

Design of the Urban Street Trees and Problems in Turkey

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Abstract

Street trees are one of a city's most important natural assets. Street trees are an important urban element that can transform the city's streets and provide environmental, aesthetic, cultural and economic benefits. Street trees should possess strong apical growth, strong branching angles, an overall high aesthetic value, and predictable growth rates and, in general, have a potential for a long life span. Unfortunately, all the cities in Turkey haven't management plan of urban street trees. However, there were many problems and mistakes about design and practices of urban trees in terms of TS#8146 standards.

According to observations in Turkey, these problems and mistake are selection of mistake trees, no project of design, planting close spacing, don't take consideration into aesthetics values, using of allergic trees, insufficient planting pit, negative effects by urban people and insufficient care and cure studies.

Key words: *street trees, design, Turkey.*

Anotacija

Gatvės medžiai – vienas svarbiausių miesto gamtinių turtų. Gatvės medžiai – svarbus miesto elementas, kuris gali pakeisti miesto gatves ir aplinką estetiniu, kultūriniu ir ekonominiu požiūriu. Gatvės medžiai turi pasižymėti stipriju apikalinu augimu, stipriais šakojimosi kampais bei turėti didelę estetinę vertę, taip pat prognozuojamus augimo tempus ir ilgos gyvenimo trukmės potencialą. Deja, ne visi Turkijos miestai turi miesto gatvių medžių tvarkymo planus. Daug problemų ir klaidų yra miesto medžių projektavime ir metoduose TS # 8146 standartų požiūriu.

Atlikti tyrimai Turkijoje rodo, kad šias problemas sukėlė netinkamų medžių parinkimas. Nėra jokių dizaino projektų, nesilaikoma atitinkamų intervalų tarp sodinamų medžių, neatsižvelgiama į estetiškes vertybes, o taip pat alergizuojančių medžių sodinimas, netinkamų sodinimui duobių problema ir miesto žmonių daromas neigiamas poveikis bei medžių priežiūros ir gydymo žinių trūkumas.

Reikšminiai žodžiai: *gatvių medžiai, projektas, Turkija.*

Introduction

The urban open and green spaces may have a number of environmental, economic and socio-cultural values. Environmental values include reduction of air pollution and protection of water resources, reduction of harmful influence of sun, wind and temperature, increase in biodiversity. Economic values include production of food, fodder, timber and fuel wood, setting for new development, new businesses and jobs, increase in property values. Socio-cultural values include improved health and possibilities for recreation, pleasant living environments and stages for social activities, keeping people in contact with nature, education and training.

Urban streets are not just thoroughfares for motor vehicles. They often double as public spaces where people walk, shop, meet, and generally participate in many social and recreational activities that make urban living enjoyable (Wolf, 2006). The street (road, sidewalk and refuge) areas in open and green areas of the city have important positions because of their aesthetical and functional benefits upon urban life, and it is an inevitable reality. The streets in city are to of importance in terms of characteristics of their effective, permanent, dominant and functional in other urban open and green areas. The use of trees as an element of the landscape is an important design concept that has been used throughout the world, and continues to shape the aesthetics and function of the streets that connect cities and towns. It is accepted that these areas also have a vitrine of urban landscape (Gezer and Gul, 2009).

Trees in cities are widely regarded as an integral component of urban infrastructure (Schmid, 1975; Bernatzky, 1978; Grey and Deneke, 1986; Miller, 1997). The urban green mosaic encompasses a wide range of habitats that may be natural, semi-natural and entirely artificial. Of the different types of urban trees, those dwelling at roadside habitats routinely encounter the most stressful impacts in terms of atmospheric and soil conditions (Watson and Neely, 1994; Bradshaw et al., 1995; Jim and Liu, 1997).

Street trees are one of the most important components of urban green space and they play an important role in street aesthetics. People's first impression of a city comes from its street landscape (Jacobs, 1993). Street trees are an important urban element that can transform the city's streets and provide environmental, aesthetic, cultural and economic benefits. In the long term, they can create a sense of place and enhance public domain (City of Sydney, 2004). Street trees are a complex study entailed technical, aesthetical, biological and ecological knowledge (Kucuk and Gul, 2005).

In many urbanized areas in Turkey, insufficient green space has been allocated as the urban population increases. At the same time, however, interest in urban trees and forests has increased in such areas. This is believed to be due to: 1) growing awareness of urban trees and forests as places to recreate and relieve stress; 2) growing awareness of nature and the perceived quality of life improvement due to natural areas. Unfortunately all the cities in Turkey haven't management plan of urban street trees. However, there were many problems and mistakes about design and practices of urban trees (Gul and Gezer, 2004; Kucuk and Gul, 2005; Gul et al., 2009).

This paper highlights the design principles and the importance of urban street trees and discusses a general problem in the practices and planning and design of street, sidewalk and refuge trees in the cities of Turkey.

Importance of Street Trees

Street trees (roads, sidewalks and refuges) are one of a city's most important natural assets. Street trees are an important urban element that can transform the city's streets and provide environmental, aesthetic, cultural and economic benefits. Street trees should possess strong apical growth, strong branching angles, overall high aesthetic values, predictable growth rates and, in general, have a potential for a long life span (Gezer and Gul, 2009).

Urban trees are crucial to maintaining the high quality of public and perpetuating the living city vision. They are also a critical component of green streets. Researchers are well aware of the many benefits and functions that trees provide in cities. Extensive research has documented environmental, social, and economic benefits for communities, municipalities, and regions (Nowak and Dwyer 2000; Wolf 2004).

Landscape architects and urban foresters encourage streetscape tree planting to enhance the livability of urban streets. Besides the benefits all trees provide, street trees serve a special role in the urban environment. They help to enclose the travel corridor by defining and reinforcing a three-dimensional space around and over the street. No man-made element of the infrastructure can accomplish this effect. Street trees are the most visible of public trees. When we travel, whether on foot, bike, by bus or car, we experience street trees more intimately than other trees in the city.

Street trees provide multiple benefits to the urban landscape by reducing the urban heat island effect, cooling the air, providing protection from the wind, reducing storm water runoff, improving air quality saving energy, reducing noise pollution, reducing erosion, improving water and air quality, filtering pollutants out of the air, water and soil, improving the urban aesthetic or visual quality, shading, physically protecting pedestrians from runoff of the road vehicles, enhancing and providing property values and wildlife habitat (Schmid, 1975; Bernatzky, 1984; Grey & Deneke, 1986; Zeigler, 1986; Miller, 1997; Aslanboğa, 1997; Akbari et al., 2001; Wolf 2003; Gezer and Gul, 2009). Street trees are even good for the economy; customers spend 12 percent more in shops on streets lined with trees than on those without trees. According to Nilsson et al. (2000), street trees are exposed to a relatively high stress level and because of their exposure to multiple stresses their average life span is short.

Trees in streets are essential for a high quality urban landscape. Healthy, established urban trees provide a long term legacy for the community. Many of the most memorable streets and localities can attribute their noteworthy status to the presence of large healthy trees. It must be remembered that we are planting trees in an artificial, constructed environment that is far removed from their natural habitat.

In this situation there are bound to be some negative aspects associated with trees in an urban environment, however it is generally considered that the benefits trees contribute to our environment much more any negative aspects. The best way to achieve a net benefit from planting a tree is to select the right tree for the right location and take care of it.

Detailed Benefits of Urban Street Trees

Street trees have environmental, aesthetic, cultural and economic benefits (Burden, 2006).

1. Reduced and more appropriate urban traffic speeds. Urban street trees create vertical walls framing streets, providing a defined edge, helping motorists guide their movement and assess their speed (leading to overall speed reductions). Street safety comparisons show reductions of run-off-the-road crashes and overall crash severity when street tree sections are compared with equivalent treeless streets.

2. Create safer walking environments, by forming and framing visual walls and providing distinct edges to sidewalks so that motorists better distinguish between their environment and one shared with people.

3. Trees call for place making planting strips and medians, which further separate motorists from one another, pedestrians, buildings and other urban fabric. This green area adds significantly to aesthetics and place making.

4. Increased security. Trees create more pleasant walking environments, bringing about increased walking, talking, pride, care of place, association and therefore actual ownership and surveillance of homes, blocks, neighborhoods plazas, businesses and other civic spaces.

5. Improved business. Businesses on treescaped streets show 12 % higher income streams, which is often the essential competitive edge needed for main street store success, versus competition from plaza discount store prices.

6. Less drainage infrastructure. Trees absorb the first 30 % of most precipitation through their leaf system, allowing evaporation back into the atmosphere. This moisture never hits the ground. Another percentage (up to 30 %) of precipitation is absorbed back into the ground and taken in and held onto by the root structure, then absorbed and then transpired back to the air. Some of this water also naturally percolates into the ground water and aquifer. Storm water runoff and flooding potential to urban properties is therefore reduced.

7. Rain, sun, heat and skin protection. For light or moderate rains, pedestrians find less need for rain protection. In cities with good tree coverage there is less need for chemical sun blocking agents. Temperature differentials of 5–15 degrees are felt when walking under tree canopied streets.

8. Reduced harm from tailpipe emissions. Automobile and truck exhaust is a major public health concern and contains significant pollutants, including carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NOx), and particulate matter (PM). Tailpipe emissions are adding to asthma, ozone and other health impacts. Impacts are reduced significantly from proximity to trees.

9. Gas transformation efficiency. Trees in street proximity absorb 9 times more pollutants than more distant trees, converting harmful gasses back into oxygen and other useful and natural gasses.

10. Lower urban air temperatures. Asphalt and concrete on streets and parking lots are known to increase urban temperature by 3–7 degrees. These temperature increases significantly impact energy costs to homeowners and consumers. A properly shaded neighborhood, mostly from urban street trees, can reduce energy bills for a household from 15 to 35%.

11. Lower Ozone. Increases in urban street temperatures that hover directly above asphalt where tailpipe emissions occurs dramatically increase creation of harmful ozone and other gasses into more noxious substances impacting health of people, animals and surrounding agricultural lands.

12. Convert streets, parking and walls into more aesthetically pleasing environments. There are few street making elements that do as much to soften wide, grey visual wastelands created by wide streets, parking lots and massive, but sometimes necessary blank walls than trees.

13. Soften and screen necessary street features such as utility poles, light poles and other needed street furniture. Trees are highly effective at screening those other vertical features to roadways that are needed for many safety and functional reasons.

14. Reduced blood pressure, improved overall emotional and psychological health. People are impacted by ugly or attractive environments where they spend time.

15. Time in travel perception. Other research and observations confirm that motorists perceive the time it takes to get through treat versus non-treat environments has a significant differential.

16. Reduced road rage. Although this may at first seem a stretch, there is strong, compelling research that motorist road rage is less in green urban versus stark suburban areas. Trees and aesthetics, which are known to reduce blood pressure, may handle some of this calming effect.

17. Improved operations potential. When properly positioned and maintained, the backdrop of street trees allow those features that should be dominant to be better seen, such as vital traffic regulatory signs.

18. Added value to adjacent homes, businesses and tax base. Realtor based estimates of street tree versus non street tree comparable streets relate a \$15-25,000 increase in home or business value. This often adds to the base tax base and operations budgets of a city allowing for added street maintenance.

19. Provides a lawn for a splash and spray zone, storage of snow, driveway elevation transition and more. Tree lawns are an essential part of the operational side of a street.

20. Filtering and screening agent. Softens and screens utility poles, light poles, on-street and off-street parking and other features creating visual pollution to the street.

21. Longer pavement life. Studies conducted in a variety of California environments show that the shade of urban street trees can add from 40-60 % more life to costly asphalt. This factor is based on reduced daily heating and cooling (expansion/contraction) of asphalt. As peak oil pricing increases roadway overlays, this will become a significant cost reduction to maintaining a more affordable roadway system.

22. Connection to nature and the human senses. Urban street trees provide a canopy, root structure and setting for important insect and bacterial life below the surface, at grade for pets and romantic people to pause for what pets and romantic people pause for, they act as essential lofty environments for song birds, seeds, nuts, squirrels and other urban life. Indeed, street trees so well establish natural and comfortable urban life it is unlikely we will ever see any advertisement for any marketed urban product, including cars, to be featured without street trees making the ultimate dominant, bold visual statement about place.

Landscape Design and Principles of Street Trees

The inclusion of living plants to enhance architectural design is one of the reasons for designing with trees. Some of the aesthetic uses of trees in the landscape include: softening line and mass; and unifying diverse architectural elements. When designing a landscape project you need to consider the four basic elements of design: form, size, color, and texture. Besides the four basic elements of landscape design, streetscape designs are also governed by three different planting concepts: Formal, informal, and combined (City of Sydney, 2004).

In addition to the various design options, it should also be consider the locations of the street trees with regard to the sidewalk and the road.

- Street trees in planting strips: a planting strip helps to separate pedestrians from traffic lanes. The wider the planting strip the larger a tree can be, and the greater the buffering capacity for pedestrians. When planted in a strip large enough to accommodate the mature growth of the trees this is probably the ideal planting location for street trees.

- Street trees planted in pits with tree grates: This is a common planting option in areas with confined planting spaces and high pedestrian traffic.

- Street trees planted behind the sidewalk: when the curb, sidewalk and other street improvements are already installed, or if the planting strip is too narrow, the only place to plant a street tree is behind the sidewalk. Planted behind the sidewalk, the tree no longer buffers the pedestrians from the traffic lane, and it becomes more difficult to obtain the canopy effect of street trees over the roadway. However, by placing the tree behind the sidewalk there is potentially more soil volume available to the roots of the tree.

General Design Principles of Street Trees (City of Sydney, 2004).

- Consistency and visual uniformity for each street: The intention of this principle is to establish a uniform visual character for each street, a sense of identity or “sense of place” that compliments architectural forms and provides streets with a distinctive and recognizable character. Inconsistent street plantings with a multiplicity of different species can add interest to the streetscape, but they are also more difficult to manage, they may be inappropriate to the location, or may have a negative impact on the amenity of the street. In most cases the proposed species is an extension of the dominant existing species if that species has been deemed to be suitable in scale and growth habit.

- Enhance the local character of distinct areas by introducing a precinct planting approach: related to the principle of a consistent and coordinated theme for individual streets is the concept of “precinct” planting. All new planting will be based on a precinct approach where tree species selection and planting will reinforce the distinct physical character of each area and be responsive to its unique environmental conditions.

- Reinforce and celebrate the gateways and key nodal intersections: gateways will be acknowledged and celebrated by public domain improvements such as footway widening, which together with new mature tree plantings, will create great tree lined avenues that highlight their importance.

- Reinforce major boulevards and avenues: these major roads form corridors of movement through our area and are considered as separate in character to the precincts and suburbs they divide or bound. These streets will be strengthened with consistent, unified tree planting schemes.

- Enhance key cultural and commercial areas: these cultural and commercial strips will be enhanced and distinguished through special tree planting.

- Permit solar access: species should be selected that will provide an appropriate level of solar access to dwellings on the southern side of the road carriageway during winter.

- Allow the borrowed landscape to take precedence around existing parks: street tree planting along these streets is discouraged in order to minimize canopy conflicts. This also allows major trees along the park edges to ‘read’ from the Street.

- Heritage associations: if appropriate, street tree planting can be sympathetic to the heritage values of the built environment to further strengthen the sense of place for these areas.

Selection Criteria for Street Trees

In the long term, they can create a sense of place and enhance public domain. Trees in streets may occupy their planting sites for 50 to 200 years, so tree selection is vitally important. The basic approach for urban street tree should be aim to plant the right tree for the right location, for the right reason. In other words, to ensure that the selection of the species is appropriate to the local environmental conditions and the constraints of the planting location (City of Sydney, 2004).

Miller (1997) proposed a species selection model for selecting species for urban uses. Important factors in the model include the site factors (include cultural and environmental

constraints), economic factors (include establishment, maintenance and removal cost) and social factors (include neighborhood, community values, functional utility, species aesthetics, public safety, and negative social externalities).

The basic properties of the trees are: 1) climate adaptation; 2) resistance to diseases; and 3) large phenotypic plasticity in the plant materials. The properties related to the urban situation are: 1) aesthetic characteristics; 2) social factors; 3) root quality; 4) growth potential and form; 5) wind resistance; 6) drought resistance; 7) resistance to breakage of limbs and 8) tolerance of air pollution (Sæbø et al., 2003).

In general, selection criteria for trees in street; climate adaptation, resistant to diseases, large plasticity, aesthetic characteristics, social factors, root quality, growth; potential and form, wind resistance, drought resistance, resistance to limb breakage, tolerance of air pollution.

The need for uniformity of shape and growth is especially emphasized for street trees. Trees of specific shapes and growth characteristics should be made available to urban forestry authorities and most growing conditions. Also the responses to pruning and other management techniques may be important characteristics of street trees. Therefore, the needs for specific tree qualities may often be best served through the selection of clones or by narrowing the variation in a seed orchard to get uniform offspring (Lagerström & Eriksson, 1996).

Street trees should possess strong apical growth, strong branching angles, an overall high aesthetic value, predictable growth rates and, in general, have a potential for a long life span. The trees should not pollute the streets with their fruits and pollen release should be in moderate amounts and not of an allergy creating type. To meet the variable requirements of the different streetscapes, a wide variety of shapes, sizes and forms are needed. Both large and small trees and trees with crown shapes ranging from narrow to relatively wide are desirable. In order to secure the supply of the most suitable plant materials, both the nurseries and the users of that material should be involved in the selection program. The selection of species aims to ensure that trees make a positive contribution to environmental, amenity, aesthetic and heritage values of the area and any negative values are minimized. There is no perfect street tree and so every selection has some compromise between positive and negative values. In order to ensure the health and longevity of street trees planted, aesthetic and design considerations will be accommodated where optimum conditions for plant growth are available. The proven performance of the species in particular environmental conditions and functional requirements will be the prime considerations for street tree selection (City of Sydney, 2004).

Street trees are easily subject to stresses due to their proximity to atmospheric pollutants, poor drainage, inhospitable soil, mechanical damage, high and low ambient temperatures, and lack of space for growth (Ware, 1994; Jim, 1999; Sæbø et al., 2005; Thaiutsa et al., 2008). These factors should also be considered in the selection of street tree species.

Tree selection criteria are divided into three categories (City of Sydney, 2004):

A. Environmental criteria: the capacity of trees to establish depends heavily on whether the environmental conditions at the planting location are within the tolerance range of the species selected. Some of the environmental factors that affect tree selection are: climate, geology and soils, topography, tolerance in paved areas – low levels of soil oxygen and soil compaction, drought tolerance, tolerance of pests and diseases, tolerance of atmospheric pollution, wildlife habitat, native versus exotic street tree selection.

B. Functional criteria: species selected for street tree planting also need to fulfill certain functional criteria to ensure successful establishment and reduced ongoing maintenance and management issues. Performance record, readily available and transplantable at advanced size, acceptable leaf and fruit fall characteristics, low risk of becoming environmental weed, not prone to major limb shear, long lived, capacity to lift pavements and kerbing, low maintenance and solar access.

C. Aesthetic / design criteria: trees play an important role in enriching the cultural experience of a place and so aesthetic characteristics need to be an important selection consideration.

- Relationship with distinctive landscape characters: the selection of species may be made to reinforce historical, cultural or natural associations from our past.

- Ultimate size tree canopies: very large trees in confined spaces often result in unacceptably high management costs. Conversely small growing trees in broad streets rarely contribute significantly to visual quality. Trees selected will be in scale with the streetscape and if allowed, utilize the largest growing species possible for the area. Species should be selected such that the ultimate mature size of the tree is in scale with the street in consideration of the site constraints, such as nature strip widths, overhead power lines, building alignments and vehicle clearances. The optimum range is not so small that it does not make a significant contribution to the amenity of the street, and not so large as to dominate and cause significant problems. In some instances the constraints imposed by the street environment will limit the optimum size of street trees or even restrict tree planting altogether. This is the case with the majority of narrow laneways and footpaths throughout the area.

- Historic / cultural associations: the selection of species may have natural, historical or cultural associations with the locality. New plantings should consider the historical context of the locality.

- Form of tree canopies: selected species should have an appropriate and predictable form with an upright trunk and stable branch structure. Street trees need to have a form that allows traffic and pedestrian movements around the tree.

- Deciduous versus evergreen: the street tree list includes both evergreen and deciduous trees. Evergreen species provide year round screening, greenery and shelter from winds. Deciduous trees provide stimulating seasonal events whilst maximizing winter light. In residential areas deciduous trees are useful to maximize summer shading and winter light particularly for buildings located on the southern side of a street.

Frequent negatives raised about street trees include:

- Allergies: concern is sometimes raised that particular tree species cause allergies and respiratory problems. All flowering plants including grasses produce pollen. Generally species that rely on wind pollination create a greater pollen load to ensure continuation of the species. Pollen in the air can contribute to hay fever, eye allergies and other respiratory problems. Plane trees (*Platanus* spp.) are often cited as the main culprit for causing allergies however it is difficult to isolate its contribution to urban pollen levels when there are many different species including grasses producing pollen at the same time. Although plane trees are pollen producers, these species have a limited season of pollen production of a few weeks only in spring compared with longer season for grass species. The young leaves of Plane trees do have a tomentose or downy covering which is gradually lost as the tree matures.

- Leaf and fruit droppings all trees, including evergreens, drop leaves. Strategies to reduce the impact of leaf litter in our streets will be the coordination of our street sweeping resources to target problem areas. Species with fleshy fruits or leaves that become mucilaginous on decomposition will be avoided for selection.

- Damage to pavements: many old established trees in our area can cause footpath uplift and cracking. These trees generally are the vigorous and larger growing species. In adhering to the principle of the "right tree for the right location" future tree selection will be mindful of the potential of various tree species to cause pavement damage. Also an important consideration is the site preparation and establishment techniques used for tree planting. The use of nature strips where possible, maximizing the size of the planting "cut outs" in pavements and the use of flexible pavements and deflection barriers will minimize future instances of pavement damage and associated risk management issues.

Methods

The paper analyzes the design and practices of street trees according to some observations and investigations in some cities of Turkey (i.e. Isparta, Usak and Afyon). It also combines a survey of the literature about urban street trees. In Turkey there is the standard of city street and square trees which was designed by Turkish Standard Institute, TS#8146 (TSI, 1990). Observations of street trees were realized according to these standard TS# 8146.

Results and Discussion

The municipalities (Office of Park and Garden) are the main authorized and responsible agent for planning and management of urban open and green areas in Turkey. It is accept that urban street, sidewalk and refuge trees are an important one of the urban open and green areas in Turkey. (Aslanboga, 97, Gezer and Gul, 2009). These areas are used to widespread by all urban residents and visible front part of urban landscape. Urban trees are more effective, lasting, dominant, functional and multiple elements than other plants (shrubs, herbaceous and ground covers). Unfortunately, all the cities in Turkey haven't management plan of urban street trees. However, according to the observed studies in some cities (i.e. Isparta, Usak and Afyon), urban street trees have not been realized to this standard.

In general, some used conifer trees are *Biota orientalis* Endl. (Biota), *Cedrus libani* A. Rich. (Taurus Cedar), *Cedrus atlantica* (Endl.) Carr. (Atlas Cedar), *Cupressus arizonica* Greene (Arizona Cypress), *Cupressus sempervirens* L. (Mediterranean Cypress), *Pinus nigra subsp. pallasiana* J.F. Arnold (Anatolia Black Pine), *Pinus brutia* Ten. (Calabrian pine), *Picea orientalis* L. (Caucasian Spruce) and *Thuja occidentalis* L. (American arbor-vitae). Some used broadleaves trees are *Acer negundo* L. (Ash-leaved Maple), *Acer pseudoplatanus* (Sycamore maple), *Aesculus hippocastanum* L. (Horsechestnut), *Ailanthus altissima* Mill. Swingle (Tree of Heaven), *Castanea sativa* Mill. (Sweet Chestnut), *Catalpa bignonioides* Walter (Cigartree), *Fraxinus ornus* L. (Manna Ash), *Fraxinus excelsior* L. (European Ash), *Betula pendula* Roth. (European Whitebirch), *Keolreuteria paniculata* Laxm. (Goldenraintree), *Laburnum alpinum* J. Presl. (Scottish laburnum), *Ligustrum japonica* L. (Common Privet), *Populus* spp. (Poplar), *Platanus orientalis* L. (Oriental Plane), *Robinia pseudoacacia* L. (Black locust), *Robinia pseudoacacia* 'Umbraculifera' L. (Umbrella Black locust) and *Tilia tomentosa* Moench. (Silver Lime), in street, side walk and refuge in Isparta, Usak and Afyon.

There are some problems about practices of street trees in Turkey. According to observed studies, the general problems of street trees in cities of Turkey can be summarized as follows:

- In general, the practices of urban street trees are not sufficient and suitable to aesthetic and functional characteristics in terms of the design principles of Landscape Architecture and the standards for street trees. Street trees should contribute to the overall unity of the street landscape, through their layout, scale and character. Careful selection of the tree species will provide scale and visual cohesion to the street.

- The existing planted trees were not established in the planning and design projects for urban trees. For adhering to the principle of the "right tree for the right location", the design project of street trees should be prepared and very well defined all environmental, social and economic conditions of location. At the beginning, the management and planning of urban street trees should be taken into consideration together with other open and green areas in Urban Construction Plan. According to Miller (2006), management planning for street tree population involves an inventory of trees and community values, using the inventory to develop management goals, developing a management plan to achieve these goals, selection, establishment and maintenance of street trees, and feedback to monitor the entire process.

- The selection of tree species must also take into consideration the width of the planting strip or diameter of the planting pit available, in order to ensure that the tree roots and trunk will not damage nearby physical infrastructure.
- Street trees have been used without taking into consideration of dendrological properties and relations between trees and environmental conditions in these cities. In street trees project should be taken into consideration density, directions, dimensions of vehicle and pedestrian traffic, installation of substructure and superstructure. Trees should be located at a distance more than 2.5 meters from substructure installation (of electricity, plumbing, gas, central heating) (TSI, 1990).
- The street trees usually have been planted close spacing in the cities. Spacing standards should be based on the characteristics and needs of each influence on size of species chosen for planting. Miller (2006) said, the spacing standards are either community wide, such as 15 meters, for all streets, or relate to the mature size of the species planted. For example, trees attaining a small mature size are planted a minimum of 7.6 meters apart; medium 10.6 meters apart and large 16.5 meters.
- In general, wrong tree species have been used on the narrow sidewalks and refuges. For example some coniferous tree species include *Cedrus libani* A. Rich. “Taurus Cedar”, *Pinus nigra subsp. pallasiana* J. F. Arnold “Anatolia Black Pine”, *Cupressus sempervirens* L. “Mediterranean Cypress” and *Cupressus arizonica* Greene “Arizona Cypress”. According to the standard of street trees (TSI#8146), street and sidewalk trees should have minimum 2 or 2.5 meters for pedestrians and minimum 4.5 meters for vehicles for height of tree trunk without branch. Therefore, there should be preference to tall trees. Coniferous tree species which have wide pyramid and crown form should not be planted in refuge less than in 4 meters. In general, it is recommended that ideal street trees have characteristics which include smooth, tall, uniform trunks, rapid growing and making a dense shadow in the summer, falling leaves in a long time; more not shed branch, bark and fruits, be too thick, and not to come into existence a bend body. Street trees also are resistant to insects, disease and fungus, to snow pressure, to trim, to mechanical effects.
- In general, street trees have not been taken into consideration in terms of aesthetics values in Turkey. It should be considered form, size, scent and color of leaf, shoot, flower, fruit and bark, seasonal foliage color, the beginning time and period of bloom, branching habit, crown shape, the habitus of tree, mature size in species selection. Miller (1996) said that diversity is important in street tree management, from both a species and an age perspective. Architectural unity and maintenance efficiency can be achieved by planting a single species on a block or several blocks. Species diversity is introduced by changing species in a regular fashion by street and by block.
- In the past, pollens of planted tree species such as poplar and plane trees made allergic effect and negatively affect on the urban life.
- Some trees were planted under power and telephone lines. The remaining trees under wires have trimmed and pruned. The trimming and pruning were made incorrectly. Used sidewalk and street trees were very often planted. And also the height and crown diameter of trees were not taken into account in future.
- The soil volume or planting pit of planted sidewalk trees are very insufficient and usually of 30 x 30 cm in size (up to 50 x 50 cm) or less in located trees. There also are the problems of soil compaction, poor drainage and aeration, high soil pH, road salting. In fact, soil surface of trees should be at least of 1m x 1m sizes on sidewalk. (TSI, 1990). And also it should be ensured a sufficient quantity and quality of soil within the anticipated root zone to support the intended mature tree. Street tree location and design should optimize passive watering of all street trees.
- The street and sidewalk trees were subjected to negative effects by urban people. These effects can be summarized by breaking of trees parts (i.e. branch, shoot and leaf), throwing to harmful materials on bottom of trees, hanging up signboard on trees, and salting away to street or sidewalk.

- It was not realized efficiently some studies on related care and cure of trees and their environmental conditions include airing of the soil surface, over manuring, healing of wound, filling of cavities, supporting of trunks, the fighting against to insect and fungus attacks on the trees.

Conclusions

As a result, the street trees play an important role in the open and green spaces. Street trees studies contain complicate information including ecological, biological, aesthetic and technical principles. It should be performed as principles of planning & design and management in order to achieve the desired objectives by professional disciplines (Landscape Architecture, Forest Engineering and others).

Species selection, planting location, and cultural practices all have an impact on the ultimate visual quality, health, and cost of street tree maintaining. The use of appropriate species, the proper location of plantings, and the implementation of a program of preventative maintenance of the street tree, will allow a cost effective tree management system. Action programs related to trees in the urban are: (I) policy making, planning and designing, etc., (II) technical focus, such as selection programs and establishment techniques and (III) management aspects (Konijnendijk & Randrup 2002).

Mentioned the recommendations for the use of street trees will lead to a more effective and aesthetically successful use of trees as a design element along streets and sidewalk. Unfortunately, the urban residents and the authorities are not widely acknowledged yet about urban trees. Therefore, it should be aim to increase of awareness and consciousness in terms of sustainable management and protection of street trees.

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Miesto gatvių medžių projektavimas ir problemos Turkijoje

(Gauta 2012 m. sausio mėn.; atiduota spaudai 2012 m. kovo mėn.; prieiga internete nuo 2012 m. balandžio 23 d.)

Santrauka

Gatvės medžiai – vienas svarbiausių miesto gamtinių turtų. Gatvės medžiai – svarbus miesto elementas, kuris gali pakeisti miesto gatves ir aplinką estetiniu, kultūriniu ir ekonominiu požiūriu. Gatvės medžiai turi pasižymėti stiprių apikalinių augimų, stipriais šakojimosi kampais bei turėti didelę estetinę vertę, taip pat prognozuojamus augimo tempus ir ilgos gyvenimo trukmės potencialą. Deja, ne visi Turkijos miestai turi miesto gatvių medžių tvarkymo planus. Daug problemų ir klaidų yra miesto medžių projektavime ir metoduose TS # 8146 standartų požiūriu.

Atlikti tyrimai Turkijoje rodo, kad šias problemas sukėlė netinkamų medžių parinkimas. Nėra jokių dizaino projektų, nesilaikoma atitinkamų intervalų tarp sodinamų medžių, neatsižvelgiama į estetiškes vertybes, o taip pat alergizuojančių medžių sodinimas, netinkamų sodinimui duobių problema ir miesto žmonių daromas neigiamas poveikis bei medžių priežiūros ir gydymo žinių trūkumas.