

5.0 ACCESS CONTROL PLAN - SH 14 (MULBERRY STREET)

5.1 Existing Conditions

5.1.1 Roadway Physical Characteristics

Typical Section

The existing typical cross-section for SH 14, hereafter referred to by its local street designation, Mulberry Street, is shown on Figure 5-1 and includes four travel lanes on the state highway mainline, two travel lanes on each frontage road, with depressed median between opposing directions of the state highway and between the highway and each frontage road. The dimensions are relatively constant throughout the corridor, with the most common dimensions being:

- Highway Travel lanes: 24 feet
- Frontage Road Travel Lanes: 24 feet - 28 feet
- Highway Shoulders: 10 feet outside, 4 feet inside
- Medians: Highway - 20 feet, Highway/Frontage Rd. - 26 feet - 36 feet
- Right-of-Way: 250 feet - approximately 420 feet

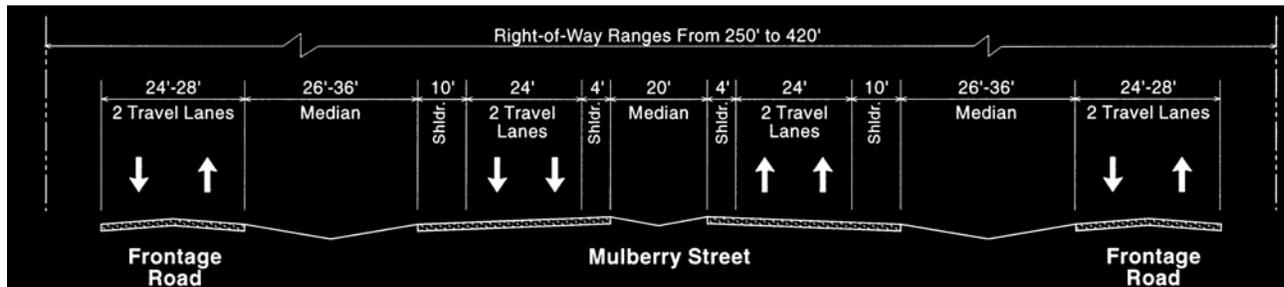


Figure 5-1
Existing Typical Mulberry Street Cross-Section

Left and right turn acceleration and deceleration lanes are provided at all of the intersections along the highway. On the frontage roads, auxiliary lanes are not provided.

Functional Classification

Roadway segments are classified as a certain type of highway based on the function that the roadway provides. Certain roadways are meant to provide for travel through an area and, therefore, mobility is the primary purpose. The primary purpose of some roadways, however, is to provide access to individual properties. Following is a description of the typical roadway functional classifications found in most communities:

Arterial roadways primarily provide mobility between two points. They can be two to six lanes wide, typically carrying significant traffic volumes at higher speeds and for longer distances. Access to abutting properties is a secondary function. An arterial functional classification is also typically divided into two sub-categories, major and minor arterials. As these classifications infer, roadway, laneage and right-of-way requirements and traffic volumes are typically greater for the major arterial classification.

A **Collector** roadway serves both access and mobility functions. A collector street can be either two or four lanes wide with speeds and traffic volumes less than an arterial street but greater than a local street. Major and minor collectors also differ in the laneage and right-of-way requirements, and traffic volume levels as their classifications imply.

Local roadways serve primarily as a means of access to adjacent land uses, whether residential, business or community facilities. They are typically low speed, two or three lanes wide (with a center left turn lane) and carry relatively low traffic volumes.

The City of Fort Collins has classified Mulberry Street as a Major Arterial Street. The cross-section features of the City's Major Arterial include:

- 3 - 12 foot travel lanes in each direction
- 1 - 8 foot bike lane in each direction
- A 19 foot median (7 foot median with a 12 foot left turn lane at major intersections)
- A seven foot sidewalk and 10 foot parkway on both sides
- 141 feet of right-of-way (minimum)

The physical and operating characteristics of Mulberry Street dictate that the Major Arterial cross-section may never be provided. Since frontage roads exist along almost the entire corridor, it is not likely that bike lanes and sidewalk would be provided along the highway. It may be more appropriate to add these elements to the adjacent frontage roads. A parkway buffer area could be provided between the highway and frontage roads, thereby visually dividing the two roadway types.

The Transportation Commission of Colorado classifies Mulberry Street as Principal Arterials. This roadway has also been designed by the Transportation Commission and the Federal Highway Administration as part of the National Highway System.

Access Code Category

In August of 1998, the Colorado Department of Transportation adopted a revised State Highway Access Code (the Code). The revised Code reevaluated the number of access categories and their respective naming convention, and established new guidelines for access along state highways. The revised access categories are defined in Table 5-1. The purpose of the Code is to “provide procedures and standards to aid in the management of the highway system” and to “protect the public health, safety and welfare, to maintain smooth traffic flow, ... and to protect the functional level of state highways while considering state, regional and local transportation needs and interests.”

**Table 5-1
Access Categories**

F-W Interstate System, Freeway Facilities	
E-X Expressway, Major Bypass	
Rural	Non-Rural
R-A Regional Highway	NR-A Regional Highway
R-B Rural Highway	NR-B Arterial
	NR-C Arterial
F-R Frontage Roads (both urban and rural)	

Mulberry Street and the frontage road system have been assigned two separate access categories. Between Riverside Avenue and Link Lane, the access category for the highway mainline is NR-B (Non-Rural Arterial), while between Link Lane and I-25, the access category for the highway mainline is EX (Expressway). The frontage road category is NR-B. Some of the access category standards include:

NR-B, Non-Rural Arterial

Access Granting Criteria: “...one access shall be granted per parcel, if it does not create safety or operational problems. The access will provide, as a minimum, for right turns only. The access may have left turns in (¾ movement) if the addition of left turns will improve operation at an adjacent full-movement intersection and meet appropriate design standards, unless significant operational or safety problems occur.”

Desirable Signal Spacing: One-half mile with good signal progression of 30% efficiency or better, or existing signal progression is not degraded.

Restricted Movements: “Additional right-turn-only access shall be allowed where required auxiliary lanes can be provided.”

EX, Expressway

Access Granting Criteria: “No private property access may be permitted unless reasonable access cannot be obtained from the general street system. When necessary to permit such access, the access shall be allowed and limited to right turns only.

Intersection Spacing: “Typical spacing of intersecting streets...shall be planned on intervals of one mile.... One-half mile spacing of public ways may be permitted to the highway only when no reasonable alternative access to the general street system exists.”

The goal of the Access Control Plan is to provide adequate and reasonable access for all properties; however, adequate spacing of access points should be introduced to relieve congestion and reduce the number of conflict points along the corridor.

Posted Speeds

Mulberry Street has two or three speed limit regulations depending upon the direction of travel. In the westbound direction, the posted speed limit is 45 mph between I-25 and Summit View Drive, and between Airpark Drive and Lemay Avenue; 50 mph between Summit View Drive and Airpark Drive; and 35 mph between Lemay and Riverside Avenues. In the eastbound direction, the posted speed limit is 45 mph between Riverside Avenue and Link Lane, and between Timberline Road and I-25; between Link Lane and Timberline Road, the speed limit is 50 MPH. The speed limit along the frontage roads is 35 MPH.

5.2 Inventory of Access Points

Access to Mulberry Street occurs only at full-movement public road intersections except for four cases. Two private accesses are available to the Mulberry Water Reclamation Facility, one about 200 feet east of Riverside Avenue and one about 900 feet east of Riverside Avenue. Both of these access points are along the north side of Mulberry Street. Two field accesses exist approximately 200 and 875 feet, respectively, east of Riverside Avenue along the south side of Mulberry Street. Some of the access points are signalized, while other full-movement access points have only stop sign control.

Access along the frontage road system is available at any point. The frontage road system, however, does not extend continuously along the length of Mulberry Street, i.e., frontage roads end at some intersecting street locations. Frontage road intersections at the public road intersections with the state highway mainline are very closely spaced and in most cases only about 30-50' from the highway through travel lanes. Following is a description of the access points with the highway:

- Public Road Signalized Intersection (PRS) - Public road signalized intersections are at-grade, full movement public road intersections with a traffic signal. All signalized intersections have left and right turn acceleration and deceleration lanes. The PRS accesses along Mulberry Street, west to east, are:
 - Riverside Avenue
 - Lemay Avenue
 - Link Lane
 - Timberline Road
 - Summit View Drive

- Public Road Unsignalized Intersection (PRU) - This type of highway access is a full movement or $\frac{3}{4}$ movement, at-grade, stop-controlled intersection. Unsignalized public roads along the corridor include only County streets. The PRU accesses along Mulberry Street, west to east, are:
 - Proposed 12th Street location (both sides of the highway)
 - Airpark Drive
 - Approximately 375 feet east of Airpark Drive (north side of the highway)
 - Midway between Airpark Drive and Timberline Road (south side of the highway)
 - Dawn Avenue (south side of the highway)
 - Greenfields Court (signalized Spring of 2000)
 - I-25 frontage road ($\frac{3}{4}$ movement only)

- Driveway Access (DA) - Four driveway access points exist along the state highway mainline:
 - Two accesses approximately 200 feet (full movements) and 900 feet (RIRO), respectively, east of Riverside Avenue at the Mulberry Water Reclamation Facility on the north side of Mulberry Street.
 - Two accesses approximately 200 and 875 feet east of Riverside Avenue (field access).

Driveway access exists along almost the entire length of the frontage road system. Driveways are defined with curb and gutter, or are undefined and access can occur along the entire frontage of a parcel. There are 129 private access points along the frontage road system.

Based on the above classifications of access points, accesses along the corridor are approximately distributed as follows:

- 5 public road intersections with signals (3.5%)
- 7 unsignalized public road intersections (5.0%)
- 129 driveway accesses (91.5%)

A detailed listing of each access point along Mulberry Street and the frontage road system between Riverside Avenue and I-25 is included in Appendix C.

5.3 Existing Traffic Conditions

Traffic Volumes

State highway mainline traffic volume data, including vehicle turning movements and Average Daily Traffic (ADT) was provided by the City of Fort Collins between Riverside Avenue and Timberline Road. Traffic volumes between Timberline Road and I-25 are from the I-25/SH 14 Interchange Area Study. The traffic volumes along both segments of Mulberry Street are from 1997 to 1999. Figures 5-2 and 5-3 illustrate the ADT and AM and PM peak hour turning movement volumes along the corridor.

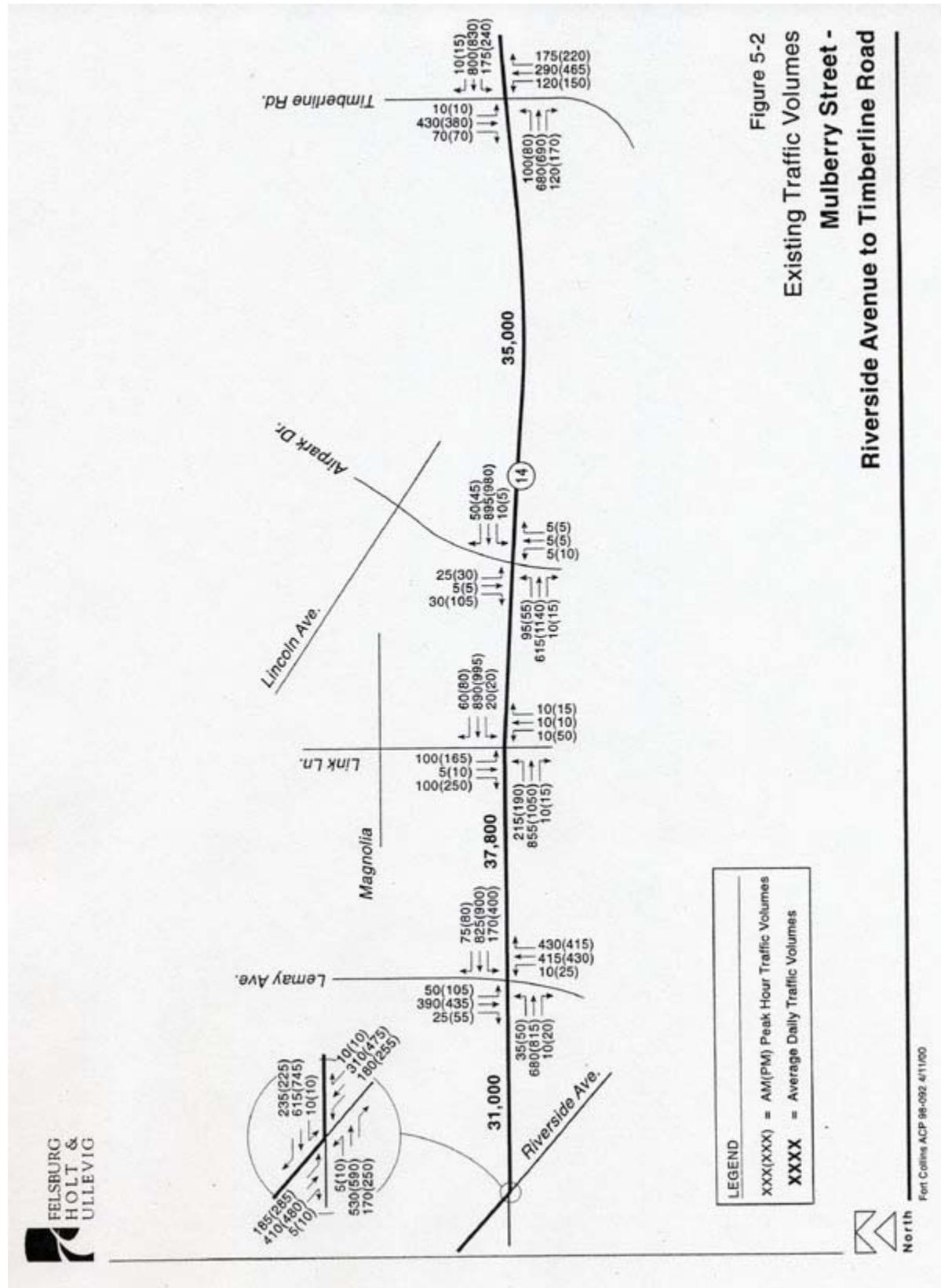
As can be seen on these figures, ADT volumes range from about 28,000 to 38,000 vehicles with the largest volume of daily traffic being between Lemay Avenue and Link Lane. Through and turning movements at the existing signalized intersections vary in level from intersection to intersection and between peak hours. Through volume along Mulberry Street ranges from about 500 vehicles per hour (vph) to approximately 1,200 vph and varies between intersections. Left and right turn movements vary considerably with several turning movements over 200 vph. The largest left turn movement is the westbound left turn at Lemay Avenue where 400 left turns were recorded in the PM peak hour.

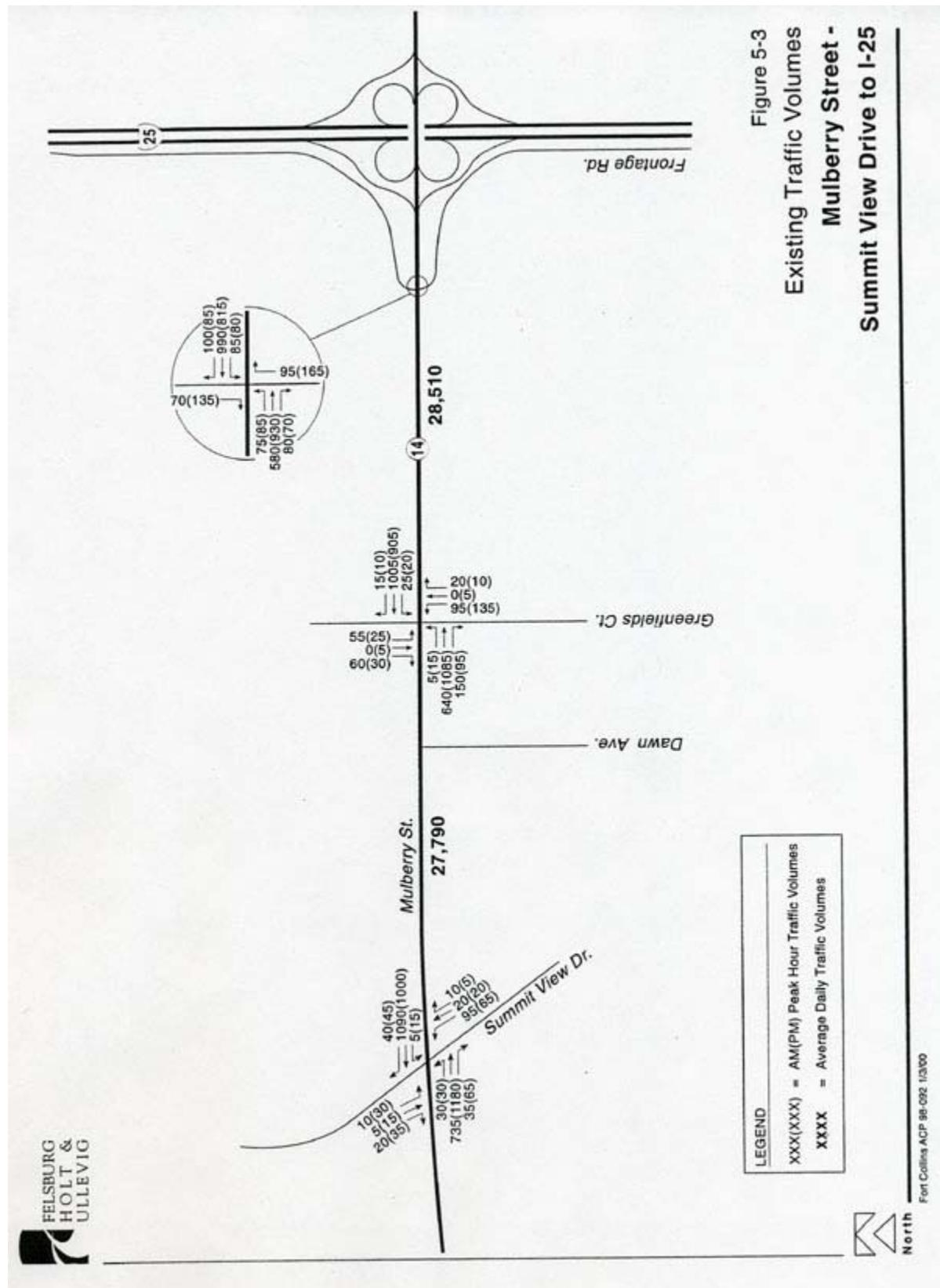
Operational Conditions

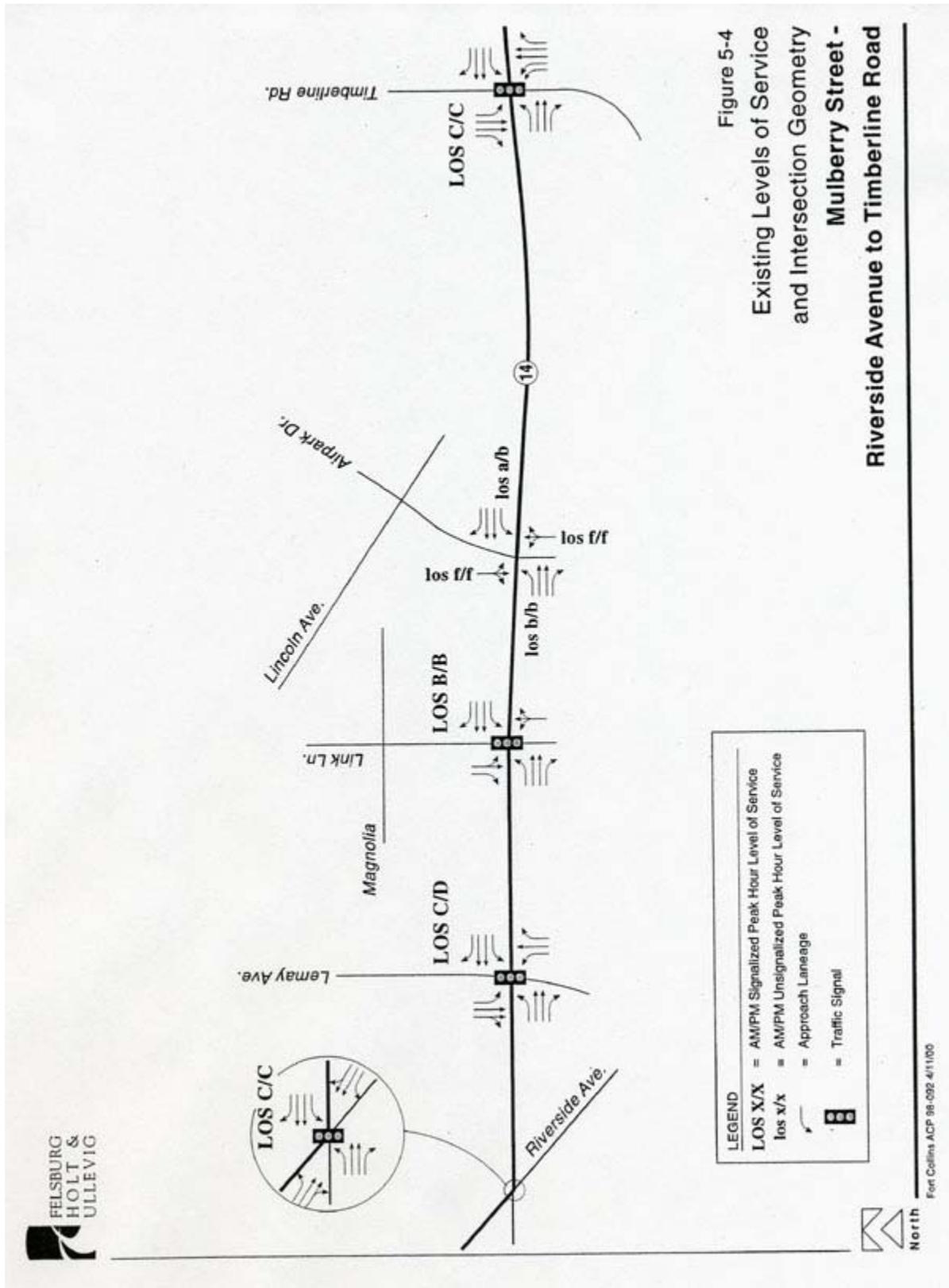
The detailed traffic analyses for this corridor is included in both the US 287/SH 14 Access Management Plan Traffic Analysis Technical Report by Balloffet & Associates, Inc. and the I-25/SH 14 Interchange Area Study by Felsburg Holt & Ullevig. The AM and PM peak hour turning movement volumes were used to estimate the traffic flow characteristics of each signalized intersection. Analysis methods documented in the 1994 Highway Capacity Manual (TRB Special Report No. 209), updated 1997, were used to establish a Level of Service (LOS) for each signalized intersection, a qualitative assessment of the traffic flow characteristics described by a letter designation ranging from LOS A (essentially uninterrupted flow) to LOS F (a breakdown of traffic flow with excessive congestion and delay). LOS D or better is generally considered to be acceptable for peak period conditions in urban areas and is used by the City of Fort Collins as a guidepost for evaluating the operation of an intersection (City of Fort Collins Multimodal Level of Service Manual). LOS D is also the accepted guidepost for Larimer County and the CDOT.

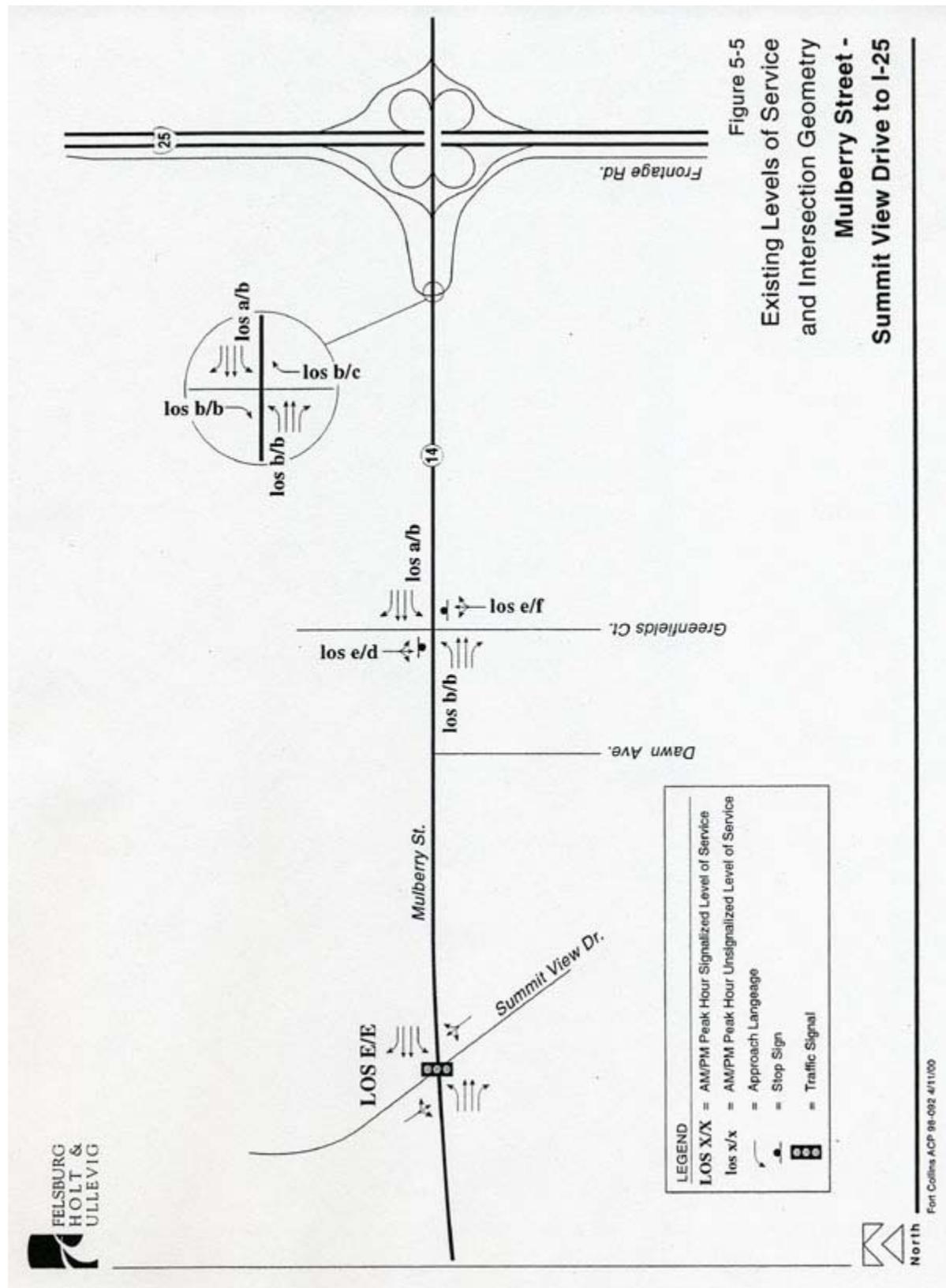
At stop-controlled intersections, LOS F results when more than 50 seconds of average stopped delay occurs. Due to the level of through traffic on Mulberry Street, it is not uncommon for left turn and through movements from the stop-controlled approach to operate at LOS F even if left turn and through movements are low and do not meet MUTCD criteria for signalization.

Existing lane geometry and signal timing information was used to estimate peak hour LOS for each signalized and unsignalized public street intersection. The results of the analyses are shown on Figures 5-4 and 5-5, and include the existing intersection geometry.









Capacity analyses indicate that each of the signalized intersections currently operate at LOS D or better during either peak hour except the Summit View Drive intersection which operates at LOS E during both peak hours. Unsignalized intersection analyses at the Mulberry Street/Greenfields Court and Mulberry Street/Frontage Road intersections found that critical turning movements operate with a wide range of levels of service. Of particular note, outbound movements from Greenfields Court operate from LOS D to LOS F during the AM and PM peak hours.

Vehicle Classification

The CDOT publication, 1996 Traffic Volume Report, was examined to identify the level of single unit (RV’s, delivery trucks) and semi-truck volume along the corridor. These data was broken into four segments and the average percent of each of these vehicle types is:

- Single Unit = 2.7%
- Semi-Truck = 4.0%

These data indicate that the percentage of semi-truck vehicles is slightly greater than single unit trucks.

Accidents

Accident data between January of 1996 and July of 1998 was compiled from three sources, the City of Fort Collins, the CDOT and the Colorado State Patrol (CSP). This 2½ year period represented the period where consistent data was available from all three sources. During this period, 167 accidents were reported along Mulberry Street. Of the reported accidents, 39 (23.4%) had at least one injury, there was 1 (0.6 percent) fatality, and the remaining 127 accidents (76.0 percent) had property damage only. See Figure 5-6.

Table 5-2 presents a summary of accident types along Mulberry Street during this period. The predominant types of accidents were rear-end (43.7%) and 90 angle (38.3%) collisions. Other common accident types were with fixed objects (6.6%) and side-swipes (4.8%). Accidents with pedestrians accounted for two (1.2%) of the total number of accidents. Diagrams of the accident history of the corridor can be found in Appendix G.

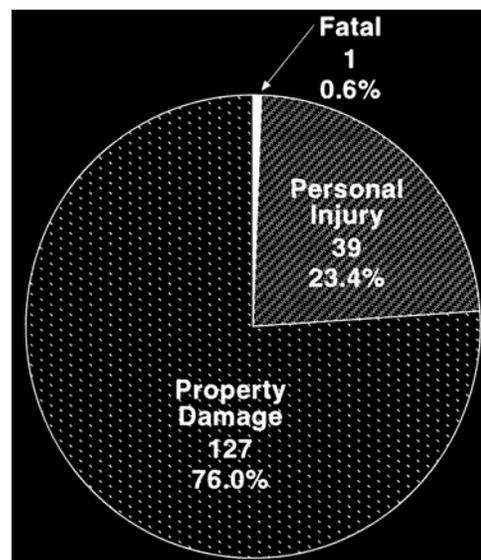


Figure 5-6
Corridor Accidents by Severity
 (January 1996 to July 1998)

Table 5-2
Corridor Accidents by Type (1/96 - 7/98)

Accident Type	Number of Accidents	Percentage
Rear-End	73	43.7%
90 Angle	64	38.3%
Fixed Object	11	6.6%
Side-Swipe	8	4.8%
Pedestrian	2	1.2%
Other	9	5.4%
Total	167	100.0%

The accident data also indicated that approximately 82 percent of all corridor accidents between January 1996 and July 1998 were access related.

The accident frequency along Mulberry Street was compared to the average accident rates for all state highways of the same highway classification. Mulberry Street is classified as a Federal-Aid Primary (Urban) highway. Mulberry Street is divided into five analysis sections: 1) Riverside Avenue to Lemay Avenue, 2) Lemay Avenue to Link Lane, 3) Link Lane to Airpark Drive, 4) Airpark Drive to Summit View Drive and 5) Summit View Drive to I-25. These data were examined for a ten year period and it was found that in each of these segments, accidents occur at less than the statewide average and in some segments, the accidents occur at a considerably lower rate. For example, in the section between Link Lane and Airpark Drive, accidents occur at only about $\frac{1}{3}$ the statewide average. Table 5-3 documents the average accident rates for Mulberry Street versus the statewide average.

Although the accident rates along these roadway segments are less than the statewide average, and less than the average segment rates for the other corridors documented in the Access Management Report, it would still be beneficial to implement access management principles along this corridor to improve pedestrian, bicyclist and motorist safety. Some of the reasoning to apply these techniques include:

- It is estimated that the accident rates are lower along Mulberry Street than the statewide average due to greater access spacing and a relatively lower number of access points, thereby suggesting that these basic access management principles will reduce accident potential.
- Accidents are concentrated more at intersections than between them, thereby supporting the need to provide the safest intersection operation as possible.

- The percentage of injury accidents along the corridor (23.4%) is almost twice the rate as along the North College Avenue (12.3%) or Jefferson Street/Riverside Avenue (11.8%) corridors. This may be a result of higher speeds along Mulberry Street, further supporting providing safe intersections.
- The close spacing of the frontage road intersections to the state highway mainline intersections results in skewed angle movements to/from these intersections and limited motorist sight distance. In addition, the number of accesses and their relative spacing to the public street/frontage road intersections increases vehicle interaction and the potential for vehicle conflicts. For example, the Link Lane/North Side Frontage Road intersection had a total of nine reported accidents (two of which were injury accidents - 22.2%) in the 2-1/2 year period, a location where several access points exist near the public street intersection.
- Numerous residents, employees and business owners have stated at public open houses that “near misses” occur frequently, a statistic that is not quantified in the recorded data. The project team has also observed “near misses” at numerous locations along the corridor.

**Table 5-3
Accident Rate¹ Comparison - Mulberry Street versus Statewide Average**

Year	Total Number of Accidents- Statewide	Statewide Accident Rate	Mulberry Street Accident Rate				
			Riverside to Lemay	Lemay to Link	Link to Airpark	Airpark to Summit View	Summit View to I-25
1997	16,337	3.16	1.29	1.25	0.43	1.20	1.44
1996	16,024	3.17	1.77	1.09	0.14	2.85	1.09
1993	13,871	3.09	1.49	1.12	0.47	2.19	1.79
1992	12,966	3.00	2.16	1.05	0.48	1.28	0.92
1991	11,950	3.04	1.04	1.40	0.00	1.15	0.54
1990	12,009	3.17	3.08	0.89	0.16	1.44	0.70
1989	12,301	3.46	1.67	1.14	0.33	1.64	2.52
1988	13,862	4.03	2.66	1.16	0.17	2.51	1.13
1987	14,293	4.16	1.63	1.49	0.12	2.07	1.21
1986	14,910	4.41	0.76	0.49	0.37	1.88	1.07
Average Accident Rates		3.47	1.76	1.11	0.27	1.82	1.24
¹ The accident rate is calculated by dividing the number of accidents by the vehicle miles of travel occurring along a particular highway section. The rate represents the average anticipated number of accidents per million miles of vehicle travel.							

5.4 Projected Conditions

Development Plan Recognition

The recommendations of the Access Control Plan were influenced by known development that is likely to occur in the immediate future. These plans could include the re-development of a parcel to a different land use or simply making improvements to a property frontage. The City and County are aware of the more immediate development plans and the recommendations of the Access Control Plan reflect that knowledge.

Proposed Mulberry Street Typical Section

The City of Fort Collins has designated Mulberry Street as a Major Arterial Street in their Master Street Plan. The Major Arterial Street section consists of six through lanes (three for each direction), a center median, bike lanes, sidewalk, and a 10' parkway buffer. It is unlikely, however, that this section will be strictly implemented due to the frontage road system along the state highway. The character of the corridor will likely remain; however, improvement such as creating a six-lane highway section, adding sidewalks and bike lanes to the frontage roads, or creating a landscaped buffer area between the frontage roads and the highway could occur. Additional width may be required for Mulberry Street and the frontage roads to accommodate necessary turn lanes. The proposed section for Mulberry Street is represented on Figure 5-7.

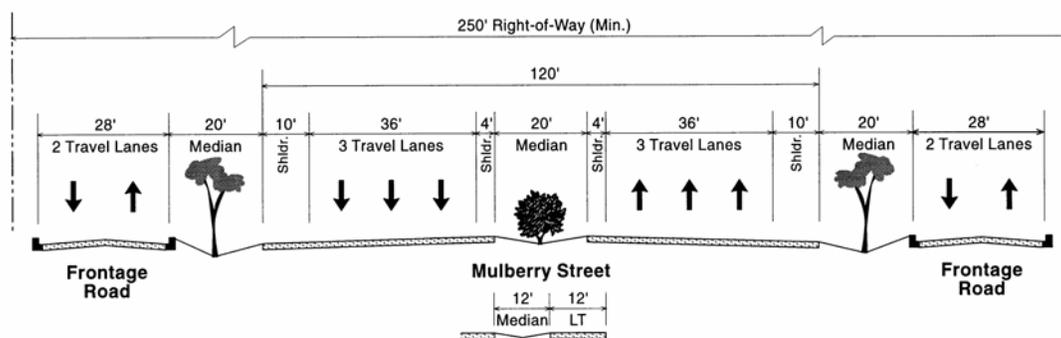
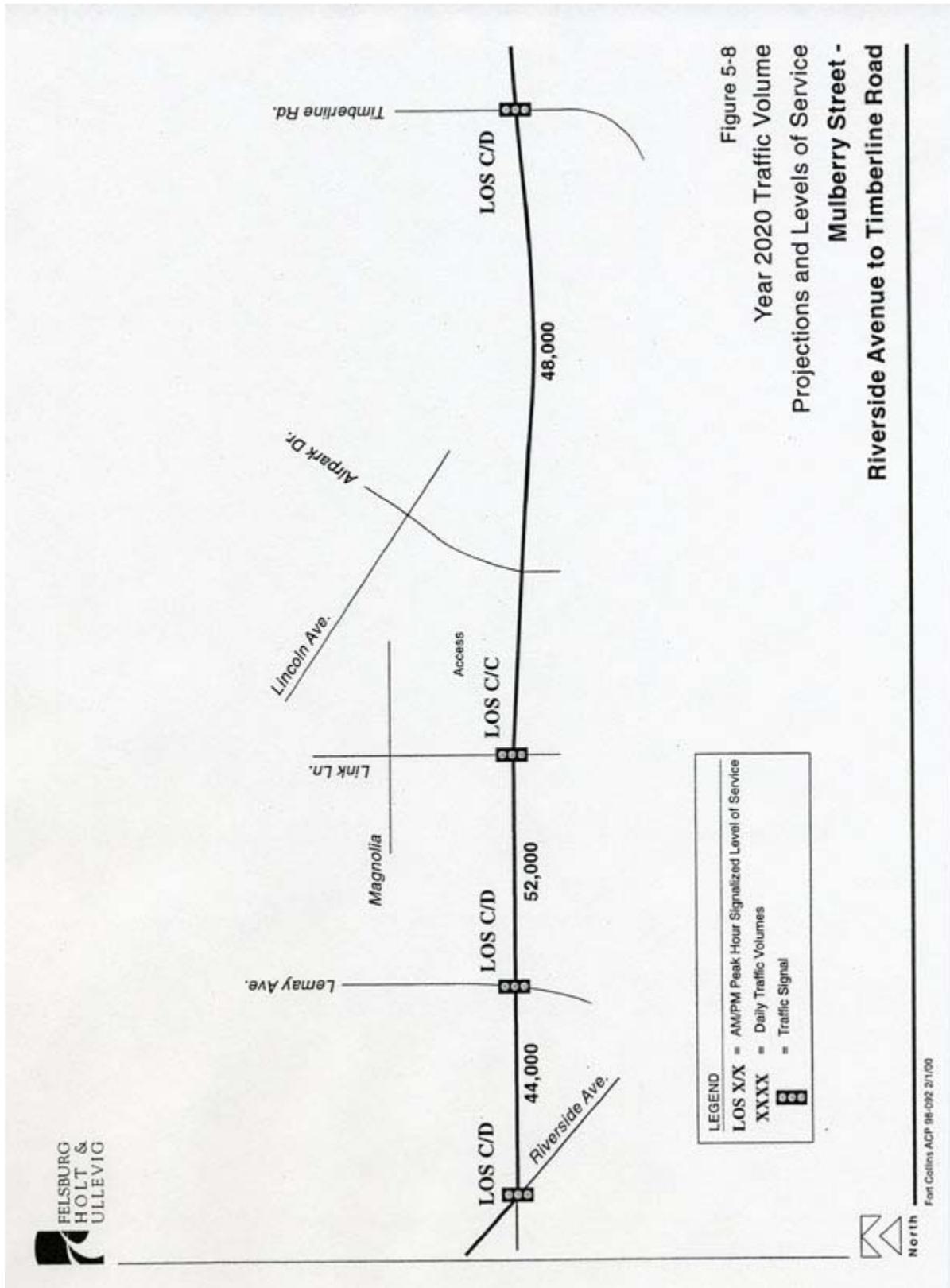


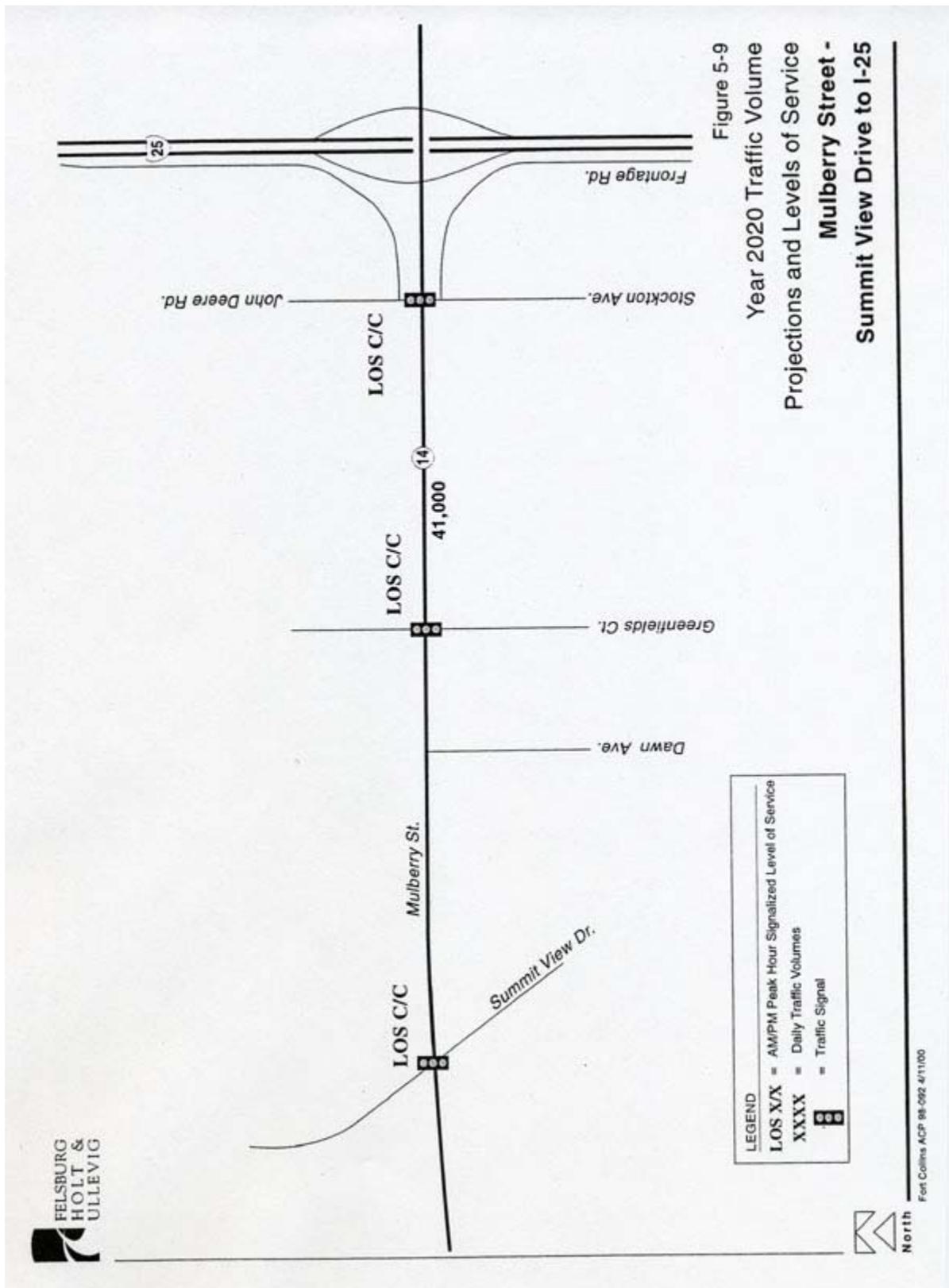
Figure 5-7
Proposed Typical Mulberry Street Cross-Section

5.5 Projected Traffic Conditions

Traffic Forecasts

Traffic volume forecasts are developed on the anticipated growth or re-development of the Mulberry Street corridor by the Year 2020. The traffic volume projections were developed by comparing information provided in the existing and Year 2020 traffic models and that the Vine Drive interchange with I-25 will be constructed by Year 2020. This information indicates that average daily traffic will increase approximately 37-44% by the Year 2020 depending upon location. Daily traffic volume levels along the corridor will range between about 41,000 vpd to approximately 52,000 vpd. The traffic volume projections are shown on Figures 5-8 and 5-9.





Operational Conditions

If the level of traffic volumes noted above are reached, it may be necessary to provide three through lanes for each direction of travel along Mulberry Street. It should be noted, however, that the I-25/SH 14 Interchange Area Study predicts that acceptable levels of service can be expected if Mulberry Street remains as a four-lane facility between Timberline Road and I-25. A six-lane roadway facility along Mulberry Street is consistent with the City's Master Street Plan.

Level of service analyses indicate that LOS D or better can be achieved at each of the signalized intersections of the corridor for Year 2020 with a six-lane roadway.

Traffic Signal Progression Analyses

As traffic volumes increase along the corridor, it may become more difficult to traverse the entire length of the corridor without excessive stops and greater vehicle delay. The measure of the speed and relative congestion of vehicles proceeding between Riverside Avenue and Timberline Road was evaluated by using the computer software program Progression Analysis and Signal System Evaluation Routine (PASSER). This program provides measures of efficiency that evaluates the relative effect of adding or removing traffic signals, the changing of signal timing or phasing patterns, or the increase or decrease in traffic volumes.

The evaluation of Mulberry Street in this area concludes that vehicle progression does not currently meet minimum CDOT Code requirements for good vehicle progression; however, the evaluation also concludes that, with certain intersection improvements (such as adding left turn lanes) the efficiency of vehicle progression between Riverside Avenue and Timberline Road could improve (see US 287/SH 14 Access Management Plan Traffic Analysis Technical Report).

Traffic signal progression analyses between Timberline Road and I-25 were used to determine the optimum location for a new traffic signal (Dawn Avenue or Greenfields Court intersections) when also considering a proposed signal at the frontage road and I-25 ramp intersections. The analyses indicated that Greenfields Court would be the most appropriate location for the new traffic signal. In addition, a traffic signal is also proposed at the intersection of Mulberry Street and John Deere Road/Stockton Avenue.