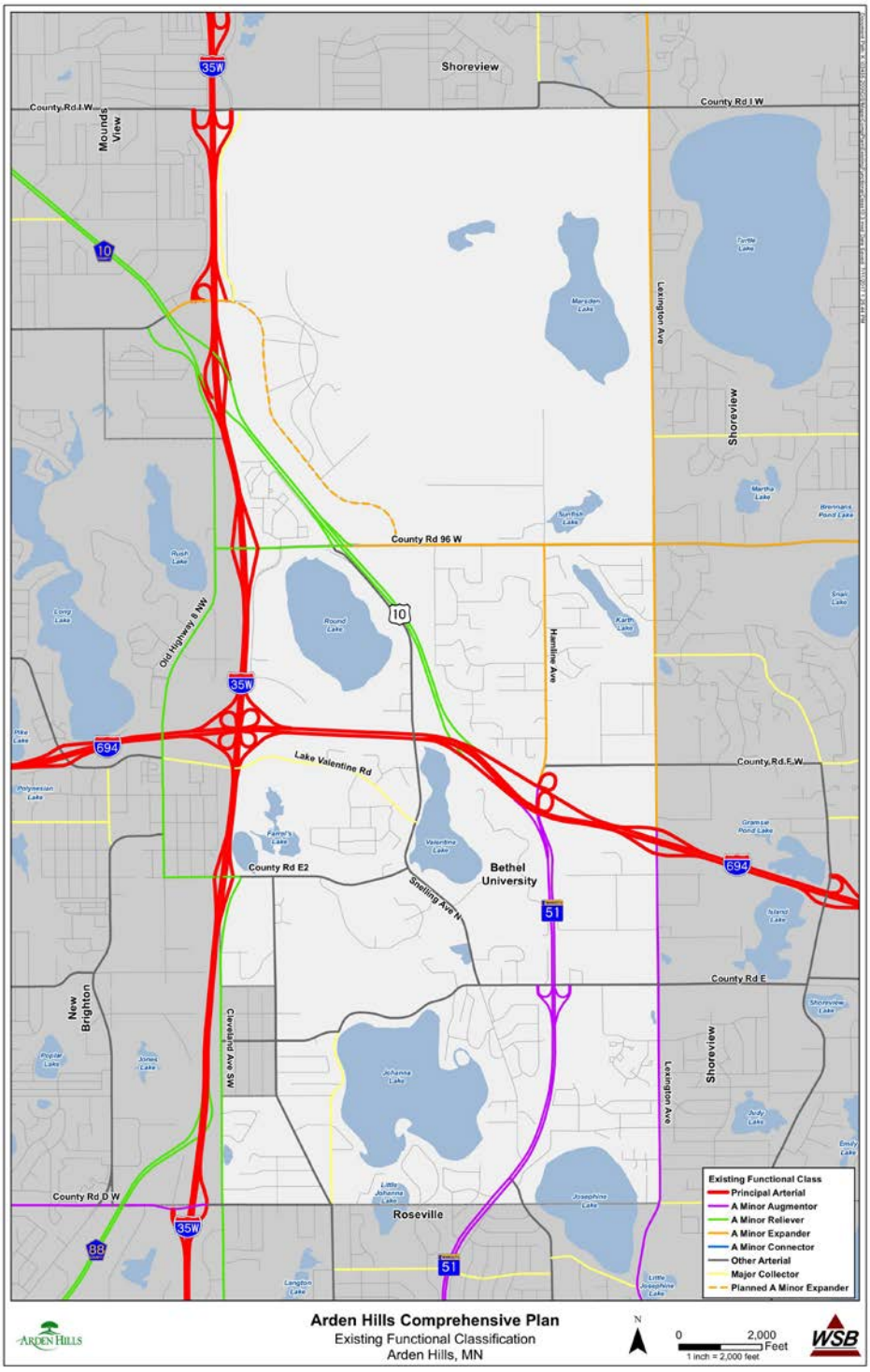
APPENDIX B: TRANSPORTATION SYSTEM PRINCIPLES AND STANDARDS

The transportation system principles and standards included in this Plan create the foundation for improving the transportation system, evaluating its effectiveness, determining future system needs, and implementing strategies to fulfill the goals and policies identified.

1. FUNCTIONAL CLASSIFICATION

It is recognized that individual roads and streets do not operate independently in any major way. Most travel involves movement through a network of roadways. It becomes necessary to determine how this travel can be channelized within the network in a logical and efficient manner. Functional classification defines the nature of this channelization process by defining the part that any particular road or street should play in serving the flow of trips through a roadway network. It is the process by which streets and highways are grouped into classes according to the character of service they are intended to provide. Functional classification involves determining what function each roadway should perform prior to determining its design features, such as street widths, speed, and intersection control. The functional classification system typically consists of five major classes of roadways: Principal Arterials, Minor Arterials, Major Collectors, Minor Collectors, and Local roadways. The existing roadways are described in this section and illustrated in Figure B.1 – Existing Roadway Functional Classification.

Figure B.1 – Existing Roadway Functional Classification



1.1 PRINCIPAL ARTERIALS

Roadways of this classification typically connect large urban areas to other large urban areas or they connect metro centers to regional business concentrations via a continuous roadway without stub connections. They are designed to accommodate the longest trips. Their emphasis is focused on mobility rather than access and as such, private access should not be allowed. They connect only with other Principal Arterials, interstate freeways, some Minor Arterials, and Collector Streets. There are two Principal Arterials within Arden Hills, Interstates I-35W and I-694.

1.2 MINOR ARTERIALS

Roadways of this classification typically link urban areas and rural Principal Arterials to larger towns and other major traffic generators capable of attracting trips over similarly long distances. Minor Arterials service medium length trips, and their emphasis is on mobility as opposed to access in urban areas. They connect with Principal Arterials, other Minor Arterials, and Collector Streets. Connections to Local Streets should be avoided if possible, and private access should not be allowed. Minor Arterials are responsible for accommodating through-trips, as well as trips beginning or ending outside the Arden Hills area. Minor Arterial roadways are typically spaced approximately one to two miles apart in urbanized communities similar to Arden Hills. Within Arden Hills there are 15 roadways classified as Minor Arterials. These roadways are US Highway 10, TH 51, Old US-10, County State Aid Highway (CSAH) 46/Cleveland Avenue, CSAH 47/New Brighton Road, CSAH 50/Hamline Avenue, CSAH 51/Lexington Avenue, CSAH 76/Snelling Avenue, CSAH 96 (CR G), CSAH 149/Lake Johanna Boulevard, County Road (CR) D (CSAH 19), CR E (CSAH 15, CSAH 149, CR 99), CR E2 (CSAH 73), CR F (CSAH 12), CR H (CSAH 9), and CR I (CSAH 3). The Spine Road is a Planned A Minor Arterial.

In the Twin Cities Metropolitan Area, there is a further breakdown of Minor Arterial roadways to establish federal funding priorities, “A Minor” and “Other” (previously referred to as “B Minor”). The A Minor Arterial classifications include Relievers, Expanders, Connectors, and Augmenters. As defined by the Twin Cities Metropolitan Council, Relievers provide ‘open up’ capacity for traffic on Metropolitan Highway Principal Arterials. Augmenters supplement the Principal Arterials within the beltway. Expanders provide connection between developing areas outside the beltway, and connect Principal Arterials. Connectors provide links between rural town centers in the urban reserve and rural area. Other Minor Arterials have a lower priority than A Minor Arterials and are not eligible for federal funding.

Within Arden Hills, the A Minor Arterial Relievers are US Highway 10, CSAH 46/Cleveland Avenue, CSAH 73/CR E2 (west of CSAH 46), and CSAH 96 (west of US

Highway 10). The A Minor Arterial Expanders are CSAH 51/Lexington Avenue (north of I-694) and CSAH 96 (east of US Highway 10). The Spine Road is a Planned A Minor Expander. The A-Minor Arterial Augmenters are TH 51, CR D (west of I - 35W), and CSAH 51/Lexington Avenue (south of I-694). The Other Minor Arterials are Old US-10, CR E, CR E2 (east of Cleveland Avenue), Hamline Avenue, Snelling Avenue (north of CR E), and New Brighton Road.

1.3 MAJOR COLLECTORS

Roadways of this classification typically link neighborhoods together within a city or they link neighborhoods to business concentrations. In highly urban areas, they also provide connectivity between major traffic generators. A trip length of less than five miles is most common for Major Collector roadways. A balance between mobility and access is desired. Major Collector street connections are predominately to Minor Arterials, but they can be connected to any of the other four roadway functional classes. Local access to Major Collectors should be provided via public streets and individual property access should be avoided. Major Collector streets are predominantly responsible for providing circulation within a city. Major Collectors that are a part of the road network in Arden Hills includes Valentine Lake Road, west of CSAH 76/Snelling Avenue; and CSAH 149/Lake Johanna Boulevard from CR D to CR E. Old Hwy 8 is designated as a Major Collector.

1.4 MINOR COLLECTORS

Roadways of this classification facilitate the collection of local traffic and convey it to Major Collectors and Minor Arterials. Minor Collector streets serve short trips at relatively low speeds. Their emphasis is focused on access rather than mobility. Minor Collectors are responsible for providing connections between neighborhoods and the Major Collector/Minor Arterial roadways. There are no roadways designated as Minor Collector roadways in the City of Arden Hills.

1.5 LOCAL STREETS

Roadways of this classification typically include city streets that facilitate the collection of local traffic and convey it to collectors and Minor Arterials. Their emphasis is to provide direct property access. The City's Pavement Management Program adopts a four-classification system of local streets generally based on the average length of trip on the street: Community Street, Neighborhood Street, Residential Street, and Special Cases. The street width varies per street classification and the Pavement Management Program includes a list of additional considerations for additional street width deviations.

2. ROADWAY CAPACITY

Capacities of roadway systems vary based on roadway functional classifications, roadway design (number of lanes, divided or undivided), and system connectivity. A two-lane divided arterial roadway has a daily capacity of 15,000 to 17,000 vehicles per day, a four-lane divided arterial street has a daily capacity of 28,000 to 32,000 vehicles per day, and a four-lane freeway has a daily capacity of approximately 60,000 to 80,000 vehicles per day. The variability in capacities are directly related to many roadway characteristics including access spacing, traffic control, adjacent land uses, as well as traffic flow characteristics, such as percentage of trucks and number of turning vehicles. Therefore, it is important that the peak hour conditions are reviewed to determine the actual volume-to-capacity on roadway segments with average daily traffic volumes approaching these capacity values.

Major Collector and Minor Collector streets have physical capacities similar to those of a two-lane arterial street; however the acceptable level of traffic on a residential street is typically significantly less than the street's physical capacity. The acceptable level of traffic volumes on Major Collectors and Minor Collector streets vary based on available right-of-way width, housing densities and setbacks, locations of parks and schools, and overall resident perceptions. Typically, traffic levels on Major Collector streets in residential/educational areas are acceptable when they are at or below 50 percent of the roadway's physical capacity, resulting in an acceptable capacity of 6,000 to 9,000 vehicles per day. In most communities, acceptable traffic levels on Minor Collector streets are considerably less. Typically, a daily traffic volume of 1,000 to 1,500 vehicles per day is acceptable on Minor Collector streets in residential areas.

In the City of Arden Hills, the roadways that function as Major Collectors currently carry 50 percent or less than the roadway capacity, except Valentine Lake Road, west of Mounds View High School, which has a volume to capacity ratio of 51 Percent. Even though the capacity ratio is over 50 percent, the volumes on the major collectors in Arden Hills are considered to generally be accepted and the roadways are interpreted as operating at or below their capacity.

2.1 ESTIMATED DAILY CAPACITIES

Table B.1 – Planning-Level Roadway Capacity in Arden Hills, identifies various roadway types and the estimated daily capacities that the given roadway in the City of Arden Hills can accommodate. A capacity deficiency exists when traffic volumes approach or exceed the capacity of the roadway.

Table B.1 – Planning-Level Roadway Capacity

Facility Type		Daily Two-Way Volume Lower Threshold	Higher Threshold
Arterials	Two-lane undivided	10,000	12,000
	Two-lane divided or three-lane undivided	15,000	17,000
	Four-lane undivided	18,000	22,000
	Four-lane divided or five-lane undivided	28,000	32,000
Freeways	Four-lane freeway	60,000	80,000
	Six-lane freeway	90,000	120,000
	Eight-lane freeway or higher	Calculated on a segment by segment basis	

2.2 LEVEL OF SERVICE

Roadway Level of Service (LOS) is used to assign a value to the level of congestion and efficiency of the roadway. The LOS is determined by the ratio of the actual roadway volume to the established capacity. In general, the higher the volume, the lower the LOS. There are six LOS, depending on the extent of congestion and service on the roadway. The LOS are defined in Table B.2 – Roadway Level of Service as follows:

Table B.2 – Roadway Level of Service

Level of Service	Volume to Capacity Ratio (v/c)
A	0.00 to 0.35
B	0.35 to 0.49
C	0.50 to 0.74
D	0.75 to 0.89
E	0.90 to 0.99
F	> 1.00
Source: Based on Highway Capacity Manual	

Generally, the City of Arden Hills should consider capacity improvements on roadways with a LOS D or worse and volume-to-capacity ratios over 0.75 during the peak hours.

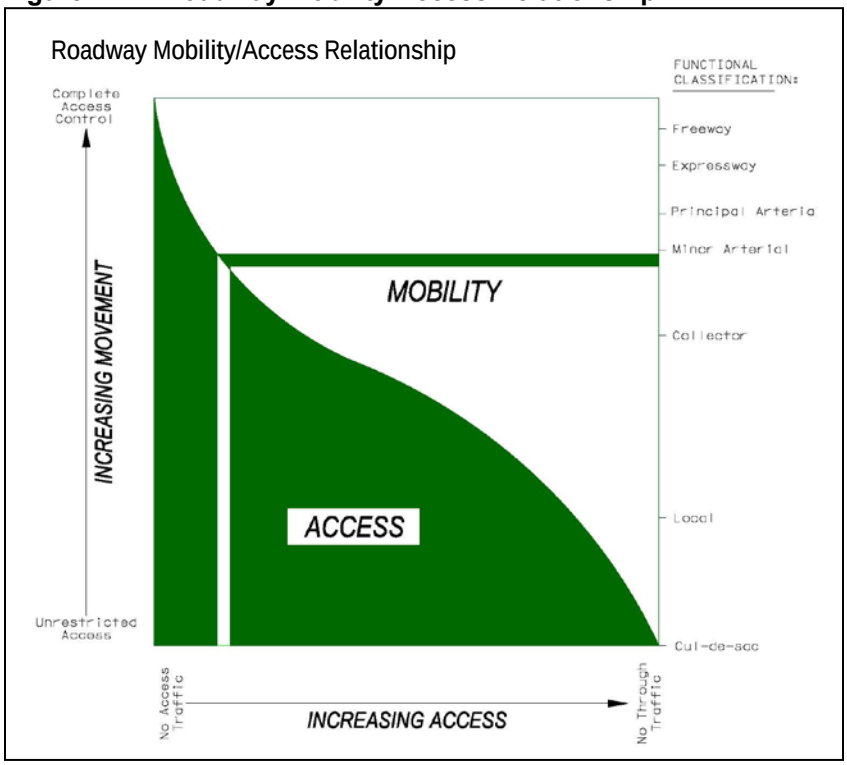
2.3 ACCESS MANAGEMENT GUIDELINES

Access management guidelines are developed to maintain traffic flow on the network so each roadway can provide its functional duties, while providing adequate access for private properties to the transportation network. This harmonization of access and mobility is the keystone to effective access management.

Mobility, as defined for this Transportation Plan, is the ability to move people, goods, and services via a transportation system component from one place to another. The degree of mobility depends on a number of factors, including the ability of the roadway system to perform its functional duty, the capacity of the roadway, and the operational level of service on the roadway system.

Access, as applied to the roadway system in Arden Hills, is the relationship between local land use and the transportation system. There is an inverse relationship between the amount of access provided and the ability to move through-traffic on a roadway. As higher levels of access are provided, the ability to move traffic is reduced. The graphic below illustrates the relationship between access and mobility.

Figure B.2 – Roadway Mobility/Access Relationship



Each access location (i.e. driveway and/or intersection) creates a potential point of conflict between vehicles moving through an area and vehicles entering and exiting the roadway. These conflicts can result from the slowing effects of merging and weaving that takes place as vehicles accelerate from a stop turning onto the roadway, or deceleration to make a turn to leave the roadway. At signalized intersections, the potential for conflicts between vehicles is increased, because through-vehicles are required to stop at the signals. If the amount of traffic moving through an area on the roadway is high and/or the speed of traffic on the roadway is high, the number and nature of vehicle conflicts are also increased.

Accordingly, the safe speed of a road, the ability to move traffic on that road, and safe access to cross streets and properties adjacent to the roadway all diminish as the number of access points increases along a specific segment of roadway. Because of these effects, there must be a balance between the level of access provided and the desired function of the roadway.

In Arden Hills, access standards and spacing guidelines are recommended as a strategy to effectively manage existing ingress/egress onto streets and to provide access controls for new development and redevelopment. While the City of Arden Hills has access authority for those roadways under its jurisdiction, Ramsey County and the Minnesota Department of Transportation (MnDOT) have access authority for roadways under their jurisdiction. The permitted width of accesses to County or State streets or roads is subject to County or State regulations. The State regulations for access standards and spacing are included in the MnDOT State-Aid design standards and the MnDOT Access Category System and Spacing Guidelines (referenced in Table B.3 and B.4).

Table B.3 – MnDOT Access Management Manual – Summary of Recommended Street Spacing for Interregional Corridors

Category	Area or Facility Type	Typical Functional Class	Public Street Spacing		Signal Spacing
			Primary Full-Movement Intersection	Secondary Intersection	
1	**High Priority Interregional Corridors & Interstate System (IRCs)**				
1F	Interstate Freeway	Principal Arterials	Interchange Access Only		⊘
1AF	Non-Interstate Freeway		Interchange Access Only (see Section 3.2.7 for interim spacing)		See Section 3.2.5 for Signalization on Interregional Corridors
1A	Rural		1 mile	1/2 mile	
1B	Urban/Urbanizing		1/2 mile	1/4 mile	
1C	Urban Core		300-660 feet dependent upon block length		
2	**Medium Priority Interregional Corridors**				
2AF	Non-Interstate Freeway	Principal Arterials	Interchange Access Only (See Section 3.2.7 for interim spacing)		See Section 3.2.5 for Signalization on Interregional Corridors
2A	Rural		1 mile	1/2 mile	
2B	Urban/Urbanizing		1/2 mile	1/4 mile	
2C	Urban Core		300-660 feet, dependent upon block length		¼ mile
3	**Regional Corridors**				
3AF	Non-Interstate Freeway	Principal and Minor Arterials	Interchange Access Only (see Section 3.2.7 for interim spacing)		Interim
3A	Rural		1 mile	1/2 mile	See Section 3.2.5
3B	Urban/Urbanizing		1/2 mile	1/4 mile	1/2 mile
3C	Urban Core		300-660 feet, dependent upon block length		1/4 mile

Source: MnDOT

Table B.4 – MnDOT Access Management Manual – Summary of Recommended Street Spacing for Non-Interregional Corridors

Category	Area or Facility Type	Typical Functional Class	Public Street Spacing		Signal Spacing
			Primary Full-Movement Intersection	Secondary Intersection	
4	**Principal Arterials in the Twin Cities Metropolitan Area and Primary Regional Trade Centers (Non-IRCs)**				
4AF	Non-Interstate Freeway	Principal Arterials	Interchange Access Only (see Section 3.2.7 for interim spacing)		Interim
4A	Rural		1 mile	1/2 mile	See Section 3.2.5
4B	Urban/Urbanizing		1/2 mile	1/4 mile	1/2 mile
4C	Urban Core		300-660 feet dependent upon block length		1/4 mile
5	**Minor Arterials**				
5A	Rural	Minor Arterials	1/2 mile	1/4 mile	See Section 3.2.5
5B	Urban/Urbanizing		1/4 mile	1/8 mile	1/4 mile
5C	Urban Core		300-660 feet, dependent upon block length		1/4 mile
6	**Collectors**				
6A	Rural	Collectors	1/2 mile	1/4 mile	See Section 3.2.5
6B	Urban/Urbanizing		1/8 mile	Not Applicable	1/4 mile
6C	Urban Core		300-660 feet, dependent upon block length		1/8 mile
7	**Specific Area Access Management Plans**				
7	All	All	By adopted plan		

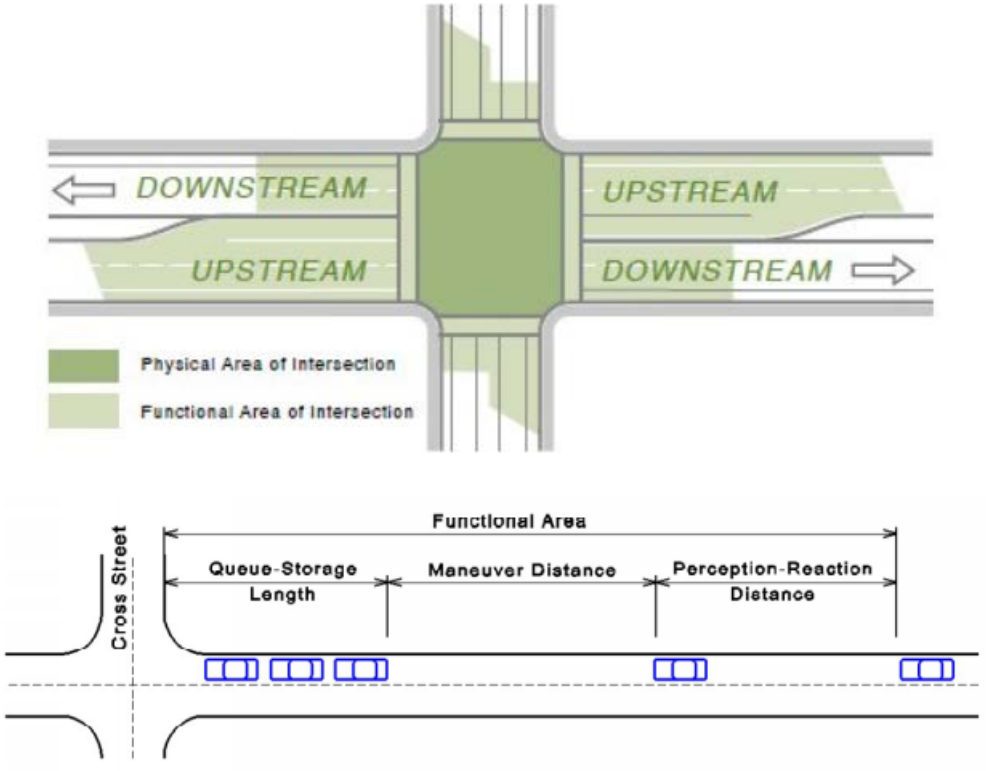
Source: MnDOT

Ramsey County has developed a draft set of access management policies. Rather than a set of specific standards, Ramsey County's draft policies "are intended to apply accepted access management principles in a context-sensitive manner to maximize the possible benefits as development occurs or as existing properties are modified." The draft policies are as follows.

- A parcel has the legal right to one access from a public street. If access can be obtained from an adjacent street, rather than from a County Road or County State Aid Highway, access should be directed to the minor street.
- Opportunities to combine or eliminate accesses shall be considered when new accesses are proposed.
- Where feasible, the access spacing standards of the MnDOT Access Management Manual shall be met.

- Where possible, new driveways shall be aligned with existing driveways or streets.
- Any proposed new access or modification of an existing access to a Ramsey County Road or County State Aid Highway requires a County access permit, with approval subject to review by the County Engineer.
- Any change in land use of a property with access to any County Road or County State Aid Highway, requires review of the access, in accordance with Minnesota Rules 8810.5200, which states in full, “In the event of a change in the land use or major change in the traffic pattern of the existing facility, existing driveways are not automatically perpetuated and new driveway access applications shall be submitted.”
- Unless no other option for access to a property exists, access will not be allowed within the functional area of a street intersection, or within the functional area of another existing access. As defined by MnDOT, the functional areas of intersections are defined as follows:
    - On roadways with posted speed limits less than 45 MPH, 435 feet.
    - On roadways with posted speed limits of 45 MPH or greater, 650 feet.
- The interpretation of the functional area of an intersection shall be made by the County Engineer and adjustments to these distances shall be made, as appropriate to the particular situation. Diagrams of intersection functional areas are shown below:

Figure B.3 – Intersection Functional Areas



- If no access to a parcel can be obtained, except from a County Road or County State Aid Highway, Ramsey County acknowledges that a parcel has the right to one access, subject to approval by the County Engineer. More than one access may be approved, but should not be assumed.
- The need for turn lanes, bypass lanes, medians or median improvements, signage, or any other accommodations necessary for safe operation of an access shall be determined by the County Engineer and incorporated into access permit provisions. All construction costs shall be paid for by the permit applicant. Ramsey County will not contribute to the costs of necessary improvements.
- The need for a Traffic Impact Study for any proposed access shall be determined by the County Engineer. The County Engineer may require installation of any mitigation measures recommended by a Traffic Impact Study.
- The County Engineer may require dedication of access control over the remainder of a parcel as a condition of granting access in a particular location.

It should be noted that there are existing access points within the City that are inconsistent with Ramsey County's draft access management policies. In many cases these access points were established prior to agency access spacing guidelines/policies. In other cases the agency has granted an exception to the existing

guidelines. As roadways are reconstructed and as development or redevelopment occurs, Ramsey County and MnDOT generally work to modify and/or relocate access points that do not meet current access spacing guidelines, recognizing that this may not be feasible in all instances.

To further the relationship of access and mobility throughout Arden Hills, the City supports managing access consistent with the roadway mobility and access relationship (Figure B.2) and supports the access spacing guidelines of the State and County. The City of Arden Hills agrees to work with Ramsey County and MnDOT to achieve desirable access and spacing standards. Table B.5 presents the access spacing guidelines for the roadway network in Arden Hills.

Table B.5 – Access Spacing Guidelines for Collector Roadways in Arden Hills [(1)]

Type of Access	Major Collector [(2)]	Minor Collector [(3)]
Private Residential	Not Permitted	As Needed
Private Commercial/Industrial	Not Permitted	As Needed
Minimum Corner Clearance from a Collector Street	660’	300’
(1) These guidelines apply to City streets only. Ramsey County has access authority for roadways under their jurisdiction.		
(2) Access to Major Collectors is limited to public street access. Steps should be taken to redirect private accesses on Major Collectors to other local streets. New private access to Major Collectors is not permitted unless deemed necessary.		
(3) Private access to Minor Collectors is to be evaluated by other factors. Whenever possible, residential access should be directed to non-continuous streets rather than Minor Collector roadways. Commercial/Industrial properties are encouraged to provide common accesses with adjacent properties when access is located on the Minor Collector system. Cross-traffic between adjacent compatible properties is to be accommodated when feasible.		

Providing direct access from private property onto collectors and arterials should be minimized in order to minimize conflict points and increase safety and mobility.

3. GEOMETRIC DESIGN STANDARDS

Geometric design standards are directly related to a roadway's functional classification and the amount of traffic that the roadway is designed to carry. For the City of Arden Hills, geometric design standards are based on MnDOT State-Aid standards. The following geometric design standards for Major and Minor Collector roadways are illustrated in Figures B.4 and B.5 A and B respectively. These design standards achieve adequate capacity within the roadway network, as well as a level of acceptance by adjacent land uses, given the constraints associated with the existing development pattern. Each component identified in the typical sections helps establish a roadway's ability to perform its function in the roadway network.

Figure B.4 – Major Collector Design Standards

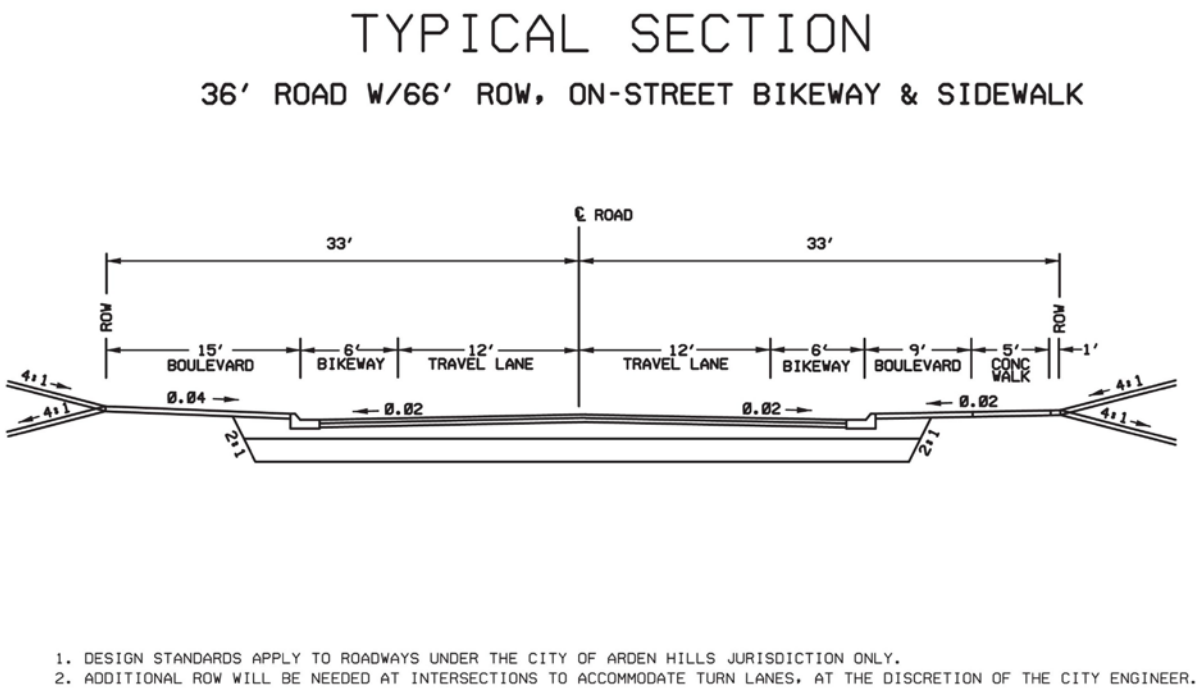


Figure B.5a – Minor Collector Design Standards

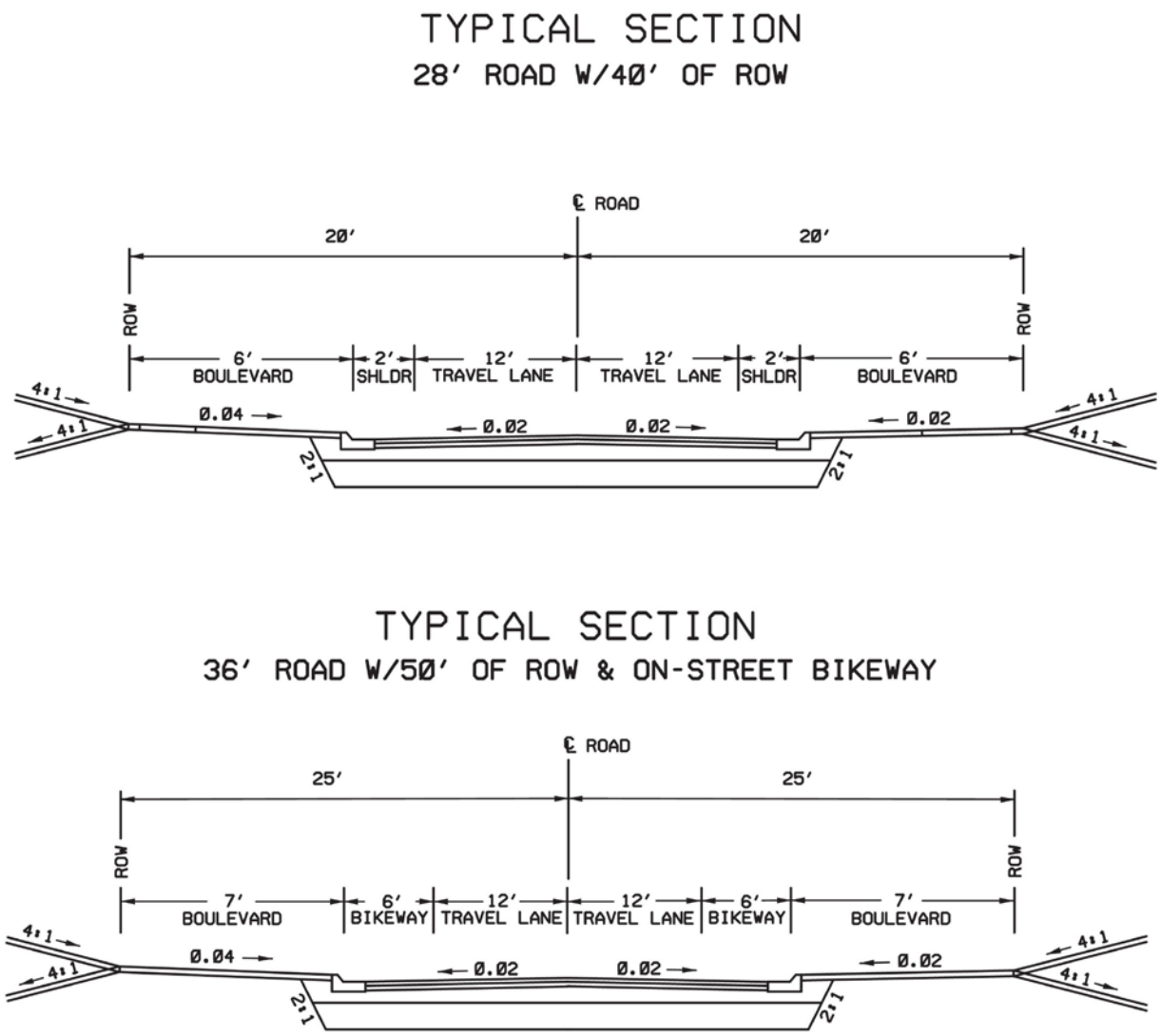
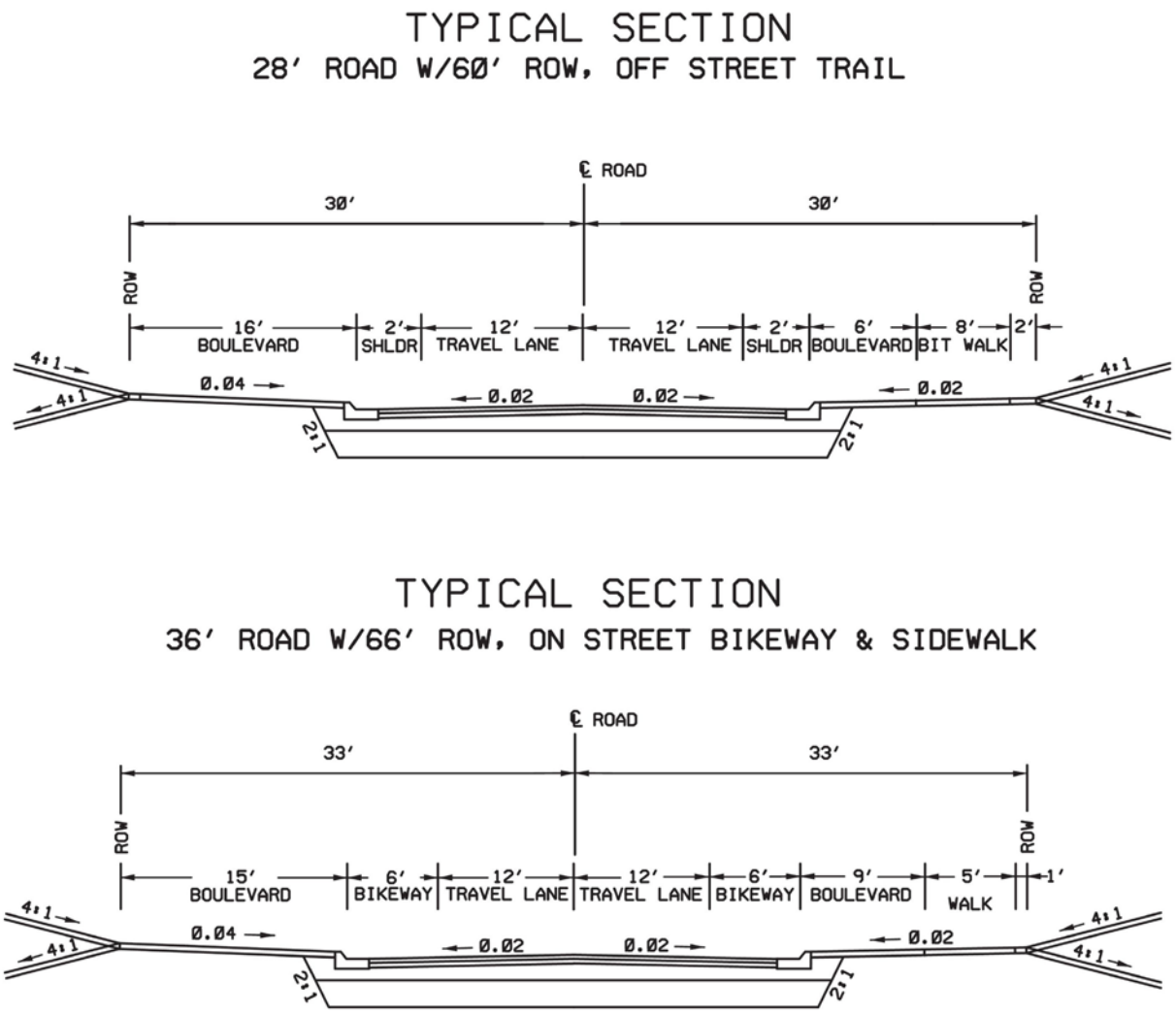


Figure B.5b – Minor Collector Design Standards



3.1 ROADWAY WIDTH

Roadway and travel lane widths are directly associated with a roadway's ability to carry vehicular traffic. On Major Collector roadways and Minor Collector streets, a 12' lane is recommended for each direction of travel. The 24' total travel width is recommended to accommodate anticipated two-way traffic volumes. In addition to the travel width, a minimum 6' shoulder lane width accommodates pedestrian and bicycle traffic, parked or stalled vehicles, and maintenance activity. Roadway widths not meeting the Geometric Design Standards results in decreased performance of the particular roadway and additional travel demand on the adjacent roadway network components. For example, a sub-standard Major Collector roadway may result in additional travel demand on an adjacent Minor Collector or local street, resulting in an overburden for adjacent landowners. Similarly, additional local circulation on an adjacent Minor Arterial results in reduced mobility for regional trips. Due to the varying right-of-way widths present in Arden Hills, Figure B.5A and B.5B identify four different typical sections for Minor Collector roadways to be considered as reconstruction is pursued.

3.2 PATHWAYS

Pathways, including bikeways, sidewalks, trails, and some roadway shoulders, are recommended to be on or adjacent to Major Collector and Minor Arterial roadways, and most Minor Collector roadways to accommodate pedestrian, bicycle, and other non-motorized travel in a safe and comfortable manner. These roadways carry a considerable amount of vehicular traffic and non-motorized facilities are recommended. Design and accommodations for non-motorized traffic facilities in Arden Hills follow the MnDOT Bikeway Facility Design Manual; Americans' with Disabilities Act (ADA); AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities; FHWA Designing Sidewalks and Trails, Part II, Best Practices Design Guide; and FHWA Design Guidance, Accommodating Bicycle and Pedestrian Travel: A Recommended Approach. The City will continue to work with Ramsey County and MnDOT to plan, evaluate, and design non-motorized facilities and integrate the facilities into reconstruction efforts. At the discretion of the City, the requirements for trails, sidewalks, bikeways, and shoulders may vary. The non-motorized traffic facilities will provide connectivity as shown in the Arden Hills Parks, Trails, and Open Space Plan.

3.3 DESIGN SPEED

The design speed of a roadway is directly related to the roadway's function in the roadway system. The focus of Minor Arterial roadways is mobility; therefore these roadways should be designed to accommodate higher travel speeds. Likewise, Minor Collector roadways are more focused on accessibility and should be designed to

accommodate lower travel speeds. The function of Major Collectors is balanced between mobility and accessibility; therefore these roadways should be designed accordingly. Table B.6 below presents the recommended design speed for the Arden Hills roadway network:

Table B.6 – Roadway Design Speed Guidelines

Functional Classification	Design Speed (1)
Minor Collector Street	30 mph
Major Collector Roadway	35 – 40 mph
Minor Arterial Roadway	45 – 55 mph
(1) At the discretion of the City Engineer for City roadways, with approval by the City Council.	

3.4 RIGHT-OF-WAY WIDTH

Right-of-way width is directly related to the roadway's width and its ability to carry vehicular and pedestrian traffic in a safe and efficient manner. The roadway right-of-way widths identified in Figures B.4 and B.5 A and B are the minimum required for Major and Minor Collector streets, respectively. For Minor Collector streets in residential areas, a minimum right-of-way width of 66' is necessary for the added roadway width, as well as to provide added setback distance between the roadway and homes along the roadway. Right-of-way widths greater than 66' may be required on Major Collector roadways within commercial areas to accommodate the potential for higher traffic volumes and the need for additional through or turning lanes. All right-of-way requirements may be increased at the discretion of the City Engineer, with approval by the City Council. Please refer to Ramsey County's right-of-way requirements for county roads in their current Transportation Plan. The City should obtain identified local and county right-of-way through any proposed redevelopment process to accommodate long-term roadway and sidewalk/trail needs.

3.5 ROADWAY JURISDICTION

Roadway jurisdiction directly relates to functional classification of roadways. Generally, roadways with higher mobility functions (such as arterials) should fall under the jurisdiction of a regional level of government. In recognizing these roadways serve greater areas resulting in longer trips and higher volumes, jurisdiction of Principal Arterial and Minor Arterial roadways should fall under the jurisdiction of the State and County, respectively. Similarly, roadways with more emphasis on local circulation and

access (such as collectors) should fall under the jurisdiction of the local government unit. These roadways serve more localized areas and result in shorter trip lengths and lower volumes. Major Collector and Minor Collector roadways should fall under the jurisdiction of the City of Arden Hills. As roadway segments are considered for turn-back to the City, efforts will be taken to evaluate the roadway features for conformance to current standards, structural integrity, and safety. This effort will help the City develop short and long-range programs to assume the responsibilities of jurisdictional authority. In the City of Arden Hills, three jurisdictions have responsibility for the overall road network. The Minnesota Department of Transportation is responsible for I-35W, I-694, TH 10, and TH 51, while Ramsey County is responsible for routes D, E, E2, F, H, I, 46, 47, 50, 51, 76, 96, and 149. Both the Spine Road and Old Hwy 8 are anticipated to be under Ramsey County's jurisdiction (CSAH 13) once constructed. The City of Arden Hills is responsible for all remaining roadways. Figure B.6 shows existing roadway jurisdiction.

Figure B.6 – Existing Roadway Jurisdiction