BMP 5.7.1: Reduce Street Imperviousness

Reduce impervious street areas by minimizing street widths and lengths.

Key Design Elements	Potential Applications
▪ Evaluate traffic volume and on-street parking requirements. ▪ Consult with local fire code standards for access requirements. ▪ Minimize pavement by using alternative roadway layouts, restricting on-street parking, minimizing cul-de-sac radii, and using permeable pavers.	Residential: Yes Commercial: Yes Ultra Urban: Limited Industrial: Yes Retrofit: Limited Highway/Road: Limited
	Stormwater Functions Volume Reduction: Very High Recharge: Very High Peak Rate Control: Very High Water Quality: Medium
	Water Quality Functions TSS: Preventive TP: Preventive NO3: Preventive

Description

Reducing impervious street areas performs valuable stormwater functions, in contrast to conventional or baseline development. Some of these functions are increasing infiltration, decreasing stormwater runoff volume, increasing stormwater time of concentration, improving water quality by decreasing the pollutant loading of streams, improving natural habitats by decreasing the deleterious effects of stormwater runoff and decreasing the concentration and energy of stormwater. Imperviousness greatly influences stormwater runoff volume and quality by facilitating the rapid transport of stormwater and collecting pollutants from atmospheric deposition, automobile leaks, and additional sources. Increased imperviousness alters an area's hydrology, habitat structure, and water quality. Stream degradation has been witnessed at impervious levels as low as 10-20% (Center for Watershed Protection, 1995).

Applications

Street Width

Streets comprise the largest single component of imperviousness in residential design. Universal application of high-volume, high-speed traffic design criteria results in many communities requiring excessively wide streets. Coupled with the perceived need to provide both on-street parking and emergency vehicle access, the end result of these requirements is residential streets that may be 36 feet or greater in width (Center for Watershed Protection, 1998).

The American Society of Civil Engineers (ASCE) and the American Association of State Highway and Transportation Officials (AASHTO) recommend that low traffic volume roads (less than 50 homes or 500 daily trips) can be as narrow as 22 feet. PennDot Pub. 70 gives a range of 18-22 foot width for low volume local roads. Some municipalities have reduced their lowest trafficable residential roads to 18 feet or less. Higher volume roads are recommended to be wider. Table 5.7-1 provides sample road widths from different jurisdictions.

The desire for adequate emergency vehicle access, notably fire trucks, also leads to wider streets. While it is perceived that very wide streets are required for fire trucks, some local fire codes permit roadway widths as narrow as 18 feet (as shown in Table 5.7-2). Concerns also exist about other vehicles and maintenance activities on narrow streets. School buses are typically nine feet wide from mirror to mirror; Prince George's and Montgomery Counties in Maryland require only a 12-foot driving lane for buses (Center for Watershed Protection, 1998). Similarly, trash trucks require only a 10-½ foot driving lane, as they are a standard width of nine feet (Waste Management, 1997; BFI, 1997). In some cases, road width for emergency vehicles may be added through use of permeable pavers for roadway shoulders (see Figure 5.7-1).

Snow removal on narrower streets is readily accomplished with narrow, 8-foot snowplows. Restricting parking to one side of the street allows accumulated snow to be piled on the other side. Safety concerns are also cited as a justification for wider streets, but increased vehicle-pedestrian accidents on narrower streets are not supported by research. The Federal Highway Administration states that narrower streets reduce vehicle travel speeds, decreasing the incidence and severity of accidents.

Higher density developments require wider streets, but alternative layouts can minimize street widths. For example, in instances where on-street parking is desired, impervious pavement is used for the travel lanes and permeable pavers are placed on the road apron for the parking lanes. The width of permeable pavers is often the width of a standard parking lane (six to eight feet). This design approach minimizes impervious area while also providing an infiltration and recharge area for the impervious roadway stormwater (Prince George's County, Maryland, 2002).

Table 5.7-1: Narrow Residential Street Widths

Jurisdiction	Residential Street Pavement Width	Maximum Daily Traffic (trips/day)
State of New Jersey	20 ft. (no parking)	0-3,500
	28 ft. (parking on one side)	0-3,500
State of Delaware	12 ft. (alley)	---
	21 ft. (parking on one side)	---
Howard County, Maryland	24 ft. (parking not regulated)	1,000
Charles County, Maryland	24 ft. (parking not regulated)	---
Morgantown, West Virginia	22 ft. (parking on one side)	---
Boulder, Colorado	20 ft.	150
	20 ft. (no parking)	350-1,000
	22 ft. (parking on one side)	350
	26 ft. (parking on both sides)	350
	26 ft. (parking on one side)	500-1,000
Bucks County, Pennsylvania	12 ft (alley)	---
	16-18 ft. (no parking)	200
	20-22 ft. (no parking)	200-1,000
	26 ft. (parking on one side)	200
	28 ft. (parking on one side)	200-1,000

(Cohen, 1997; Bucks County Planning Commission, 1980; Center for Watershed Protection, 1998)

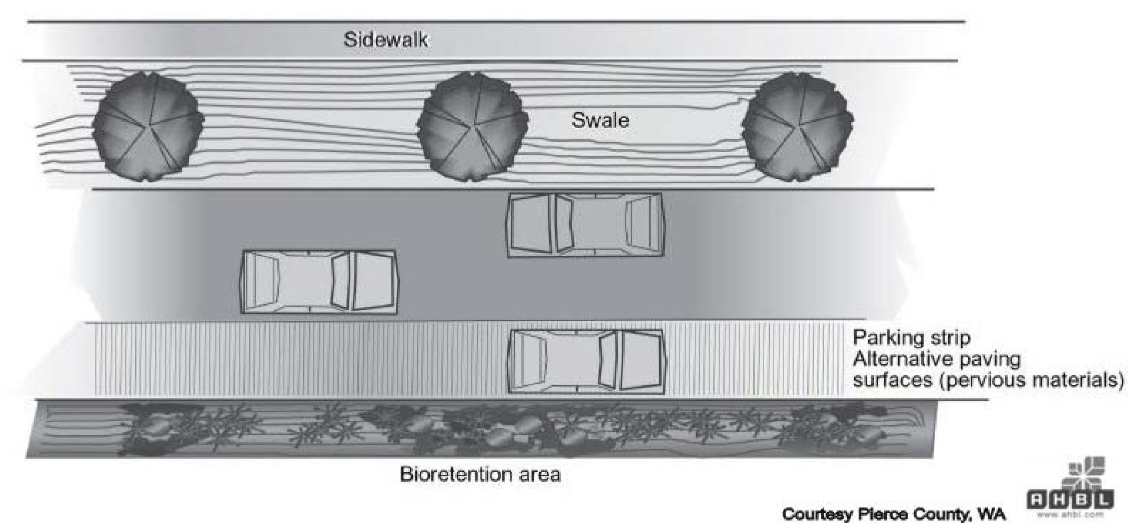

Figure 5.7-1 Reduced road width using adjacent pervious strips.

Table 5.7-2 Fire Vehicle Street Requirements

Source	Residential Street Width
U.S. Fire Administration	18-20 ft.
Baltimore County, Maryland Fire Department	16 ft. (no on-street parking) 24 ft. (on-street parking)
Virginia State Fire Marshall	18 ft. minimum
Prince George's County, Maryland Department of Environmental Resources	24 ft. (no parking) 30 ft. (parking on one side) 36 ft. (parking on both sides) 20 ft. (fire truck access)
Portland, Oregon Office of Transportation	18 ft. (parking on one side) 26 ft. (parking on both sides)

(Adapted from Center for Watershed Protection, 1998)

In residential neighborhoods, the perception of the need for large quantities of parking may lead developers to provide on-street parking; residential land use will greatly influence the quantity needed. Each on-street lane increases street impervious cover by 25%. Many communities require 2-2.5 parking spaces per residence. In single-lot neighborhoods, with both standard and reduced setbacks, parking requirements can likely be met using private driveways and garages. In townhouse communities, if on-street parking is required, providing one on-street space per residence is likely sufficient. Urban settings will require the greatest use of on-street parking. However, continuous parking lanes on both sides of the street, while common for all residential land uses, is often unnecessary.

When on-street parking is necessary, queuing lanes provide a parking system alternative that minimizes imperviousness. Communities are using queuing lanes to narrow roads while also providing two-way traffic access. In a queuing lane design, one traffic lane is used by moving traffic and the parking lanes allow oncoming traffic to pull over and let opposite traffic pass (Center for Watershed Protection, 1998). Figure 5.7-2 shows traditional and queuing lane designs.

Street Length

Numerous factors influence street length including clustering techniques (discussed in a separate Chapter). As with street width, street length greatly impacts the overall imperviousness of a developed site. While no one prescriptive technique exists for reducing street length, alternative street layouts should be investigated for options to minimize impervious cover.

Cul-de-sacs

The use of cul-de-sacs introduces large areas of imperviousness into residential developments, with some communities requiring the cul-de-sac radius to be as large as 50 to 60 feet. In most instances, and in large radius cul-de-sac designs especially, the full area of the circle is neither necessary nor utilized. When cul-de-sacs are necessary, two primary alternatives can reduce their imperviousness.

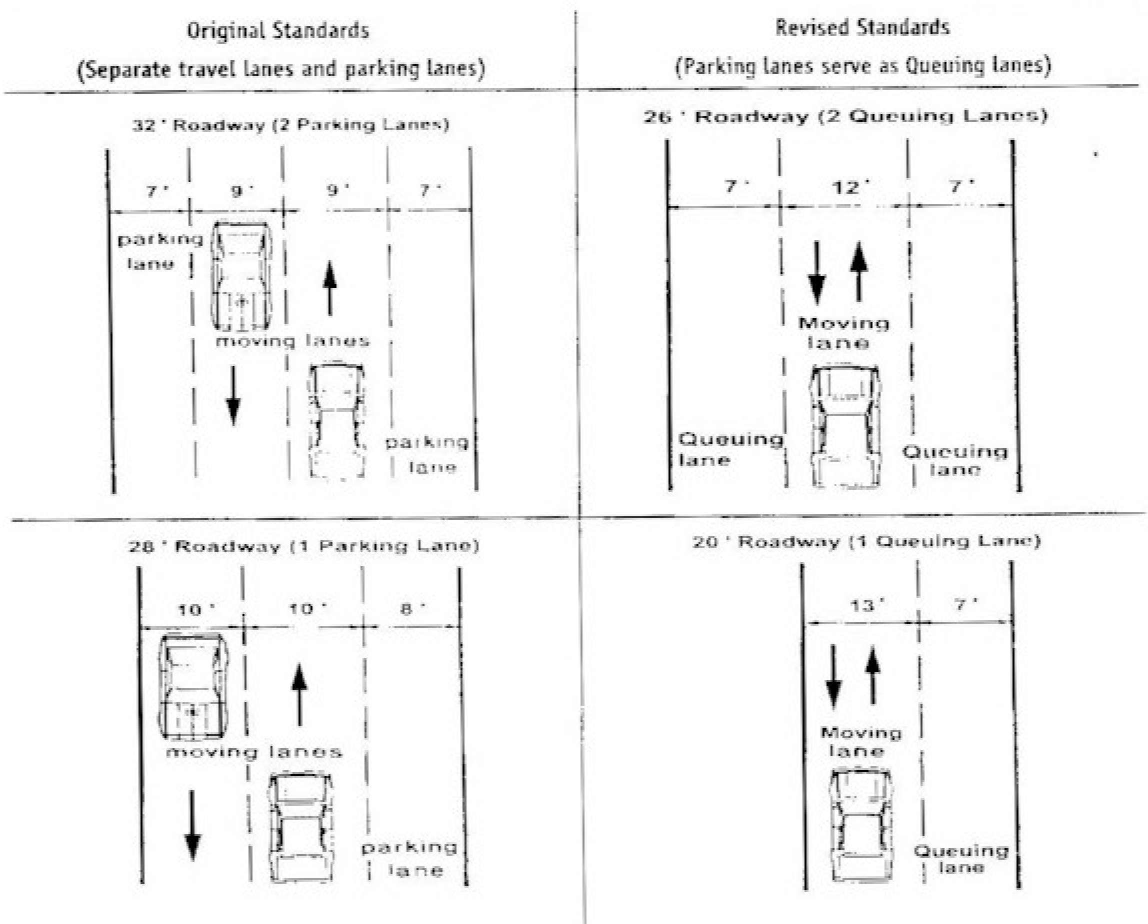

Figure 5.9-2 Traditional Streets vs. Traffic Queuing (Portland, Oregon Office of Transportation, 1994)

The first alternative is to reduce the required radius of the cul-de-sac. Many jurisdictions have identified required turnaround radii (shown in Table 5.7-3).

A second alternative is to incorporate a landscaped island into the center of the cul-de-sac. This design approach provides the necessary turning radius, minimizes impervious cover, and provides an aesthetic amenity to the community. In some instance, developments are placing bioretention cells (discussed in Chapter 6) in the center of cul-de-sacs to not only reduce imperviousness, but also provide a distributed method of treating stormwater runoff. Other cul-de-sac configurations have been developed which reduce impervious area.

Cost Issues

Street Width

Costs for paving have been estimated to be approximately \$15/yd^2 (Center for Watershed Protection, 1998). At this cost, for each one-foot reduction in street width, estimated savings are \$1.67 per linear foot of paved street. For example reducing the width of a 500-foot road by 5 feet would result in a savings of over \$4,100. This cost is exclusive of other construction costs including grading and infrastructure.

Street Length

In addition to pavement, costs for street lengths, including traditional curb and gutter and stormwater management controls, are approximately $150 per linear foot of road (Center for Watershed Protection, 1998). Decreasing road length by 100 feet can produce a savings of $15,000. Simply factoring in pavement costs at $15/yd^2, a 100-foot length reduction in a 25-foot wide road would produce a savings in excess of $4,000.

Table 5.7-3: Example Cul-de-sac Turnaround Radii

Source	Residential Street Width
Portland, Oregon Office of Transportation	35 ft. (with Fire Deaprtment Approval)
Buck County, Pennsylvania Planning Commission	38 ft. (outside turning radius)
Fairfax County, Virginia Fire and Rescue	45 ft.
Baltimore County, Maryland Fire Department	35 ft. (with Fire Deaprtment Approval)
Montgomery County, Maryland Fire Department	45 ft.
Prince George’s County, Maryland Fire Department	43 ft.

(Adapted from Center for Watershed Protection, 1998)

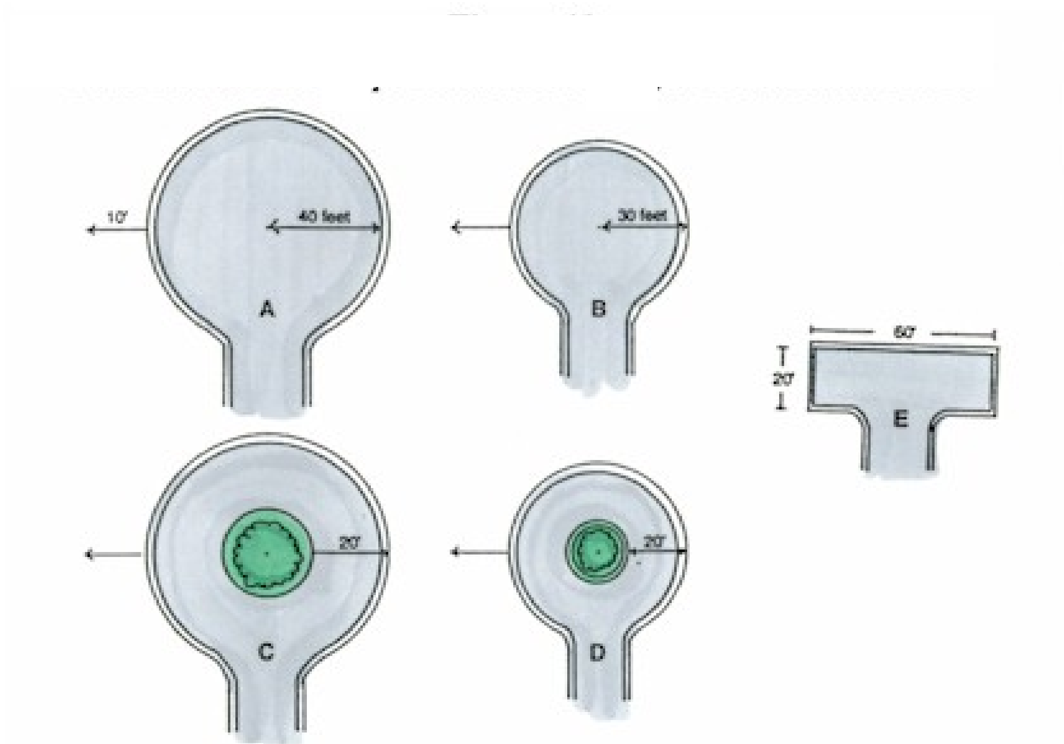

Figure 5.7-3 Five Turnaround Options for the end of a Residential Street, (“Better Site Design: A Handbook for Changing Development Rules in Your Community”, Center for Watershed Protection, August, 1998)