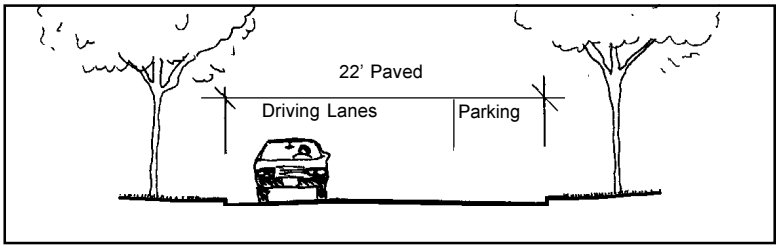
Street Design



Description

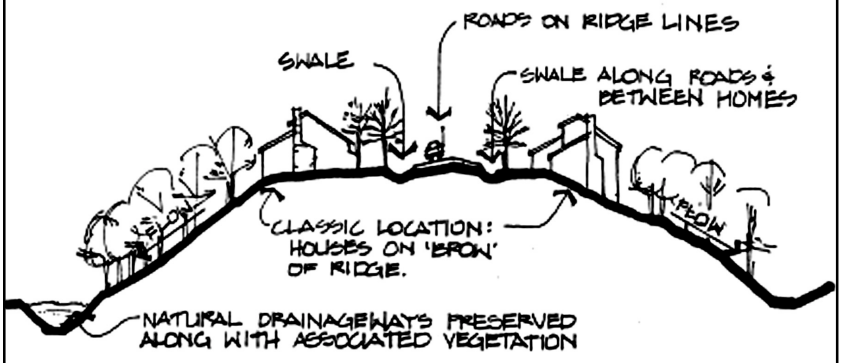
Street design offers numerous opportunities to reduce impervious surfaces and thus decrease runoff and associated stormwater management requirements. Areas of opportunity include the siting of streets, street width and drainage design.

Siting Streets

In new developments, road siting and street network layout are important considerations. To maximize stormwater filtration and infiltration, municipalities should aim to preserve natural drainage patterns whenever possible and avoid locating streets (and other impervious surfaces) in low areas or on highly permeable soils.

For example, locate roads on ridge lines, allowing water to drain naturally downhill. (See Fig. 1.) Whenever possible, choose sites with the least permeable soils for roads.

While designers must consider development character and context when designing a street system, they also should be aware that the



Place roads along ridge lines. Keep construction area away from low areas and valley flow lines.

Figure 1
Source: MPCA, 2000

Purpose

Water Quantity

Flow attenuation ◧

Runoff volume reduction ■

Water Quality

Pollution prevention

Soil erosion □

Sediment control ◧

Nutrient loading ◧

■ Primary design benefit
◧ Secondary design benefit
□ Little or no design benefit

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type of network selected affects the total amount of pavement. A typical grid system, for example, results in approximately 20,800 lineal feet of pavement, while a scheme of "loops and lollipops" (cul-de-sacs) results in 15,300 lineal feet of pavement. (See Fig. 2.)

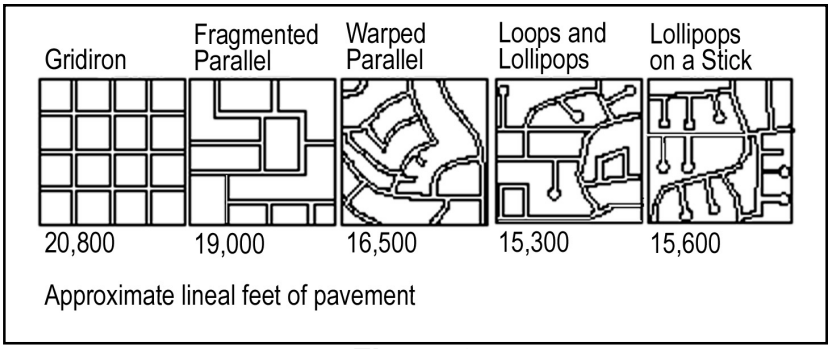

Figure 2

Source: Prince George's County, 2000 (adapted from ULI, 1980)

Design Width

Many residential streets are wider than necessary. They should be designed with the minimum pavement width that will support the area's traffic volume; on-street parking needs; and emergency, maintenance and service vehicles.

A simple way to narrow a suburban residential street is to provide for one parking lane rather than two. In especially low traffic areas, sidewalks may be restricted to one side of street or, in certain situations, eliminated.

Street Drainage

While curb-and-gutter is often considered the "standard" in road design, it tends to amplify stormwater volume and velocity while discouraging infiltration and groundwater recharge. Curbless road design, such as the so-called "rural residential section," encourages infiltration via roadside swales. (See Fig. 3.) On low-traffic streets without curbs, grass shoulders can serve as an occasional parking lane, allowing a narrower paved area.

Advantages

- Thoughtful siting and design of streets helps achieve stormwater control "at the source," which means less runoff requiring management, less stormwater infrastructure, and less impact on downstream water bodies.
- Reducing paving lowers development and maintenance costs.
- Forgoing curb-and-gutter in favor of a rural residential section results in major cost savings.
- Rural-section streets can incorporate attractive "rain garden" plantings in low areas adjacent the roadway, when soils permit.
- Narrower streets tend to slow traffic and create a more pedestrian-friendly environment.
- Reducing pavement lessens the urban heat island effect—the increase in air temperature that occurs when highly developed areas are exposed to the sun.

Limitations

- Local ordinances may preclude narrowed or curbless street design.
- Cities' desire to design roads to accommodate future growth may impede innovations.

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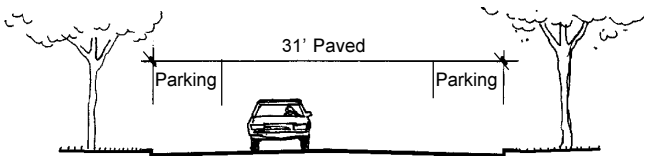
- Roadside swales are difficult to accommodate in single family residential developments with net densities above 8 units per acre.
- Good drainage for road subgrade must be provided when using roadside infiltration methods.
- Soil and topography may limit street siting opportunities.

Requirements

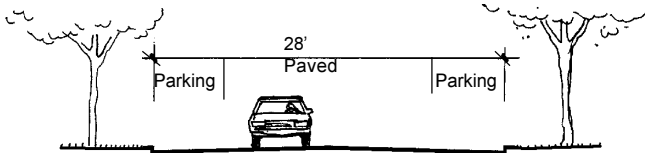
Design

- Design residential streets with the minimum pavement width necessary to support: the traffic volume; on-street parking needs; and emergency, maintenance, and service vehicles.
- Use shallow, grassed roadside swales (rural residential cross-section) instead of curb and gutter when net densities are 6 to 8 units per acre or less.
- Swales to catch road runoff should be sloped no more than 3:1 (See Lot Level Infiltration and Rain Gardens.)

Modest Street Widths, Two-Side Parking

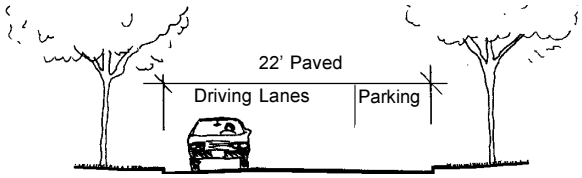


Standard width for residential collector streets, with parking on both sides. Dimension Source: Maple Grove, Minnesota.

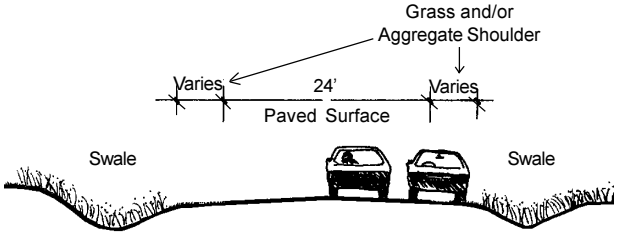


Standard width for residential minor streets, with parking on both sides. Dimension Source: Eden Prairie, Minn.

Other Alternatives



Allowing parking on only one side can further reduce the width of low-volume residential streets. Dimension Source: Robert Engstrom Companies (Fields of St. Croix, Lake Elmo, Minn.).



Crowned, curbless road drains to roadside swales. Grass shoulders function as occasional parking lanes. Dimension Source: Afton, Minn.

Figure 3

Source: Valley Branch Watershed District, 2000

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Requirements

Design (continued)

- Limit sidewalks to one side on roads with less than 400 Average Daily Traffic (ADT) (or 200 ADT for cul-de-sacs).
- Resist designing for distant future growth.

Construction

- Take care not to compact adjacent, permeable soils during road construction.
- Protect swales and other infiltration areas from sediment influx during construction, or remove sediment after construction is complete.
- For subgrade drainage options, see Lot Level Infiltration BMP.

Maintenance

- Swales planted with perennials grasses and wildflowers rather than turfgrass must be weeded at least monthly during the first two to three years. After that, weeding once or twice a growing season may suffice.
- Swales will need periodic sediment removal to maintain volume and filtering ability (see Rain Garden BMP).

Sources

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