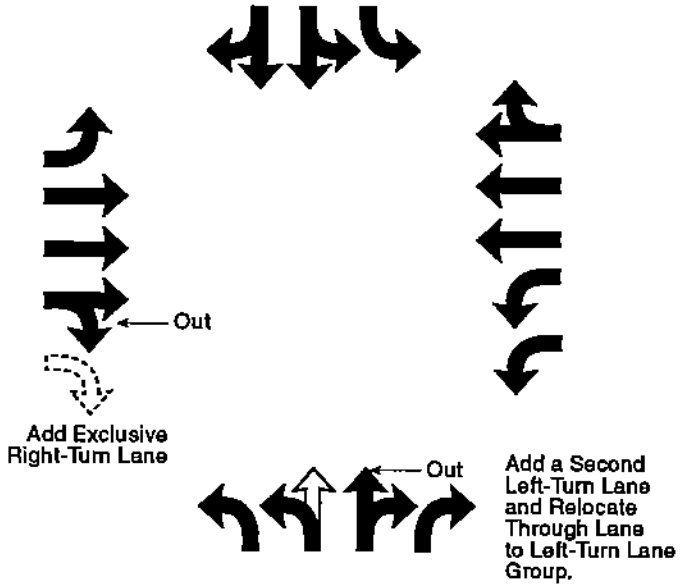
5. BELLEVIEW / HOLLY



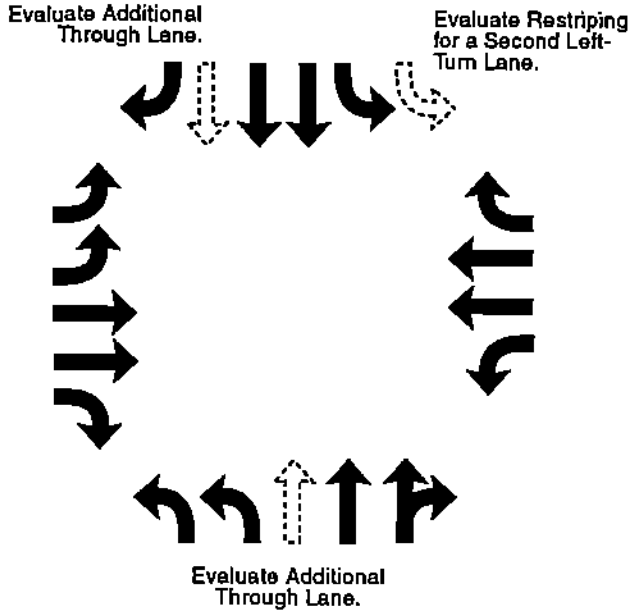
6. ORCHARD / HOLLY



7. BELLEVIEW / QUEBEC



8. DTC BLVD. / YOSEMITE / ORCHARD



LEGEND

= Existing

= Recommended Improvements

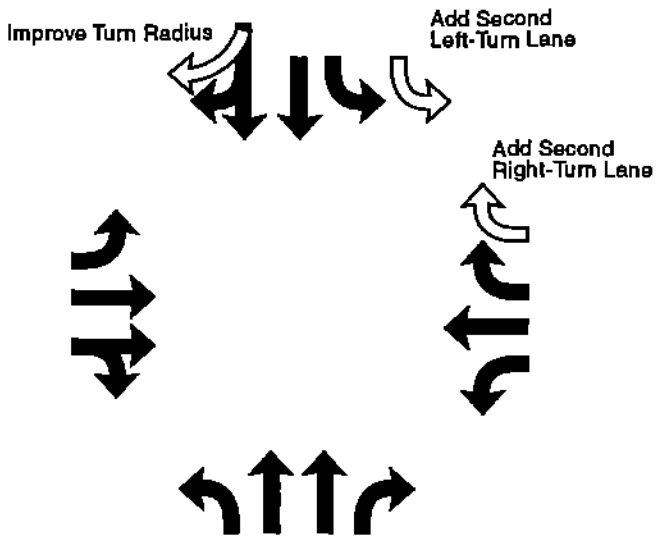
= Recommended for Further Evaluation

North

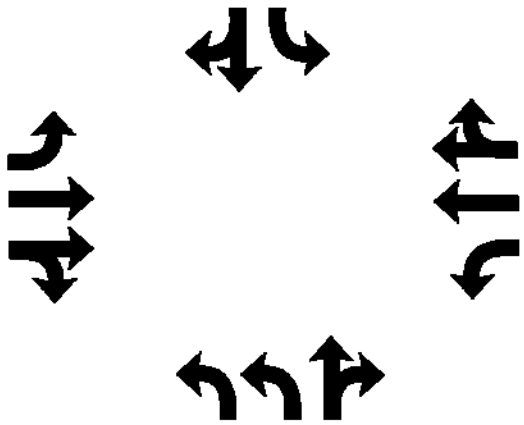
Intersection and Spot Improvement Recommendations (5-8)

Concept Sketches (Corresponding to Table 10)

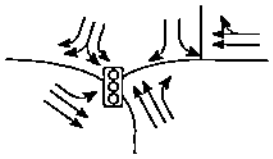
9. CALEY / YOSEMITE



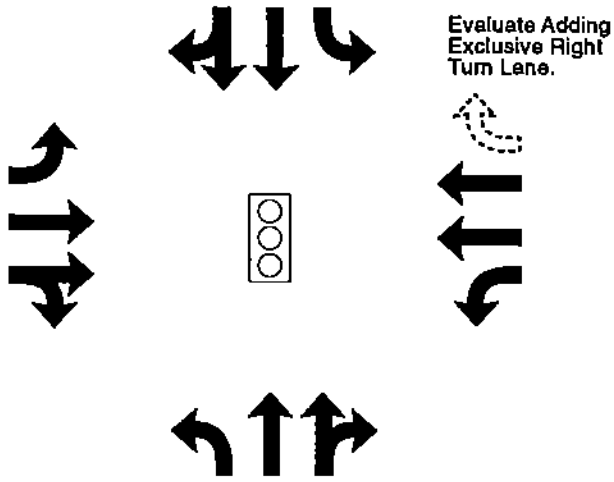
10. BOSTON / CALEY



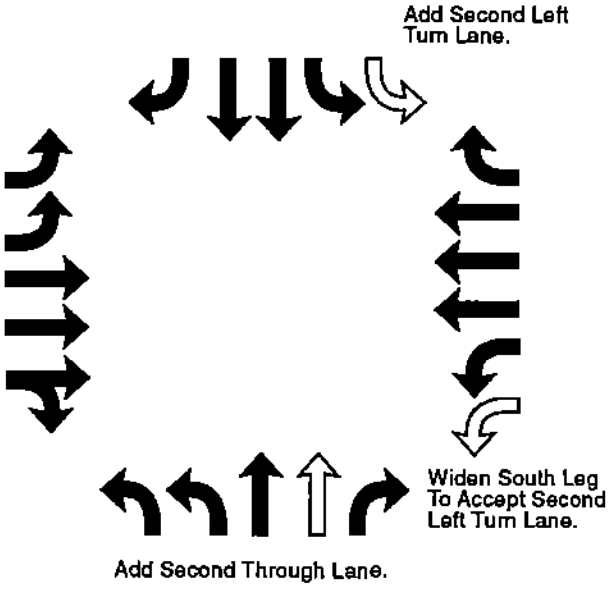
Reconfigure To Make Boston - Caley Movement Predominant, Signalize Intersection



11. BOSTON / PEAKVIEW



12. ARAPAHOE / CLINTON / BOSTON



LEGEND

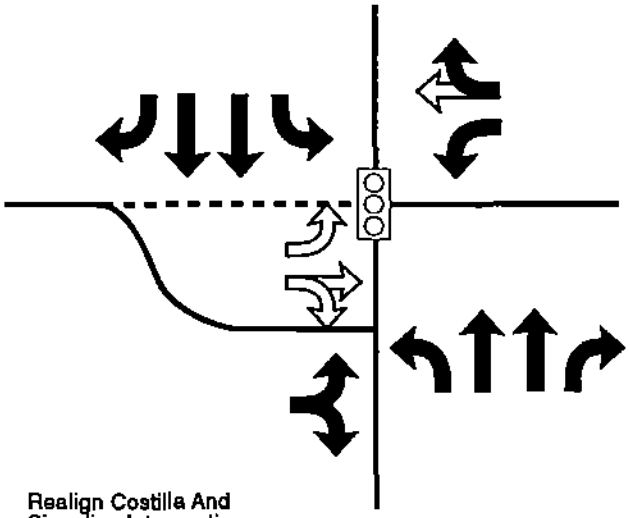
- = Existing
- = Recommended Improvements
- = Recommended for Further Evaluation
- = Recommended Traffic Signal

North

Intersection and Spot Improvement Recommendations (9-12)

Concept Sketches (Corresponding to Table 10)

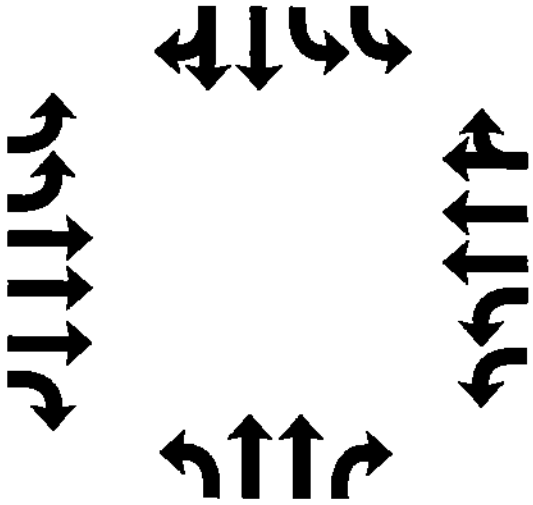
13. CLINTON / COSTILLA



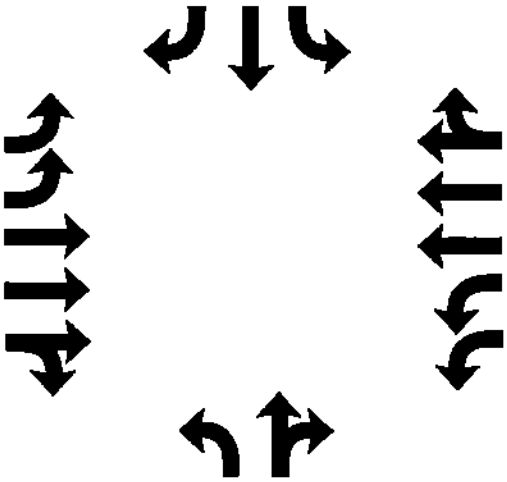
Realign Costilla And Signalize Intersection.

14. ARAPAHOE / YOSEMITE

Complete Reconstruction And Signal Upgrade.

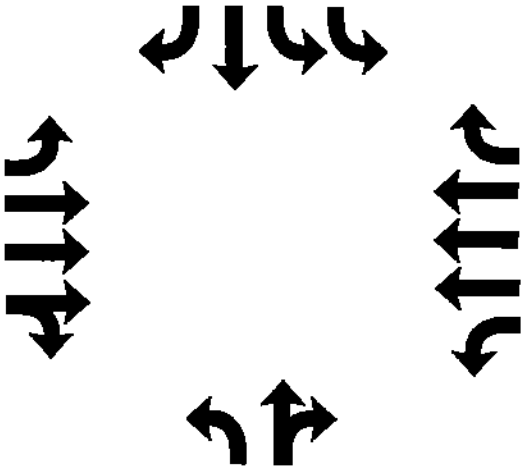


15. ARAPAHOE / DAYTON



Evaluate Improvements As Part Of Arapahoe Rd. Corridor Study.

16. ARAPAHOE / GREENWOOD PLAZA



Evaluate Improvements As Part Of Arapahoe Rd. Corridor Study.

LEGEND

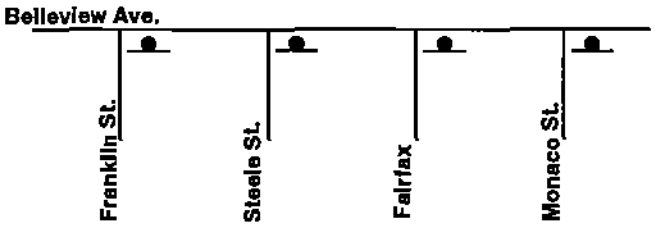
- = Existing
- = Recommended Improvements
- = New Road
- = Recommended Traffic Signal

North

Intersection and Spot Improvement Recommendations (13-16)

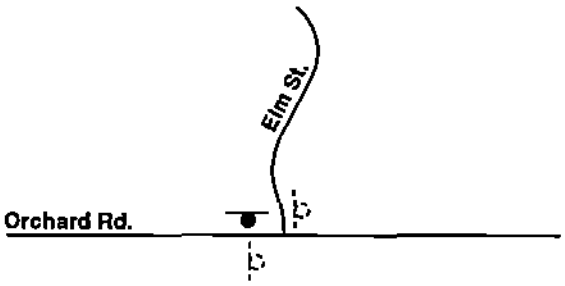
Concept Sketches (Corresponding to Table 10)

1. BELLEVIEW AT FRANKLIN, STEELE, FAIRFAX AND MONACO



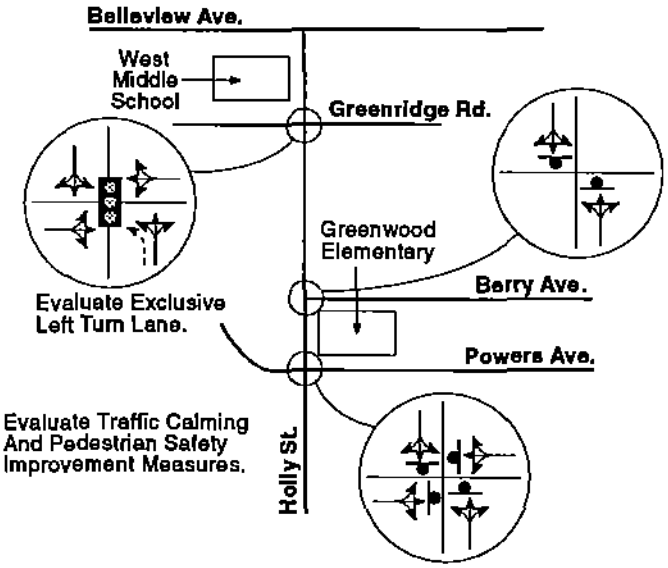
Perform Access Study For Corridor - Evaluate Potential Signalization or Geometric Improvements.

2. ORCHARD AT ELM

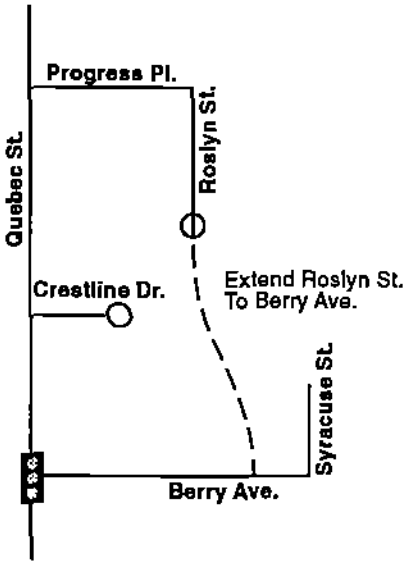


Evaluate Need For All-Way Stop Control.

3. HOLLY AT GREENWOOD ELEMENTARY AND WEST MIDDLE SCHOOL



4. QUEBEC AT PROGRESS



LEGEND

- ——— = Existing
- — — — = Recommended Improvements
- - - - - - = Recommended for Further Evaluation

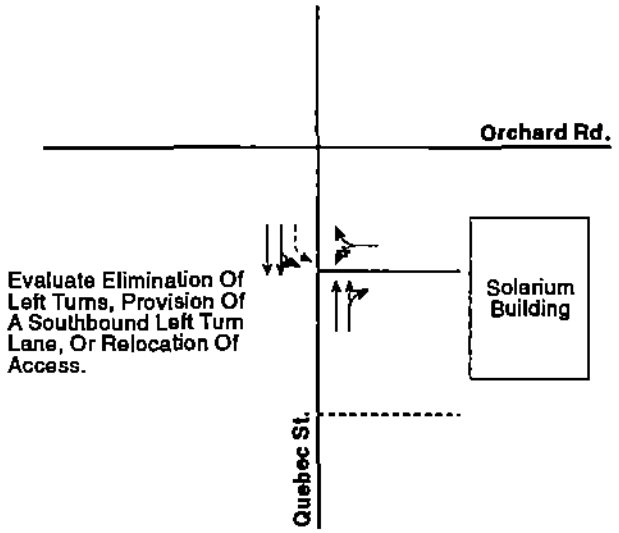
NOT TO SCALE

North

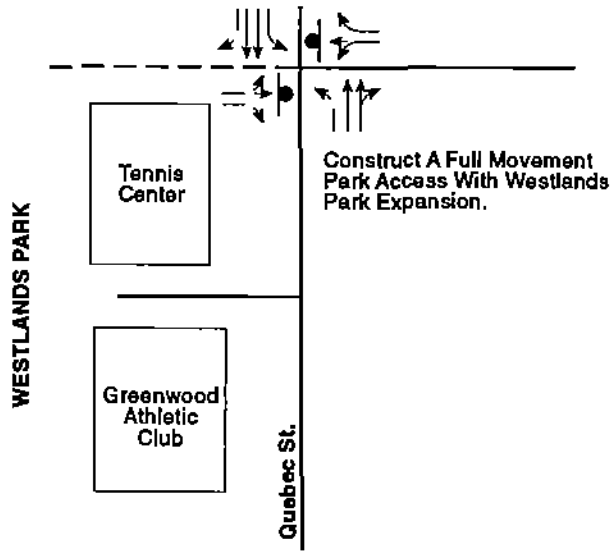
Access Enhancement Recommendations (1-4)

Concept Sketches (Corresponding to Table 12)

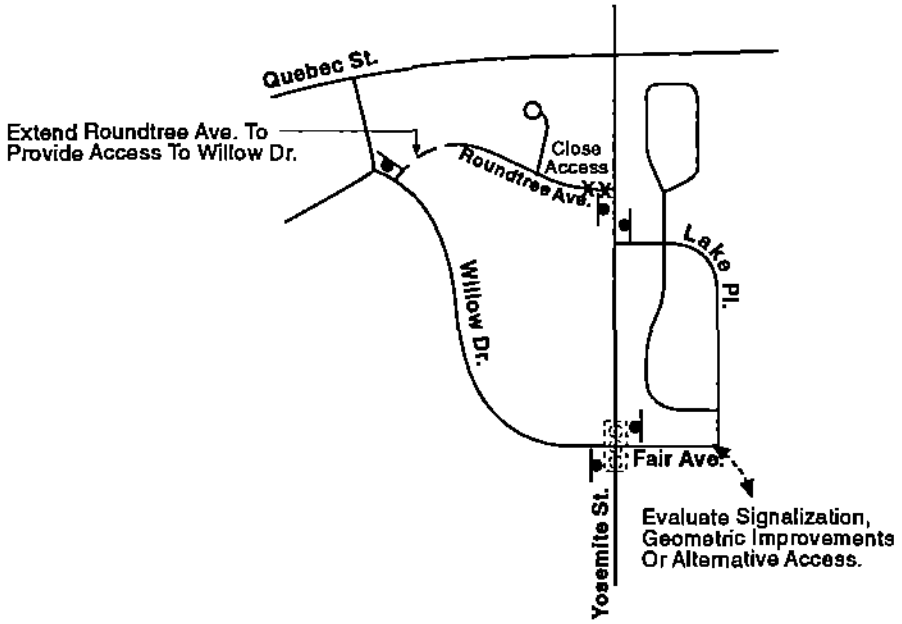
5. QUEBEC AT SOLARIUM BLDG.



6. QUEBEC AT WESTLANDS PARK



7 & 8. ROUNDTREE NEIGHBORHOOD ACCESS AND YOSEMITE AT FAIR



LEGEND

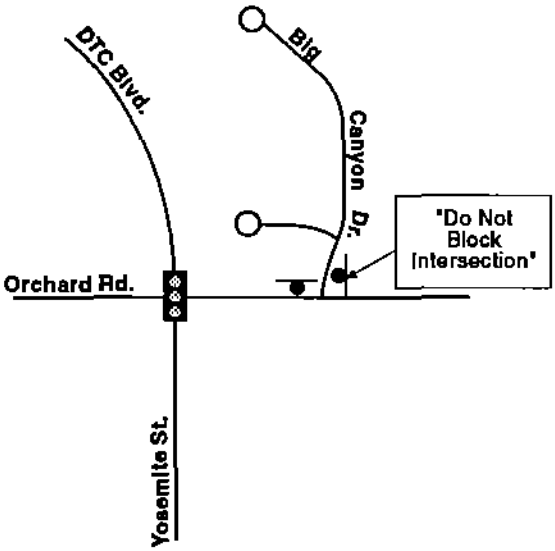
- ——— = Existing
- — — — = Recommended Improvements
- - - - - - - = Recommended for Further Evaluation

North

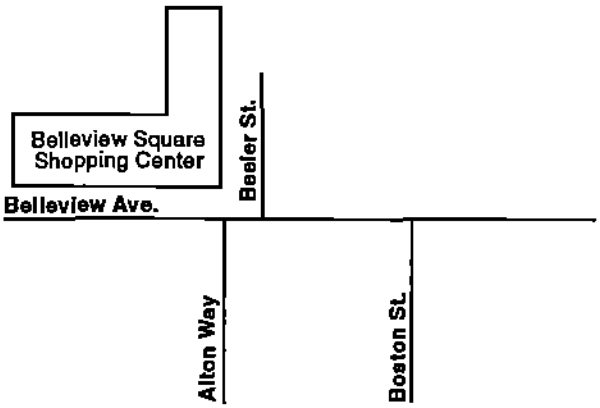
NOT TO SCALE

Access Enhancement Recommendations (5-8)
Concept Sketches (Corresponding to Table 12)

9. ORCHARD AT BIG CANYON



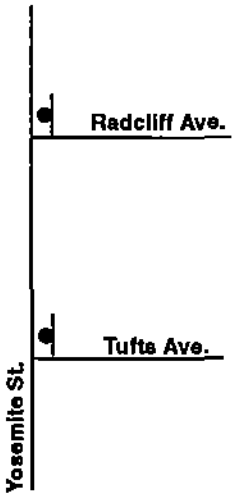
10. BELLEVIEW AT BELLEVIEW SQUARE, BOSTON AND BEELER



Evaluate Access Improvements With Design Of Left Turn Lane On Belleview.

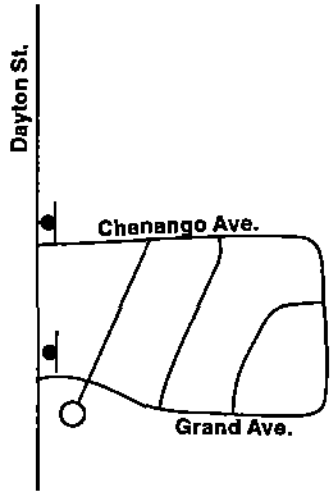
11. YOSEMITE AT RADCLIFF AND TUFTS

Monitor Operations After Implementation Of DTC Blvd./ I-225 Slip Ramps.



12. CHERRY CREEK VILLAGE ON THE LAKE

Incorporate Neighborhood Access Issues In Dayton / Union Improvement Design Process.



LEGEND

- ——— = Existing
- — — — = Recommended Improvements
- - - - - - - - = Recommended for Further Evaluation

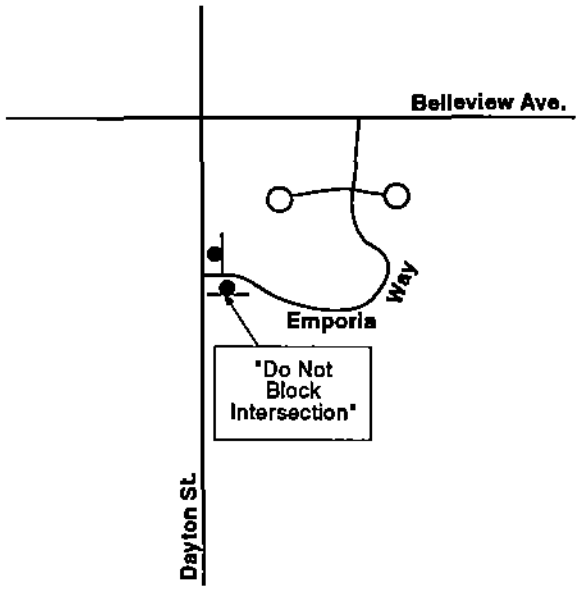
North

NOT TO SCALE

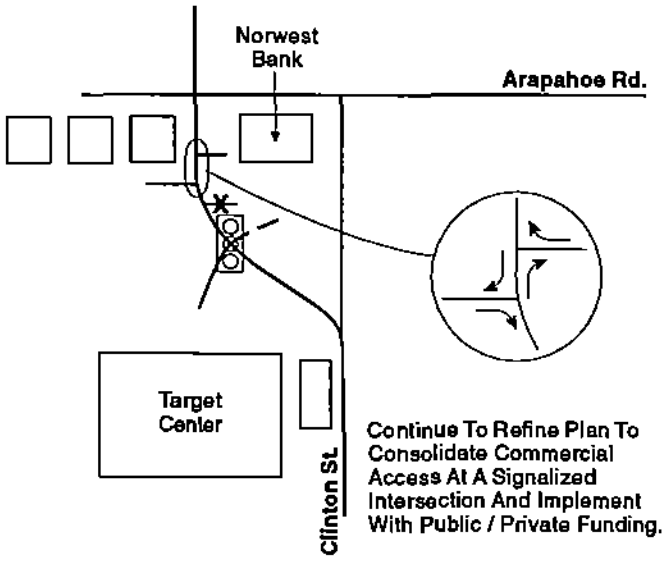
Access Enhancement Recommendations (9-12)

Concept Sketches (Corresponding to Table 12)

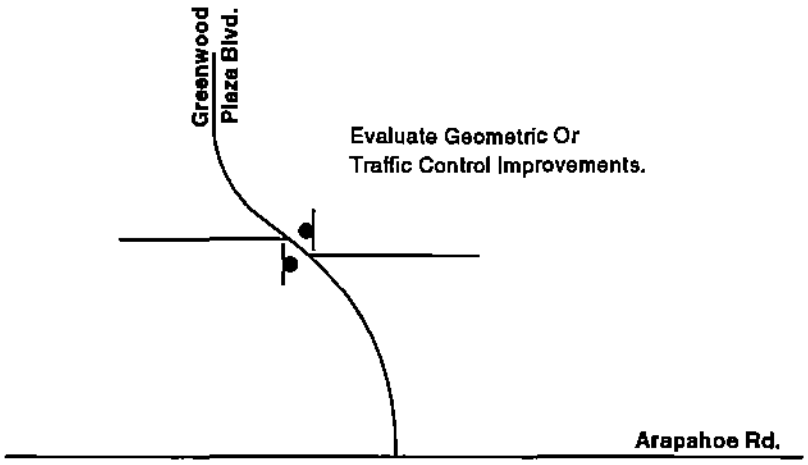
13. GREENWOOD GARDENS



14. CLINTON AT TARGET CENTER AND NORWEST BANK



15. GREENWOOD PLAZA AT COMMERCIAL ACCESS NORTH OF ARAPAHOE RD.



LEGEND

- ——— = Existing
- — — — = Recommended Improvements
- - - - - - - = Recommended for Further Evaluation

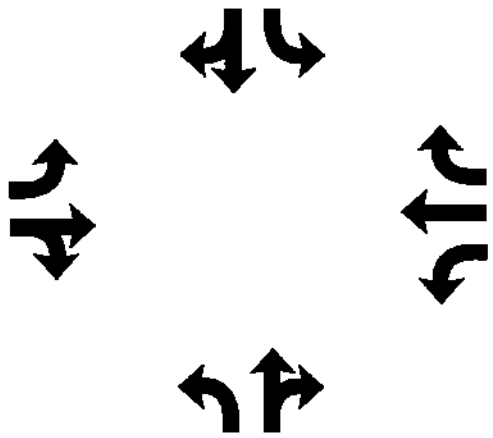
North

NOT TO SCALE

Access Enhancement Recommendations (13-15)

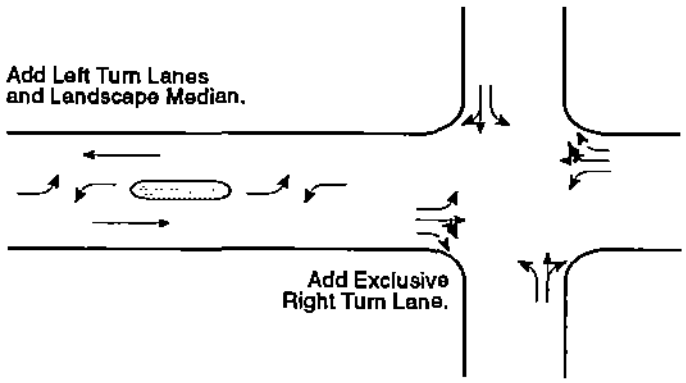
Concept Sketches (Corresponding to Table 12)

1. ORCHARD / DAYTON

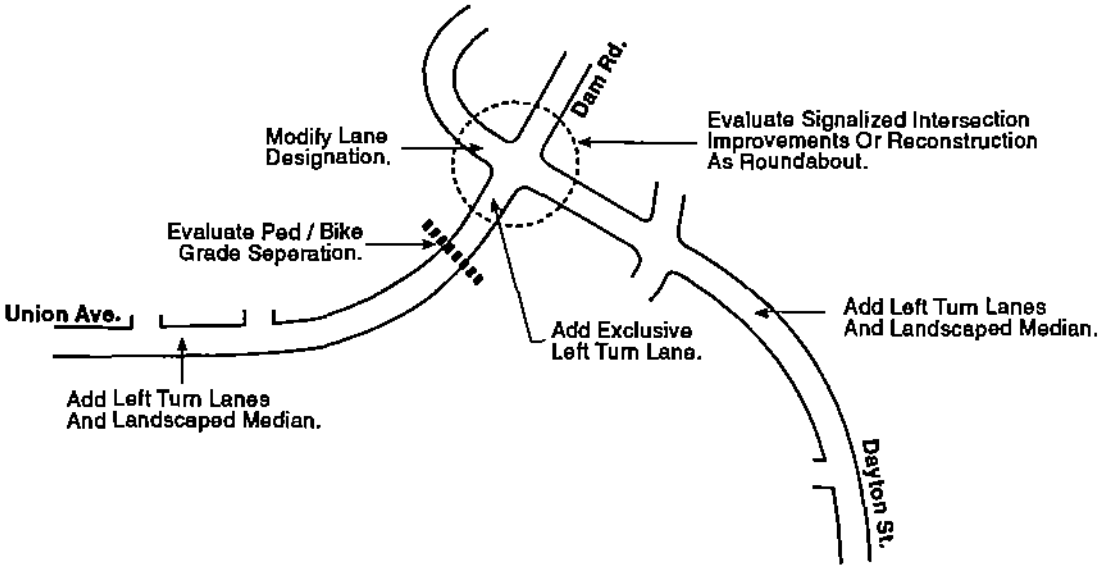


Evaluate Minor Turn Radius Improvements.

2 & 5. BELLEVIEW / DAYTON AND BELLEVIEW FROM YOSEMITE TO DAYTON



3 & 4. UNION / DAYTON / DAM ROAD AND UNION AND DAYTON ALONG CHERRY CREEK CAMPUS PERIMETER



LEGEND

- ——— = Existing
- — — — = Recommended Improvements
- - - - - - - - - = Recommended for Further Evaluation

Neighborhood-Level Streets -

Intersection and Spot Improvement Recommendations (1-5)

Concept Sketches (Corresponding to Table 13)

NOT TO SCALE

North

APPENDIX 2
LEVEL OF SERVICE DEFINITIONS

Source: 1994 Highway Capacity Manual, Transportation Research Board

The concept of levels of service uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels of service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level of service (LOS A) representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions.

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of service for signalized intersections is defined in terms of delay, which is a measure of drive discomfort and frustration, fuel consumption, and lost travel time. Specifically, level of service (LOS) criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The criteria are given in the table. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent upon a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group in question.

Level of Service Criteria for Signalized Intersections
Table A-1

Level of Service	Stopped Delay per Vehicle (Sec)
A	$\leq$ 5.0
B	> 5.0 and $\leq$ 15.0
C	> 15.0 and $\leq$ 25.0
D	> 25.0 and $\leq$ 40.0
E	> 40.0 and $\leq$ 60.0
F	> 60.0

LOS A describes operations with very low delay, up to 5 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

LOS B describes operations with delay greater than 5 and up to 15 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.

LOS C describes operations with delay greater than 15 and up to 25 sec per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with delay greater than 25 and up to 40 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with delay greater than 40 and up to 60 sec per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.

LOS F describes operations with delay in excess of 60 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with over saturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

APPENDIX 3
INTERSECTION AND OPERATIONAL IMPROVEMENT EVALUATIONS

Table A-2
Intersection and Operational Improvement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
1. Belleview/ University	AM and PM Congestion	Widen bridge to extend northbound right-turn lane	Would increase storage and marginally improve AM peak operations	Extend northbound right-turn lane when bridge is reconstructed. Conduct an interchange feasibility study
		Reconstruct as a grade-separated interchange	No at-grade solutions are available to solve congestion problems. An interchange would dramatically reduce congestion but would be costly and could have high impacts.	
2. Orchard/ University	AM LOS - E PM LOS - E	More green time for University Add a SB right turn lane	AM LOS improves to D PM LOS remains at E	Implement
3. Orchard/ Quebec	AM LOS - E PM LOS - F WB through movement has particularly long delays in PM peak #3 Accident Location Rear end and left turn lane accidents most frequent	Add a SB right turn lane Add a 2nd WB through lane to Holly Adjust signal timing Allow WB left turns on green arrow only	AM LOS improves to D PM LOS improves to C Based on new signal timing and phasing	Evaluate intersection improvements in detailed evaluation of Orchard Road between Quebec and Holly. If an additional westbound lane is not included in final recommendation, then change striping to create a right-hand lane drop.
		Add a SB right turn lane and allow right turns on red	AM LOS improves to D PM LOS improves to E Based on new signal timing and phasing	
		Modify striping to create right-hand lane drop rather than current left-hand lane drop	Lowers the number of merges to the right for WB through vehicles at Quebec.	
4. Orchard/ Greenwood Plaza	AM LOS - E PM LOS - E #7 Accident Location Rear end most frequent	Add EB right turn lane	AM LOS improves to D PM LOS remains at E	Implement EB right-turn lane. Retain current left-lane drop.
		Lane balancing of WB lanes - eliminate current lane drop by creating continuous 3rd lane to drop at Quebec	AM peak left-turn demand justifies current lane drop. Recommended reconfiguration at Orchard/Quebec would improve lane continuity.	

Table A-2 (Continued)
City-Level Streets - Intersection and Operational Improvement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
5. Belleview/Holly	Left Turn LOS	Add a left turn arrow for NB Holly	AM LOS minimal improvement PM LOS for NB left turns improves from E to D	Consider as part of Holly Traffic Calming Study
6. Orchard/Holly	AM LOS- E PM LOS - E	Add 2nd EB through lane Improve signal timing Add WB right turn lane	AM LOS improves to C PM LOS improves to D but poor LOS for EB and NB left turns	Evaluate intersection improvements or reconfiguration as part of detailed evaluation of Orchard Road between Quebec and Holly and of Holly traffic calming study
		New signal timing only	AM LOS improves to D PM LOS improves to D	
		Roundabout	Would create a transition between 4-lane arterial and 2-lane collector segments Heavy movements would probably necessitate 2-lane roundabout	
		Eliminate 2nd northbound right-turn lane, to avoid NB right-turns filling of EB Orchard capacity and reducing EB through capacity Optimize signal timing	AM NB right-turn demand is very heavy for a single turn lane	
7. Holly/West Middle School	NB left-turners block NB through lanes	Create exclusive northbound left-turn lane	Improves northbound traffic flow and safety	Coordinate with Cherry Creek Schools and consider as part of Holly Street improvement/ calming project
8. Belleview/ Quebec	AM LOS - F PM LOS - E #2 Accident location; rear end, right angle, and side swipe most frequent	NB Quebec Widening	AM LOS improves to D PM LOS improves to D Improves safety for NB movements	Implement both NB Quebec widening and EB right-turn lane
		NB Quebec Widening Add EB right turn lane	AM LOS improves to C/D PM LOS improves to C Improves safety for NB and EB movements	

Table A-2 (Continued)
City-Level Streets - Intersection and Operational Improvement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
9. DTC/Orchard	AM LOS - D PM LOS - E	2nd SB left-turn lane	Minimal improvement	Initiate detailed evaluation of DTC Blvd./Yosemite corridor improvements.
		3rd northbound and southbound through lanes	AM LOS improves to C PM LOS improves to D Difficult Right-of-Way	
10. Caley/ Yosemite	SB left turns and WB right-turns have long delay; SB LT queues spill into through lanes AM LOS - D PM LOS - D	Improvements as part of the Serpentine Road project, including 2nd SB left and 2nd WB right turn lane.	Decreases delay and improves operations AM LOS improves to C PM LOS improves to C	Implement
11. Boston/Caley	Significant delays for some movements Confusion at wide all-way stop intersection Desire to improve capacity and travel time for Serpentine movements	Signalize with basic current configuration	Solves congestion and safety problems but does not optimize Serpentine Road movements	Reconfigure and signalize.
		Reconfigure to make Serpentine Road movement between west and south legs predominant Signalize reconfigured intersection	Solves congestion and safety problems and optimizes Serpentine Road movements	
12. Boston/ Peakview	Significant delays for some movements Confusion at wide all-way stop intersection Desire to improve Peakview connection to Boston/Serpentine corridor	Signalize with basic current configuration Add a westbound right-turn lane	Solves congestion and safety problems Maintains direct north-south continuity of Boston	Implement signalization. Evaluate WB right turn lane need as part of signal design. Do not reconfigure intersection.
		Reconfigure to make the movement between west and south legs predominant Signalize reconfigured intersection	Does not maintain direct north-south continuity of Boston	

Table A-2 (Continued)
City-Level Streets - Intersection and Operational Improvement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
13. Belleview/ Yosemite	#6 Accident Location; awkward east-west lane continuity contributes Peak delays for some movements	Add a second northbound left-turn lane or add a northbound left-turn arrow	Only minor improvement; not justified by turn demand	Implement westbound left-turn arrow.
		Add a westbound left-turn arrow	Potential to improve safety for east-west traffic movements	
		Add additional through lanes on Belleview east of Yosemite to improve east-west lane continuity	Not consistent with residential character of Belleview	
14. Union / Yosemite	Difficulty making southbound left-turns during peaks	A left-turn arrow has been added	Delays have been reduced	Retain
15. Arapahoe / Clinton/Boston	Congestion PM LOS - E #1 Accident Location Through/Left Turn and Rear-end Accidents most frequent.	2nd NB through lane 2nd WB left turn lane 2nd SB left turn lane Increased NB left turn storage	PM LOS improves to C	Implement turn lane improvements and consider modification of signal timing. Do not implement Clinton one-way pair. Consider left-turn into K-Mart as part of planned Arapahoe Road corridor study.
		Same Improvements as above but Eliminate Permissive Left Turns	PM improves to LOS D	
		Convert Clinton Street and Clinton Court to a one-way pair	Required signal at Clinton Ct./Arapahoe Rd. intersection would interfere with surrounding signals Northbound movements from Clinton to Boston would require multiple turns at Arapahoe intersections	
		Provide an eastbound Arapahoe Rd. left-turn lane into K-Mart to reduce left-turn demand at Boston	Would not reduce total traffic through the Arapahoe/Boston intersection. Would require CDOT approval on the access-controlled Arapahoe Road corridor.	

Table A-2 (Continued)
City-Level Streets - Intersection and Operational Improvement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
16. Clinton/ Costilla	Difficulty entering or crossing Costilla during peak hours	Signalize intersection	Programmed to be signalized	Implement
17. Arapahoe / Yosemite	Poor pavement condition and outdated signal equipment	Reconstruct and new signal installation	Programmed to be improved	Implement
18. Arapahoe / Dayton	Number 8 accident location in GWV	Reconstruct and improve geometrics. Remove or relocate Hugh M. Woods access onto Dayton.	Would be reconstructed and modified with Arapahoe Rd. widening to 8 lanes	Consider as part of planned Arapahoe Rd. corridor study
19. Arapahoe / Greenwood Plaza	Number 9 accident location in GWV	Reconstruct and new signal installation	Pavement condition and signal equipment upgrades would match programmed Arapahoe/Yosemite project.	Consider as part of planned Arapahoe Rd. corridor study

APPENDIX 4
ACCESS ENHANCEMENT EVALUATIONS

Table A-3
Access Enhancement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
1. Belleview at Franklin, Steele, Fairfax, and Monaco	Difficulty turning onto Belleview	Center refuges	Constructing center refuges is difficult at locations with streets to the north	Evaluate in detail as part of the Belleview Access Study, budgeted for 1998 in the GWV CIP
		Signalization	New signals would requires further signal timing evaluation and CDOT and Cherry Hills coordination Uncertain if signal warrants can be met	
		Use of gaps created by other Belleview signals	Same comment as above	
		Prohibit left-turns onto Belleview and improve U-Turn capabilities	Creates out-of-direction travel	
2. Orchard at Elm and Colorado	Difficulty turning onto Orchard	All-way STOP at Elm	Traffic volumes on Orchard may be compatible with all-way STOP. Could have calming effect on this segment of Orchard if Orchard is widened east of Holly.	Perform traffic counts and consider implementation of all way STOP at Elm, particularly if Orchard is widened east of Holly
		Left-turn lane from eastbound Orchard to Elm	Would improve eastbound Orchard flow, but the Holly intersection is the primary constraint for Orchard traffic	
		Signals	Unknown whether signal warrants can be met. Existing four-way STOP at Colorado works well.	
3. Holly at Greenwood Elementary	Signal has been suggested to reduce delays at existing all-way STOPs	Signals at Powers and/or Berry	Unknown whether signal warrants can be met. Would increase capacity on Holly Street. One signal and one all-way STOP would not be compatible - both or neither intersection should be signalized.	Consider appropriate improvements as part of planned Holly traffic calming study
4. Holly at West Middle School	Delays on Holly due to the lack of a left-turn lane into the Middle School	Add a left-turn lane	Would reduce delays on Holly, improve safety for turning vehicles, and allow for a potential left-turn arrow during peak periods.	Consider as part of planned Holly traffic calming study

Table A-3 (Continued)
Access Enhancement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
5. Quebec at Progress Place	Difficulty turning onto Quebec	Extend Roslyn Street to Berry Avenue, allowing traffic to utilize the existing signal at Berry/Quebec	Would improve access to Quebec without adding a new signal and accompanying delay to Quebec; Capacity at Quebec/Berry is adequate to handle additional demand	Extension of Roslyn Street is recommended, has been approved by Council and is scheduled for construction in the year 2000.
		Signal at Progress/Quebec	Would add delay for some Quebec Street traffic	
6. Quebec at Solarium Building	Confusion and impacts on through traffic for southbound Quebec traffic wishing to turn left into Solarium Building visitor parking without a left-turn lane	Widen Quebec to allow for a separate southbound left-turn lane	Would be expensive due to right-of-way constraints and grade differentials	Evaluate alternative improvements as part of any Quebec/Orchard intersection reconstruction project
		Convert Solarium entrance to right-turn only access by signing no left-turns	Would be difficult to enforce because fire station to west prevents construction of a median barrier	
		Relocate entrance to Solarium farther south and develop a short left-turn lane	Would require reconfiguration of Solarium visitor parking lot	
7. Quebec at Greenwood Athletic Club and Westlands Park	Need to maintain adequate access with planned improvements to Westlands Park and GAC expansion	Creation of a full movement access north of the GAC to serve Westlands Park has been included in Westlands Park expansion plans	Favored solution to provide dedicated access for park users	Implement with Westlands Park expansion project
8. Roundtree Neighborhood Access	Difficulty accessing Yosemite Street from Roundtree Ave.	Close existing Yosemite access and replace with access to Willow Drive on the west	Would improve accessibility and safety since Willow traffic is considerably lighter than Yosemite	Implement
9. Yosemite at Fair	Difficulty accessing Yosemite Street	Signalize intersection	Would improve access but introduce delays for Yosemite traffic	Evaluate appropriate improvements as part of programmed CIP project
		Provide alternative access	Needs to be evaluated for potential neighborhood impacts	

Table A-3 (Continued)
Access Enhancement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
10. Orchard at Big Canon	Difficulty accessing Orchard Road	Sign and enforce "Do Not Block Intersection" regulation	Compliance would improve ability of drivers to enter Orchard when westbound traffic is queued from Yosemite/DTC Blvd. during AM peaks	Implement
11. Dayton, Orchard to Belleview	Difficulty accessing Dayton, particularly when Cherry Creek School is in session; Congestion on Dayton caused by vehicles waiting to turn from Dayton	All-way STOPs	All-way STOPs at certain intersections would create steadier flow on Dayton and make access from other streets more difficult. Few, if any, intersecting streets have enough traffic to warrant all-way STOPs.	Do not implement. Undesirable consequences would outweigh benefits.
		Add a center left-turn lane	Adjacent properties, trail, and sidewalks constrain right-of-way	
12. Belleview at Belleview Square, Boston, Beeler	Difficulty accessing Belleview; Congestion on Belleview caused by vehicles waiting to turn from Belleview	Add a center left-turn lane. Install intermittent median and modify existing median. Evaluate other potential access and intersection modifications.	Would reduce congestion and improve access.	Conduct detailed design on Belleview and implement selected design.
13. Yosemite at Radcliff and Tufts	Difficulty accessing Yosemite Street	Signal at Radcliff	Unlikely that signal warrants can be met Signal would introduce delays on Yosemite Current striping of center refuge for vehicles turning left onto Yosemite appears to be effective	Monitor Yosemite operations after implementation of DTC Blvd. slip ramps; Evaluate relocation of access opposite Tufts if still needed
		Signal at Tufts	Unlikely that signal warrants can be met Signal would introduce delays on Yosemite	
		Relocate residential access across from Tufts to the south to allow similar striping as Radcliff	Would improve ability to turn out onto Yosemite from either side	

Table A-3 (Continued)
Access Enhancement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
14. Cherry Creek Village on the Lake	Difficulty accessing Dayton	Signal at Chenango Place	Uncertain if signal warrants can be met Signal would introduce delay and stops/starts for Dayton traffic	Monitor operations when planned improvements to Dayton are implemented
15. Greenwood Gardens	Difficulty accessing Dayton and Belleview	Sign and enforce "Do Not Block Intersection" regulation on Dayton at Emporia Way	Compliance would improve ability of drivers to enter Dayton when northbound traffic is queued from Belleview	Implement
16. Clinton at Target, Norwest and Costilla	Difficulty exiting onto Clinton during noon and PM peaks	Costilla is programmed for signalization Create a full movement signalized access for the Target Center and Norwest Bank.	Would improve intersection LOS, safety, and reduce conflicts with the Arapahoe/Clinton intersection	Implement; Need to finalize decision on best location for signal
17. Greenwood Plaza at Commercial Access to the North	Poor sight distances and difficulty entering and crossing Greenwood Plaza Blvd.	4-way STOP and/or improve sight distances.	Traffic counts not available, but conditions appear to be compatible.	Collect traffic counts and evaluate further.

APPENDIX 5
NEIGHBORHOOD LEVEL STREETS
INTERSECTION AND SPOT IMPROVEMENT EVALUATIONS

Table A-4
Neighborhood-Level Streets - Intersection and Spot Improvement Evaluations

Number/Location	Problem	Improvement Alternatives	Evaluation/Results	Preliminary Recommendation
1. Orchard/ Dayton	AM LOS - F PM LOS - E	EB and SB right turn lanes	AM LOS improves to D PM LOS improves to C Difficult right-of-way	Explore R.O.W. issues further
		Improve turn radii	Improves operations for some vehicles	Implement
		Possible traffic circle	Potential traffic calming measure	Consider as part of Orchard Road traffic calming design
2. Belleview/ Dayton	AM LOS F PM LOS E	Mediation agreement - EB and WB right turn lanes	AM LOS improves to D PM LOS remains at E with reduced delays	Implement
		EB left turn arrow	No impact on intersection LOS. Helps create gaps in westbound traffic during peaks.	Implement
		Lengthen SB left turn lane	Would better contain queued vehicles	Implement
3. Union/ Dayton/ Dam Road	Poor LOS AM and PM peak hours	Candidate for roundabout per Mediation agreement	Traffic and physical conditions appear to be compatible with roundabout	Initiate feasibility study for roundabout or other improvements
		Signalized intersection improvements, including an additional lane on Union approach and designation of an exclusive right turn lane from Village Greens Park	Would improve LOS, particularly with Village Greens Park expansion.	
4. Union and Dayton Along Cherry Creek Campus Perimeter	Conflicts between turning and through vehicles	Add center left-turn lanes and modify access control	Would reduce conflicts and decrease delays for through vehicles	Implement
5. Belleview from Yosemite to Dayton	Conflicts between turning and through vehicles	Add a center left-turn lane and modify access control	Would reduce conflicts and decrease delays for through vehicles	Implement

ADDENDA