6. SOFOULI STREET

6.1. Case Study Area and Character Sections

Case Study Area

Sofouli case study street is located at the northwest part of Kalamaria. Until 1995, Sofouli was a two direction secondary arterial, connecting Kalamaria with eastern Thessaloniki. Due to traffic capacity problems, the Traffic Plan of 1989 [7] proposed the creation of a pair of one-way streets, in order to increase capacity and reduce delays. As a result of that, Sofouli street was turned to one-way operation (change in operational characteristics) in September 1995.

Sofouli street study area has a length of 750 m and a carriageway width of 8.0m. It is a part of the main road network of Kalamaria and runs along the northwest coastal zone at a distance of approximately 90 m from the coast line. It carries an average daily traffic volume of 14,000 - 18,000 vehicles. Two public transport (bus) routes use the street.

Building height varies from 1 to 6 floors. The main use of the upper floors is residential, while the ground floor houses commercial uses such as Banks, Shopping centres, Super Markets, home furniture and equipment, restaurants, cafeterias etc. Finally, two schools (one high school an one primary) are located at the study area.

The implementation of the new scheme caused a series of problems, such as illegal on-street parking at both sides of the street. In addition, the main goal of the project was only partially fulfilled, since only one traffic lane is still used.
Character Sections

Sofouli Street Study Area is divided into two Character Sections.

The first one (220 m long) starts at Papagou Street and ends at Kerasountos street, and has a two-way operation.

The second section (530m long) starts at Kerasountos and ends at Argonafton street and operates as a one-way street.

After the implementation of the scheme in 1995, the following changes were resulted in the street operation:

- Increase in on-street parking accumulation
- Reduction in traffic flow, since vehicles of the opposite direction were transferred to other streets
- Increase in queues and delays at certain signalized junctions, because on-street parking lowers capacity
6.2. Street Attribute Descriptors

6.2.1 Built Form

**Buildings**

**Building Height:**

Most of the buildings have 4 main floors.

There is a significant difference between the two street sides regarding the building height. At the northwest side only a few buildings of low height are built, while the southeast side is densely built.

The average height of roofline on southeast side of street is 14m for the total street case. Most buildings have 4 floors, while new buildings have up to 6 or 7 floors.

**Change Before/After reconstruction**

There has been an increase in the number of floors and respectively in the building height during the years. This change is due to the demolishing of old houses and construction of new apartment buildings and is irrelevant to the street reconstruction.

**Cross sections**

[Diagram showing cross sections of the street, with labels for case study street, case study area, character section edges, and character section numbers 1, 2. Diagram includes measurements and annotations for street width, building height, and other relevant dimensions.]
Spacing of Buildings:

Northwest side
- Length of frontages: 135m
- Length of space between frontages: 557m
- Ratio of frontage to space between frontages: 0.24

Southeast side
- Length of frontages: 409m
- Length of space between frontages: 164m
- Ratio of frontage to space between frontages: 2.49

Inactive Frontages:

Northwest side
- Number of inactive frontages: 0
- Length of inactive frontages: 0m

Southeast side
- Number of inactive frontages: 1
- Length of inactive frontages: 21m

Doorways:

Northwest side
- Number of doorways opened onto the public realm: 8
- Number of doorways per 100m: 1.1

Southeast side
- Number of doorways opened onto the public realm: 33
- Number of doorways per 100m: 4.4

Historically important buildings:

There are no historically important buildings along Sofouli street.

Quality of Built Fabric:

Buildings are newly constructed, with modern style and materials. Both character sections present a nice image in terms of the quality of built fabric: reinforced concrete and masonry are the basic materials used, due to strict Greek building regulations and seismic code. The street reconstruction did no change the quality of built fabric.
Space Between Buildings
Primary Descriptors

Street Width: The average distance between opposing building lines is 32m. This number varies significantly from section to section. It is 37m in Section 1 and narrows to 31m in Section 2.

The average width of public space between buildings is 10m shorter than the distance between opposing building lines, that is 5m in each side of the street. The 5m wide areas in front of buildings belong to the neighbour properties. In some cases it is enclosed by a fence and is used as a private garden, but in many cases it is embodied to the public side space.

<table>
<thead>
<tr>
<th>Side Space Width</th>
<th>Width of side space at the Northwest side of str (m)</th>
<th>Width of side space at the Southeast side of str (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>7.4 (6.0-section1 7.9-Section 2)</td>
<td>6.2 (6.2-section1 6.3-Section 2)</td>
</tr>
<tr>
<td>Narrowest</td>
<td>4.5 (5.2-section1 4.5-Section 2)</td>
<td>5.8 (6.0-section1 5.8-Section 2)</td>
</tr>
<tr>
<td>Widest</td>
<td>9.4 (6.8-section1 9.4-Section 2)</td>
<td>6.7 (6.3-section1 6.7-Section 2)</td>
</tr>
</tbody>
</table>

The following photos are taken successively in different points, walking from Section 1 to Section 2.

Median Strip: Sofouli Street does not have median strip.

Width Between Side Space: The width between side spaces is 8m all along Sofouli street.

In Section 2, where Sofouli street has a one-way operation, the carriageway is used both for circulation and on-street parking. As there is a significant parking demand in the area, parked cars occupy almost constantly a 2m wide lane in each side of the carriageway, leaving one lane to traffic.

In Section 1, where Sofouli street operates in two directions, the 8m wide carriageway is used exclusively by traffic.
Green has an influence on Sofouli street space. There are a lot of flowerbeds at the side space, planted with bushes, small palm trees and other decorative trees.

At the northwest side of the street there is a Municipal area, still not developed, which, according to urban planning proposals will be rehabilitated to a landscape gardening.

Street surfaces, furniture and other design elements:

Sofouli street is paved with asphalt. The sidewalks are covered with concrete blocks or stone slabs. The carriageway pavement is in good condition. Sporadic patches and cracks have been observed.

Pedestrian zebra crossings are provided at all signalised intersections. The pavement markings maintenance is good. Close to the high school, in Section 1, warning and speed limit signs are painted on the pavement to indicate the school area and to warn drivers to reduce their speed.

Low kerbs and ramps are provided at all pedestrian crossings. Most of them are well designed and constructed.

Guard Railing:

Bollards are used sporadically, in order to prevent cars from parking on sidewalks.
Along Sofouli street there are only two places for people to congregate, even if the recreational land uses, the school complexes and the residences generate people movements.

Both public places are in Section 2. The first one includes a park and a playground and is located by a pedestrian street. A small number of trees and bushes are planted in the park, but its overall image is not very well attended.

The second public space is located between Sofouli street and the sea and is not shaped as a park or garden, except for some olive trees and grass, which grow in it. The Municipality plans to develop the place with landscaping and athletics installations, according to the Local Plan.

Sofouli street has two rows of street lighting in both character sections. The average distance between two successive lighting poles (of the same row) is 37m.

The light is adequate both on the footway and on the carriageway.

### Secondary Descriptors

<table>
<thead>
<tr>
<th>1A Definition</th>
<th>Ratio of street width to building height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of green</td>
<td>'Influence' = green has an influence on the street space</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1B Definition</th>
<th>The average width between side spaces is 8m. Total average side space is 14m. Not all of the side space is public.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The enclosure effect is minimum, as there are not many buildings at the Northwest side of the street</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1C Transparency</th>
<th>Inactive building line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of doorways per 100 metres of building line</td>
<td>3.2 (2.8-Section 1 3.5-Section 2)</td>
</tr>
</tbody>
</table>

| Illuminated building line |
| There are only few heavily illuminated large windows at the ground floor level on both sides of Sofouli street. |
6.2.2 Function, Management and Regulation

Primary Descriptors

One-Way or Two-Way Working:

Section 1 of the study area operates as a two way street, while Section 2 has one-way operation.

The first major parallel to Sofouli street is Ikonomidi street, which has a two way operation between Papagou and Kerasountos str., exactly like Sofouli, and after that it becomes a one-way street, with the opposite direction to Sofouli street.

All the crossing streets operate in two directions.

Change before/after reconstruction

The major change after reconstruction was the implementation of one-way operation in character Section 2. The initial Traffic Plan of Kalamaria, aiming to increase the street capacity, proposed this scheme. In the meantime, many several traffic control measures were taken in order to increase traffic safety along the street.

Kerasountos junction, change from 2way to 1way

Rubber detail for traffic division

Speed limit:

In Section 1, the speed limit is 40 km/h because of the school.
In Section 2 the speed limit is 50 km/h.
Traffic Calming Measures:

Traffic calming measures in Section 1 include warning and guide traffic signs and pavement markings, which indicate the school site and impose the speed limit.

No traffic calming measures were implemented in Section 2.

Number of Marked Traffic Lanes:

There are 2 marked traffic lanes at Sofouli street study area.
In Section 1 that operates in both ways, on-street parking is not allowed and there is 1 traffic lane in each direction.
In Section 2 that works one way, traffic lanes are restricted by on street parking in both sides of the street, so, most often only one lane is effective for traffic.

Change before/after reconstruction

After reconstruction the pavement markings were changed, to indicate the one-way operation. Besides the lines, the new markings included arrows indicating the direction of traffic. At Sofouli-Kerasounto junction, where Sofouli street’s operation changes from one-way to two ways, a special pavement marking together with elastic reflecting elements was applied in order to guide the drivers.

Lane Width:

The lanes’ width is 4m.

Visual Width:

There is no visual reduction of carriageway width.

Division/Allocation of Carriageway Space:

- **Segregation of carriageway**
  - **bus**
    - ☒ separate
    - ☒ in mix
  - **bicycles**
    - ☒ separate
    - ☒ in mix
  - **pedestrians**
    - ☒ separate
    - ☒ in mix
  - **HOV / taxis etc**
    - ☒ separate
    - ☒ in mix

Pedestrians use the sidewalks.
Bicycles are not specially cared for and they use the carriageway or the sidewalks.

Pedestrian Crossings:

All pedestrian crossings are signalized and have zebra markings and lowered kerbs with ramps.
There are 3 signalized pedestrian crossings along the study area, every 250m in average.
Two of them are at signalized junctions. In front of the school there is a pedestrian-actuated traffic signal There are no pedestrian over / underpasses, neither built pedestrian crossings.
Occasionally refuse bins or illegally parked cars obstruct pedestrian crossings.
Even if there is enough signalized pedestrian crossings, many pedestrians cross Sofouli street anywhere, especially students near the school area. This situation is extremely hazardous and although measures have been taken, the problem still remains because of wrong pedestrian behavior.
There are 3 signalized junctions along Sofouli street study area. No special phase is provided for cyclists or buses.

Sofouli Street has no roundabout junctions.

Sofouli Street has 10 non-signalised (priority) junctions.

On-street parking is not prohibited along Section 2, where there are 130 on-street parking spaces. There are no restrictions nor specially reserved parking places.

In Section 1, on-street parking is not allowed.

There is a number of cars illegally parked on sidewalks.

The major change after the street reconstruction was the appearance of parked vehicles at both sides of the street. The Municipality intends to take parking control measures, to prevent parking from at least one the street sides. In addition, the Municipality considers to apply time restrictions or to charge on-street parking, in order to increase turnover.

Cyclists are not especially cared for along Sofouli street. There are no special facilities for them, but the lowered kerbs and ramps for pedestrians and handicaps are used by the cyclist as well.

Nevertheless, the Municipality has designed and will implement a bicycle route on the south-eastern sidewalk of Sofouli street.

There are two (2) bus stops along the study area, both in Section 2. The average distance between successive bus stops is approximately 380m.

Bus stops are clearly indicated by a special sign and provide shelter with a bench and a map showing the bus routes within Kalamaria. Parking in front of bus stops to a length of 25m is prohibited by Greek traffic regulations.
### 6.2.3 Patterns of Use

#### Traffic Primary Descriptors

<table>
<thead>
<tr>
<th>Average Vehicle Flow</th>
<th>Average Daily traffic flow (24 hour AADT) by vehicle type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars/vans</td>
<td>12,750 in Section 1</td>
</tr>
<tr>
<td></td>
<td>16,700 in Section 2</td>
</tr>
<tr>
<td>Vans/trucks &gt;3.5T</td>
<td>200 in Section 1</td>
</tr>
<tr>
<td></td>
<td>180 in Section 2</td>
</tr>
<tr>
<td>Buses</td>
<td>140 in Section 1</td>
</tr>
<tr>
<td></td>
<td>200 in Section 2</td>
</tr>
<tr>
<td>Motorcycles/mopeds</td>
<td>850 in Section 1</td>
</tr>
<tr>
<td></td>
<td>750 in Section 2</td>
</tr>
<tr>
<td></td>
<td>There is one major cross street with significant traffic, Kerasountos str.</td>
</tr>
</tbody>
</table>

**Change before/after reconstruction**

Most of the traffic volume of Sofouli street is through going traffic.

<table>
<thead>
<tr>
<th>Peak Vehicle Flow</th>
<th>Peak Hour traffic flow along Sofouli street by vehicle type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars/vans</td>
<td>900 in Section 1</td>
</tr>
<tr>
<td></td>
<td>1,250 in Section 2</td>
</tr>
<tr>
<td>Vans/trucks &gt;3.5T</td>
<td>15 in both sections</td>
</tr>
<tr>
<td>Buses</td>
<td>10 in Section 1</td>
</tr>
<tr>
<td></td>
<td>20 in Section 2</td>
</tr>
<tr>
<td>Motorcycles/mopeds</td>
<td>70 in Section 1</td>
</tr>
<tr>
<td></td>
<td>50 in Section 2</td>
</tr>
</tbody>
</table>

**Bus Reliability:**

The average bus delay is 1 minute. Although the calculated average delay is too low, it is possible to deviate from the average, which affects bus reliability.
There are various pedestrian street activities along Sofouli street. During the morning hours, the residential uses generate every-day pedestrian trips, home to work, school, shops etc. The yachting club, which accommodates courts and various sports facilities, also generates pedestrian trips in the study area.

A significant pedestrian mobility is observed also during the evening, as in the study area there are various cafés, bars and restaurants.

Pedestrian flows along the road sections of the study area were not available from Municipal or other sources. These flows vary significantly with time of day, season and exact location. Therefore, flow counts in one period and at one point only are not indicative of the real situation and representative of the pedestrians’ level of service. Nevertheless limited pedestrian flow counts were conducted according to the ARTISTS’ suggested instructions, in November 2002. These counts were taken during afternoon peak period (around 13:00) and resulted in the following figures:

650 pedestrians / h in Section 1
150 pedestrians / h in Section 2

(in both street sides at the busiest point)

It is worth mentioning that although there are several obstacles on the sidewalks, such as illegally parked cars, flower beds, kiosks, bus stops, trees and poles (lighting, electricity, telecommunication, traffic signals, advertisement etc.), the effective walkway width is quite wide. Thus, pedestrian mobility is not significantly obstructed and is rather free.
In a similar manner, observations of pedestrian flows at peak hour (afternoon around 13:00) were conducted and resulted in the following figures:

600 pedestrians/h Section 1
120 pedestrians/h Section 2

(in both directions at the busiest point in winter)

There are a lot of pedestrians crossing the street at non-protected (traffic signals, zebra crossings etc) points; especially students in Section 1.

Most buildings within the study area have mixed residential and retail use. Section 1 has a stronger residential use than Section 2.

<table>
<thead>
<tr>
<th>Number of workplaces on ground floor *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total str</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
<tr>
<td>Retail</td>
</tr>
<tr>
<td>Public service</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of workplaces on ground &amp; upper floors *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total str</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
<tr>
<td>Retail</td>
</tr>
<tr>
<td>Public service</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Floor space in m² of ground &amp; upper floors*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total str</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
<tr>
<td>Retail</td>
</tr>
<tr>
<td>Public service</td>
</tr>
</tbody>
</table>

The upper floors’ use is primarily residential. There are a couple of office buildings in the area. In addition, offices can be found at the upper floors of some residential buildings.

The ground floor of buildings in front of Sofouli street has mainly recreational use (bars, restaurants, cafes).
Off-Street Parking:

There are two off-street parking lots at the study area, both of them at Section 2, at the Northwest side of the street.

The first one is located close to Kapetanidou street and has a capacity of 120 parking spaces. The second is located close to Kolhidos street and has a capacity of 150 spaces.

Both are open-air public parking lots with no restrictions (time or charge). None of them is a properly organized and designed.
6.3. Performance Indicators

6.3.1 Street Safety

Traffic deaths and injuries:

Existing Situation

The numbers of accidents presented hereby are referred to the period 1999-2001.
Total number of road deaths = 0
Seriously injured pedestrians = 0
Slightly injured pedestrians = 0
Seriously injured two-wheelers = 0
Slightly injured two-wheelers = 3
Seriously injured in motorised vehicles = 0
Slightly injured in motorised vehicles = 4

The following totals are given separately for the total length of the street case, as well as for the two character sections.
Serious road injuries = 0 (Section 1: 0 Section 2: 0)
Slight road injuries = 7 (Section 1: 3 Section 2: 4)
Killed and injured = 7 (Section 1: 3 Section 2: 4)
Accidents = 6 (Section 1: 2 Section 2: 4)

From the above is concluded that the number of fatal and serious accidents along Sofouli street is not very high. Most of the accidents involve two-wheelers. All accidents occur at intersections. A high concentration of accidents occurs at Kerasountos junction, where Sofouli becomes one-way street.

Changes before/after reconstruction

There has been a significant reduction of road accidents during the past years and especially after the reconstruction of Sofouli street. This is due to the implementation of many measures aiming to improve traffic safety (traffic signals, warning and guide traffic signs and marking), as well as to the extensive information campaign before and after the reconstruction of the street.

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Road Deaths</th>
<th>Serious Road Injuries</th>
<th>Slight Road Injuries</th>
<th>Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-2001</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>1995-1997</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>1987-1989</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>19</td>
</tr>
</tbody>
</table>

Accidents during 1999-2001

- Fatalities - 0
- Heavy injuries - 0
- Light injuries - 7

Distribution of accidents by participants:
- Single vehicle
- Two or more vehicles
- Two wheelers

Number of casualties

<table>
<thead>
<tr>
<th>Number of Casualties</th>
<th>0</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newest</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Vehicle Speed: Average speed of motorised vehicles in km/h (free flow conditions)

59-Total str  54-Section 1  65-Section 2

V85 of motorised vehicles in km/h
71-Total str  58-Section 1  83-Section 2

In free flow conditions drivers violate the speed limit in both sections, especially after the implementation of one-way operation.

6.3.2 Economy

Viability: Homes (Apartments): The average rent of a 80m² flat for one year is € 5,650 (estimated for 2002).

Homes (Apartments): The purchase price per owner-occupied flat is € 3,500 per m² (estimated for 2002).

Kalamaria, and the particular neighbourhood, is a place of high-income households. Many of the apartment buildings are constructed within the last fifteen years and they are of very good quality. Therefore, the cost of renting or buying a house is rather high comparing to other districts of Thessaloniki.

Retail: Average rent price per year is € 247 per m² (estimated for 2002).

Office: Average rent price per year is € 71 per m² (estimated for 2002).

This very high rental price of retail shops in Sofouli is due to the recreational character of the street. The office rental price is similar to the average for Kalamaria.

Residential Population: The total population of the Study area is 2330, which is equally divided between the two sections. The population density of the area is medium towards low (53 m² of space per inhabitant), mostly due to the un-built northwest side.

6.3.3 Noise

The noise level due to traffic along Sofouli street varies from 66 to 71 dB (Leq). This value exceeds the limit imposed by the Greek and European legislation for residential areas (67 dBA).
6.4. Decision-Making and Design Processes

The traffic problems in Sofouli street were firstly detected by the initial Traffic Management Plan (1989). Sofouli street was then a very important two-ways arterial, connecting Kalamaria to the central Municipality of Thessaloniki. Traffic flows had been increasing constantly, and in the same time the parking demand was increasing as well. Therefore, the Traffic Management Plan proposed the implementation of one-way operation, in order to improve car traffic level of service. The reconstruction took place in 1995.

Before reconstruction, all the procedures demanded by legislation, when a traffic control measure is to be implemented, took place. Therefore:

• The study was presented to the relevant Municipal Committee for approval. The Resolution of the Committee was published to a local newspaper and attached to a board of announcements at the Town Hall. For ten (10) days after the publication of the Committee's Resolution, the citizens had the right to object it.

• The above Resolution was submitted to the City Council, which decided for the implementation of the project, after an open to the public presentation. The specific day many residents were present and expressed their opinion on the project.

• The City Council Resolution was published again to the local newspapers. In addition all the stakeholders were informed (Traffic Police, Municipality of Thessaloniki, Municipal Police, and Public Transport Organization).

• The beginning of the implementation of the project was again announced at a local newspaper.

The major modification of the project was the implementation of one-way operation. In addition, the project included:

• Installation of traffic signs to identify the new traffic control measures.

• Installation of traffic signals at all major intersections, in order to control traffic.

• Modification of public transport routes, because of the one-way operation.

• Installation of Pavement markings, mainly to enhance traffic safety. Pavement markings included pedestrian crossings, lane separation etc.

A much extended public information and involvement took place before and after the implementation of the project. The project was designed and implemented by the Technical Department of the Municipality.