TRANSPORTATION

I. INTRODUCTION

The Transportation component is developed in order that a total transportation plan is considered. Such a plan embraces several modes including automobile, bicycle, pedestrian, rail, public transit, and air. Other important elements include access management of the roadway system and the goals of the plan. Each of these is intended to serve the existing and projected land use patterns and plans within the community. The effect of community expansion into those identified areas for expansion is taken into consideration by extension of the roadway thoroughfare plan into those growth areas.

This Plan is proposed with the goal of providing a system that accommodates the growth of Alexandria. As with most plans, it requires continuous monitoring and revision in order to react to presently unforeseen changes in the economy and in the market conditions that foster expansion of the community.

This Chapter of the Comprehensive Plan includes an overview of various transportation system components within the City of Alexandria. The principal components of this section include:

- Functional Classification System of Roadways;
- Analysis of Existing Transportation System;
- Land Use Impact on Future Volumes;
- Local, Regional and State Transportation Plans; and
- Transportation Goals and Recommendations.

This element of the Comprehensive Plan is intended to provide guidance for the development of a transportation system that serves the access and mobility needs of the City in a safe, efficient and cost-effective manner. It is important the local transportation system is coordinated with respect to county, regional and state plans and that the system enhances quality economic and residential development within the City.

II. FUNCTIONAL CLASSIFICATION SYSTEM OF ROADWAYS

Roadways are classified based on the type of function they are performing or intended to perform, within and through the City. The purpose of classifying roadways is to ensure they provide access in a safe and efficient manner. The classification assists in designing the appropriate roadway widths, speed limits, intersection control, design features, accessibility and maintenance priorities. Land use and development should be taken into account when planning functional classifications and roadway design. The ideal system is not always possible due to existing conditions, topography or other natural features. The classification system is intended to be used as a guideline and may need to be adapted as actual roadways are developed. The Federal Highway Administration (FHWA) has established detailed criteria for all of the different functional classifications.

Access and mobility are the two of six key elements in transportation planning. Mobility is more important on arterials, which requires limited access points onto the arterial roadway. Access is more important on local roadways, which results in more limited mobility. Other functional design stages include:

- Main movement
- Transition
- Distribution
- Collection
- Access; and
- Termination

As a part of the transportation plan analysis, an inventory of the roadway system is necessary in order to view certain characteristics. A key transportation goal for road authorities is to attempt to balance mobility (through traffic need) and access (abutting property owner need) functions of roadways. The concept of functionally classifying a road system provides some guidance and suggests that a ***complete system*** should consist of a mix of various types of roads to best address the needs of a variety of users. Therefore, an ideal system includes major arterials (strictly emphasize mobility), minor arterials (emphasize mobility), collectors (address mobility and limited access) and local (focus on access) streets. Functional classes of the same roadways may vary in different areas and access management guidelines and roadway characteristics differ depending on the nature of the surrounding land use (i.e. urban, urbanizing or about to become urban and/or rural). All street classifications within Alexandria are defined as being within an urban boundary (as opposed to urbanizing and/or rural areas). The functional classification of roadways within the City of Alexandria are illustrated on Map 7-1. They are classified as follows: Principal Arterial, Minor Arterial, Major Collector, Minor Collector and Local Roadway.

A. Principal Arterials:

Interstate 94 (I-94) is classified as a principal arterial which is located at the southern border of the City. Principal arterials connect communities with other areas in the state and other states. Emphasis is placed on mobility rather than land access. Intersections with principal arterials are usually limited and controlled. Direct access to principal arterials from local or residential streets is generally not allowed and should be discouraged. The nature of land uses adjacent to principal arterials is typically of a higher intensity. Principal arterials as described by the Douglas County Comprehensive Plan are typically spaced every 2 to 3 miles for developing areas and about 10 miles in rural areas. Principal arterials generally carry 5,000 to 25,000 vehicles per day with speed limits of 55 to 70 miles per hour.

B. Minor Arterials:

Like principal arterials, minor arterials emphasize mobility as opposed to land access. Highway 27, Highway 29, CSAH's 45, 46, 82 and 34th Avenue are classified as minor arterials. Minor arterials generally connect urban service areas in developed communities to areas outside. They typically provide access for medium to short trips. Minor Arterials are generally spaced every ½ to ¾ mile apart in metropolitan areas and 1 to 2 miles in developing areas. Minor Arterials are designed to allow traffic to flow at an average speed of 20 to 30 miles per hour during peak traffic times. It is noted that Highways 27 and 29 warrant special consideration and will not always follow the characteristics of a typical arterial because they run through the City and its commercial core.

C. Major Collector Streets:

The major collector street system facilitates movement from minor arterials and serves shorter trips within the County. Collector streets have equal emphasis on both access and mobility. Collector roads are typically spaced every ¼ to ¾ mile in fully developed areas and ½ to 1 mile in developing areas. Major collector streets within the City of Alexandria include: 30th Avenue, 22nd Avenue east of Highways 27 and 29, South Broadway, Nokomis, 10th Avenue in the downtown area, Fillmore Street between 10th and 3rd Avenues, Hawthorne Street between 10th and 3rd Avenues, 6th Avenue in the downtown area, 6th Avenue in the downtown area, Geneva Road, McKay Avenue north of Highway 27 and CSAH 44 and CSAH's 42 and 22.

D. Minor Collector Streets:

Minor collector streets are typically spaced every ¼ to ¾ mile in fully developed areas and ½ to 1 mile in developing areas. Minor collectors provide supplementary interconnection among growth rural centers and have emphasis on land access. Minor collector streets within the City of Alexandria include: 50th Ave. east of Highway 29, Dakota Street, 18th Avenue east of Highways 27 and 29, 17th Avenue, 13th Avenue West of Broadway, 12th Avenue East of Broadway, Jefferson Street, Cedar Street, Fairgrounds Road, Agnes Boulevard, Willow/Latoka Drive and Birch Avenue.

E. Local Streets:

Local streets connect blocks and land parcels. The primary emphasis is on land access. In most cases, local streets will connect to other local streets and collector streets. In some cases, they will connect to minor arterials. Local streets serve short trips at low speeds and carry less than 100 vehicles per day at speeds less than 35 miles per hour. Local streets generally occur at every block. Due to the number of local streets, a listing of street names is not included.

III. ANALYSIS OF EXISTING TRANSPORTATION SYSTEM

The existing conditions of the transportation system are an important consideration in the determination of future needs. Discussion of certain existing elements of the roadway, rail, air and transit systems in Alexandria follows.

A. Existing Traffic Counts

The Douglas County Highway Department and the Minnesota Department of Transportation have recorded traffic volume information for major roadways within the City of Alexandria. Daily volumes are illustrated in Table 7-1 and indicative of 2004 County data. The historic volumes are also indicated and reflect the growth/decline percentage at each location from 1998 to the most current estimate available (2006). Map 7-2 graphically represents the Traffic Count data. Douglas County updates traffic counts every four years. The next traffic counts will be completed in the year 2010. Last Bypass completion (1996, 1998 & *2004*). *(Verify date)*

Table 7-1
Historic Average Daily Traffic Counts

Roadway	Location	ADT 1998	ADT 2006	Percent Change
I-94	East of Hwy. 29	13,600	17,200	20.9%
I-94	West of Hwy. 29	12,300	16,200	24.1%
Highway 29	I-94 to Junction 27	12,700	33,200	61.7%
Highways 29/27	Junction. to 12th Ave.	20,000	18,700	-7.0%
Highways 29/27	12th to 5th Aves.	18,300	18,000	-1.7%
Highways 29/27	5th to 3rd Aves.	14,000	14,100	0.01%
Highways 29/27	Broadway to Nokomis	15,800	16,200	2.5%
Highway 29	3rd Ave to Lakeview Ave.	17,300	18,400	6.0%
Highway 29	Lakeview Ave. to Junction CSAH 42	13,000	16,100	19.3%
Highway 29	Junct. CSAH 42 to Junct. CSAH 43	8,000	9,300	14.0%
Highway 27	Nokomis to CSAH 43	7,600	9,500	20.0%
Highway 27	CSAH 43 to Birch Ave.	5,400	8,900	39.3%
Highway 27	West of Alexandria	6,000	5,900	-1.7%
34th Avenue	East of Hwy. 29 to Broadway	4,150	6,400	35.2%
34th Avenue	East of Broadway	2,200	6,400	65.6%
S. Broadway	South of 30th Ave.	5,000	7,900	36.7%
S. Broadway	30th Ave. to 22nd Ave.	7,700	6,800	-13.2%
30th Avenue	30th Ave. Hwy. 27/29 to 22nd Ave.	6,100	6,800	10.3%
Nokomis Street	CSAH 23 to CR 123	7,000	6,900	-1.4%
Nokomis Street	CR 123 to 12th Ave.	7,300	15,700	53.5%
Nokomis Street	12 Ave. to 10th Ave.	9,500	9,300	-2.2%
Nokomis Street	10th Ave. to 6th Ave.	8,800	10,200	13.7%
Nokomis Street	6th Ave. to 3rd Ave.	7,100	8,100	12.3%
Fillmore Street	North of 5th Ave.	3,850	4,300	10.5%
Fillmore Street	South of 5th Ave.	2,350	2,700	13.0%
22nd Avenue	Junction 27/29 to Broadway	10,300	7,900	-30.4%
22nd Avenue	Broadway to Jefferson St.	2,750	5,900	53.4%

22nd Avenue	East of Jefferson	5,200	5,670	8.3%
10th Avenue	West of Broadway	3,400	3,500	2.9%
10th Avenue	East of Broadway	3,150	2,500	-26.0%
6th Avenue	West of Hawthorne	4,250	3,300	-123.7%
6th Avenue	Hawthorne to Nokomis	4,050	3,350	-20.9%
6th Avenue	Nokomis to Roosevelt St.	7,800	4,800	-62.5%
6th Avenue	East of Roosevelt St.	5,400	3,850	-40.3%
3rd Avenue	West of Broadway	8,700	10,900	20.2%
Jefferson Street	CSAH 23 to 18th Ave.	2,450	4,200	41.7%
Jefferson Street	18th Ave. to 15th Ave.	3,450	4,500	23.3%
Jefferson Street	15th Ave. to 12th Ave.	1,200	4,650	74.2%
Jefferson Street	12th Ave. to 10th Ave.	1,900	2,500	24.0%
McKay	South of Hwy.27	1,750	8,500	79.4%
McKay	North of Hwy. 27	5,400	6,600	18.2%
CSAH 42	North of Junction 29	5,900	12,000	50.8%

Source: Douglas County

B. Physical Condition of Roadways

Community survey participants were asked to rank the overall physical condition of roadways within the community, results follow:

RATING	NUMBER	PERCENT
Excellent	2	4%
Good	32	70%
Fair	11	24%
Poor	1	2%
TOTAL	46	100%

Survey participants were also asked to identify specific priorities for the improvement of roadways within the community.

RESPONSE	NUMBER	PERCENT
50th	6	14%
42	5	12%
Downtown - congestion	5	12%
Fillmore	5	12%
Collector/arterial E & W of city	4	10%
18th Avenue	2	5%
CR 11	2	5%
New 19th Avenue no	2	5%
New 19th Avenue yes	2	5%
22	1	2%
27	1	2%
29	1	2%
Around lakes	1	2%
Downtown - add parking	1	2%
Leave 42 as is	1	2%
Local street (condition of)	1	2%
North Nokomis	1	2%
Township roads	1	2%
TOTAL	42	100%

C. Bicycle and Pedestrian Facilities

With the development of the Central Lakes Trail and several other local and regional trails throughout the greater area, much has been completed in recent years to facilitate the transportation needs of bicyclists, pedestrians and snowmobiles. Bicycle and pedestrian facilities, however, are not limited to the development of large, regional trails. Local sidewalk linkages, as well as bicycle lanes, routes and paths all play an important role in the transportation network. Alexandria's sidewalks do not cover the entire City but are dispersed in the older, more dense areas of the community, however they do not all connect or extend. The Subdivision Ordinance does not require the installation of sidewalks and/or trails within new subdivisions. The City should at minimum require sidewalks along collector streets and arterials as well as leading to parks. Sidewalks and trails within the City of Alexandria are depicted on Map 7-3.

Recommendations relative to bicycle and pedestrian facilities follow below:

1. Construct continuous pedestrian facilities along all major streets and highways; these should be direct and interconnect with all other modes of transportation.

2. Provide safe, secure and convenient facilities for pedestrians into and within commercial developments (downtown).

3. Relate sidewalk design to the function and the anticipated amount of pedestrian traffic. Locate sidewalks to take advantage of views and other amenities, when appropriate.

4. Require pedestrian facilities as land is developed based on standards for the street classification.

5. Provide ramps and curb cuts throughout the pedestrian system for physically challenged persons.

Additional information relating to trails is contained within Chapter 10 entitled, "Parks, Trails and Recreation".

D. Aviation

Alexandria Municipal Airport (Chandler Field) located in the southwest quadrant of the City, approximately two miles from the downtown, was once considered on the outer edge of the growth area is now surrounded by development on all sides. The airport is an important part of the community's transportation system, occupies significant acreage, and impacts adjacent land uses. It is important to note the role the airport and its location will have on future development within the City.

Map 7-4 illustrates the layout of the airport and its facilities. Airport services include 100LL Jet-A fuel, parking hangars and major airframe and power plant services. Flight services available at the airport include airfreight, charter flights, flight instruction and aircraft rental. While the municipal airport facility does not have a control tower, an attendant is on duty daily. Navigational aids include a lighted wind indicator, a segmented circle, lighted runways and a white-green beacon. No landing fee is applicable. The airport elevation is 1,424 feet as surveyed.

There are 53 aircraft based on the field including forty-three (43) single engine, nine (9) multi-engines and one (1) ultra light. The airport reports an average of seventy-six (76) aircraft operations per day with an estimated 50% transient general aviation operations, 38% local general aviation flights, 11% air taxi and less than 1% military in nature.

The airport features two runways. Information on each follows:

Runway 4/22

Dimensions: 4099 x 75 ft. / 1249 x 23 m
Surface: asphalt, in good condition
Weight limitations: Single wheel: 35,000 lbs
Double wheel: 60,000 lbs
Runway edge lights: medium intensity

	RUNWAY 4	**RUNWAY 22**
Traffic pattern	Left	Left
Runway heading	044 magnetic 049 true	224 magnetic 229 true
Markings	Non-precision instrument	Non-precision instrument
Markings condition	Good	Good
Latitude	45-51-45.334N	45-52-11.720N
Longitude	095-23-58.806W	095-23-14.902W
Elevation	1424.3 feet	1417.5 feet
Runway end identifier lights	Yes	Yes
Touchdown point	Yes	Yes

Runway 13/31

Dimensions: 5100 x 100 ft. / 1554 x 30 m
Surface: asphalt, in good condition
Weight limitations: Single wheel: 35,000 lbs
Double wheel: 60,000 lbs
Runway edge lights: medium intensity

	RUNWAY 13	**RUNWAY 31**
Traffic pattern	Left	Left
Runway heading	134 magnetic 139 true	314 magnetic 319 true
Markings	Non-precision instrument	Non-precision instrument
Markings condition	Good	Good
Latitude	45-52-17.876N	45-51-39.705N
Longitude	095-24-07.473W	095-23-20.491W
Elevation	1410.7 feet	1421.3 feet
Runway end identifier lights	Yes	Yes
Touchdown point	Yes	Yes

An Airport Manager conducts day-to-day operations of the airport. An Airport Commission is charged with the duty of administering the airport, making all decisions relative to airport use and capital improvements. The Airport Commission, consisting of three members appointed by the City Council for three-year terms, generally holds its regular meeting once a month, with special meetings concerning items that need immediate attention held on an as needed basis. In addition a Joint Airport Zoning Board is responsible for adopting, administering, and enforcing airport zoning regulations in the airport hazard zone. The Board consists of two members appointed by the City Council and two members appointed by the Douglas County Board of Commissioners for two-year terms.

The City of Alexandria protects low altitude airways in the regional airspace from tall structures. Current City of Alexandria local controls allow a maximum building height of three stories. Building heights in excess of those standards contained in each district may be permitted

variance. The City has adopted an Airport Zoning Ordinance, in addition to the City's Land Use Regulations (Zoning), which regulates development and the subdivision of land near the airport.

In 2006, the Cities of Alexandria and Glenwood, together with their respective airport commissions, Douglas and Pope Counties, and the Alexandria Area Economic Development Commission, partnered together as a Regional Airport Taskforce (RAT). The partnership was formed for the purpose of developing and conducting a survey of airport users, aviation related companies and target members of the community/region to identify current, as well as anticipated future needs, and assess whether a regional airport should be considered. A report was prepared which analyzed the existing and future operations at the Alexandria Municipal Airport – Chandler Field and Glenwood Municipal Airport and further recommended critical aircraft/aircraft group and associated runway length necessary to meet 20–year projected aviation needs.

To further analyze the ultimate location for the Alexandria Municipal Airport, it is suggested that the continuance of a comprehensive analysis of available options be solicited. Insight from the RAT and Alexandria residents should be included in the study along with a fiscal analysis outlining the costs for land acquisition, repayments to the state, facility relocation or construction as well as the potential revenue from the redevelopment of the airport land and opportunities for adjacent businesses to expand. As the City continues to grow, the feasibility of adding commuter service to the Minneapolis-St. Paul International airport should be reviewed. If the airport remains in its current location enforcement of setback regulations will be important to protect the integrity of the airport.

E. Rail

Although two railroad corridors had existed within the City, today the only operating line, the Soo Line runs north-south through the eastern part of the City. The rail line serves area industry and is the major link to Minneapolis – St. Paul. The railroad has diminished in importance, although it still provides vital service to many cities, including the City of Alexandria.

At one time the Burlington Northern Railroad also served the City, however, in the late 1980's it was abandoned. The City has worked to convert the rail line for recreational trail purposes. Additional information on the trail system is included in the park, recreation and trail section of the Comprehensive Plan.

F. Other Transit Service

Rainbow Rider currently provides public transit for Douglas, Pope, Stevens and Traverse Counties with handicapped accessible buses and a volunteer driver program. The service is supported by passenger fares, service contracts, state and federal taxes, sales of advertising space, local county appropriations, and donations and is governed by the Rainbow Rider Transit Board. Rainbow Rider offers door-to-door service with extra care given to children and senior citizens. Door-to-door service means drivers assist passengers with a steadying arm between the bus and the exterior door of their pick-up and drop-off locations and carry up to three small packages (up to 25 pounds or what can be carried in one trip). All buses are handicapped accessible and equipped with an infant safety seat, two-way radio and cellular phone.

Private transit services are available through a variety of options. The Greyhound Bus Company has a daily rout to Minneapolis/St. Paul and the Fargo-Moorhead, Grand Forks and Winnepeg areas. Taxi service within the City of Alexandria is offered by three private services, one of which has charter service and shuttle service to and from Minneapolis International Airport. There is one medical transportation service that also serves the Alexandria area.

IV. LAND USE IMPACT ON FUTURE TRAFFIC VOLUMES

The analysis of the transportation system of Alexandria is primarily concerned with the roadway system since that is the principal element through which people and goods are transported. The preparation of a thoroughfare plan considers many factors including, but not limited to; existing roadways, regional transportation plans (state and county) and future volume projections.

A. Projected Traffic Volumes

The projection of traffic volumes to a future year is highly dependent upon expected development within the City of Alexandria and the growth area. Another factor, particularly as it relates to arterial roadways, is the expected increase in through traffic volumes on those facilities. Those volumes, which may or may not have destination within the City, are dependent upon regional and state growth. Table 7-3 illustrates projected traffic (average trips/day) based upon land use calculations (acreages needed to support growth versus actual acreages included in the growth boundaries) established in Chapter 5 of the Comprehensive Plan.

Table 7-3
Vehicular Trips Generated By New Development

Land Use	Assumed Density for Volume Projections	Total Units Assumed	Daily Trip Rate per Unit	Estimated Daily Trips
Residential–Low Density (Single & Three Family Residential, Including Manufactured Homes)	1.87 units per acre	1,594	10.0/DU	15,940
Residential – High Density*	8.31 units per acre	683	7.0/DU	4,781
Commercial/Industrial	514 acres	514 acres	55/ac	28,270
			Sub Total Additional Trips	48,991
			Assume 50 percent of the Highway Commercial Trips are Pass-By or Dual Purpose Trip Types	-14,135
			Total Net Additional Trips	**34,856**

- Assumes 70% of new households low density & 30% of new households high density
- The assumed land use traffic generation is developed by application of trip generation rates in the Institute of Transportation Engineers (ITE) report title Trip Generation, 7th Edition, 2003.

The calculations for the new development assumptions indicate nearly 35,000 additional daily vehicle trips could be generated by projected land uses within the City by the year 2030. Although these trips will be spread out across the entire roadway system, roadways primarily being impacted are expected to include Highways 29 and 27, Nokomis Street, Broadway and 3rd Avenue.

Table 7-4 lists traffic counts for specified roadways within Alexandria in 2006 compared with those projected for 2026. These numbers should be updated as more recent counts are made available from MNDOT or Douglas County.

Table 7-3
2020 Projected Traffic Volumes

Roadway	Location	2006 ADT	2026 Projection
I-94	East of Hwy. 29	17,200	27,520
I-94	West of Hwy. 29	16,200	25,920
Highway 29	I-94 to Junction 27	33,200	53,120
Highways 29/27	Junction. to 12th Ave.	18,700	29,920
Highways 29/27	12th to 5th Aves.	18,000	28,800
Highways 29/27	5th to 3rd Aves.	14,100	22,560
Highways 29/27	Broadway to Nokomis	16,200	25,920
Highway 29	3rd Ave to Henry Ave.	18,400	29,440
Highway 29	Henry Ave. to Junction CSAH 42	16,100	25,760
Highway 29	Junct. CSAH 42 to Junct. CSAH 43	9,300	14,880
Highway 27	Nokomis to CSAH 43	9,500	15,200
Highway 27	CSAH 43 to Birch Ave.	8,900	14,240
Highway 27	West of Alexandria	5,900	9,440
34th Avenue	East of Hwy. 29 to Broadway	6,400	10,240
34th Avenue	East of Broadway	6,400	10,240
Broadway	South of 30th Ave.	7,900	12,640
Broadway	30th Ave. to 22nd Ave.	6,800	10,880
30th Avenue	30th Ave. Hwy. 27/29 to 22nd Ave.	6,800	10,880
Nokomis Street	CSAH 23 to CR 123	6,900	11,040
Nokomis Street	CR 123 to 12th Ave.	15,700	25,120
Nokomis Street	12 Ave. to 10th Ave.	9,300	14,880
Nokomis Street	10th Ave. to 6th Ave.	10,200	16,320
Nokomis Street	6th Ave. to 3rd Ave.	8,100	12,960
Fillmore Street	North of 5th Ave.	4,300	6,880
Fillmore Street	South of 5th Ave.	2,700	4,320
22nd Avenue	Junction 27/29 to Broadway	7,900	12,640
22nd Avenue	Broadway to Jefferson St.	5,900	9,440
22nd Avenue	East of Jefferson	5,670	9,072
10th Avenue	West of Broadway	3,500	5,600
10th Avenue	East of Broadway	2,500	4,000
6th Avenue	West of Hawthorne	1,900	3,040
6th Avenue	Hawthorne to Nokomis	3,350	5,360
6th Avenue	Nokomis to Roosevelt St.	4,800	7,680
6th Avenue	East of Roosevelt St.	3,850	6,160
3rd Avenue	West of Broadway	10,900	17,440
Jefferson Street	CSAH 23 to 18th Ave.	4,200	6,720
Jefferson Street	18th Ave. to 15th Ave.	4,500	7,200
Jefferson Street	15th Ave. to 12th Ave.	4,650	7,440
Jefferson Street	12th Ave. to 10th Ave.	2,500	4,000

McKay	South of Hwy.27	8,500	13,600
McKay	North of Hwy. 27	6,600	10,560
CSAH 42	North of Junction 29	12,000	19,200

Source: Douglas County standard projection rate (1.6). vs. Traffic Analysis Zones (TAZ). Volumes may be higher based on proposed new land uses in this Comprehensive Plan.

B. Access Management

The management of access along roadway systems, particularly arterial and collector roadways is a very important component of maximizing the capacity of a roadway and decreasing the crash potential along those facilities. Arterial roadways have a function of accommodating larger volumes of traffic and often at higher speeds. Therefore, access to such facilities must be limited in order to protect the integrity of the arterial function. Collector roadways provide a link from local streets to arterial roadways and are designed to provide more access to local land uses since the volumes and speeds are often lesser than arterial roadways.

The Minnesota Department of Transportation reports that studies have shown that as the density of accesses increase, whether public or private, the traffic carrying capacity of the roadway decreases and the vehicular crash rate increases. Businesses suffer financially on roadways with poorly designed access. Well-designed access to commercial properties supports long-term economic vitality.

As with many transportation related decisions, land use activity and planning is an integral part of creation of a safe and efficient roadway system. Land use decisions have a major impact on the access conditions along the roadway system. Every land use plan amendment, subdivision, rezoning, conditional use permit, or site plan involves access and creates potential impact to the efficiency of the transportation system. Properties have access rights and good design will minimize the deleterious effect upon the roadway system. Access management is a combination of good land use planning and effective design of access to property.

The granting of access in the City of Alexandria is shared by the City, Douglas County and by MnDOT, with each having the permitting process responsibility over roadways under their control.

The guidelines are presented for functionally classified arterial and collector roadways without reference to the jurisdiction over these roadways. The basic references for the spacing guidelines are MnDOT guidelines. The access guidelines are presented in Table 7-5, which follows. The stated values are meant to be “minimum” values. It is also recognized that some existing connections, both public and private, may not meet these guidelines. It is also recognized that, due to various circumstances, access may need to be granted that cannot adhere to these guidelines.

Table 7-5
MNDOT Recommended Access Spacing

Functional Class	Median Treatment	Existing and Proposed Land Use	Typical Posted Speed (MPH)	Full Median Opening Spacing (Miles)	Minimum Signal Spacing (Miles)	Spacing Between Connections (Feet)**
Principal Arterial	Divided	Rural	65	1	1	1320
		Urban	>=45	½	½	1320
		Urban Core	<45	¼	¼	440
	Undivided	Rural	55	NA	1	860
		Urban	>=45	NA	½	860
		Urban Core	<45	NA	¼	440
Minor Arterial	Divided	Rural	55	½	½	820
		Urban	>=40	½	½	490
		Urban Core	<40	¼	¼	275
	Undivided	Rural	55	NA	½	820
		Urban	>=40	NA	½	490
		Urban Core	<40	NA	¼	350
Collectors Highway	Divided	Urban	>=40	¼	¼	435
		Urban Core	<40	1/8	1/8	275
	Undivided	Rural	55	NA	½	585
		Urban	>=40	NA	¼	435
		Urban Core	<40	NA	1/8	310

Source: MnDOT
*Distances are based upon spacing between connections (major roads, local public streets and private driveways. Distances are minimum and greater spacing is beneficial.

C. Traffic Calming

During the past few years, traffic calming in residential areas has been a hot topic. In the very near future, it is expected that calming may be a technique that could spread to collectors and arterials and in some areas of the country, traffic calming of collectors is being pursued.

Traffic calming is a popular way of addressing various traffic aspects on residential streets. It allows interested citizens to voice their opinions on what they don't like, and to suggest improvements. Traffic calming can be a viable approach to decreasing volume and speed problems on residential streets. Residential traffic calming and traditional neighborhood designs are tools that can be used to help address the complex demands for more livable communities. The goal of moving traffic efficiently and safely and, at the same time, providing more "comfort" in our communities is bringing together the many various elements used when analyzing roadways. This concept of bringing together various transportation planning and design features is called harmonization.

There are many residential street traffic-calming techniques being used throughout the United States. Some are successful and some are not. The last segment of this Chapter will discuss available techniques and their levels of success. A wide range of traffic calming techniques has been used over the years. They range from physical changes to the roadway system to traffic control techniques that use signing and/or pavement markings. A list of the various "traffic calming" techniques and a brief description of each technique follows, as Appendix A to this Chapter. Graphic illustrations of some of these techniques are contained with the description. Due to the recently and future annexation areas, it may be beneficial for the City to research the integration of traffic calming techniques into the residential areas as a means of promoting safe and efficient traffic movement.

V. TRANSPORTATION PLANS

The thoroughfare plan for the City in conjunction with the land use plan and other infrastructure plans, provides a guideline for which growth can be accommodated in a reasonable fashion and existing issues regarding transportation can be addressed. Local, regional and state transportation plans follow below.

A. City Plans

Local street improvement projects which have been identified within the City's 2007 Capital Improvement Plan include:

Project Area & Description	Year Scheduled	2007 CIP Amt.
Overlay - various locations	2007	225,000
10th Broadway to Nokomis	2007	118,000
15th Ave, Broadway to Jefferson	2007	47,520
Cedar, 5th to 10th	2007	96,525
Fillmore, 3rd to 7th	2007	661,630
Overlay - various locations	2008	250,000
Signal at Nokomis & Agnes Ave.	2008	150,000
Reconstruction - various locations	2008	600,000
10th Ave, Nokomis to CR 46	2008	1,760,000
18th Ave, Broadway to Jefferson (new street)	2008	485,600
Emerson Street, reconstruction	2008	258,717
Victoria Heights, reconstruction	2008	386,098
Overlay - various locations	2009	250,000
Reconstruction - various locations	2009	600,000
18th Ave, Nokomis to CR 46	2009	1,400,000
Dakota St, Hwy 27 to 29	2009	1,661,372
Geneva Rd Enhancement	2009	912,100
Glacier/Geneva Dr, reconstruction	2009	309,165
Overlay - various locations	2010	275,000
Reconstruction - various locations	2010	600,000
3rd Ave, CR 22 to Broadway	2010	175,824
18th Ave, Jefferson to Nokomis	2010	71,280
30th, Aga Dr to Hwy 29	2010	49,896
34th, Hwy 29 to S. Broadway	2010	116,424
Kinkhead Dr, reconstruction	2010	55,023
Overlay - various locations	2011	275,000
Reconstruction - various locations	2011	600,000
44th Ave, S. Broadway to Hwy 29 S.	2011	200,000
50th Ave, S. Broadway to Railroad	2011	760,335
Agnes Ave, McKay to Rosewood	2011	150,000
Agnes Blvd, CR 44 to Broadway	2011	1,430,000
Kenwood St.	2011	455,000
Victor St., S. of 8th Ave	2011	38,600
TOTAL		15,424,909

B. County Plans

The Douglas County Comprehensive Plan identifies transportation issues on a county wide basis to be addressed. It calls for the reclassification of roadways as well as addition of roadways throughout the County. The functional classification system used by Douglas County varies slightly from the City of Alexandria. Improvement projects included on the County 2007-2011 Construction Program include two reconstruction projects: CSAH 11 (CSAH 42 – Carlos/Darling

Drive) and CSAH 42 (South LeHomme Dieu Drive – CSAH 11). Noted transportation issues within the 1998 Douglas County Comprehensive Plan for Alexandria include:

- Future of regional airport in Alexandria
- Congestion on TH 29
- Jurisdictional Transfers
  CSAH 37 between 29 and CSAH 44
  34th Avenue for CSAH 37
  McKay Ave South of TH 27 for CSAH 3

C. State Plans

Alexandria or the immediate surrounding areas are not included in the MnDOT 10-year Highway Work Plan 2004-2013. Recent completed projects included the rebuilding 3rd Avenue (Highway 27/29) in 2005.

D. Transportation Funding

There are a number of various funding mechanisms available to support transportation projects these include the following:

1. **Federal Funding.** Alexandria may apply for federal funds for highways through the Surface Transportation Program of the Federal Highway Trust Fund, through MnDOT's District 4. Solicitation occurs approximately every two years, with federal funding covering 80% of a project cost. Types of projects funded include highway reconstruction, safety projects, trails which are part of a project, transit and park-and-ride projects.

2. **MSAS System.** The State of Minnesota, through the gas tax and license fees, collects funds to be used to construct and maintain the State's transportation system. Most of the funds collected are distributed for use on the State's Trunk Highway (TH) system, the County State Aid Highway (CSAH) system and the Municipal State Aid Street (MSAS) system. Of the funds available they are distributed 62% TH, 29% CSAH and 9% MSAS. When a City's population goes above 5,000 they become eligible to receive a portion of the MSAS funding.

3. **MnDOT Cooperative Funds.** The State of Minnesota has funds available to assist with cooperative projects which increase safety and mobility.

4. **Minnesota Railroad-Highway Grade Crossing Safety Improvement Program**. This program is available to increase the safety at at-grade railroad crossings. Funds may be used for the installation of warning devices, signal installation and upgrades, signs and pavement markings, crossing closures, roadway relocations, lighting, crossing alignments and grade improvements and grade separations.

5. **MN Department of Natural Resources Grants**. Various federal and state grants are available for the development or reconstruction of trails. Typically grants require a 50% match and illustration that the trail is not only of local importance but also of regional significance. Grant programs through the DNR for trail projects include the Federal Recreational Trail Grant Program, Regional Trail Grant Program, Outdoor Recreation Grant Program, and Local Trail Connections Program.

6. **Collector and Local Streets.** Developers may be required to fund the entire cost of minor and major collector streets, as well as local streets as a part of their development fees.

VI. Transportation Goals and Recommendations.

The City of Alexandria, in order that a safe and efficient transportation system can be provided, is committed to adherence to the following goals. Such goals are dependant upon the ability to finance the elements needed to improve safety and mobility for the citizens and businesses of the community. The following lists the goals of the overall transportation system.

Objective: Provide a transportation system that serves the existing and future access and mobility needs of the City.

Policies/Recommendations:

1. To most efficiently provide for the development of future roadways, the City should develop an official future transportation map with collector streets, spacing guidelines (every ½ mile) and inclusion of a possible collector street around the west side of the city , if the airport is relocated. Important principal arterials or future interchange areas that are located in development-prone areas can be protected through an official mapping process. Zoning and subdivision ordinances should be revised to provide for dedication of officially mapped corridors at the time of platting.

2. The City should consider the adoption of access management plan guidelines for City collector streets. This would allow for determining the best location and number of access locations to allow on city controlled roadways. This access management plan should be coordinated with MnDOT and Douglas County.

Objective: Provide a safe and efficient transportation system that is cost effective.

Policies/Recommendations:

1. Special attention should be given to improving pedestrian access, movement and crossings throughout the Highway 27/29 corridors to provide both convenience and safety.

Objective: Ensure that the transportation system, in the implementation phases, is as environmentally sensitive as possible.

Objective: Provide a coordinated transportation system with respect to regional and county plans.

1. To further analyze the ultimate location for the Alexandria Municipal Airport, it is suggested that the continuance of a comprehensive analysis of available options be solicited. Insight from the RAT and Alexandria residents should be included in the study along with a fiscal analysis outlining the costs for land acquisition, repayments to the state, facility relocation or construction as well as the potential revenue from the redevelopment of the airport land and opportunities for adjacent businesses to expand.

2. In the context of regional transportation planning and to most efficiently provide for the development of future roadways, the City should work with Douglas County and MnDOT to develop an official future transportation plan and map examining:

    - The capacity of existing streets and the timing of improvements/reconstruction based on threshold increases in vehicle trips;

    - The projected costs of said improvements/reconstruction;

- Depiction of future collector street corridors which reflect spacing guidelines consistent with urbanizing and rural development factors; projected municipal costs associated with the identification of collector street corridors, right of way acquisition, etc.

- The City should continue to work with County elected and appointed officials to include on the County's Capital Improvement Plan to address needed reconstruction to an urban design and potential trails along the roadways when improved.

Objective: Provide a transportation system that supports multi-modal transportation whenever and wherever feasible and advantageous.

- To diminish congestion in the downtown area, the City should encourage alternate transportation methods which are less dependent on motor vehicles. The City could promote and encourage walking and biking as alternate transportation methods.

- The City may wish to incorporate park and ride facilities near the I-94 interchange for people who live in Alexandria and work elsewhere as a means of encouraging car-pooling and ride sharing.

- City bus service is an important amenity in the community and should be sustained.

A number of general and specific recommendations for transportation planning are noted throughout this Chapter. Following are recommendations related to specific roadway or functional classification:

A. Interstate 94

The principal arterial which provides primary regional access to the City of Alexandria is Interstate 94. This arterial has long served as the access route to/from the metropolitan areas in Minnesota (such as Minneapolis, St. Paul and St. Cloud) in addition to areas in western Minnesota and North Dakota (Moorhead and Fargo). Additionally the roadway provides access to the City accommodating approximately 16,000 to 17,000 vehicles per day on its four-lane section. The speed limit on the interstate is 70 miles per hour with access provided to the City through one interchange.

Specific Policies/Recommendations:

1. Future development is expected along the I-94 corridor. It is recommended future land uses be of a higher intensity, such as industrial and commercial uses that are dependent on highway access and large traffic volumes. Future development shall be served accordingly by collector streets.

2. Growth in the Alexandria Area necessitates the addition of an I94 interchange for the eastern portion of our region. Several sites, including County Road 17, Burgen Rest Area and Nevada Street, all have potential and all would allow for future expansion of industrial and highway commercial development. In addition to providing alternative access, it will allow an alternative route for north and south travelers around the city. The City of Alexandria, Douglas County and MnDOT should work cooperatively to study the need for this proposed interchange.

B. Highway 27/29 Corridors

The roadways that provide primary access to the City of Alexandria are Highways 27 and 29. Highway 27 runs mostly east-west through the Alexandria area. Highway 29 primarily follows a north-south course. Highways 27/29 converge in the southern portion of the City and run conterminously through the downtown area splitting in the northeastern portion of the City. Both minor arterial have long served as the City's Main Street, however, they also serve as primary routes to move moderate and long distance travelers between communities. The 27/29 roadway accommodates approximately 17,000 to 19,000 vehicle trips per day. This average daily trip count has decreased over the past five years when it was 18,000 to 22,000 trips per day in 2003. It is understood the Highway 27 and Highway 29 corridors are of primary importance to the accessibility of business and employment concentrations that have been, and will continue to be, developed along its length. MnDOT has jurisdiction over Highway 27/29. In the late-1990's construction of two bypasses (east & west of the city) were completed. Traffic patterns since completion of the projects appear to support the 'bypass' concept. City and County officials label the bypasses 'very effective'. Full crossing exist at nearly every block along the Highway 27/29 corridor. Stoplights control several intersections in the downtown area and in the retail corridor located in the southern portion of the City. In 2005, MnDOT rebuilt Highway 27/29 (3rd Avenue). The improvements included left turn lanes, signals and street lights.

Specific Policies/Recommendations:

1. The City of Alexandria should continue to work with MnDOT to assure the historic character and small town nature of Broadway in the downtown is preserved despite roadway reconstruction. The City should also encourage streetscape design and amenities which encourage pedestrian use of the 3rd Avenue area while maintaining pedestrian safety.

2. The City of Alexandria is experiencing growth along the Highway 27/29 Corridor in the southern portion of the City. Growth activity has primarily included industrial development and highway commercial development. It is expected that this growth will continue to occur. Such growth has placed additional emphasis on the need to provide adequate and effective access to/from Highway 27/29. An ongoing challenge continues to be pedestrian safety and pedestrian access to retail areas in the southern portion of the City. It is recommended pedestrians be provided access to the area via sidewalk and/or trail systems. Utilization of additional collector streets should be considered. In the future, access management issues may be minimized by limiting the number of new intersections in developing areas. The objective of access spacing is management and maintenance of mobility during peak traffic periods. A balanced approach to access management is the key to providing mobility while not instituting barriers that force internal traffic to travel greater distances than necessary in order to move from one part of the city to another.

C. Collector Streets

The location of collector streets promotes orderly development. As development plans are presented to the City, future collector streets should be designed to provide continuity and prudent access to other collector streets and arterials and adhere to the recommended access management guidelines.

The location of community collector streets is a major determinant of what land use patterns will look like. Future collector streets have been identified on Map 7-5. The location of these collector streets has been based on recommended spacing of collector streets, land uses, topography and existing roadways. It is important to note the attached map is for illustrative purposes only and not intended to constitute an official transportation map.

Specific Policies/Recommendations:

1. Future growth patterns shall correspond to existing community collector streets where possible. The spacing of future community and neighborhood collector streets should balance a strong need for mobility with a lesser need for land use access. Collector streets shall be designed to provide continuity and prudent access to minor and principal arterials. Since the primary purpose of collector streets is to provide large volumes of through traffic with a high level of mobility, continuity is critical. Intersections should be controlled with cross street stop signs or traffic signals. Stop signs should not be used to stop traffic on collector streets except for intersections with other collector or arterial streets. Each segment of the collector street system should be designed to satisfactorily perform its specific role within the overall transportation system.

D. Local Streets

Local streets primarily function to serve residential neighborhoods and other areas of lesser daily traffic volumes. The extension and/or spacing of future local streets should promote excellent access to lower intensity land uses and discourage excessive vehicle speeds. Local streets should not be used for on-site traffic circulation which should be accommodated off the right-of-way.

Local streets should be laid out to permit efficient plat layout while being compatible with the area's topography, municipal utility plans and environmental constraints.

As the street system continues to expand, street maintenance such as snowplowing, grading rural roadways, dust coating, routine maintenance, etc. will become increasingly important issues. Additional street construction will either increase contracted labor expenses or necessitate an expansion of the City's services provided by the municipal public works department. Prior to approving proposed subdivisions, consideration should be given to the City's ability to provide municipal services, facilities and equipment for snowplowing, street grading, minor street repair, dust-coating, etc. on either a contracted or staff basis.

Additional vehicle trips generated by proposed development and dispersed over the existing roadway system shall be examined relative to the capacity of existing roadways to accommodate increased traffic.

Specific Policies/Recommendations:

1. Traffic calming alternatives should be explored to provide a viable approach to decreasing volume and speed problems on residential streets.

2. To avoid duplicate costs the City should continue to correlate future road construction/reconstruction with municipal utility construction and reconstruction.

3. The City should advise private utility service providers of proposed urban subdivisions and/or construction/reconstruction project to ensure efficient construction/repair/replacement of services including natural gas, electrical and telephone facilities.

APPENDIX A
Traffic Calming Techniques

A. Physical changes to the street include:

- Street narrowing
- Curvilinear street
- Choker
- Chicane
- Speed bump/hump
- Traffic circle
- Protected parking bays
- Street closure
- Diagonal diverter
- Semi-diverter
- Trumpet island
- Change in road surface material or color
- Streetscape material or landscape plantings
- Rumble strips

B. Traffic control techniques include:

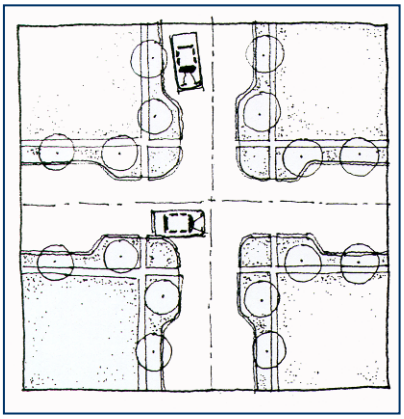
- Police enforcement
- Marked crosswalks
- Turn restrictions
- Speed watch program
- One-way streets
- Variable-speed display board
- Vehicle restrictions

Choker – A choker narrows the width of the traveled lanes. A choker can be constructed at an intersection or at mid-block locations.

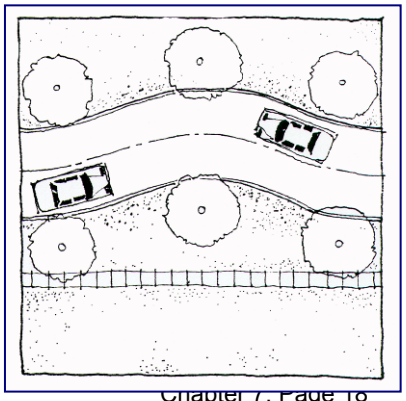
Street Narrowing – A street can be narrowed one of two ways – The street width can be reduced by removing some of the pavement surface, or a psychological narrowing can be accomplished by using a white pavement edge line that indicates narrower travel lanes. Street narrowing may minimize or eliminate street parking, compromise bicycle safety, and affect emergency vehicle response times. On the plus side, street beautification can accompany street narrowing projects. Pavement markings can play a dual role by also identifying bike lanes.

Curvilinear Street – The construction or reconstruction of an existing street can be done in a curvilinear fashion that, in theory, slows traffic. This can be done with a curved centerline alignment and a uniform roadway width, or through the use of chokers and alternative side barriers.

Chicane – Like the choker, the chicane narrows the street, mid-block, by construction curb bulbs that are staggered, thus creating a serpentine effect along the traveled lanes.



Choker

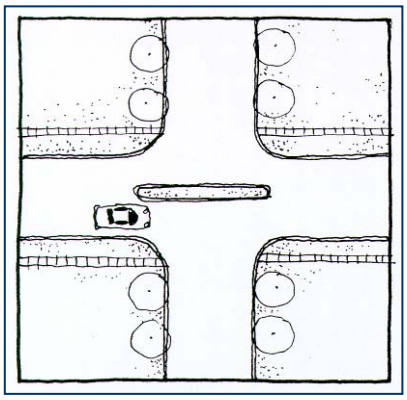


Chicane

Speed Humps – These are raised areas in the roadway that extend across the roadway perpendicular to traffic flow. Speed humps are generally 3 to 4 inches high and approximately 12 feet long. Some cities use them on local streets. Speed humps should only be used on streets where the speed limits are 30 mph or less. The speed humps are not traffic control devices but are geometric design features. Accepted engineering judgment and principles should be used in their design and installation.

Traffic Circle – A traffic circle is a raised island placed in the intersection of local streets. The island, approximately 20 feet in diameter, deflects the path of through traffic around the island, slowing traffic speeds. These traffic circles must be carefully designed so that the desired objective of slowing traffic is achieved without compromising safety.

The traffic circle is different than a traffic roundabout. Roundabouts, popular in Europe and becoming increasingly more popular in the United States, are normally used on higher volume roadways and involve different design elements.

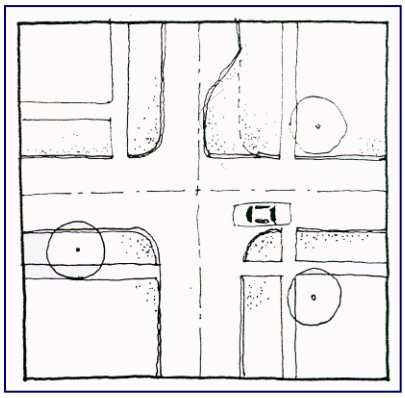


Median Island

Median Island – A median island, or barrier, is a method of eliminating through traffic and left turns to/from one street of an intersection. Routes for traffic that would be diverted must be carefully analyzed so that the problem being solved isn't merely shifted to another location. Emergency vehicle access must be carefully analyzed when considering this geometric technique.

Protected Parking Bays – Narrowing a street to provide protected parking bays can slow traffic. The extent to which traffic is slowed depends on the width of the lanes that remain for moving traffic.

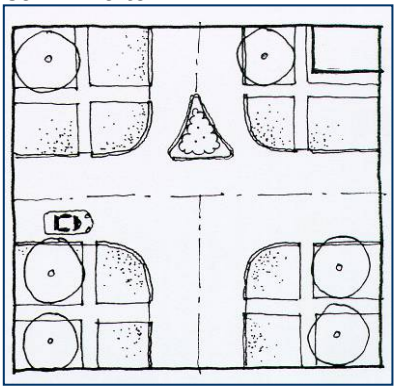
Street Closure – One effective way to reduce traffic volumes on a local street is closing that street at an intersection, normally with a cul-de-sac. A detailed analysis of where diverted traffic will go needs to be completed to avoid introducing new and possibly unwanted traffic on an adjacent street. The effect of such a closure must also be analyzed from an emergency vehicle access standpoint. While a street study and/or closure can be accomplished as a single action, it is normally part of a larger scale, areawide analysis and control project.



Semi-Diverter

Semi-Diverter – This partial diverter narrows a two-way street at an intersection so that only one direction of travel is allowed. The semi-diverter can be designed to eliminate either entering or exiting traffic.

Diagonal Diverter – The diagonal diverter, placed at the intersection of two local streets, prohibits through and left-turn traffic. This diverter is normally a raised barrier than can be landscaped. The diverter can be successful in reducing "cut-through" traffic in neighborhoods. As with previous devices, an area wide treatment is normally the best practice. Care has to be exercised so that emergency vehicle traffic response times are not significantly affected.



Trumpet Island

Trumpet Island (right turn diverter) – This raised island, placed on any leg of an intersection, allows for right turns in/out for a particular roadway. A trumpet island is normally used in situations where left turns and through traffic are safety concerns. Generally traffic volumes are reduced.

Change in Road Material, Surface, or Color – This psychological method of attempting to slow traffic is normally used as a part of an area wide beautification effort. Reconstruction is normally required.

Streetscape Material or Landscape Plantings – This is another beautification option that could affect traffic speed. The design concept/type provides the illusion that the street is narrower, generally causing drivers to slow down.

Rumble Strips – Rumble strips are historically used to alert drivers of an upcoming traffic signal or stop control situation, or to indicate the roadway's edge. These are normally used on higher speed roadways. They have little effect on local streets.

C. Traffic Control Techniques

Police Enforcement – Increasing the use of radar to curb speeding can be an effective control tool – if it is administered consistently. However, radar can be costly, and assigning officers to this lower-priority task is often difficult. Though productive for the short-term, sporadic enforcement, or removing enforcement after a period of time, will see speeds creeping back up over time.

One-Way Streets – Converting a pair or series of streets to one-way operations has safety benefits and causes a shift in traffic volumes. One-way pairs, alternating one-ways, or divergent/convergent one-ways create benefits, but can be a problem for certain local users as they can cause increased driving distances to arrive at their residences. Detailed analyses should be conducted before this concept is implemented.

Stop Signs – Stop signs should only be installed where warranted and as the result of an engineering analysis. Stop signs are not recommended for use as a speed control device. Removing stop signs, when warranted as part of an engineering study, can be as sensitive as installing one.

Marked Crosswalks – Painted crosswalks direct pedestrians to a crossing location that is judged safe for them and, equally important, visible to vehicular traffic. Crosswalks only need to be painted where pedestrian traffic is high, such as near parks and schools.

Variable Speed Display Board – The speed display unit, or trailer, uses radar to record and display a motorist's speed, along with the posted limit. Motorists do respond to this technique, but it should be repeated to gain maximum effectiveness.

Turn Restrictions – Turn Restrictions (no left turn, no right turn) along major streets at residential street intersections can be an effective technique to reducing neighborhood "cut-through" traffic. Such turn restrictions are usually posted for the peak traffic hours. Since this is not a physical deterrent, there are usually some, albeit minimal, violations.

Vehicle Restrictions – Restricting vehicles, namely trucks, from certain streets is often the result of citizen complaints. Trucks are important to the economic viability of the area. The City has designated streets upon which trucks are allowed daily travel. Explaining the impetus behind the truck route layout generally satisfies a citizen's concerns when complaints are lodged.

Speed Alert/Watch Programs – This program allows residents to become a part of the solution. Under this program, citizens are trained to operate radar units by law enforcement personnel. One person runs the radar unit while another records speed and vehicle information. Speeders are then sent letters by the police department pointing out their recorded speed and asking them to slow down. In many cases, the speeders are area residents.

D. Effectiveness of Traffic Calming Techniques

Traffic calming techniques are being used on residential streets throughout Minnesota and the United States with varying success. In some cases, projects that had been installed have been subsequently removed, often at the request of the same people who requested the calming technique in the first place. Much research is still needed to determine the expected effects of these various control and geometric elements. Most research on the effects of these residential street-calming efforts has been project specific. Data and research on this topic are still in its infancy.

Some of the benefits anticipated for a specific project are based on engineering judgment, but they need to be verified. This will occur as more research is undertaken. However, some case studies have identified benefits to certain projects, often reported as an "enhancement to the street environment." These statements can be interpreted to mean residents are experiencing a feeling of improved safety, street "livability," and an overall improvement in their perceived quality of life.

There have been efforts, in research and project reporting studies, to indicate the types of improvements that can be expected when certain traffic calming techniques are used. These expectations are based on first-hand experience and subjective analysis.

In 1996 – 1997, the Minnesota Department of Transportation and the Minnesota Local Road Research Board sponsored a research study[1] that examined the extent of traffic calming activity in Minnesota and the degree of actual and perceived success of such projects.

Effectiveness was rated as:

- Highly Effective
- Effective
- Slightly Effective
- Uncertain of Effectiveness
- Not Effective

The study rated the effect of the project type on four different elements:

- Vehicle Speeds
- Traffic Volumes
- Street Safety
- Enhancing Perceived Street Environment

Tables A7-1 through A7-5 on the following pages present the results of these ratings.

A document prepared in 1994 by the North Central Section of the Institute of Transportation Engineers[2] (NCITE) contained an evaluation of the effects of various traffic engineering and traffic calming techniques. The units of measure were weighed against a variety of elements and rated for their effect – low, mid or high. The engineering/calming techniques were called a "tool box." Table 7-6 on the following page presents the ratings from the report.

---

[1] Traffic Calming Activity in Minnesota, LRRB, SRF Consulting Group, December 1997.

[2] Neighborhood Traffic Control, North Central Section of the Institute of Transportation Engineers, January 1994

TABLE A7-1
Effectiveness of Traffic Calming Measures on Vehicle Speeds

Traffic Calming Measures	Highly Effective	Effective	Slightly Effective	Uncertain of Effectiveness	Not Effective
Street Width Adjustments:					
Street Narrowing			X		
Choker		X			
Median Island			X		
On-Street Angled Parking			X		
Protected Parking Bays			X		
Traditional Traffic Control Techniques:					
Vehicle Restrictions					X
Turn Restrictions					X
One-Way Streets				X	
Variable-Speed Display Board		X			
Trumpet Island				X	
Marked Crosswalks			X		
Stop Signs			X		
Vertical or Horizontal Realignments:					
Speed hump or bump		X			
Traffic Circle		X			
Chicane				X	
Route Modifications:					
Street Closure (cul-de-sac)			X		
Diagonal Diverter		X			
Semi-Diverter				X	
Perceptual Enhancements:					
Change in Road Surface, Materials, or Color				X	
Streetscape Materials or Landscape Plantings			X		

TABLE A7-2
Effectiveness of Traffic Calming Measures on Traffic Volumes

Traffic Calming Measures	Highly Effective	Effective	Slightly Effective	Uncertain of Effectiveness	Not Effective
Street Width Adjustments:					
Street Narrowing			X		
Choker			X		
Median Island			X		
On-Street Angled Parking				X	
Protected Parking Bays				X	
Traditional Traffic Control Techniques:					
Vehicle Restrictions		X			
Turn Restrictions	X				
One-Way Streets		X			
Variable-Speed Display Board				X	
Trumpet Island			X		
Marked Crosswalks					X
Stop Signs			X		
Vertical or Horizontal Realignments:					
Speed hump or bump		X			
Traffic Circle			X		
Chicane				X	
Route Modifications:					
Street Closure (cul-de-sac)	X				
Diagonal Diverter	X				
Semi-Diverter	X				
Perceptual Enhancements:					
Change in Road Surface, Materials, or Color				X	
Streetscape Materials or Landscape Plantings				X	

TABLE A7-3
Effectiveness of Traffic Calming Measures to Improve Street Safety

Traffic Calming Measures	Highly Effective	Effective	Slightly Effective	Uncertain of Effectiveness	Not Effective
Street Width Adjustments:					
Street Narrowing			X		
Choker			X		
Median Island			X		
On-Street Angled Parking				X	
Protected Parking Bays			X		
Traditional Traffic Control Techniques:					
Vehicle Restrictions		X			
Turn Restrictions				X	
One-Way Streets				X	
Variable-Speed Display Board			X		
Trumpet Island			X		
Marked Crosswalks			X		
Stop Signs		X			
Vertical or Horizontal Realignments:					
Speed hump or bump				X	
Traffic Circle				X	
Chicane				X	
Route Modifications:					
Street Closure (cul-de-sac)		X			
Diagonal Diverter				X	
Semi-Diverter			X		
Perceptual Enhancements:					
Change in Road Surface, Materials, or Color					X
Streetscape Materials or Landscape Plantings			X		

TABLE A7-4
Effectiveness of Traffic Calming Measures for Enhancing Perceived Street Environment

Traffic Calming Measures	Highly Effective	Effective	Slightly Effective	Uncertain of Effectiveness	Not Effective
Street Width Adjustments:					
Street Narrowing	X				
Choker	X				
Median Island	X				
On-Street Angled Parking			X		
Protected Parking Bays			X		
Traditional Traffic Control Techniques:					
Vehicle Restrictions		X			
Turn Restrictions		X			
One-Way Streets				X	
Variable-Speed Display Board				X	
Trumpet Island				X	
Marked Crosswalks		X			
Stop Signs			X		
Vertical or Horizontal Realignments:					
Speed hump or bump			X		
Traffic Circle		X			
Chicane				X	
Route Modifications:					
Street Closure (cul-de-sac)		X			
Diagonal Diverter		X			
Semi-Diverter		X			
Perceptual Enhancements:					
Change in Road Surface, Materials, or Color		X			
Streetscape Materials or Landscape Plantings	X				

A document prepared in 1994 by the North Central Section of the Institute of Transportation Engineers[2] (NCITE) contained an evaluation of the effects of various traffic engineering and traffic calming techniques. The units of measure were weighed against a variety of elements and rated for their effect – low, mid or high. The engineering/calming techniques were called a "tool box." Table 7-6 on the following page presents the ratings from the report.

---

[2] Neighborhood Traffic Control, North Central Section of the Institute of Transportation Engineers, January 1994

TABLE A7-5
North Central Section of the Institute of Transportation Engineers Ratings Evaluation

Engineering/ Calming Technique	Volume Reduction	Speed Reduction	Safety Improvements	Pollution Reduction	Access Restriction	Emergency Access	Maintenance Problems	Level Of Violation	Community Acceptance	Cost
Truck Restrictions	○	○	○	◊	●	○	○	○	●	○
Increased Enforcement	○	●	◘	○	○	○	○	n/a	●	◘
Speed Watch	○	●	◘	○	○	○	○	n/a	●	○
Variable Speed Display	○	●	◘	○	○	○	○	n/a	●	○
Watch for Children	○	○	○	○	○	○	○	n/a	●	○
Pavement Markings	○	○	○	○	○	○	○	n/a	●	○
Street Narrowing	○	◘	◘	○	○	○	○	n/a	○	◘
Turn Restrictions	●	◘	◘	◊	●	○	○	○	○	○
Private Streets	◘	◘	◘	●	◘	●	○	n/a	○	●
Basket Weave Stop Signs	○	◘	●	○	○	○	○	○	●	○
Yield Signs	○	◘	○	○	○	○	○	◘	●	○
Do Not Enter	◘	○	◘	◊	●	○	○	◘	○	○
Speed Limit Changes	○	○	○	○	○	○	○	●	●	○
Parking Restrictions	○	○	◘	○	○	○	○	○	○	○
All Way Stop	○	◘	◘	○	○	○	○	◘	●	○
One Way Streets	◘	○	◘	○	●	○	○	○	○	○
Stop Sign Removal	○	○	◘	●	○	○	○	n/a	●	○
Chokers	◘	○	◘	○	○	○	○	n/a	●	●
Partial Diverters	◘	◘	◘	◊	●	●	○	○	○	●
Street Closure	◘	●	◘	●	●	●	●	n/a	○	●
Full Diverters	◘	◘	◘	◊	●	●	●	n/a	○	●
Traffic Circles	○	◘	◘	○	○	●	◘	n/a	○	●
Median Barriers	●	○	●	◊	●	●	○	n/a	○	◘
Speed Bumps/Humps	◘	●	○	○	○	●	◘	n/a	○	◘
Curvilinear Reconstruction	◘	◘	◘	○	○	○	○	n/a	○	●

○ Low, Unlikely, No
◘ Mid, Moderate, Possible
● High, Likely, Yes
◊ Shift

SOURCE: Neighborhood Traffic Control, NCITE, January 1994