

## ***Reducing Heat Island Effect by Code***

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“Use vegetation and reflective materials to reduce urban heat islands and minimize effects on microclimate and on human and wildlife habitat.”  
Sustainable Sites Initiative Guidelines & Benchmarks, 2009

### **PARKING LOTS GOING GREEN**

Green parking may be new to you. In previous editions of this column discussions have been put forward the fact that parking lots are going green and that landscape codes are helping to push this trend. In a recent column ([LASN Vol. 27, No. 2](#)) green parking lots have been defined as places that “do environmental work” and urban spaces that serve several purposes beyond storing cars.

Greening parking lots is a trend that landscape architects need to pay attention too, and for one good reason. The most familiar space to most Americans is not the backyard garden, neighborhood park or the town square. It is the parking space they use every day. Yes, this is American’s most used outdoor space and it is in general a hot, exposed, oily slab of reinforced concrete or uneven and pitted asphalt.

This column takes a look at a community codes that address parking lot shading. One of the first principles behind greening parking lots is to cover it with an overhead canopy to reduce the urban heat island effect.

### **Shading Codes**

Parking lot shading codes which have been around since the early 1980’s are not new, but are extremely rare across the country. Most landscape codes merely require a certain number of trees in parking lot, not a specified amount of shade. Shading codes go beyond tree planting for beautification and actually require calculations of shadow patterns, the extent of that pattern and best means for positioning trees to achieve the shading effects desired.

## **Calculating Shade**

The Sacramento city code *Title 17, Zoning, Division II, Development Standards Chapter 17.68 Landscaping and Paving Regulations, § 17.68.040 Tree Shading Requirements for Parking Lots* is among the best landscape codes in the country in regard to reducing the urban heat island effect with trees. This code drafted in 1983 sets standards to lower the amount of solar heat gain and increase solar reflectivity emanating from urban parking lots. At the same time this code sees trees as a tool that does several environmental improvements to the parking lot environment.

The code writes standards for surface parking facilities, expansion of existing parking lots and specific standards for tree shading. The language of the code sets forth standards and procedures for shade calculations, creating shading plans and drafting specifications for installation and maintenance.

The designer must prepare the plans, do the calculations and certify that shading complies with the standards set forth in the design manual titled *Parking Lot Tree Shading Design & Maintenance Guidelines* dated November 2001.

The technical essence of these calculations are based upon determining shade patterns and the extent of coverage over all surface parking facilities, including all surfacing on which a vehicle can drive, all parking stalls; all driveways and drive-through service lanes within the property.

The central technical standard to this code and several like it require tree plantings and tree planting areas to be so designed as to produce 50% shade coverage at a point in time fifteen (15) years from the time of planting.

The code assumes a calculation based upon a midday sun angle and sun altitude for approximate latitude 38 degrees, 52 minutes. Design guidelines provided by the city set forth a plant list whose square footage of a tree crown has been estimated at 15 years. This can be easily calculated on the plan. Existing trees or nearby shade producing street trees may also be calculated in to the 50% standard. Covered structures built over parking areas is also included in the calculation.

Tree specifications are set forth in *Appendix A* of the design manual include 35, 30, 25 and 20 foot radius tree canopy after 15 years. These are considered, maximum crown diameters to use in the calculations. Also provided to the designer in the guidelines are the height, *growth rate*, *roots character* and *tree form*. These diameters will of course vary across the country due to species, soils, moisture and climate.

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### **Green Parking VIII**

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The landscape plan must provide a tree symbol list, tree type designation (or plant species), tree quantity and the square footage of the parking area surface. The later must include the design of all interior planting areas walkways, travel lanes and parking spaces. The drawing shown in **Figure 1** shows a section of a parking lot which is to be calculated for shade.

Calculated on the plans are the Total Surfaced Area (**TSA**), Shade Area Required (**SAR**), Total Tree Shade (**TTS**) and the Total Shade Area Provided (**TSAP**) after 15 years of growth. Shading credits for individual trees are calculated as 100%, 75%, 50% 25% of canopy coverage. Overlaps are not counted more than once.

Calculations may be presented in graphic form as seen in *Exhibit A* of the design manual and shown in **Figure 2** below. This parking lot example calculates to a **73%** canopy coverage for the 23 space *Parking Grove* that is a segment of a green parking lot under design in California's Napa Valley.

A digital copy of an easy to use shade calculator is available for the asking from the author of this column.

### **Shading Parking Lots**

Studies at UC Davis by the *Center for Urban Forestry Research*, a program of the USDA reported in the January 2002 Informational Flyer as well as Fact Sheet no. 3 set forth the environmental problems associated with open paved parking as well as the economic benefits of planting trees in parking lots. They present some serious recommendations as to how tree plantings and maintenance practices can improve the environmental efficiency of urban parking lots.

They call for the strengthening of landscape codes to set a better standard for parking lot tree plantings.

Perhaps more cities should adopt the Sacramento Shading Standards into their community landscape code. Proper shading of parking lots will make environmental improvements to the large expanses of paved surfaces found in all American cities.

Email the author at [lsugreenlaws@aol.com](mailto:lsugreenlaws@aol.com) to request a copy of an Excel™ **Spreadsheet Shade Calculator** mentioned in this story.

Word count 982 LASN Green Parking VII Urban Heat Islands



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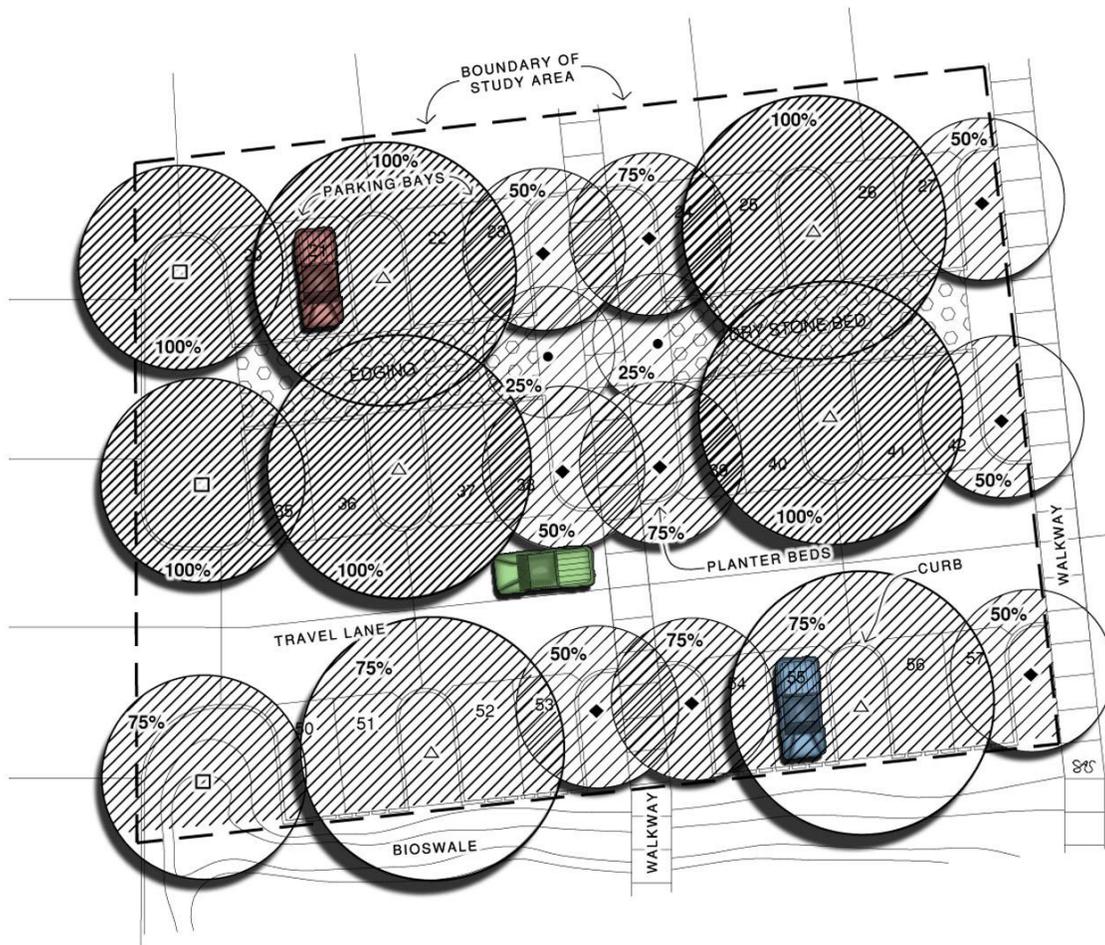


Fig. 1.0 Shade Calculations Napa Valley Green Parking Lot. Sarah Smith, Abbey Associates, Inc.

**Green Parking VIII**

SHADE CALCULATION TABLE									
TYPE	#	100%	#	75%	#	50%	#	25%	TOTAL SF
XL Δ	4	962	2	721	0		0		5290
L □	2	707	1	530	0		0		1944
M ◆	0		3	368	6	246	0		1596
S ●	0		0		0		2	79	158
TOTAL TREE SHADE (TTS)									8988 SF
SURFACE AREA*	PARKING +		14260		TOTAL SURFACE AREA (TSA)				
	CANOPY -		800					13460 SF	
SHADE AREA REQUIRED (SAR) 50%									6,730 SF
# Must show all 20 trees from plan TOTAL SHADE AREA PROVIDED (TSAP)									9788 SF
Note: stalls 56 & 57 covered (800sf) TOTAL AUXILIARY SHADE									800 SF
* Note: planters included in calculation PERCENT SHADE COVERAGE									0.727

Fig. 2.0 Shade Calculations Sacramento Code Exhibit A. Sarah Smith, Abbey Associates, Inc.

**AUTHOR NOTE:** Figure no. 3.0 shown below is not mentioned in this story. It could be an interesting graphic to attract reader's attention if space allows.



Fig. 3.0 A Green Parking Lot. Adam McGovern, Abbey Associates, Inc.

***Green Parking VIII***

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