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ORTHODONTIC OFFICE DESIGN Landscaping

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Landscaping is an essential component of any office location. A successful landscape works from detailed and imaginative plans, and is conscientious in site supervision. Lack of follow-up and detailing can turn an otherwise excellent design into a mediocre finished product.

For large or unusual jobs, a landscape architect should be a charter member of the site-plan development team.1 An accurate site plan of the lot will provide the landscaper with such vital information as the exact location of the building; the location of property lines, setbacks, and easements; placements of ingress and egress; and the size and location of parking areas.1

If the land has unusual undulations, is wooded, or requires major grading, a topographic analysis of the plot will also be necessary. A topographic survey accurately locates trees, other native vegetation, rock outcroppings, and any artificial features that may affect the design scheme. This information will allow an experienced landscaper to determine the most economical and esthetic way to handle slopes and water control, to make optimum use of the land with minimum maintenance, and to reduce future growth problems.

Climate Considerations

Solar activity is intensive for long periods of the day at some latitudes in the United States, and the cost of air-conditioning a building in the summer and heating it in the winter can be significant.

Landscapers divide climates into four general types – cool, temperate, hot and arid, and hot and humid. Experienced planners know their limitations well, and they select plants that can thrive in the local environment. The objective is to develop a landscaping strategy that controls solar radiation, temperature, humidity, and air movements (winds) while presenting an esthetic appearance.

The north side of a building is naturally the coolest, because it remains in the shade throughout even the sunniest days. To create an energy-efficient environment, however, the landscaper must consider the solar path and its relationship to the building during all four seasons of the year (Fig. 1). The solar path has two components: the sun's absolute height in the sky, known as the "altitude angle", and the distance it travels between the eastern sunrise and the western sunset, called the "bearing angle" (Fig. 2). You can obtain an accurate chart from books available in your local library that describes the sun's exact position, according to these two measurements, at any time of any day of the year at your latitude. The sun's longest and highest arc (summer solstice) occurs on June 22, and its shortest and lowest arc (winter solstice) on Dec. 22.

Trees and Other Vegetation

Most solar radiation is reflected back into space by atmospheric particles and clouds; only about 20% of the light and heat reaches the earth. Trees act as nature's air conditioners by blocking and filtering much of the remaining sunlight. They moderate the climate, reducing extremes of heat, wind, aridity, and glare (Fig. 3). University of Indiana scientists found that with an air temperature of 84°F, the surface temperature of a concrete street was 108°F. Where shade trees were planted, the surface temperature dropped by 20°F.2

Prudent tree and shrub placement in a landscape plan can greatly reduce utility bills, but some varieties of trees are more effective in intercepting the sun than others. For example, the Norway maple (*Acer platanoides*) and American linden (*Tila americana*), which have dense foliage and canopies with multiple leaf layers, can absorb about 75% of the sun's energy and 95% of its light. In temperate climates, deciduous plants in full leaf are the best interceptors of solar heat and radiation during the summer. In the winter, when their leaves have shed, they allow the sunshine to warm the building.

On a typical site survey, the landscaper delineates the outlines of wooded areas, the elevation of the land, and the types and sizes of trees at least 3-4" in trunk caliper. The following decisions must be made concerning tree use:

- Removal due to building placement
- Removal due to age or illness
- Transplantation of existing trees
- Planting of new trees

In some cases, local covenants will restrict gross removal of trees. If a lot is heavily wooded, carefully planned thinning of trees can open up vistas to and from the building. Prudent tree management should esthetically display and advantageously expose the building to passing traffic.

It takes about 35 years for the average tree to reach maturity, whereas the estimated life of most buildings (especially with wood construction) is about 50 years. Therefore, when new trees are planted, the time required for them to grow an efficient canopy to deflect heat and provide shade is an important consideration. Many trees grow to 35' in 10 years, but there are exceptions–the common green ash, for example, grows to only 25', and the red oak to only 18'. Evergreens, which provide color year-round, are a popular selection because they thrive in a wide range of North American climates, transplant well, make excellent windbreaks, and grow an average of 12" per year under ideal conditions and care.

In fact, trees increase the value of a site for many reasons other than their purely esthetic contribution. Trees can disperse noise from passing traffic–a particular problem in urban areas. Sound energy (measured in decibels) spreads out and dissipates in transmission. It can be absorbed, fragmented, and reduced by materials in its immediate environment. Plants absorb sound waves through their leaves and branches; those with thick, fleshy leaves and thin petioles are the most efficient (Fig. 4). A good tree for noise reduction is little-leaf linden (*Tila cordata*), which has a dense, compact crown and thrives in all but hot-arid climates.2

Some species of trees must not be planted too close to buildings because of their invasive root systems. The allowable distance depends on factors such as the type of subsoil, the building's foundation, and the local climate. Fast-growing trees with tenacious root systems, such as poplars and willows, should be planted at safe distances. Even slower-growing trees, upon reaching maturity, may affect sewer lines, foundations, patios, sidewalks, and parking lots. Therefore, care should be taken in the selection of all types of vegetation that surround the perimeter of buildings (Table 1).

The final arrangement of trees, shrubs, and ground covers depends on functional needs such as sun and wind control, as well as on esthetic considerations. Site planners know which plants thrive when grouped together; for example, they often group flowering trees by color, time of bloom, and watering needs. An accomplished landscaper will take advantage of arrangements that complement the existing land forms, and will select vegetation to enhance the beauty of the building on the site. In

communities that are subject to periodic water restrictions, it is wise to select plants that are native to the region.

Watering and Care

Selecting ground covers usually involves a choice between a higher initial investment with less future maintenance and a lower initial investment with greater maintenance costs. A good example is a grass lawn, which can be among the least expensive to establish, but later requires more time and care. Maintaining an excellent lawn involves fertilization, weeding, an investment in machinery or hired labor to cut the grass, and watering. On the other hand, many ground covers are almost self-sustaining in temperate climates. There are varieties of ground cover that require no additional watering beyond the region's natural rainfall and no grooming other than occasional trimming and pruning.

In semi-arid or arid climates (generally in the western United States), water and its cost can be a problem. Landscapers must consider conservation of local resources, economics of maintenance, and moisture requirements for the vegetation they select. A growing trend among planners is "xeriscaping" (from the Greek word xeros, meaning "dry"), which is a word coined to describe landscaping with water conservation as a major objective. Xeriscapes are not necessarily restricted to rocks and cacti. Waterwise landscaping in dry climates can include many kinds of trees and flowers, and such water-efficient plants can effectively surround a building.

Watering deeply, and only when plants need water, encourages root growth and produces healthier, drought-tolerant plants. Mulches applied and maintained at proper depths in planting beds help the soil retain moisture, reduce weed growth, prevent erosion, and decrease maintenance requirements. Grouping plants with similar water needs is more efficient because it creates their own water-retentive microclimate. These methods can produce as much as a 25-50% savings in irrigation costs.3

Even in arid climates, parcels of grass are not out of the question. Turf-type tall fescue, which requires less water than bluegrass, performs well in semi-arid areas. In drier climates, buffalo grass and blue gama can remain green for weeks without watering, even in the hottest summer weather. For more information on xeriscaping, check with the water resource department in your city or state. This is a growing movement nationwide, especially in water-conscious states.

Walls

Walls can be used as an enclosure for the landscaping plan or to articulate a specific space, such as a garden viewed from within the building. Walls fall into four categories:

- 1. Higher than eye level, forming a complete physical and visual barrier (Fig. 5)–used in high-density projects, where land is expensive, for privacy, and for unifying building complexes.
- 2. Below eye level–used as an alternative to bushes or fences.
- 3. Dwarf walls, 3' or lower–used as a strong physical barrier or as a more dramatic substitute for a thick hedge (Fig. 6).
- 4. Retaining walls of various heights–used to ensure the integrity of abrupt changes in land forms or to replace berming.

Berming can be attractive even when highlighted only by grass. A well-placed berm arranged with trees, shrubs, and ground cover can modify extremes of wind and climate and contribute to privacy. Applications of this principle have been found to reduce noise levels by as much as 80%.4

Stone and brick walls less than 3' high do not require footings more than 12-18" below the finished grade. Walls that are any higher should be approved by a structural engineer, because certain materials will require rebar reinforcement for structural integrity. Depending on the height, soil conditions, and climate, such walls may require footings 30-36" below grade for frost protection. Stone walls are generally more expensive and labor-intensive than those made of other materials, but they can more than compensate by contributing a powerful element to the landscape design (Fig. 6).

Low walls extending from the primary structure, especially when like materials are used, add a dramatic horizontal expanse to the building, making it appear larger. Lighter colors of stone provide a contrasting backdrop to enhance the natural beauty and form of ornamental trees, low shrubs, and other vegetation. Lower walls can reduce snow drifting in northern latitudes and help direct the flow of pedestrian and vehicular traffic.

A well-placed wall also acts as a windbreak. The maximum wind protection from a barrier is calculated at 5 times the height of the barrier.4 For example, a 25' group of trees provides most effective protection within 125' downwind. A deciduous tree retains only 60% of its wind-blocking ability in the winter. Therefore, a mixture of deciduous and evergreen trees of varying heights offers better wind protection throughout the year (Fig. 7).

Trellises

Trellises are commonly used to shelter the south faces of roofs, walls, windows, and patios. A trellis can control solar exposure on the west side of a building, which is a problem in all climates (Fig. 8). A well-designed trellis provides an intimate sense of enclosure and enhances the beauty of the primary structure (Fig. 9). Like a low wall, it is a relatively inexpensive method of dramatically extending the horizontal lines of a building and making it appear larger. When combined with vegetation, it can soften the appearance of a bland or stark building (as with many stucco structures).

Properly angled trellis slats allow the winter sun to enter, but keep out the summer sun (Fig. 10). In hot and humid areas where moisture is plentiful, a trellis can be covered with thick vines for additional shade. Coral vine (*Antigon leptopus*) or cat's-claw vine can be used in marginally hot climates with more limited moisture (Fig. 11).

Trellises with trumpet honeysuckle vines (*Lonicera sempervirens*) attract hummingbirds, which can be entertaining in a garden facing an operatory. Morning glories, another member of this vine family, also have attractive flowers and profuse foliage and are popular in warmer climates. They are fast growers, however, and require frequent trimming. Landscapers often select plants that attract butterflies for gardens and patio alcoves.

Parking

When possible, parking should be placed behind an office building. This maximizes the possibility of developing an impressive landscaping plan that enhances the view of the building from the street.1 Landscaping techniques should be used to alleviate the harsh appearance of paved parking lots. For example, a 3-1/2' hedge can be used to screen the parking lot from public view, as well from view within the building when parked cars are close to the structure.

If existing trees cannot be used, new trees should be planted in medians throughout the parking area. The honey locust (*Gleditsia triacanthos*) is a popular tree for parking lots, since its narrow trunk does not impair vision, and its root system is non-invasive and can tolerate small island dividers when

necessary. It grows rapidly, its canopy of smaller leaves filters some sunlight, and it provides acceptable levels of shade. A major advantage is that it is virtually maintenance-free: it is hardy and drought-resistant, and its small leaves disintegrate upon shedding, reducing the clean-up problems common with thick-leafed shade trees.

When parking must be placed in the front of the building, consider land contouring and berms that place parked cars below eye level (Fig. 12). Select trees whose canopies are high and whose trunks will not obstruct the view of the building from street traffic. Try to use as many trees and shrubs as possible throughout the lot, without blocking views, to create some color and points of interest.

Examples

The following examples show how the landscaping principles we have described can be applied to different needs. Dr. Mark Lenz of Racine, Wisconsin, placed his building on a corner lot to take advantage of existing trees and foliage (Fig. 13). Some trees were removed to establish a clear vista to the building and signage. Fortunately, some large, well-established trees were present on the northwest part of the lot. These trees became an excellent barrier against the harsh prevailing winter winds. Other existing and planted trees provided shade for the south side of the parking lot (Fig. 14). As they grow, they will eventually create an even greater cooling effect for the south side of the building.

Dr. Gary Wolf of Norwalk, Ohio, built on a site with slopes and elevated contours (Fig. 15). Fortunately, his slopes did not require extensive retaining walls, and the use of simple grass berming and ground cover protected the topsoil from erosion.

Dr. Harry White of Laguna Nigel, California, had a unique landscaping problem, with the rear of his building up against a steep mountain incline. A retaining wall system had to be designed to protect the building from potential mudslides (Fig. 16). A timber retaining wall was considered, but timbers can discolor and, over the years, are subject to termites and rotting in certain environments. Because waterfalls and a stream were part of Dr. White's plan, an esthetic, corrosion-resistant stone was selected. This forms a good interlock with the soil mass, is compatible with vegetation and the native bougainvillea ground cover, and is readily observable from the operatory. A trellis system provided shade for the operatory, with its southern exposure.

Conclusion

It is always prudent–and often economical in the long run–to obtain the best professional advice for any project. Architects, space planners, and interior decorators play an important role in designing an efficient and exceptional facility. Do not overlook the talents of a trained landscape planner in making your site into an esthetic and functional setting for your building. □

FIGURES

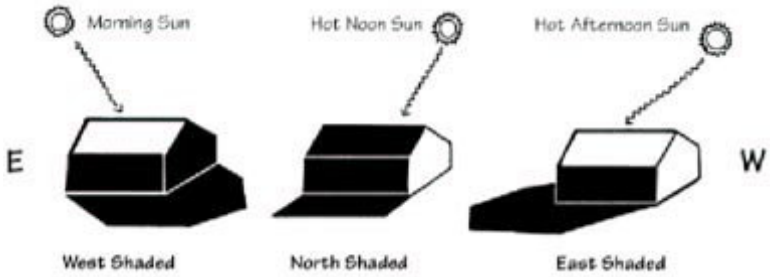

Fig. 1 Typical shading of west, north, and east exposures.

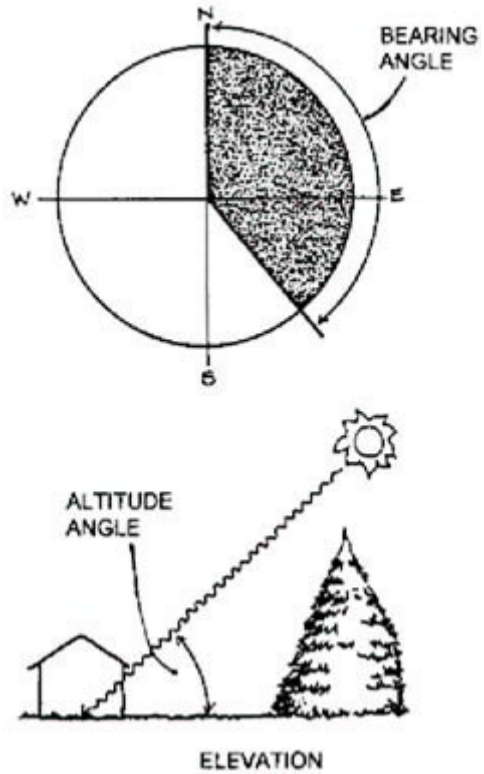

Fig. 2 Illustration of sun's bearing and altitude angles.

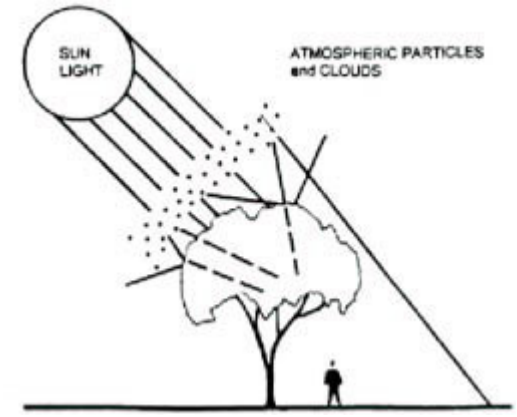

Fig. 3 Trees block considerable amount of glare from sun.

Fig. 4 Large and intermediate-size trees provide bulk-to-plant mass.

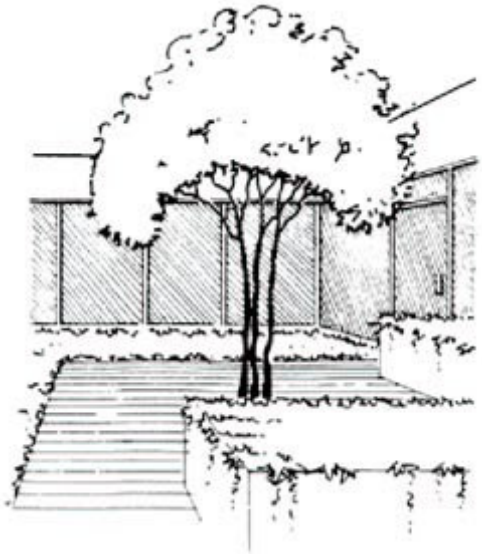

Fig. 5 High patio fence for privacy, with small accent tree.

Fig. 6 Curved decorative wall offers wind shelter for flower beds and ground cover in enclosed garden.

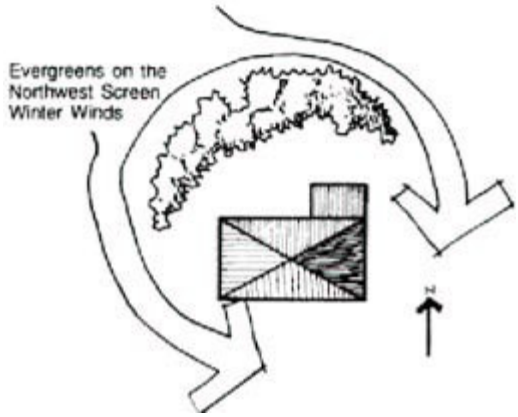

Fig. 7 Dense grouping of evergreens provides northwest screen against prevailing winter winds.

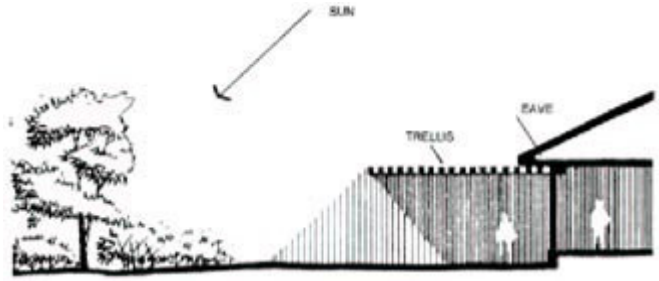

Fig. 8 Large eave and wide trellis, backed by grouping of low trees with thick canopy, offer relief from heat and glare on west side of building.

Fig. 9 Use of trellis on site of Dr. Harry White, Laguna Nigel, CA.

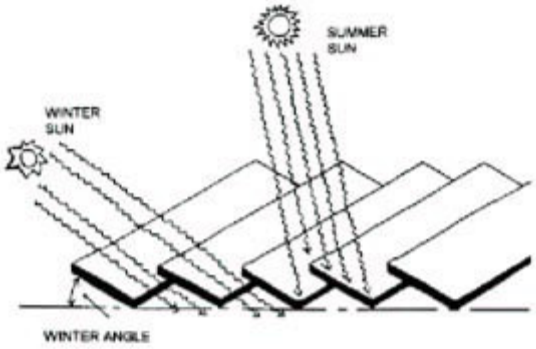

Fig. 10 Trellis with slats at proper angle for passive solar control.

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Fig. 11 Trellis with vines provides shade for south side of building.

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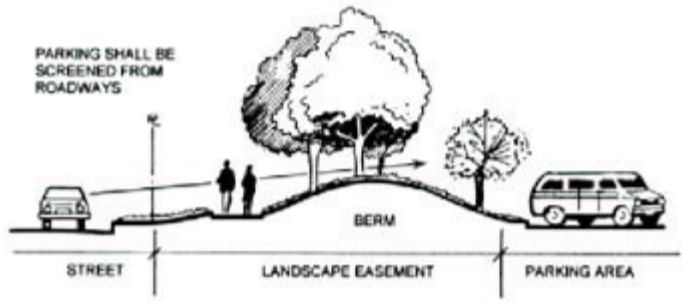

Fig. 12 Front parking area screened from road by landscaping.

Fig. 12 Front parking area screened from road by landscaping.

Fig. 13 Existing trees and foliage on corner lot of Dr. Mark Lenz, Racine, WI.

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Fig. 14 Trees provide shade for south side of parking lot and building of Dr. Mark Lenz, Racine, WI.

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Fig. 15 Grass berming and ground cover on highly contoured site of Dr. Gary Wolf, Norwalk, OH.

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Fig. 16 Office of Dr. Harry White, Laguna Nigel, CA, abuts steep mountain incline.

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TABLES

TABLE 1
CRITERIA FOR SELECTION OF PLANT MATERIAL

Hardiness
1. Is a specific tree, shrub, or ground cover native to the site? (Hardiness depends primarily on temperature and precipitation.)
2. Does the plant grow in or withstand the soil properties present (moist or dry, acidic or alkaline)?
3. Will the plant survive in city conditions if required? Will a tree be close to paved areas? Will it damage paving? Can it tolerate pollution and the salt or chemicals used for snow removal?
4. Does the plant prefer or thrive on northern slopes or southern slopes?
5. Is the tree, shrub, or ground cover easily susceptible to disease?

Form and Structure
1. What is the height of the plant at maturity? How long does it take to reach maturity?
2. Is the tree, shrub, or ground cover deciduous or evergreen?
3. Does the tree have good branch strength, structure, and bark color?

Foliage, Flowers, and Fruits
1. What is the foliage size, form, and color?
2. Does the plant provide shade, or does it have light, airy foliage?
3. Is there autumn color, and to what degree?
4. Are the flowers or fruits significant? When do they occur? How long do they bloom? What is their color?
5. Are the flowers fragrant?

Care
1. Is the tree, shrub, or ground cover difficult to transplant?
2. Does the plant require much maintenance?
3. Once the plant is established, is more than normal rainfall required?

Table. 1

REFERENCES

1 Hamula, W.; Hamula, D.W.; and Dwyer, F.: Orthodontic Office Design: Site planning, J. Clin. Orthod. 31:47-53, 1997.

2 Rubenstein, H.M.: A Guide to Site Planning and Landscape Construction, John Wiley and Sons, New York, 1996, pp. 297-299.

3 City of Aurora, CO: Landscaping for Water Conservation: Xeriscape! Denver Water Department, Denver, 1989.

4 Moffat, A.S. and Schiler, M.: Energy Efficient and Environmental Landscaping, Appropriate Solutions Press, 1993, pp. 24-31.