Stormwater Best Management Practice

Green Parking

Minimum Measure: Post Construction Stormwater Management in New Development and Redevelopment
Subcategory: Innovative BMPs for Site Plans

Description

"Green parking" refers to several techniques that, together, reduce stormwater discharge from parking lots. Green parking techniques include setting the maximum number of parking spaces, right-sizing the dimensions of parking spaces, substituting alternative surfaces for asphalt in overflow parking areas, using green infrastructure to treat stormwater, encouraging shared parking and providing economic incentives for structured parking.

Applicability

All green parking practices in the above description are applicable to new developments, and some are applicable to redevelopment projects, depending on site characteristics. In urban areas, practices such as encouraging shared parking and providing economic incentives for structured parking are practical and often necessary. Commercial areas can have excessively high parking ratios (the number of spaces per building area), providing an opportunity to convert impervious surfaces with infrequent use to permeable surfaces.

Implementation

The most straightforward green parking strategy is to right-size the number of parking spaces, ensuring that there are enough spaces for the intended uses. Parking lots typically have far more spaces than necessary. By right-sizing parking, planners, developers and the community can ensure that there is enough parking without creating unnecessary impervious surface. The problem of too much parking results from designing parking ratios around the highest hourly parking needs during peak seasons—a common practice in parking lot design. Designing to average demand, as opposed to the peak demand, results in fewer spaces and less impervious space. For existing developments, design engineers can reduce the number of parking spaces and convert unused spaces to landscaped islands that provide aesthetic benefits and reduce impervious area. Table 1 provides examples of conventional parking requirements and compares them to average parking demand.

A parking lot designed with green infrastructure, vegetated buffers, and alternative surfaces can improve the quality of stormwater from the parking lot.

Resources

- *Parking Spaces/Community Places: Finding the Balance through Smart Growth Solutions* is a guidebook about parking policies and includes examples of how they can save money, improve the environment and meet broader community goals.
- *EPA's Mixed-Use Trip Generation Model* can help local governments better estimate parking demand.

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Table 1. Conventional minimum parking ratios.

Land Use	Unit	ULI Standard Parking Value[a]	ITE Standard Parking Value[b]	Actual Parking Demand[c]
Apartment/ condominium	Spaces per dwelling unit	1.50–1.70	1.20–1.38	0.41–2.82
Retail	Spaces per 1,000 ft^2 GFA	3.60	2.65	0.36–3.0
Hotel	Spaces per room	1.00	0.64	0.31–15.35
Lounge	Spaces per 1,000 ft^2 GFA	10.00	13.30	3.93–8.38
Office	Spaces per 1,000 ft^2 GFA	3.8	2.84	0.56–2.88
Restaurant	Spaces per 1,000 ft^2 GFA	10.50	10.10	2.05–14.75

Source: Kimley-Horn, 2016

GFA = Gross floor area of a building without storage or utility spaces.

[a] Standard rate from Urban Land Institute (ULI) as cited in Kimley-Horn, 2016.

[b] Standard rate from Institute of Transportation Engineers (ITE) as cited in Kimley-Horn, 2016.

[c] Range of rates for 12 municipalities studied in Kimley-Horn, 2016.

Using permeable concrete instead of asphalt can reduce stormwater quantity and improve water quality.

Minimizing the length and width of individual parking spaces is another technique that can minimize impervious area. Planners often cite large sport utility vehicles as barriers to minimization techniques. One option to address this problem is to provide a mix of parking space sizes and designate smaller spaces for compact cars. New technologies also allow for the use of intelligent parking reservation systems that can assign a driver to a parking space according to their vehicle size (Caicedo et al., 2012).

Another effective green parking technique is the use of alternative surfaces. Alternative surfaces include permeable surfaces and reduce stormwater discharges by increasing infiltration. They can include gravel, cobbles, wood mulch, brick, grass pavers, turf blocks, natural stone and permeable pavements. Permeable pavements include permeable pavers, pervious concrete and porous asphalt and can be effective substitutes for conventional asphalt and concrete, given their durability. For more information on permeable pavements, refer to the Permeable Pavements fact sheet.

Green infrastructure practices such as bioretention practices and grassed swales are other green parking techniques that can effectively treat stormwater before it leaves a parking lot.

- Bioretention practices are shallow, landscaped areas that temporarily store stormwater. Stored water then filters down through the bed of the system, where it either infiltrates into the subsurface soils or is collected by an underdrain pipe for discharge into a storm sewer system or another stormwater facility. For redevelopment projects, design engineers can convert underutilized parking spaces to bioretention practices.
- Grassed swales are vegetated conveyances that slow stormwater flow, allowing solids to settle. Depending on site conditions and design type, grassed swales can also promote infiltration.

Design engineers can integrate both bioretention and grassed swale stormwater controls into parking lot landscaped areas and maintain them along with other landscaped areas.

In mixed-use areas, shared and structured parking can reduce the conversion of land to impervious cover.

- A shared parking arrangement involves two parties that share one lot. For example, an office that experiences peak demand during weekdays can share its parking lot with an adjacent church that experiences peak demand during weekends and evenings.
- Structured parking, such as above- or below-ground parking garages, can greatly reduce the amount of stormwater-generating area for a given parking demand.

Limitations

Limitations to green parking techniques include applicability, cost and maintenance. For example, shared parking is practical only in mixed-use areas, and the cost of land versus the cost of construction may limit structured parking.

The cost of individual green infrastructure practices may also be prohibitive in some cases. Permeable pavements, bioretention practices and grassed swales can be more costly than traditional development—though it is important to take into account the cost savings that can be achieved by reduced stormwater management requirements.

The pressure to provide an excessive number of parking spaces can result from the fear of customer complaints about limited parking. These factors can pressure developers into constructing more parking than is necessary. Together, these barriers inhibit the construction of parking lots using the maximum number of green parking techniques.

Effectiveness

In most cases, design engineers can use multiple practices together, increasing overall effectiveness. Depending on the combination of strategies designers implement, green parking can reduce the amount of impervious surface, reduce stormwater flow rates and volumes, reduce stormwater pollutant concentrations, and provide a range of other environmental benefits.

Heifer International's parking lot is an example of the benefits of rethinking parking lot design (Industrial Economics, Inc., 2007). This nonprofit sustainable community development organization in Little Rock, Arkansas, designed an environmentally friendly parking lot for its new headquarters. The lot features green parking techniques including permeable pavement for parking spaces and five bioswales to convey water to a detention pond and treatment wetland next to the site. The company also provided on-site bike racks and dedicated parking spaces for carpooling and hybrid vehicles. Water quality benefits include significant reductions in stormwater volume and pollutants, including nitrogen, phosphorus, suspended solids and several heavy metals.

Cost Considerations

While some green parking materials have higher construction costs than conventional development materials, implementing green parking techniques can lead to lower maintenance and stormwater management costs. For example, in Bellingham, Washington, Bloedel Donovan Park retrofitted part of its parking lot to add a 550-square-foot bioretention practice. In addition to offering

an aesthetic benefit by adding native plants to the parking area, the bioretention practice reduced impervious cover in the parking lot and saved 75 to 80 percent over conventional stormwater management costs (LaCroix et al., 2004). Limiting the number of parking spaces, minimizing parking space dimensions and encouraging shared parking can also reduce construction costs.

Specific costs associated with individual stormwater controls can be found in the following fact sheets:

- Permeable Pavements
- Bioretention Practices
- Grassed Swales

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

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Industrial Economics, Inc. (2007). *Green parking lot case study: Heifer International, Inc.*

Kimley-Horn. (2016). *Parking generation—Replacing flawed standards with the custom realities of Park+*. Kimley-Horn and Associates, Inc.

LaCroix, R., Reilly, B., Monjure, J., & Spens, K. (2004). *A case study of the City of Bellingham's use of rain gardens to manage stormwater*. Puget Sound Action Team.

Disclaimer

This fact sheet is intended to be used for informational purposes only. These examples and references are not intended to be comprehensive and do not preclude the use of other technically sound practices. State or local requirements may apply.