



by Khaled Asfour

King Fahd Expressway

Riyadh, Saudi Arabia



Landscape Architect

BW&P, Bödeker, Wagenfeld & Partners

Client

Arriyadh Development Authority

Design

1985

Completed

1991

I. Introduction

The King Fahd Expressway is a major spine that runs through Riyadh in the north-south direction. Five kilometres of this spine pass through the downtown area, and it is landscaped in order to transform it from a major transportation route that typically downgrades every place it passes through into an urban development that improves the quality of the surrounding environment.

II. Contextual Information

a. *Historical background*

During the early decades of modernising Riyadh, there was a 200-metre wide road that linked both ends of the city in the north-south direction. The road was full of fly-overs that visually divided Riyadh into two halves. In the mid 1980s, there was a proposal to rebuild the spine by the planning firm Dar al-Handasah, in order to deal with the much larger volume of traffic. This proposal was for a continuous fly-over that carried rapidly traffic from one end of the city to the other with few exit or entry points into the city itself. The project was purely transportation planning with no consideration of the impact it would have on the surrounding environment regarding visual appearance, pollution, noise, and the neighbourhoods' expectations.

Dr. Mohammed Al-Sheikh, the former president of the Arriyadh Development Authority, convinced higher authorities of another alternative in which the expressway is not just another traffic spine but also a green backbone that connects both sides of the city with visually and functionally appealing parks. This was possible after sinking most of the road under ground level, thus further decreasing air and noise pollution.

b. *Local architectural character*

The local character of highways in Riyadh is usually one of straight lines with occasional meandering sections; they are large, dominating, serious, and are designed from an engineering perspective; that is, their function is to move a certain quantity of traffic flow from point A to point B in the least time and with minimum congestion. There are many highways in Riyadh and they dominate the visual character of the city. One can easily say that it is very difficult to move from one place in Riyadh to another without stumbling across one.

Landscaping on highways (if present) is usually made up of straight lines of shrubs in the median and widely scattered trees on the sides. Landscaping in this context is not meant for pedestrian use but is an act of beautification for the drivers. Trees that for a long time have been commonly planted in public streets here are of umbrella type such as *Ficus Altissima* and *Prosopis Juliflora*. These trees are sustainable in hot dry climates as their long roots reach for water. They are partially deciduous trees. If there are palm trees they are usually *Phoenix Dactylifera*.

c. *Climatic conditions*

The climate of Riyadh is that typical of a hot, arid zone. In summer, the temperature can reach 45°C during the day, and in winter it can drop as low as 10°C. Diurnal amplitude reaches +/- 10°C in summer and +/- 25°C in winter. Rainfall is extremely low, as is humidity.

d. *Immediate surrounding*

The immediate surroundings of this 5.1-km portion of the expressway are a densely populated area, largely characterised as poor to middle class. The type of fabric is old, either traditional mud houses

with courtyards and intertwined alleys, or early modern buildings in a primitive grid layout; in all cases it is a run-down place. In recent times, the area has seen aggressive large-scale developments such as Qasr al-Hokm and Al-Dera projects.

Landscaping is almost non-existent, and there is a clear need for public parks as breathing spaces for this densely populated area.

III. Programme

a. Conditions of programme formulation

The presence of Dr. Mohammed Al-Sheikh as a bureaucrat with a vision to integrate limited projects within an overall philosophy of city development created the special conditions for this project.

The existing road dated from the early modern era and was 200-m wide with asphalt ground cover. In summer the average 40° to 45°C daytime temperature is elevated in the environment of the road. The proposed plan in the mid-1980s by the Ministry of Transportation was equally ecologically poor; it was another spine, this time a continuous fly-over, cutting through the densest urban fabric of Riyadh with the only consideration being rapid car movement.

Dr. Al-Sheikh, originally a transportation engineer, soon realised that the project had to be stopped not only from an ecological point of view but also because it would malfunction. It did not serve the inner core of the city but rather was mostly interested in moving cars from one end of the city to another. This government official worked on resolving two problems, one political, another technical. On the political front, he convinced authorities, after they had already granted approval to start bidding for the original project, to take more time evaluating the design. On the technical end, he formed a team that included the German landscaping firm Bödeker, Wagenfeld & Partners, and started working on an alternate design after pointing out the deficiencies in the existing proposal.

The new design corrected all the weaknesses of the existing proposal, and considered cultural, environmental, and real-estate factors. The project thus became a unique national development rather than another mundane highway.

The political tangle to take a project from another ministry was very complex, but Dr. Al-Sheikh succeeded in transferring the project and the allocated funds to the Arriyadh Development Authority. The project in the end cost far less (by two-thirds) than what was originally conceived in the initial design.

b. Objectives

The expressway was to serve the inner city and not only its borders. It was to be environmentally friendly. Noise and air pollution levels needed to be carefully studied to be kept to a minimum, and surroundings neighbourhoods enhanced. Existing land ownership overlooking the project was not to be harmed by the project. Pedestrians needed to be able to move from one side of the road to the other, and be provided with safe, shaded walkways.

c. Functional requirements

The project sought to transform this stretch of road into a green corridor, linking the parts of the city with each other. It was necessary for the road landscaping to supply visual screening and micro-climatic improvement. It was also to provide small green spaces for urban recreation as well as a central garden in the middle of the development. Road intersections were to be planted with trees and

shrubs lining the walkways. Adjacent neighbourhoods were to be incorporated by landscaping the remaining unused, appropriated pieces of land.

IV. Description

a. *Project data*

Length of road section is 5.1 km, site area 5.6 ha. Total ground area for intensive planting: 200'000 m².

b. *Evolution of design concepts*

Response to physical constraints

The design concept evolved as a reaction to the poor design originally proposed as well as to the existing road. By analysing the proposal and the existing road, planners realised that there was a need to respond to the harsh environment of Riyadh as well as the delicate needs of the surrounding social fabric.

The site offered two constraints:

First, the project passes right through one of the densest urban fabrics in the city. Thus there was the need to sink the expressway below ground level as much as possible to reduce sound and air pollution and to "stitch" the fabric that was divided by the existing highway. The dense urban fabric also prompted the idea of generating parks on ground level wherever possible, to be used for recreation in this low-to-middle class community.

Second, the nature of the soil and the condition of the sewage and water systems were instrumental in making the idea of generating parks feasible. The city suffers from a serious leakage of water from sewage and water systems (18%). This water accumulates over a non-porous layer at 20 to 40 m below ground level, a geological feature of Riyadh soil. An aquifer is thus formed causing the underground water table to raise continuously as urbanisation increases. This situation was always a problem in laying foundations for any construction in the area. With this project, the idea evolved to use this trapped water for irrigating all the parks over and along the expressway. This was made possible by creating slopes to drain the water through underground channels and collect it in reservoirs. The water is then treated and pumped for irrigation.

The climatic constraints were obvious to the environmentally conscious client. The severe effect of the harsh climate in the city could not be further exacerbated by the large uncovered asphalt areas of a major highway. Hence the idea of landscaping pedestrian walkways, medians, and parks with a continuous umbrella of trees and shrubs arose.

Response to user requirements

The expressway is in most places sunk 10 to 15 metre under ground level. The 5.1-km development facilitated the connection of downtown with the outskirts, through 20 exit and entry points as opposed to 3 or 4 in the initial proposal. This layout also enabled the development of a central park over a sunken portion.

The spatial organisation of the parks is mostly informal in nature and reacts spontaneously to the setting of each site. There was no preset formula for the sites. Tying the parks on both sides of the expressway are walkways shaded throughout by umbrella trees. The development is very much

The central park, located on top of a sunken portion of the expressway, has a formal layout. The garden contains two major walkways lined by palm trees which cut the garden space into four quadrants, at the centre of which is a large fountain area. The garden is covered by a lawn and is elliptical in shape with pergolas and small concentration of umbrella trees on the sides.

Formal aspects

The central idea of the landscaping is focused on the use of shade trees in clusters which constitute a distinguished facade and mass for the project compared to other sections of the expressway. Trees that already exist in the area and are known to thrive in such an environment are frequently used. Examples are *Prosopis Juliflora*, *Albizzia Lebbek*, *Ficus Altissima*, *Zizyphus Spinaphristi* (Arabian Apple) and *Ficus Religiosa*. The palm tree commonly used is *Phoenix Dactylifera*. The landscaped areas, particularly the side parks, are characterised by the frequent use of hard landscape, such as gravel, tiles and rock formation, as ground cover under clusters of umbrella trees. The central park is meant to be the highlight of the development, so a different mass and facade is given to it. The garden is located in a rectangular block surrounded by roads of medium traffic density. Walking around the block, one sees that the garden is fenced by a concrete wall that has arched openings covered by wooden grilles at the entrances. The garden proper is elliptical, with a large triangular pocket at each of the four corners of the block. These pockets are planted with dense clusters of shade trees under which there is gravel. This treatment of the four triangular corners give the garden a familiar look compared to the side parks scattered along the expressway, but the curved elliptical fence covered by Riyadh limestone, and pierced with arched openings gives the park a distinguished elevation. Entering the park, one is struck by vast areas of well-maintained Bermuda grass and this, together with its formal layout, gives the park a unique look vis-à-vis the rest of the development along the 5.1-km stretch.

c. Structure, Materials, Technology

Structural systems

Structural design for landscaped areas on concrete slabs, which cover sunken segments of the road, required a depth of 1 to 2 metres for soil and special waterproofing material.

Materials

Concrete pavers and gravel are used in most instances for ground cover in the parks. Small children's play areas are covered by rubber tiles. In the central garden, pergolas have a concrete prefabricated structure, wooden screens, and metal sheets for roofing. For sensitive plants, such as jasmine, there are large metal encasements for protection against vandalism. Water proofing is not simple bitumen, as it attracts roots. Instead a special foil resistant to humid acid, root pressure, and sudden impact is used. Some water features are made of marble.

Construction Technology

The vegetation technology applied includes drip irrigation systems for trees and pop-up irrigation systems for lawns. Concrete work and hard landscape used prefabrication technology.

Building services, site utilities

Site utilities include wooden structures for children's play area, metal benches and lamp posts. Building services include water treatment and pump plants, WC facilities, and pedestrian bridges that move people from one side of the expressway to the other.

d. *Origin of technology, materials, labour force, professionals*

The water-proofing technology is German. The technology associated with soil mechanics, nursing of vegetation, irrigation systems, water treatment, and water drainage are all Western in origin but have been practised and manufactured in Saudi Arabia for a long time and are now part of the local knowledge.

The rocks are Riyadh limestone and soil is local; grass and shrubs are mixed components. Most plants have foreign origins, but have been used in the area for a long time and are produced by local nurseries. They are originally from desert climates such as California in the United States, Australia, South Africa, and India. The gravel is local, and the rubber tiles are German.

The labour force is comprised of Bangladeshi and Filipino workers.

The landscape architecture was carried out by a German firm, the General Contractor was French, and the Street Engineers, German.

V. Construction Schedule and Costs

a. *History of project*

Commission and design:	July 1985.
Completion of design:	December 1985.
Construction commencement:	May 1987.
Completion of construction:	December 1990.
Date of project occupancy:	1991.

b. *Total costs*

SAR 389'000'000, or USD 103'700'000.

c. *Qualitative analysis of costs*

Cost per m² is SAR 845'700'000, or USD 225'500'000.

d. *Maintenance costs*

For the central park, the annual operational and maintenance cost is SAR 235'000, or USD 62'666.

VI. Technical Assessment

a. *Functional assessment*

The expressway is becoming the lifeline of the city, not only in terms of traffic mobility but also as a vital source of greenery.

Side Parks:

The plan drew strength from the fact that there are so many leftover spaces of appropriated land that could be transformed into parks with very simple and humane designs. Old houses have doorways and

windows that open directly onto the parks. Neighbours around these parks use them as outdoor space for sleeping, social gathering, children playing, etc.

What helped the parks to flourish is the feeling of protection and exclusion they offer to the inhabitants through the placement of shrubs and walkways and sometimes berms as buffer zones between the green spaces and the street. Also, the clustering of trees to provide continuous shade, and the independent character of each park, due to designs in tune with the surrounding conditions, have imbued the inhabitants with a strong sense of territoriality.

In this way, the project should be conceived of as an urban upgrade of dilapidated areas with the expressway as a starting point for the development.

Central Park:

The design of the central garden is meant to contrast with the side parks as an alternative space for recreation. There is no doubt that the large area of grass, together with marble water features give the garden a unique finish and an expensive look in the context of Riyadh climate. The walls all around the garden have controlled access to protect the park from casual vandalism.

Another unique feature of the park is the alternative spaces it offers for sitting. People have the option of sitting on the grass after sunset, under concrete pergolas on the sides of the park, or under the shade of small clusters of trees. A family in this way may use the park again and again, at different times, each in a different setting.

The idea of cross-axial walkways that end in pavilions and gateways may have started from a vague notion about Islamic gardens, but soon developed to respond to immediate surroundings. The elliptical form of the garden enabled the architect to leave triangular corners that are packed with umbrella trees. These act as a screen that significantly reduces noise and pollution produced at traffic lights located on these corners. They also help in establishing a better microclimate for the park. People feel the difference in atmosphere when in this park compared to their own living places located in nearby districts.

b. *Climatic performance*

On hot days the parks are densely populated because of the improved microclimate they offer. The trees have flourished in the Riyadh climate.

c. *Choice of materials, level of technology*

For lawns, a pop-up irrigation system is used, with sprinklers that are projected above grass level by water pressure to irrigate grass in a circular motion. When irrigation is completed, they pop underground again. For trees and shrubs, a drip irrigation system is preferred because fine tubes with water spouts can be at the same level or slightly above the gravel. The systems are not only technically successful and useful in the desert climate, but also survive acts of vandalism as they are not easily seen.

The choice of material is logical and useful. Trees are the essential ingredient in the landscaping of side parks and walkways. The species used are common in the region, and their response to the climate and soil has been studied for decades. For example, *Prosopis Juliflora* is one of the best umbrella trees in the region as it adapts to the very harsh environment. It has deep roots that fetch water and grows rapidly. *Albizia Lebbek* has a very beautiful smell. *Ficus Altissima* is a very fast-growing tree. It has fruits that attract birds. It can operate, together with shrubs, as a good sound barrier because of its thick leaves that absorb vibration. *Ficus Religiosa* is very dense and thus gives

good shade when in clusters. *Zizyphus Spinaphristi* has small, delicious apple-like fruits. A mixture of different kinds of trees in one location gives a variety of advantages and characteristics. Common mistakes are avoided such as the planting of *Eucalyptus* and *Casuarina*, which draw all the nutrients from the soil and kill other trees

The use of concrete pavers and gravel as ground cover is appropriate, for they can stand harsh use, and can be used by those who prefer to stretch a rug on the floor to sit and socialise.

d. *Ageing and maintenance*

Maintenance is a big problem in Riyadh parks, both in the Diplomatic Quarter and in the King Fahd Expressway. The problem has nothing to do with technical issues such as irrigation systems, drainage networks, the survival of species in local climate, etc. It is primarily related to acts of vandalism. Examples of items that are continuously vandalised are water spouts, water taps, water nozzles, drippers, fountain bodies, WC furniture, trash cans, lanterns, tree branches, sensitive shrubs, grass lawns, etc. At the time of the landscaping of the expressway, the client and the architect had just finished that of Diplomatic Quarter and did not have much experience with acts of vandalism. Several years later, the experience gained by the maintenance department led to a gradual improvement of the situation.

About 80% of the ground covers, such as *Wedelia Trilobata* (Creeping Daisy), have been replaced by shrubs to withstand the acts of vandalism. Some delicate shrubs have been replaced for the same reason. One particular shrub that has proved successful here is *Carisa Grandiflora*, which has a very attractive smell but is full of thorns. The selection of trees has been successful and they do not require any unusual maintenance. The trunks are completely surrounded by metal encasements. In some side parks where lawns are planted, the maintenance department has placed rocks so that children do not play soccer and ruin the grass.

The planners' solution, to place umbrella trees and hard landscaping in parks that are heavily visited, while more sensitive plantation such as grass is planted in parks that are used occasionally, is a success.

e. *Design features*

The central park, employing a more sophisticated design than the side parks, has many design features that are not duplicated elsewhere. One of these is the extensive use of grass. As grass does not thrive in the shade of umbrella trees, it is preferable for it to be grown in direct sunlight. Another design feature provides shade, namely, pergolas. However, they are used in just one strip of modules aligned with the edge of the elliptical garden. In most cases they have just enough room for one family per module. Shade is also present under small clusters of umbrella trees close to the pergolas.

There is a smaller percentage of shaded areas in the central park than in the side parks. Is this a contradiction in the design, or is it simply a case of multiple alternatives? On Fridays, on a summer afternoon, families like to picnic in the central park. Do they prefer to sit in the sun or under a pergola? Is there a real choice in the hot weather? I believe there may be no real alternatives on summer afternoons to the pergolas and trees, but there are not enough in the central park. However, in the evenings, people would rather sit under the sky, and there is a lot of space on the grass for this purpose.

VII. Users

a. Beneficiaries of the programme

The users are local poor people with poor education who are living in old quarters nearby. The central garden is also visited by low-to-middle class foreigners of Asian origin.

b. Response to project

Very positive.

VIII. Persons involved

Client:

Former president of the Arriyadh Development Authority, Dr. Mohammed Al-Sheikh.

Role:

Instrumental in setting the objectives and design ideas of the project as well as pushing the design to its maximum potential.

Landscape architects:

BW&P, Bödeker, Wagenfeld & Partner

People Involved in the Project:

Richard Bödeker	Senior Landscape Architect
Horst Wagenfeld	Senior Landscape Architect
Hein van der Plas	Landscape Architect
Gunhild Brandhoff	Landscape Architect
Michael Dane	Landscape Architect
Joachim Müller	On Site Design & Project Supervi
Olaf Bux	Landscape Supervisor

General Contractor:

Dumez (Saudi Arabia - France)

Street Engineering:

Rhein-Ruhr Ingenieur GmbH

Khaled Asfour

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