4 Design Controls

The Minneapolis street system is consistent with a built urban environment and, with a limited number of exceptions, operates under low speed conditions (30 mph or less)[5]. Block length, urban form, walkability and connectivity in Minneapolis reinforce this low speed operating environment. These conditions are important from the standpoint that geometric design controls as defined in AASHTO's *Policy on Geometric Design of Highways and Streets*[6] are speed sensitive and differ between urban and rural conditions. Because of the consistency in the operating environment on Minneapolis streets, the physical design elements focus on a single design regime and are tailored only to low speed urban conditions. In this context, low speed is taken to be 25 to 35 mph. Conditions of 40 to 45 mph are treated as high speed.

The importance of speed to the design process is that, at low speeds, accepted design practice allows for a closer separation of functions on a roadway. Because of the physics of lower speed operation, less separation distance is needed to allow for drivers to make decisions or recover from unexpected situations. This allows for minimal clear zones adjacent to the roadway, allows for urban (curb and gutter) drainage adjacent to the travel lane, and allows for curb parking adjacent to a moving lane. Similarly, the dynamic envelope of the vehicle (i.e., the space it occupies while moving) is closer to the actual size of the vehicle at low speeds. This allows for narrower lane widths. (As speeds increase above 35 mph, wider lanes and more separation at the edge of the moving lane is desirable for safety reasons, curb parking is not desirable and as speeds move above 45 mph, curb and gutter adjacent to a moving lane may be replaced by shoulders and clear zones or linear barriers.)

4.1 Sources for General Design Guidance

There are three primary sources for general guidance on the design of streets in this document. A number of other documents, listed in Appendix A, were also referenced for peer city experience and guidance on specific design elements.

- American Association of State Highway Transportation Officials (AASHTO), *Policy on Geometric Design of Highways and Streets (*also known as the *"Green Book"),* 5th Edition, 2004.
- Institute of Transportation Engineers (ITE), *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities,* Proposed Recommended Practice RP-036, 2006 (sponsored by Federal Highway Administration). While this document is currently in draft form, final revisions are expected in 2008.
- Minnesota Department of Transportation, *State Aid Manual,* 2007 Edition.

[5] By statute, the maximum speed on the majority of streets in Minneapolis is 30 mph. Isolated instances of higher speed roadways, other than freeways, are found on commuter streets such as Olson Memorial Highway and Hiawatha Avenue.

[6] American Association of State highway and Transportation Officials, *Policy on Geometric Design of Highways and Streets,* 5th Edition, 2004.

The typical design controls that are used for street design are described in AASHTO's *Policy on Geometric Design of Highways and Streets,* also known as the "Green Book". They include functional class, urban/rural location, design vehicle, design speed, driver, traffic volume and operations (level of service). In the context of street design within Minneapolis or any fully built urban environment, not all of these controls exert the same level of influence on the design process. The location element is irrelevant, because Minneapolis is entirely urban. The hierarchy of arterial, collector and local streets is addressed through the street design types. While design decisions should be based on the street design type, it is important to maintain a link to functional class as this information is required for funding purposes (see Section 2 for further discussion).

This leaves traffic volume, design vehicle and speed as the primary design controls for streets within the City of Minneapolis. Each of these is discussed in more detail below from the standpoint of how they affect all of the street design types.

4.2 Traffic Volumes

Regional norms tend toward use of Level of Service D during the peak hour as the goal for traffic operations during peak periods. This effectively establishes the amount of traffic a roadway can carry on the basis solely of traffic operations without regard to other modes of travel or recognition of the context the roadway passes through. The Minneapolis corridor design process deviates from this approach by incorporating other modal priorities and place type into the selection of street design type. The choice of an appropriate street design type dictates the *maximum size* of the street (number of lanes/carrying capacity) and, in some cases, the dominant intersection treatments with regard to turn lanes. Traffic volumes will need to be considered in determining number of through lanes, appropriate locations for turn lanes, and implementation of traffic management strategies. However, in the vast majority of cases, the city is limited to working within existing right-of-way and must seek ways to increase the use of alternative modes of transportation and to efficiently manage traffic through operations rather than the addition of lane capacity. In some cases, this approach may result in slower traffic speeds, lower levels of service, and/or longer time periods of congested operations. The number of hours of congestion becomes more important than the level of service during a single hour of the day.

The design guidelines reference low, medium and high traffic volumes. The thresholds for establishing these volume categories were based on a review of 2006 and 2007 traffic counts from a sample of 500 count locations. All counts below 1000 Average Daily Traffic (ADT) were eliminated from the analysis. Streets with volumes below 1000 ADT are all local residential streets. The traffic volumes at the sample count locations ranged from 1,612 to 50,490 ADT. The 75th percentile was 14,800 ADT; the 50th percentile was 9,875 ADT and the 25th percentile was 6,400 ADT. Based on this distribution of traffic volumes, the low, medium and high traffic volume categories are defined as follows:

Low	-	< 6,000 ADT
Medium	-	6,000 - 15,000 ADT
High	-	> 15,000 ADT

4.3 Design Vehicle

The expected mix of operators that would be using the street can be critical, particularly where the proportion of older drivers may be large. At a citywide level, a proportional representation of drivers is expected to use the system and the design guidance is provided on that basis. It is important to note that professional drivers (particularly bus operators) are trained to operate vehicles in confined urban environments.

In the design process, the design vehicle is an important determinant for lane widths and curb-return radii. Selection of an appropriately sized vehicle is a critical aspect of achieving walkable streets that support the urban context. In terms of width, vehicles tend to fall into two groups:

- Passenger vehicles, including automobiles, SUVs, vans and passenger trucks, typically range up to about 7 feet in width, not including mirrors.
- Buses, trucks, delivery vans and other large vehicles typically range up to about 8.5 feet in width, not including mirrors. Federal law limits the width of a vehicle to 8.5 feet.

Vehicle type is also important based on the turning radius of the vehicle. This affects the amount of space required for a vehicle to turn a corner. Buses and multi-axle trucks typically have the widest turning radius although multiple unit vehicles such as an articulated bus will typically have a tighter turning radius than a single unit truck or bus.

As noted in ITE RP-036[7],the recommended approach to design vehicle is to "*select the largest design vehicle that will use the facility with* ***considerable frequency*** *(for example, bus on bus routes, semi-tractor trailer on primary freight routes or accessing loading docks, etc.). In general, consideration must be given to a design vehicle (a vehicle that must be regularly accommodated without encroachment into the opposing traffic lanes) and a control vehicle (an infrequent vehicle that must be accommodated, but encroachment into the opposing traffic lanes, multiple- point turns, or minor encroachment into the roadside is acceptable) in street design. If the control vehicle is larger than the design vehicle, its consideration will inform the practitioner of the potential ramifications to the design.*"

The recommended design vehicles for the street design types are shown in Figure 4-1. It should be noted that large trucks (semi-tractor trailers) must be accommodated on county roads.

[7] Institute of Transportation Engineers, *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities,* Proposed Recommended Practice RP-036, 2006.

Figure 4-1 Design Vehicles

Street Type	Design Vehicle	Design Vehicle Width[1]	Control Vehicle
Commuter Street	Semi-Trailer Truck (WB 50)	8.5' plus mirrors	Semi-Trailer Truck (WB 62)[2]
Commerce Street	Transit Bus on PTN streets Single Unit Truck	8.5' plus mirrors	Transit Bus or Semi-Trailer Truck (WB 50)
Activity Area Street	Transit Bus on PTN streets Single Unit Truck	Varies	Varies
Community Connector Street Neighborhood Connector Street	Passenger Auto/Pick Up	7.0' plus mirrors	Transit bus if PTN route; WB 50 if county road; single unit truck if not PTN route and not county road
Industrial Connector Street	Semi-Trailer Truck (WB 50)	8.5' plus mirrors	Semi-Trailer Truck (WB 62)
Parkway Street	Passenger Auto/Pick Up	7.0' plus mirrors	Transit bus[3] if PTN route; single unit truck if not PTN route
Local Street	Passenger Auto/Pick Up	7.0' plus mirrors	Single Unit Truck
Alley	Single Unit (Trash) Truck	8.5' plus mirrors	Single Unit (Trash) Truck

Notes
1. Vehicle widths do not include mirrors – mirrors add 1-2' in width, depending on type/make of vehicle and mounting of mirror.
2. Semi-trailer trucks, because of the configuration of the vehicle have unique turning requirements. Convention is to define those requirements in terms of the wheelbase of the vehicle. A WB 62 is a semi-trailer with a distance (wheelbase) of 62 feet between the front wheels and the rear most wheels. A WB 50 is a similar vehicle with a wheelbase of 50 feet.
3. Buses are provisionally allowed on parkway streets. For this reason, they are identified as the control vehicle for parkway streets that are PTN routes.

4.4 Target Speed

Target speed is the desired actual operating speed and should be the posted speed limit. The concept of target speed is used to define a uniform operating environment that provides cues to the driver to observe the speed limit. The intent of designating a target speed is to resolve differences between posted speed limit, operating speeds and design speed, primarily on low speed roadways (i.e., under 35 mph), where current practice tends to "over design" by use of design speeds that are usually selected to be higher than the desired operating speed to provide a factor of safety. Within the low speed regime, design speed and posted speed limit are set to reflect the maximum desired operating speed for a street with regard to walkability and compatibility with fronting land use and urban form. For streets with speed limits of 40 mph and higher, the practice of using a design speed higher than the target speed is used to provide for a factor of safety.

As noted in ITE RP-036, "*The target speed is not set arbitrarily, but achieved through a combination of measures that include:*

- *Setting an appropriate and realistic speed limit;*

- *Using physical measures such as curb extensions and medians to narrow the traveled way;*
- *Setting signal timing for moderate progressive speeds from intersection to intersection;*
- *Using narrower travel lanes that cause motorists to naturally slow; and*
- *Using design elements such as on-street parking to create side friction."*

The recommended target operating speeds for the street design types are shown in Figure 4-2.

Figure 4-2 Target Speed

Street Type	Target Operating Speed	Design Speed
Commuter Street	40 mph	45 mph
Commerce Street Activity Area Street Community Connector Street	30 mph	30 mph
Neighborhood Connector Street	30 mph	30 mph
Industrial Connector Street	30 mph	30 mph
Parkway Street	25 mph	25 mph
Local Street[1]	25-30 mph	25-30 mph

Note
[1]Local streets may have target operating speeds of less than 30 mph but, based on state law, have a legal posted speed limit of 30 mph unless signed otherwise.

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