

# APPENDIX D

## TRAFFIC MANAGEMENT DEVICES

Traffic calming relies upon physical changes to streets to slow motor vehicles or to reduce traffic volumes. These changes are designed to affect drivers' perceptions of the street and to influence driver behavior in a manner that is self-enforcing. Unlike traditional methods of traffic management, traffic calming does not rely primarily upon the threat of police enforcement for its effectiveness. Items which may be considered as traffic calming devices and which may be applied in a NTMP project are shown in Table 1.

### 1. Street and Lane Narrowing

Motorists tend to drive at speeds they consider safe and reasonable and tend to drive more slowly on narrower roads and traffic lanes than wider ones. Reducing road widths by widening boulevards or sidewalks intermittently, introducing medians, or striping bike lanes can reduce traffic speeds. The judicious placement of parking (protected by curbs and made more visible by landscaping) can achieve the same effect, if there is evidence that the on-street parking will be used. Road narrowings have the added advantage of reducing the expanse of road to be crossed by pedestrians, thus reducing pedestrian crossing time.

Other criteria to be applied and considered prior to street narrowing include:

- ⇒ Bicycle Accommodations: On local streets designated as a bike route or servicing a significant volume of bicycle traffic, a sufficiently wide bicycle lane should be provided through the narrowed area. Where traffic and/or bicycle volumes are sufficiently low, exclusive bicycle lanes may not be required.
- ⇒ Snow Removal: The pavement width of streets shall not be narrowed to a point where it becomes an impediment to snow removal.
- ⇒ Parking Restrictions: In most cases on local access streets, street narrowing, such as with the installation of a pedestrian refuge island at an intersection, will require the prohibition of parking at all times along the street curb the full length of the narrowed section plus approximately 20 feet.



Typical parking restriction for a pedestrian refuge island (N. Baldwin St. at Mifflin St)

TABLE 1: NEIGHBORHOOD TRAFFIC MANAGEMENT DEVICES

Devices	Safety	Speed Reduction	Pedestrian, Bicyclists Access	Traffic Diversion	Noise	Exhaust Emissions	Emergency Services	Acceptable for Traffic Management
Police Enforcement	Improvement	Depends on Amount	Possible Improvement	No Effect	No Effect	No Effect	No Effect	Yes
Speed Humps	Unknown	Yes	Mixed Results	Possible	Increase	Small Increase	Possible Problem	Yes
Education	Possible Improvement	Possible	Possible Improvement	N.A.	N.A.	N.A.	No Effect	Yes
Entrance Treatments	Possible Improvement	Unlikely	Possible Improvement	Mixed Result	No Effect	No Effect	Possible Problems	Yes
Curb Extensions	Improve Ped Crossing	Unlikely	Yes	No Effect	No Effect	No Effect	Possible Problems	Yes
Partial diverters/ Diverters/Cul-de-Sac	Possible Improvement	Possible	Possible	Yes	Possible Reduction	No Effect	Possible Problems	Possible
Chicanes	Possible Improvement	Possible	Possible	Possible	No Effect	Small Increase	Possible Problems	Yes
Traffic Circles	Improved	Yes	Possible	Possible	No Effect	No Effect	Possible Problems	Yes
One-way Streets	Possible Improvement	No	Mixed Results	Possible	No Effect	No Effect	Possible Problems	Yes
Median Barrier	Possible Improvement	No	Mixed Result	Possible	No Effect	No Effect	Possible Problems	Yes
Improve Arterial Streets	Possible Improvement	Unlikely	Possible Improvement	Possible Improvement	Possible Improvement	Possible Decrease	No Effect	Limited
<b>Traffic Control Devices: e.g. Prohibitory Signaling</b>	Possible Improvement	Unlikely	Possible Improvement	Yes	Possible Improvement	No Effect	No Effect	Possible

- ⇒ Landscaping: Median landscaping can be selected by the neighborhood association from an approved landscaping materials list provided by the City. Initial landscaping will be provided and installed by the City and will be maintained by the neighborhood association or landscape volunteer. If the landscaping is not maintained, the median will be topped with an asphalt or concrete pavement.
- ⇒ Median Width/Lane Width: Where medians are used to narrow streets, the preferred minimum width for medians is six feet, but actual width will be determined based on existing circumstances. Travel lanes shall not be narrowed to a width less than nine feet, exclusive of gutter. Bicycle lanes where required shall be four feet wide exclusive of gutter. If parking is allowed, the parking and bicycle lane combination shall be a minimum of 13 feet.

## **2. Bicycle Lanes**

Lane widths available to motorists can be reduced on some streets by the installation of bicycle lanes, either next to curb (preventing stopping or parking by motor vehicles) or adjacent to parking. The space needed for bicycle lanes introduced on an existing street may reduce the width or number of general traffic lanes or the amount of parking. Bicycle lanes shall be constructed to the standard specifications of the Madison Department of Transportation, Traffic Engineering Division.

## **3. Raised Street Sections or Speed Humps**

Raised street sections or speed humps can reduce vehicle speeds on local streets. The hump is a raised area, no greater than 3.5 inches high, extending transversely across the street. Speed humps typically are constructed with a longitudinal length of 22 ft.

Other criteria to be applied prior to installation of speed humps include:

- ⇒ Signing; Marking  
Speed humps are required to be signed with a combination of signs and/or pavement markings to warn motorists and bicyclists of their presence.
- ⇒ Traffic Safety and Diversion  
Any use of speed humps must take into consideration the impact the installation will have on long-wheel-based vehicles (fire apparatus, ambulances, snow plows and garbage trucks) and the potential to divert traffic to other adjacent streets.
- ⇒ Street Functional Classification  
Speed humps should only be installed to address documented safety problems or traffic concerns supported by traffic engineering studies. Speed humps can be considered on local and neighborhood collector streets as functionally classified by MDOT with traffic volumes up to 3,000 vehicles per day. Consideration of speed humps on collector streets with traffic volumes between 3,000 and 5,000 vehicles per day will be based on a case-by-case review, considering traffic volume and Madison Metro and Madison Fire Department operations.
- ⇒ Street Width  
Speed humps should be used only on streets with no more than two travel lanes and less than or equal to 32 feet in width. In addition, the pavement should have good surface and drainage qualities.

- ⇒ Street Grade  
Speed humps should only be considered on streets with grades of 8% or less approaching the hump.
- ⇒ Street Alignment  
Speed humps should not be placed within severe horizontal or vertical curves that might result in substantial horizontal or vertical forces on a vehicle traversing the hump. Humps should be avoided within horizontal curves of less than 300 feet centerline radius and on vertical curves with less than the minimum safe stopping sight distance. If possible, humps should be located on tangent rather than curve sections.
- ⇒ Sight Distance  
Speed humps should generally be installed only where the minimum safe stopping sight distance (as defined in AASHTO's *A Policy on Geometric Design of Streets*) can be provided.
- ⇒ Traffic Speeds  
Speed humps should generally be installed only on streets where the posted or prima facie speed limit is 25 mph or less. Speed humps should be carefully considered on streets where the 85th percentile speed is in excess of 40 mph.
- ⇒ Traffic Volumes  
Speed humps should typically be installed only on streets with 5,000 vehicles per day or less. Madison Metro and Madison Fire Department need to be consulted before speed humps can be installed on streets with traffic volumes between 3,000 and 5,000 vehicles per day.
- ⇒ Emergency Vehicle Access  
Speed humps should not be installed on streets that are defined or used as primary or routine emergency vehicle access routes.
- ⇒ Transit Routes  
Speed humps may be considered for use along streets serving as Madison Metro bus routes and meeting the following criteria:

Functional Class	Local and neighborhood collector streets as determined by MDOT. <sup>3</sup>
Bus Stops	Speed humps should not be installed at locations on streets where Metro vehicles must transition from the travel lane across a speed hump to the curb bus stop. On streets with Metro bus routes, speed humps should be located in consultation with Madison Metro in such a way as to insure that transit vehicles can traverse the speed hump perpendicular.

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<sup>3</sup> Neighborhood collectors may be considered on a case-by-case basis with consultation with Madison Metro, Traffic Engineering and Madison Fire Department.

#### **4. Full or Partial Road Closures [Semi-Diverter/Diverter/Cul-de-sac]**

Roads can be closed to motor vehicles at intersections, preventing through movement and requiring access to be gained from other streets. Closure should be undertaken in such a way as to avoid simple displacement of traffic to adjacent residential streets. It will usually be possible and desirable to retain pedestrian and bicycle access.

- ⇒ Partial intersection closures can be achieved by narrowing a street to one lane at an intersection and instituting an entry restriction. Another technique is to introduce a “diagonal diverter” or barrier diagonally across an intersection which forces traffic off a favored short-cut. Gaps can be left to allow access by pedestrians and bicyclists.
- ⇒ Partial Closures  
Partial roadway closures at intersections will require consideration of pedestrian and bicycle access and lane width requirements similar to those defined under *Street and Lane Narrowing*.

#### **5. Chicanes**

Chicanes are a form of curb extension which alternate from one side of the street to the other. The road is in effect narrowed first from one side then the other and finally from the first side again in relatively short succession. Chicanes break up the typically long sight lines along streets and thus combine physical and psychological techniques to reduce speeds.

- ⇒ Lane Width: Where chicanes are used, the travel lanes shall not be narrowed to a width less than nine feet, exclusive of gutter. Bicycle lanes where required shall be four feet wide exclusive of gutter.
- ⇒ Snow Removal: Chicanes shall be designed to minimize the accumulation of snow piles and trash in the gutter interface between existing curb and gutter and chicane.
- ⇒ Landscaping: Landscaping will typically consist of grass. Other landscaping may be selected from an approved landscaping list provided by the City. Initial landscaping will be provided and installed by the City and will be maintained by the neighborhood association or landscaping volunteer. Landscaping will not be approved which will obstruct the driver's vision of approaching traffic, pedestrians or bicyclists.

#### **6. Traffic Circles**

Traffic circles are circles of varying diameter formed by curbs. Motorists must drive around the circle or in the case of longer vehicles drivers may drive slowly onto and over a mountable concrete curb forming the circle. Traffic circles reduce motor vehicle speeds through the intersection, depending on the current intersection controls in place.

Other criteria to be applied and considered prior to installation include:

- ⇒ Design Considerations  
For each intersection the size of the circle will vary depending on the circumstances for that specific intersection. In general, the size of the circle will be determined by the geometrics of the intersection with the largest circle that meets the design considerations being

constructed. *Note that in most instances the circle constructed will be smaller to accommodate snow removal equipment.*

⇒ Where intersecting streets differ significantly in width, it may be more appropriate to design an elongated "circle" using half circles with tangent sections between them. Smaller circles will be considered on a case-by-case basis. Normally the circle will be located as close to the middle of the intersection as practical. Under special circumstances, such as being on a Fire Department response route, bus route or due to snow removal accommodations, the size and/or location of the circle will be adjusted to more appropriately meet these special circumstances.

⇒ Design Considerations for "T" Intersections

For "T" type intersections, all of the above design considerations apply. In addition, curb extensions (or curb bulbs) may be included along the top of the "T" at the entrance and exit to the intersection.

⇒ Signage

Signs will be used to identify and delineate traffic circles. Normally, one sign facing each vehicle approach shall be installed. An object marker sign shall be installed on a post whenever practical. The post shall be installed in the circle and offset – approximately one foot from the center of the roadways. The bottom of the lower set of signs shall be mounted at about three feet above the surface grade of the street. Where there is a significant upgrade approaching the circle, the higher mounted signs shall face that approach. Otherwise, the higher mounted sign shall face the approaches on the lower volume street. The warning signs will be installed as necessary. These signs should be installed approximately 150 ft. in advance of the traffic circle. The actual location is to be determined by a field investigation to assure adequate visibility. Other signs as may be appropriate may also be used in connection with a circle.

⇒ Channelization

On vehicle approaches with a grade in excess of 8%, or where the retro-reflective lane line markers on the circle become visible less than 90 feet from the circle as determined by a field investigation, "shear lines" may be installed. The purpose of the shear line is to indicate to approaching drivers that they should be steering their vehicles to the right even before the circle is visible. The shear line shall be two four inch wide yellow lane lines.

Yellow retro-reflective lane line markers may be placed on top of the circle at its outer edge.

Silver retro-reflective lane line markers shall be placed on the top of the curb for any curb extensions. These shall be placed at about five-foot spacings.

⇒ Parking Removal

Normally, parking will not be prohibited in the vicinity of the circle beyond that which is prohibited by the City of Madison, i.e., "within the intersection" or "within 15 ft. of crosswalk area" [Sec. 12.125(6)]. However, where special circumstances dictate, such as where the circle is on a response route for the Fire Department or to accommodate snow removal, or in an area where there is an unusually high use by trucks, additional parking may be prohibited as needed.

⇒ Sign Removal

At intersections where circles are to be installed, any previous right-of-way controls may be removed at the time of circle construction completion. However, where special circumstances dictate, the existing traffic control may remain in place or be otherwise modified at the direction of the City Traffic Engineer.

#### ⇒ Landscaping

Landscaping will be selected by the neighborhood association or citizen traffic committee from an approved landscaping materials list provided by the City. Initial landscaping will be provided and installed by the City and will be maintained by the neighborhood association. If the landscaping is not maintained, the traffic circle will be topped with an asphalt pavement.

**Volunteer Required:** Plant material will only be installed at traffic circles where a local resident or the neighborhood association has volunteered to maintain the plant material. This maintenance will include watering, weeding and litter pick-up, as needed. All volunteers will be provided with information on maintenance of the plant material and common problems.

**Points at which volunteers will be required:** During initial contact, the person or neighborhood association requesting participation in the NTMP will be informed of the need for a volunteer for landscaping. In the notice of the neighborhood meeting before construction, all residents in the project area will be informed of the need for a maintenance volunteer. This will be reiterated at the meeting if no one has volunteered. If no one has volunteered by the time that the circle is constructed, a special letter will be distributed to all residents in the project area informing them of the need for a volunteer. A final notice to the residents will be included in the cover letter for the "after" survey of the residents.

**Plant Replacement:** Where the Engineering Department had installed plant material in a traffic circle, the Department will replace any plant material which is damaged by traffic or vandalism or which dies due to planting, for a period of one year after the initial planting. If such damage is a persistent problem, the Department may decide to cover the circle with an asphalt topping rather than continue to replace plant materials.

## **Stop Signs**

In some instances stop signs can be used as an effective traffic management and safety device. However, in most instances stop signs are not used as a traffic management device within the NTMP.

Stop signs are used to assign the right-of-way at an intersection. They are installed at intersections where a crash problem is identified, where unremovable visibility restrictions exist (such as buildings or topography), and/or where volumes are high enough that the normal right-of-way rule is unduly hazardous.

Stop signs are generally not installed to divert traffic or reduce speeding. Studies from other jurisdictions show that such use of stop signs seldom has the desired effect. In fact, the use of stop signs solely to regulate speed typically causes negative traffic safety impacts (non-compliance with the signs and increased crashes as well as mid-block speeding).