COST Action 358: Pedestrian Quality Needs

National Report of Greece

Contributors

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SUMMARY

This report is prepared in the framework of the COST Action 358 “Pedestrian Quality Needs” and concerns the experience in Greece about various pedestrian relates issues.

The improvement of quality of life and the environment in urban areas became a primary objective for both central government and local authorities all over the world during the last two decades. More especially, the provision of a safe and attractive environment for the pedestrians is of great importance.

Within the framework of this report, an attempt is made to present the general situation of pedestrians related issues in Greece (Demography, Transport and Travel, Urban Land Use and Health Data). Special attention was given to Safety due to high percentages of accidents which involve pedestrians in the country.

Additionally, in order to obtain a clear image concerning the situation about pedestrians in Greece; recent publications on pedestrian issues, research projects, policy statements and legal position of pedestrians are included in this report. Also, a series of innovations are presented in order to show that pedestrians’ needs would be achieved with an introduction of different types of measures. Finally, it must be mentioned at this point that the information included in this report will continue to be enriched in the framework of the COST Action 358.

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Chapter 1: Introduction

General

As the human population has increased, land use design become a serious problem in Greece. This problem mainly affects the pedestrians since there are not many areas left for them in urban areas. According to research results, Greeks walk less than anywhere else in Europe [1].

In most cases drivers believe that the road network is constructed only for them. As a result, they ignore pedestrians and use the road network without taking care of them and more especially of vulnerable users (children, people with baby carriage, elderly, and handicapped). Car drivers use crosswalks and pavements for parking their vehicles and this result to the reduction of free public space for pedestrians and especially for vulnerable users. Additionally, drivers of motorcycles and mopets illegally use pavements, pedestrian zones and pedestrian crossings. The walking environment becomes more and more unfriendly for pedestrians. Research results have shown that people are ready to walk more than today (increase of walking distance at a percentage of 70%) in case of the improvement of public space [2].

According to National Statistical Data, pedestrians are responsible for 70% of the number of accidents involving a pedestrian in Greek urban areas. Pedestrians often reveal offensive behaviour, crossing roads away from the pedestrian crossings, violating red signals, walking across the streets, sudden direction changing, careless road-entering. As a result this leads to difficulties for the general traffic and drivers in many cases since they are unable to react quickly in such situations. At this point it should be mentioned that according to research results about Traffic Management measures in Greek urban areas [3] 37% of accidents involving pedestrians caused by pedestrians careless, 31% from violation of red signals and only 16% of drivers who are responsible for accident due to drivers careless.
Nowadays, a very important attempt is made from the Greek State, and especially from respective Ministries (Ministry of Environment, Physical Planning and Public Works, Ministry of Transport and Communications, Ministry of Public Health and Social Welfare and Ministry of Public Order) to promote non-motorised travel and offer an acceptable level of convenience, efficiency, comfort, safety and security to pedestrians with emphasis to vulnerable users.
Chapter 2: Statistical Data

2.1 Demographic Data, Population

Greece has an area of 131,957 km$^2$. Its population is 11,018,400 inhabitants according to the National Statistical Survey (2003). Greek Statistical Service carries out a Questionnaire survey for collecting demographic data of Greece’s population every ten years. Table 2.1.1 presents the population of Greece in 1971, 1981, 1991 and 2001. Additionally, Table 2.1.1 also presents data about the population of men and women, age groups and their percentages.


<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total population</strong></td>
<td>8,768,372</td>
<td>9,739,589</td>
<td>10,259,900</td>
<td>10,964,020</td>
</tr>
<tr>
<td>Men</td>
<td>4,286,748</td>
<td>4,779,571</td>
<td>5,055,408</td>
<td>5,427,682</td>
</tr>
<tr>
<td>Women</td>
<td>4,481,624</td>
<td>4,960,018</td>
<td>5,204,492</td>
<td>5,536,338</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-14</td>
<td>2,223,904</td>
<td>2,307,297</td>
<td>1,974,867</td>
<td>1,664,085</td>
</tr>
<tr>
<td>15-64</td>
<td>5,587,352</td>
<td>6,192,751</td>
<td>6,880,681</td>
<td>7,468,395</td>
</tr>
<tr>
<td>&gt;=65</td>
<td>957,116</td>
<td>1,239,541</td>
<td>1,404,352</td>
<td>1,831,540</td>
</tr>
<tr>
<td><strong>Percentage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>48.89%</td>
<td>49.07%</td>
<td>49.27%</td>
<td>49.50%</td>
</tr>
<tr>
<td>Women</td>
<td>51.11%</td>
<td>50.93%</td>
<td>50.73%</td>
<td>50.50%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-14</td>
<td>25.36%</td>
<td>23.69%</td>
<td>19.25%</td>
<td>15.18%</td>
</tr>
<tr>
<td>15-64</td>
<td>63.72%</td>
<td>63.58%</td>
<td>67.06%</td>
<td>68.12%</td>
</tr>
<tr>
<td>&gt;=65</td>
<td>10.92%</td>
<td>12.73%</td>
<td>13.69%</td>
<td>16.71%</td>
</tr>
</tbody>
</table>

Source: [4]
2.2 Transport and Travel Data

According to research, the Road Network in Greece is 116,707 km (2000) and the Passenger Car Occupancy is 339 passenger cars per 1000 inhabitants (2002).

Table 2.2.1 presents the number of passengers who traveled by train and by bus. It should be mentioned that the amount of bus passengers express the total number of people who traveled by buses in the urban and interurban road network. The results which are presented to Tables 2.2.1 and 2.2.2 were based on National Statistical Service Data.

Table 2.2.1 Passengers traveling by train and by bus (urban and interurban)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Train</td>
<td>10,388</td>
<td>12,253</td>
<td>13,935</td>
<td>14,238</td>
<td>8884</td>
<td>9483</td>
</tr>
<tr>
<td>Bus</td>
<td>1,020,325</td>
<td>902,978</td>
<td>927,354</td>
<td>870,947</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: [4]

Table 2.2.2 presents the total number of different categories of vehicles. The higher percentage is associated to cars which are responsible for the major part of the traffic and associated environmental problems in urban areas and more especially in the central areas [4].

Table 2.2.2 Total Number of various categories of Vehicles

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>912,385</td>
<td>1,777,484</td>
<td>3,423,704</td>
<td>3,646,069</td>
<td>3,839,549</td>
<td>4,073,511</td>
</tr>
<tr>
<td>Buses</td>
<td>17,367</td>
<td>22,080</td>
<td>27,115</td>
<td>27,247</td>
<td>27,139</td>
<td>26,780</td>
</tr>
<tr>
<td>Trucks</td>
<td>441,081</td>
<td>792,770</td>
<td>1,085,811</td>
<td>1,109,137</td>
<td>1,131,027</td>
<td>1,159,137</td>
</tr>
<tr>
<td>Motorcycles</td>
<td>106,381</td>
<td>295,675</td>
<td>853,366</td>
<td>910,555</td>
<td>969,895</td>
<td>1,042,605</td>
</tr>
</tbody>
</table>

Source: [4]
2.3 Urban Land Use Data

As far as land use system is concerned, National Statistical Service carried out a research and its results are presented in Table 2.3.1. As presented in this Table, high is the amount of buildings (as it was expected). The land’s occupation from buildings and roads make life of pedestrians difficult in urban areas because they have not enough space for their needs.

Table 2.3.1 presents the total number of buildings in Greece on December 2000. In addition, it shows the distribution of different types of land uses.

<table>
<thead>
<tr>
<th>Total number of buildings</th>
<th>3,990,970</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings which have only one use</td>
<td>3,577,355</td>
</tr>
<tr>
<td>Houses</td>
<td>2,755,570</td>
</tr>
<tr>
<td>Churches-monasteries</td>
<td>43,463</td>
</tr>
<tr>
<td>Hotels</td>
<td>22,830</td>
</tr>
<tr>
<td>Factories</td>
<td>31,422</td>
</tr>
<tr>
<td>Schools</td>
<td>16,804</td>
</tr>
<tr>
<td>Shops-offices</td>
<td>111,097</td>
</tr>
<tr>
<td>Parking</td>
<td>510</td>
</tr>
<tr>
<td>Hospitals</td>
<td>1961</td>
</tr>
<tr>
<td>Other uses</td>
<td>593,698</td>
</tr>
</tbody>
</table>

As an example, the distribution of land uses presented for the Municipality of Thessaloniki in the Table 2.3.2. At this point it should be mentioned that Thessaloniki is the second largest city in Greece and is characterised by severe traffic and environmental associated problems, especially in its central area.
Table 2.3.2 Distribution of different types of land uses, Thessaloniki, (December 2000)

<table>
<thead>
<tr>
<th>Total number of buildings</th>
<th>23,563</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings which have only one use</td>
<td>12,987</td>
</tr>
<tr>
<td>Houses</td>
<td>10,538</td>
</tr>
<tr>
<td>Churches-monasteries</td>
<td>68</td>
</tr>
<tr>
<td>Hotels</td>
<td>43</td>
</tr>
<tr>
<td>Factories</td>
<td>228</td>
</tr>
<tr>
<td>Schools</td>
<td>206</td>
</tr>
<tr>
<td>Shops-offices</td>
<td>1184</td>
</tr>
<tr>
<td>Parking</td>
<td>24</td>
</tr>
<tr>
<td>Hospitals</td>
<td>54</td>
</tr>
<tr>
<td>Other uses</td>
<td>642</td>
</tr>
</tbody>
</table>

Source: [4]

2.4 Health and Competences Data

Traffic-related air pollution, noise, road crashes, cause of a wide range of adverse effects on health such as increased mortality, cardio-respiratory and stress-related diseases, cancer and physical injury. The impact goes beyond transport users, affecting the general population. Children and the elderly, as well as cyclists and pedestrians, are the most vulnerable users.

Recent research has shown that “walking” is the best way of protecting people from different types of diseases such as cardiovascular diseases, obesity, diabetes, cancer. For making walking attractive to pedestrians a friendly environment is needed with low levels of noise and low levels of air pollution. At this point it should be mentioned that 1342-7247 people died every year in Athens from diseases associated to air pollution which is caused by the vehicular traffic among other sources [5]. Table 2.4.1 presents the air pollutants in the pedestrian zone of Aristotelous square in Thessaloniki’s city centre. Aristotelous square is the main and largest crosswalk in the city centre of Thessaloniki [6].
Table 2.4.1 Air Pollutants in Pedestrian Zone of Aristotelous Square, Thessaloniki

<table>
<thead>
<tr>
<th></th>
<th>Smoke (mg/m³)</th>
<th>SO₂ (mg/m³)</th>
<th>NO₂ (mg/m³)</th>
<th>PM₁₀ (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2004</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>205</td>
<td>300</td>
<td>224</td>
<td>955</td>
</tr>
<tr>
<td>Mean</td>
<td>41</td>
<td>17</td>
<td>70</td>
<td>58</td>
</tr>
<tr>
<td><strong>2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>137</td>
<td>365</td>
<td>242</td>
<td>135</td>
</tr>
<tr>
<td>Mean</td>
<td>30</td>
<td>27</td>
<td>71</td>
<td>53</td>
</tr>
</tbody>
</table>

Source: [4]

The value of smoke was calculated every 24 hours while the other pollutants were calculated every hour.

Noise is a very common nuisance in Greek cities, especially for residents of high traffic volume streets and pedestrians who travel close to such streets [7]. Measurements were done at five main streets of Thessaloniki for a duration of five weeks, one hour, ten minute and daily average noise levels were calculated. For the purpose of the study, a Reten electronics RS103 sound level meter with a stable high-grade condenser electret microphone and an A-filter was used. The measuring range is 25 db (A)-130 db (A) or 40 db-130 db linear.

As it is mentioned above, measurements were carried out at five main streets of Thessaloniki where high traffic volumes are observed. The measurements were carried out during May and June 1998. Table 2.4.2 presents the measurement location and duration. As it is shown in this table, the sound level meter was placed in different floors for taking more accurate results.
As it was observed, the noise levels difference between working days and weekends was around 1-2 db (A) during daytime. Figure 2.4.1 presents the comparison of hourly noise levels in four streets during one day.

Data showed that there is a significant correlation between traffic noise and average traffic volume. Additionally, no exceedances have been observed. The average daily values are closed to the national limit of 67 db (A) but an additional study was required for addressing and limiting the traffic noise problem.
Additionally, another research about monitoring noise levels in Thessaloniki was carried out during 2000 by the Organization for the Master Plan and Environmental Protection of Thessaloniki (OMPEPT) [8] in collaboration with the Laboratory of Architectural Technology of the Engineering School of the Aristotle University of Thessaloniki [9].

For estimating urban noise levels which cause problems to pedestrians’ health, an environmental evaluation of various traffic scenarios is realised in Thessaloniki’s city centre. The calculated levels of noise (calculated as L10) are close to the measured noise levels (measured as Lden), although they represent different time periods of a day.

In the framework of the noise monitoring project, the annual average levels of noise (Lden) in six regions of Thessaloniki have been determined [9, 10, 11]. The noise levels (calculated as L10 and measured as Lden) during 2000 in Thessaloniki city centre (Vas. Olgas road and Dimokratias Square, which are monitoring stations in the most problematic areas) are presented in Figure 2.4.2. It is resulted that the calculated levels of noise are close to the measured levels, although they represent different time periods of a day.

![Figure 2.4.2 Calculated (L10) and measured (Lden) noise levels in Thessaloniki city centre (Vas. Olgas Street and Dimokratias Square)](image)

Additionally research is needed in order to reduce noise levels in Thessaloniki and improve environment and quality of life for residents and occasional pedestrians.
Chapter 3: Safety in the Greek Road Network

3.1 General

Road accidents are one of the main reasons of deaths in Greece every year especially for children and adults. The socioeconomic cost is huge due to the annual number of road accidents. Every year more than 1600 people die and more than 20,000 injure [12]. Road accidents are forecasted to be the third reason of death in 2020 [2]. Pedestrians consist of the main part of the vulnerable users. During the period 1996-2003 237,577 road accidents involving children and adults (younger than 25 years old) are recorded. The 50% of children (0-14 years old) who have been involved in accidents were pedestrians [13].

In order to understand the importance of road accidents it is necessary to examine the number of fatalities, serious and light injuries in Greece and the associated percentage of pedestrians. The annual number of accidents, injured persons and various indicators of danger (accidents and injured persons per 1 million of population) are presented in the current chapter.

Figure 3.1.1 presents the annual number of road accidents during the last three decades. As it is noticed, the number of accidents increased in 1991 due to the increase of private car but was reduced during the last decade [4] due to the measures taken by the Greek State.
Figure 3.1.2 presents the total number of road accidents from 1996 to 2004. The annual number of accidents with injured person presents an increase in 1998 with 24,819 accidents. After year 1998, a reduction was noticed to the annual number of road accidents (e.g., 15,399 road accidents were recorded in year 2004).

![Annual Number of accidents with injured people](image)

**Figure 3.1.2 Annual Numbers of Injuries**

In Table 3.1, the number of fatalities, serious and light injuries from year 1990 to 2005 are presented.
Table 3.1: Number of people injured in road accidents (fatalities, serious and light injuries) for the period 1990-2005

<table>
<thead>
<tr>
<th>Years</th>
<th>Fatalities</th>
<th>Serious Injuries</th>
<th>Light Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1981</td>
<td>3685</td>
<td>27,460</td>
</tr>
<tr>
<td>1991</td>
<td>2012</td>
<td>3882</td>
<td>27,900</td>
</tr>
<tr>
<td>1992</td>
<td>1995</td>
<td>4000</td>
<td>28,786</td>
</tr>
<tr>
<td>1993</td>
<td>2008</td>
<td>3277</td>
<td>29,368</td>
</tr>
<tr>
<td>1994</td>
<td>2076</td>
<td>3387</td>
<td>28,672</td>
</tr>
<tr>
<td>1995</td>
<td>2149</td>
<td>3492</td>
<td>28,402</td>
</tr>
<tr>
<td>1996</td>
<td>2175</td>
<td>3313</td>
<td>29,388</td>
</tr>
<tr>
<td>1997</td>
<td>2141</td>
<td>4359</td>
<td>28,490</td>
</tr>
<tr>
<td>1998</td>
<td>2229</td>
<td>4889</td>
<td>28,224</td>
</tr>
<tr>
<td>1999</td>
<td>2181</td>
<td>4702</td>
<td>27,649</td>
</tr>
<tr>
<td>2000</td>
<td>2103</td>
<td>4213</td>
<td>26,166</td>
</tr>
<tr>
<td>2001</td>
<td>1911</td>
<td>3251</td>
<td>22,758</td>
</tr>
<tr>
<td>2002</td>
<td>1655</td>
<td>2581</td>
<td>19,625</td>
</tr>
<tr>
<td>2003</td>
<td>1613</td>
<td>2345</td>
<td>18,218</td>
</tr>
<tr>
<td>2004</td>
<td>1547</td>
<td>2521</td>
<td>17,254</td>
</tr>
<tr>
<td>2005</td>
<td>1470</td>
<td>2327</td>
<td>19,133</td>
</tr>
<tr>
<td>Total</td>
<td>31,246</td>
<td>56,224</td>
<td>407,493</td>
</tr>
<tr>
<td>Average</td>
<td>1952</td>
<td>3514</td>
<td>25,468</td>
</tr>
</tbody>
</table>

Source: [4]

The maximum value of fatal accidents recorded in year 1998 (2229 people killed). A reduction was noticed after year 1998.

![Figure 3.1.3 Annual Numbers of Fatalities](image-url)
Figure 3.1.4 presents the annual number of persons seriously injured in road accidents where a huge increase is noticed during year 1998 (4889) and year 1999 (4702). It must be mentioned that the average value for serious injuries for the period 1990-2005 is 3514.

The number of persons with light injuries in road accidents presents its maximum value in 1996 (29,388 injured people). A reduction was noticed after year 1996 but with a small but not important increase in year 2005.
Hereinafter, detailed data concerning road safety in Greece are presented for the period 1996-2003.

3.2 Temporal evolution of accidents and injured persons for the period 1996-2003

Figure 3.2.1 presents the temporal evolution of indicators of accidents and injured persons per 1 million of population. Comparatively with other European countries [14] indicators of accidents are very high.

![Temporal Evolution of Indicators of Accidents and People Injured per 1 million of population](image)

Figure 3.2.1 Temporal evolution of indicators of accidents and injured persons per 1 million of population for the period 1996-2003
3.3 Categories of persons injured in road accidents and their temporal evolution

The percentages of killed, seriously and lightly injured persons are presented in Figure 3.3.1.

![Temporal Evolution of % of Killed, Seriously & Lightly injured persons](image)

Figure 3.3.1 Temporal evolution of % of people killed and serious and light injured in road accidents for the period 1996-2003

3.4 Types of persons injured in road accidents (drivers, co-drivers, passengers, pedestrians)

The road accident data which are presented below refer to the period 1996-2003 in Greece. Figure 3.4.1 presents the temporal evolution of fatalities with regard to drivers, co-drivers, passengers and pedestrians. The majority of fatalities constitute of drivers with the maximum value to appear in 1998 (1261 killed drivers). A reduction of fatalities
was noticed after 1998. The number of pedestrians killed in road accidents is continuously decreasing (from 422 in 1996 to 257 in 2003). At this point it should be mentioned that the number of killed pedestrians is too high in respect of other categories of road users.

Figure 3.4.1 Temporal evolution of annual number of fatalities (drivers, co-drivers, passengers and pedestrians) for the period 1996-2003.

Figure 3.4.2 presents the temporal evolution of percentage of fatalities for drivers, co-drivers, passengers and pedestrians during the period 1996-2003.

Figure 3.4.2 Temporal evolution of % of killed drivers, co-drivers, passengers and pedestrians for the period 1996-2003
Figures 3.4.3 and 3.4.4 present the temporal evolution of serious injuries and their percentages as well. The majority of serious injuries constitute of drivers with the maximum value to appear in 1999 (2,801 drivers seriously injured in road accidents). From the results presented in these figures it appears that the number of pedestrians seriously injured in road accidents is decreasing after year 1998 with the minimum value to appear in year 2003 (374 heavily injured pedestrians).
As it is noticed, once again, the number of pedestrians seriously injured in road accidents is too high in respect to other categories.

Figures 3.4.5 and 3.4.6, present the temporal evolution of light injuries and their percentages as well. The majority of light injuries constitute of drivers with the maximum value to appear in year 1996 (1760 light injured drivers). From the results presented in these Figures it appears that the number of pedestrians not seriously injured in road accidents is decreasing after the year 1998, where the minimum value (2464 pedestrians light injured in road accidents) is noticed in year 2002. The percentage of light injured pedestrians is smaller than the ones of light injured drivers, co-drivers and passengers.
Figures 3.4.7 and 3.4.8 respectively present the number of killed and injured pedestrians in road accidents per one million of population (safety indicators). From the results presented in these Figures it appears that problems are more important in the case of pedestrians who are over 60 years old and especially for men. Injuries also appear to be high as far as children are concerned.
Number of Pedestrians killed in road accidents per 1 million of population for the period 1996-2003

Figure 3.4.7 Number of killed pedestrians per 1 million of population for the period 1996-2003

Number of Pedestrians injured in road accidents per 1 million of population for the period 1996-2003

Figure 3.4.8 Number of pedestrians injured in road accidents per 1 million of population for the period 1996-2003
3.5 Temporal evolution of accidents and injured persons in residential and non-residential areas

Figures 3.5.1 and 3.5.2 present the temporal evolution of accidents and persons injured in road accidents in residential and non-residential areas.

Figure 3.5.1 Temporal evolution of accidents and injured persons in residential areas for the period 1996-2003

Figure 3.5.2 Temporal evolution of accidents and injured persons in non-residential areas for the period 1996-2003
Comparing the two Figures it is obvious that the majority of accidents with injured persons (72%) are near residential areas, and the same conclusion applies in the case of the majority of persons (66%) injured near residential areas.

The temporal evolution of percentage of injured persons (drivers, co-drivers, passengers & pedestrians) in residential and non-residential areas is presented in Figures 3.5.3 and 3.5.4.

![Temporal Evolution of % of Injuries (Drivers, Co-drivers, Passengers & Pedestrians) in Residential Areas](image)

**Figure 3.5.3 Temporal evolution of % of injuries (drivers, co-drivers, passengers & pedestrians) in residential areas for the period 1996-2003**

As it is noticed in these Figures, the percentage of injured pedestrians is higher in residential areas (three times higher) than in non-residential areas due to high volumes of pedestrians in residential areas. Additionally, the percentage of pedestrians injured in road accidents is second in order in terms of the whole number of users injured in residential areas; in contrast with non-residential areas where the percentage of injured pedestrians is smaller than other users. Finally, the percentage of pedestrians injured in road accidents is stable from 1996 to 2003 despite the fact that the total number of accidents for residential areas is decreased (from 16.8% in the year 1996 to 17.4% in the year 2003) together with the numbers in non residential areas (from 4.3% in the year 1996 to 4.1% in the year 2003).
Figure 3.5.4 presents the temporal evolution of percentage of injuries (drivers, co-drivers, passengers & pedestrians) in non-residential areas for the period 1996-2003.

<table>
<thead>
<tr>
<th>Year</th>
<th>Drivers</th>
<th>Co-drivers</th>
<th>Passengers</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>4.3%</td>
<td>18.9%</td>
<td>56.3%</td>
<td>3.9%</td>
</tr>
<tr>
<td>1997</td>
<td>5.5%</td>
<td>17.5%</td>
<td>56.6%</td>
<td>4.1%</td>
</tr>
<tr>
<td>1998</td>
<td>5.4%</td>
<td>17.1%</td>
<td>56.5%</td>
<td>3.9%</td>
</tr>
<tr>
<td>1999</td>
<td>4.9%</td>
<td>18.1%</td>
<td>56.4%</td>
<td>3.0%</td>
</tr>
<tr>
<td>2000</td>
<td>5.1%</td>
<td>16.4%</td>
<td>57.6%</td>
<td>4.9%</td>
</tr>
<tr>
<td>2001</td>
<td>3.0%</td>
<td>16.6%</td>
<td>58.8%</td>
<td>4.3%</td>
</tr>
<tr>
<td>2002</td>
<td>3.9%</td>
<td>18.3%</td>
<td>56.6%</td>
<td>5.1%</td>
</tr>
<tr>
<td>2003</td>
<td>4.1%</td>
<td>17.6%</td>
<td>57.2%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

Figure 3.5.4 Temporal evolution of % of injuries (drivers, co-drivers, passengers & pedestrians) in non-residential areas for the period 1996-2003

### 3.6 Temporal evolution of pedestrians killed in road accidents per 1 million of vehicle population for the period 1996-2003

In order to evaluate the safety level for the pedestrians, the following indicator is used: number of pedestrians killed per 1 million of vehicles. As shown in Figure 3.6.1 the value of the specific indicators is high in the case of buses and taxis. This can be partially explained by the fact that both buses and taxis are usually found in urban areas with high pedestrian volumes.
Finally, Figure 3.6.2 presents the most serious pedestrian accidents which are caused from different categories of vehicles. The most serious accidents caused from heavy vehicles (trucks and buses) due to their weight and dimensions followed by taxis, cars and motorcycles.
3.7 Forecasting Models

In order to forecast future number of accidents, scientists tried to develop Forecasting Models. According to Greek experience, the predictive models which are used in different situations are mentioned below.

More than 2/3 of urban traffic accidents in Greece take place at intersections. This fact constitutes the basic stimulus in order to forecast the traffic safety level at intersections. The most effective way to do this is the use of mathematic models, which predict indicators that specify the safety level. The predictive model is [15]:

\[ F(x_t) = \alpha, F_{10\text{odoit}} F_{20\text{odoit}} e^{(\beta_2 F_{1\text{moxt}}, \beta_4 F_{2\text{moxt}})} \]

Where \( F(x_t) \): number of accidents at \( t \) intersection

\( F_1 \) : volume of first direction

\( F_2 \) : volume of second direction

\( F_{1\text{moxt}}, F_{2\text{moxt}} \) : illegal volumes at \( t \) intersection

\( \alpha, \beta_1, \beta_2, \beta_3, \beta_4 \) : coefficients of variables

Additionally, M. Pitsiava-Latinopulou (Professor at the Aristotle University of Thessaloniki) and G. Georgiou (Transport Engineer) carried out a research about Pedestrian accident analysis at urban intersections and have used the following pedestrian accident predictive model [16]:

\[ Y = 334.7x^2 - 1510.4x + 2007.2 \]

where \( x \): number of accidents and \( y \): pedestrian volume and \( R^2 = 0.7559 \).

Also, G. Tsoxos (Professor at the Aristotle University of Thessaloniki) and K. Xaitopoulos (Engineer) used the following equations in order to predict fatalities, serious and light injuries. The equations which were used are [17]:

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Likewise, V.Porfilidis (Associated Professor at the Dimocritus University of Thrace) and Dr. G.Botzoris (Transport Planner and Engineer) used a relationship between road safety and economical development. The numbers of accidents are reduced with the increase of economical development. Thus, the predicted model is as follows [18]:

\[ Y = a \times \log(GDP) + b \]

Where \( Y \): number of accidents per 1000 vehicles
\( a: -0.206905, b: 2.3356, R^2 = 0.77 \)

GDP: Gross Domestic Product

### 3.8 Remarks concerning road safety

The annual number of road accidents and injured persons present an overall reduction from year 1990 to year 2005. An increase was noticed during summer and a reduction in winter time. Safety indicators vary for different Prefectures/Municipalities in Greece.

The majority of road accidents for the period 1996-2003 include conflicts between different categories of vehicles (62%). Then, 17% of accidents include pedestrians and all other accidents consist of a small percentage of road accidents. Safety indicators are found to be increased in two categories: people who are 20-24 and 25-29 years old.
The majority of accidents (72%) and injured persons (66%) recorded in residential areas for the period 1996-2003. In these areas the percentage of pedestrians injured is higher than this of non-residential areas. As it was mentioned above, the majority of accidents with injured people take place in city roads (66%) while the majority of fatalities (64.5%) take place in highways.

Especially, the number of *pedestrians* killed or seriously injured in road accidents is higher than the respective injuries of co-drivers and passengers. The majority of injured pedestrians are older than 65 years old. The percentage of men is higher than this of women. At this point it should be mentioned that children present high percentage of injuries in road accidents, (especially between 2-10 years old). Additionally, buses and taxis are responsible for the most serious pedestrians’ injuries. The main reason [16] is the careless of pedestrians (37%), the second reason is the violation of red light for the pedestrians (31%) from pedestrians and the third reason is the careless of drivers (16%). According to the categories of vehicles, the majority of road accidents included cars (54%) and motorcycles (30%). Trucks cover 11% of accidents and taxis and buses 3.5% and 1.5% correspondingly.
Chapter 4: Indicative publications on pedestrian related issues

4.1 General

According to National Statistical Data, pedestrians are responsible for 70% of the number of roads accidents involve pedestrians in Greek urban areas. As it was mentioned in chapter one, pedestrians often reveal offensive behaviour. Indicative publications, important surveys and books including among other things pedestrian related materials are presented in this chapter

4.2 Effectiveness of measures for the pedestrian in an arterial street in Thessaloniki, Greece [19]

The purpose of the paper is to present the first results of a study on pedestrians’ issues at a city-centre main arterial road in Thessaloniki, Greece. The pedestrian behaviour is examined against measures implemented to improve pedestrian safety at that area where both high traffic and pedestrian volumes are observed.

The study includes observations about pedestrians (measurements of pedestrians’ volumes on pavements and intersections and measurements of Highway Code violators) and finally a questionnaire survey. According to the research results, the majority of pedestrians (84%) stated that they would prefer to have areas without parked cars. A percentage of 79% stated that they require a pleasant walking environment and 18% mentioned other reasons. The study results show that even after the implementation of restraint measures, the risk undertaken by the pedestrians seems to remain the same: no significant reduction of the number of illegal crossings has been observed. On the contrary, due to the nature of the specific measure, the exposure time after the implementation of the safety measures is almost doubled. Regardless the fact that the measure is seen as significantly positive one, only one out of five pedestrians is willing to change his/her behaviour.
4.3 Safety Evaluation of Pedestrianisation medium-size towns-The DUMAS EU Project [20]

The purpose of the paper is to present the results of Traffic Management measures in order to consider current practice of dealing with Urban Road Safety as part of Urban Management and to produce frameworks for the design and evaluation of cost effective and successful urban safety initiatives. The implementation of pedestrianisation schemes in two cities of Greece, namely Larissa and Katerini, was carried out in order to improve the level of service for the pedestrians. The emphasis is given to the extensive pedestrianisations and the reduction of pedestrian accidents in the two cities. Furthermore the evolution between years 1985 and 1995 concerning the percent of pedestrian accidents related to total accidents was examined.

The collected data include road accidents and traffic flows. The accident analysis carried out shows that pedestrianisations have a positive effect in both cities, not only in terms of the primary purpose of improving the environment but also in safety terms. After the implementation of pedestrianisations, a reduction was presented in two cities: 49.6% for Katerini and 36.3% for Larissa.

4.4 The impact of Pedestrianisation schemes on the Environmental quality at central areas [21]

This paper makes an attempt to present the impact evaluation of pedestrianisation schemes on the environmental aspects for two Greek cities: Katerini and Rhodes. Generally, pedestrianisation schemes are quite often implemented at central areas which are characterised by significant traffic and environmental problems. A pedestrianisation scheme was designed within the framework of two research projects which were carried out by the Aristotle University of Thessaloniki for both cities. Specifically, in Katerini a pedestrianisation scheme was implemented and the same scheme was designed for the city of Rhodes. The majority of traffic and environmental problems are examined in both cases in the city centre.
4.5 The Involvement of the Public in the design process of short-term traffic management measures [22]

Short-term traffic management measures are used in order to solve traffic and associated environmental problems in urban areas. For this reason questionnaire surveys carried out in Thessaloniki, especially in the city centre (1994). Respondents were grouped into four classes. The results of questionnaire survey showed that residents, employees and visitors of Thessaloniki’s city centre had as their first priority the improvement of the environment (27%) while shopkeepers demanded better pedestrian facilities (28%). The first priority for the pedestrians was the improvement of the environment and their second choice referred to parking conditions. When people were asked how they rank the quality of the environment in the study area, 32% responded that the quality is unacceptable, 26% that the quality is bad, 31% moderate, 8% good, 2% very good and 1% gave no answer.

4.6 Evaluation of traffic calming measures in Thessaloniki Metropolitan area [23]

The provision of a safe environment for the pedestrians is of great importance. The use of traffic calming techniques aims at the provision of an adequate environment in the urban areas that face severe traffic and safety problems. Special attention was given to the examination of the traffic safety impacts for both pedestrians and drivers through the analysis of accident data “before” and “after” the implementation of the traffic calming measures in Thessaloniki Metropolitan area. The data came from the official police records and were evaluated both in quantitative and qualitative terms. Additionally, questionnaire survey was carried out in order to examine pedestrians’ opinion before and after the implementation of traffic calming schemes. Reduction of accidents presented after the introduction of measures. The study results that pedestrians were very satisfied from pedestrianisation schemes due to increase of level of service offered to them.
4.7 Traffic Management Measures in Greek urban areas. Evaluation of their implementation in safety through a quantitative and qualitative perspective [3]

The purpose of the paper is to present the results of various traffic management measures which were implemented in two municipalities of Thessaloniki, the municipality of Kalamaria and the municipality of Thessaloniki (focused on the city centre), in terms of road safety, through before-and-after accident studies.

Accident analysis and questionnaire survey were carried out in order to evaluate the effectiveness of measures. The majority of pedestrians (76%) believe in the effectiveness of measures due to the reduction of accidents after the implementation of traffic calming schemes and pedestrianisation schemes. There was acceptance of the measures from all road users (9 up to 10), especially from the pedestrians, as the majority of measures are focused on them.

4.8 Public awareness and behaviour related to environmental and traffic management measures [24]

This paper presents the results from the implementation of Traffic Management measures and public’s acceptance as well. Especially, the paper presents data on environmental quality and pedestrians in the Thessaloniki hypercentre. The demand for the majority of respondents is the same: a) need for more pedestrians streets, in order to improve their safety, and b) reduction of environmental problems.

4.9 Design and Evaluation of traffic calming schemes in urban areas – the case of the city of Larissa [25]

Within the framework of this paper, the design and evaluation of traffic calming schemes such as pedestrians’ facilities, interventions at intersections, traffic calming areas, 30 km
zones etc. which aiming at the improvement of traffic and associated environmental situation especially for pedestrians are presented for the Greek city of Larissa.

The evaluation of these measures is based on the use of both qualitative and quantitative criteria, which were selected in accordance with the objectives and type of the proposed measures such as the degree of use of the respective infrastructure by the pedestrians, the parking rules violations, the overall perception of the environment as a safe one by the road users etc.

4.10 Pedestrian survey of ATTICO METRO S.A. [26]

The purpose of the survey was the evaluation of pedestrian behaviour and the quality of the level of service offered to them. The study includes:

- Identification and Investigation of pedestrian zones
- Detailed examination of areas with high pedestrian volumes
- Recording of pedestrian volumes in 200 sites (i.e., sidewalks)
- Level of pedestrian service (comfortable and safe movement of pedestrians on sidewalks, barriers which cause problems to pedestrians and reason for which a pedestrian make a stop (i.e. "window shopping")

4.11 “Smile” Project, pedestrian network, Larissa, Greece [27]

Larissa, a Greek city with 150,000 inhabitants, decided to construct a pedestrian network for improving the level of service for their residents. Project’s objectives were:

- Creation of an integrated pedestrian network with new pedestrian streets added to the existing ones
- Reduction of motorised traffic in the city centre
- Improvement of quality of life for all citizens
• Design of a friendly, accessible and sustainable environment

After the introduction of pedestrianisation schemes, citizens were very satisfied. More residents used the pedestrian streets due to better conditions and as a result, traffic pollution was reduced and shop owners gross earnings were increased.

4.12 Pedestrian and Bicycle Safety in central urban areas in Greece [28]

The purpose of this paper is to present the key elements of Traffic Management schemes which are designed and implemented in different Municipalities in Greece in order to improve traffic conditions and quality of life for both drivers and pedestrians. The most crucial objective of these schemes is the establishment of a convenient and safe pedestrian/bicycle system. Additionally, an evaluation was carried out concerning the effectiveness of traffic management schemes. Finally, the level of service and existing infrastructure for pedestrians and cyclists in central urban areas and accident data for vulnerable road users are presented.

4.13 Evaluation of the level of service for the movement of people with special needs in urban areas in Greece - Future prospects through the use of new technologies [29]

The objective of this paper is to evaluate the level of service for the movements of people with special needs in urban areas in Greece. For this purpose a detailed reference to Greek guidelines concerning the design of urban areas for people with special needs is made. Additionally, measures concerning people with special needs, which were implemented were recorded, analysed and assessed in order to determine the existing situation and its efficiency in terms of mobility for people with special needs. Finally, useful conclusions concerning the provided level of service were drawn.
4.14 Investigation of accidents involving vulnerable road users in Greek urban areas [30]

This paper presents the results of investigation of accidents involving vulnerable road users in Greek urban areas. Specifically, the evolution of road accidents with vulnerable road users in Greece for the period 1993-1996 and the main reasons of their involvement in road accidents were examined. Among the main reasons, poor infrastructure for their protection e.g pedestrian crossings, pedestrian streets etc were considered together with the aggressive driving behaviour. From the pedestrian accident data analysis in a number of 25 intersections in Thessaloniki for the period 1990-92 it was found that the most parameters which influence a pedestrian accident are the type of intersection, lighting conditions, the pedestrian and vehicle flow as well as the traffic composition and the geometric characteristics of the intersection. Finally, the results of road accident survey for eleven municipalities in Thessaloniki Metropolitan area for the period 1998-99 were presented.

4.15 Traffic Safety Study at Thessaloniki selected intersections using the Traffic Conflicts Technique [31]

The Traffic Conflict Technique is used in order to estimate the level of traffic safety at intersections, without analysis of traffic accident data. The analysis of the traffic conflicts that were recorded with video-tape at three intersections at Thessaloniki includes a large number of data and especially pedestrians’ conflicts (where 17% of conflicts include one or more pedestrians). As it was noticed, the most serious conflicts included pedestrians. The observations and results about pedestrians contribute to the existing knowledge about pedestrians’ behaviour at selected intersections.
4.16 Pedestrian Accident Analysis at urban intersections, The Thessaloniki Case Study [32]

A comprehensive analysis of 205 accidents at 25 intersections of Thessaloniki was carried out for the period 1990-1992 in order to assess the parameters which are influenced a pedestrian accident such as pedestrian and vehicle flows, speed, geometric characteristics etc. Interesting results are extracted from the analysis of accidents. It must be also mentioned that this experience contributed to the development of an accident predictive model. The mathematical model which was developed can predict the number of pedestrians accidents based on pedestrian flow at a statistically significant level.

4.17 Pedestrian Mobility Infrastructures and Road Safety: a Proposal for the West Thessaloniki area [33]

The purpose of this paper is to consider the urban space as a system with the following major components: pedestrian and rest of transport modes, land uses location, structural characteristics of the network and quality of urban transportation network infrastructure regarding accommodation of pedestrian mobility. Based on the statistic analysis of the accidents recorded in the West Thessaloniki urban area, a combined examination of the above components was performed as follows:

- Examination of the dispersion of land uses in regards with pedestrian flows transportation infrastructures
- Examination of the structure and the geometric characteristics of the road network in the areas were pedestrians accidents are occurred
- Examination of the design of the pedestrian crossings in regards with the national standards accepted for this type of constructions
- Examination of the location of Public Transport stops along specific road axes where accidents involving pedestrians were recorded
- Examination of the relation of illegal parking, irrespect the appearance of accidents involving pedestrians
4.18 Road Safety through Traffic Management Studies in Greece: Problems and Prospectives [34]

Within this paper, the existing regulations and specifications of Traffic Management Studies for the Greek situation are examined. Traffic Management measures are included in these studies in order to improve road safety, among other things. The emphasis is given on the analysis of pedestrian accident data, especially accidents in which children and elderly were involved. Additionally, interesting results arose from meetings of the researchers with specific population groups such as local councils, parents’ councils, elders’ councils etc, in order to consider their opinions and perceptions about road safety.

4.19 Impacts of the Traffic Management Measures on Road Safety: the Case of the City of Katerini [35]

This paper presents the impact of Traffic Management measures on road safety level for the Greek city of Katerini. Among traffic management measures which were implemented by the Municipality of Katerini, pedestrianisation schemes and new/improved traffic signal programs at basic intersections in the city centre are included. The data collection survey was carried out during the period of 1986-1995. Reduction of pedestrian accidents near walking areas was noticed and results in case of pedestrians’ behaviour were obtained.

4.20 The role of Environment in Traffic Management studies: Need for a new approach [36]

This paper attempts to provide a synthesis of the existing experience in Greece, with respect to the environmental considerations made in the various transport/traffic studies at the city/municipality level. Furthermore, it attempts an assessment of the suitability and completeness of these considerations by putting emphasis on the analysis of current environmental related processes in order to show how important are the Traffic Management measures which improve the environment and make public areas more friendly and sustainable for all categories of users and especially for the pedestrians.
4.21 Design of a sustainable and accessible environment in central areas [37]

In the framework of this paper an integrated scheme for a sustainable and accessible environment in central areas is presented. The scheme refers to the city of Ioannina, which is an important trade, transport and cultural centre of North-Western Greece. The basic objective of the integrated scheme was the improvement of pedestrians’ conditions in the central area of the city by actually removing vehicular traffic to a great extent, and at the same time providing an extensive network of pedestrian streets and squares.

4.22 Evaluation of the Impact of new Developments in traffic congested urban areas [38]

Within the framework of this paper the evaluation of the impact of the construction of the new Concert Hall in the central eastern part of the city of Thessaloniki is presented together with traffic management measures in order to overcome traffic problems due to Concert’s location. Concert Hall is close to sea coast and its location is characterised by high volumes of vehicular traffic and pedestrians. Proposed measures cover both pedestrians and drivers and emphasis is given to Public Transport system and parking demand after the construction of the new development.

4.23 Land Use changes and Sustainability in traffic congested urban areas [39]

This paper presents a case study in the N.E. part of the Municipality of Thessaloniki concerning an integrated land use transport plan in traffic congested urban area. The existing situation is characterised by a variety of land uses (i.e. administration, education, athletics, etc) and high volume of residents. The redesign of the transportation system was decided in order to reduce the environmental and traffic problems in the study area and to improve the quality of life of residents and visitors. Special provision was made for the safe movement of pedestrians in the study area.
4.24 Environmental Impact Assessment of major Pedestrianisation Schemes through the use of modeling techniques [40]

This paper presents the implementation of major pedestrianisation schemes introduced in central areas. The implementation of scheme is analysed and evaluated through the use of traffic simulation modeling. Parameters such as traffic volumes, delays, speed, use of road network and Public Transport system data are examined, with special consideration given to the environmental impacts of such measures (vehicle emissions, fuel consumption). The modelling results showed that special attention must be paid in the near area of the pedestrianisation schemes in order to improve the efficiency of the road network, to promote the relieving effects of pedestrianisation and to minimize possible negative environmental impacts due to excess traffic.

4.25 Environmental evaluation of traffic scenarios in a congested central city area, [41]

This paper presents Dimokratias Square which is a congested central city area of Thessaloniki. Dimokratias Square presents not only high volume of traffic but also high volumes of pedestrians. The most important crossroads of Thessaloniki are examined using traffic data and pollutant emissions and concentrations. Eight street links are included in the study area. Traffic data refer to traffic volumes, composition and vehicle speed. Emissions have been calculated for the pollutants: CO, NOx, SO₂, VOC and TSP. Air quality data concern the pollutants: CO, NO₂, SO₂ and TSP. The evolution of the relationship traffic - emissions – air quality during the decade 1988-98 is examined in a first step. Furthermore, the relationship traffic – emissions is examined for 4 traffic scenarios: a) 1998, b) 2004, c) 2014 and d) 2014+ and a qualitative and semi-quantitative prediction is made for the expected air quality levels.
4.26 Bus Lanes and Vehicle Emission Reduction in Urban Areas [42]

The implementation of a bus lane system in an urban area is a very efficient tool in order to reduce considerably the air pollutant vehicle emissions and make the walking environment friendlier to pedestrians. The aim of this paper is to estimate the expected vehicle emission decrease after the implementation of new bus lanes in Thessaloniki and to correlate it with the vehicle emission decrease expected from other traffic measures and construction. A significant decrease of CO, NOx and HC emissions were presented in the streets where the bus lanes applied. It must be mentioned at this point that these streets are also characterised by heavy pedestrian volumes and thus any effect of traffic to the environment also affect pedestrians.

4.27 Environmental and Traffic Evaluation of Bus lanes [43]

The aim of the paper is to evaluate the environmental and traffic impacts of bus lanes introduced in urban areas, using modelling techniques. Parameters such as traffic volumes, delays, speed, use of road network and Public Transport system data are examined, with special consideration given to the environmental impacts: vehicle pollutant emissions and fuel consumption, using the traffic simulation model SATURN. The reference area is the city of Thessaloniki and the examined bus lanes are Egnatia and Mitropoleos which are characterised by high volumes of vehicular traffic and pedestrians as well. The introduction of bus lanes led to an overall improvement of the air quality offering a friendly and convenient environment to pedestrians and also to the people who work/live in the study area.
4.28 Relative Contribution of Various Diesel Vehicle Classes to the Thessaloniki Urban Air Pollution [44]

This paper attempts to assess the relative contribution of the main diesel vehicle classes; namely, buses, taxis and heavy goods vehicles (HGVs) to the air pollution of the Thessaloniki (Greece) urban area based on an emission factors approach. Data sets refer to the situation before and after the construction of the city ring road (1988-1998). The use of city centre by HGVs was reduced while small changes have been observed during the same period for the bus and taxi traffic in the same area. Reduction of the urban air pollution and the improvement of the environment is noticed; the environment becomes more sustainable especially for residents, employees and visitors.

4.29 Urban Noise Levels based on Traffic Modelling and Monitoring [45]

In this paper an environmental evaluation of various traffic scenarios is realized in Thessaloniki city centre in order to show that urban noise levels are high enough to cause problems to pedestrians’ health. The calculated levels of noise (calculated as L10) are close to the measured noise levels (measured as Lden), although they represent different time periods of a day.

It is resulted that the examined traffic interventions and works are not sufficient for noise considerable decrease in Thessaloniki city centre and further noise-reduction measures are needed in order to fulfill the European standards in the future, given the fact that noise levels seem to be over the limits today in main central area arterials where high pedestrian concentration take place.
4.30 Exploratory Traffic Noise Measurements at five main streets of Thessaloniki, Greece [46]

Noise is a very common nuisance in Greek cities, especially for residents of high traffic volume streets and pedestrians who walk close to such streets (4). Measurements were done at five main streets of Thessaloniki during May and June 1998 for duration of five weeks, one hour, ten minutes and daily average noise levels were calculated. It is resulted that the mean daily values are closed to the national limit of 67 db (A) but an additional study is required for addressing and limiting the traffic noise problem for a friendlier, sustainable and accessible environment.

4.31 Incorporation of traffic education in school syllabus in Greece [47]

Greek schools do not include Traffic education as a special lecture. In recent years there was an attempt to include education material in elementary schools concerning the basic tasks of safe walking and road crossing. Additionally, an attempt is made by the Ministry of Transport and Communications to assist Greek Municipalities to construct Traffic Education Centers (T.E.Cs). These TECs offer practical exercise on transportation rules to children (5-12 years old). In T.E.Cs.’ infrastructure, children attend traffic educational courses related to the right traffic behaviour aware mainly about walking on foot and being a passenger of a car or public transport modes, and less about riding a bike, as well as driving a car. The basic objective of T.E.Cs is to make children understand how to behave safely as pedestrian and obey the rules of the Highway Code.

4.32 Books including among other things pedestrian related materials

“Urban Transport, Control and Traffic Management” (C.Taxiltaris, Thessaloniki 1996)

Handbook for undergraduate students of Faculty of Rural and Surveying Engineering, Aristotle University of Thessaloniki, Department of Transportation & Hydraulic, Greece.
This Handbook contains information about the design of a convenient and safe environment, especially for the pedestrians:

- Pavements.
- Traffic Islands.
- Walking Areas.
- Traffic Calming Areas.
- Special design and rules near schools.
- Special design about handicapped.

“Environmental Highway” (G. Tsohos, University Studio Press, Thessaloniki, 2000)

Aristotle University of Thessaloniki, Faculty of Civil Engineering, Department of Transport and Organisation section, Greece.

“Traffic Calming Measures” (G. Tsohos, M. Pitsiava-Latinopoulou, University Studio Press, Thessaloniki, 2001)

Aristotle University of Thessaloniki, Faculty of Civil Engineering, Department of Transport and Organisation section, Greece

“Traffic Management”

I. Frantzeskakis, M. Pitsiava-Latinopoulou and D. Tsamboulas, (1997), Papasotiriou, Athens

National Technical University of Athens, Department of Transportation Planning and Engineering, Greece

Aristotle University of Thessaloniki, Faculty of Civil Engineering, Department of Transport and Organisation section, Greece.
Chapter 5: Indicative Research Projects (completed and on-going)

Greek Authorities participate in many research projects concerning transportation issues related to pedestrians. An indicative list of such projects is presented hereinafter:

5.1 The “DUMAS” Project (completed)

The DUMAS project (Developing Urban Management Safety) has been commissioned in January 1997 by the European Commission (DG VII) in order to consider current practice of dealing with Urban Road Safety as part of Urban Management and to produce frameworks for the design and evaluation of cost effective and successful urban safety initiatives. The project was completed on December 2000.

The following ten partners from nine European countries have been involved in the DUMAS project [20]:

- Transport Research Laboratory / TRL (UK) coordinator.
- Institut National de Recherche sur les Transports et leur Securite / INRETS (Fr).
- Road Directorate of the Ministry of Transport (DK).
- Development and Engineering Consultants Ltd / DENCO Ltd-Consultants and Aristotle University of Thessaloniki / AUTh (Gr).
- University of Brescia (It), Bundesanstalt.
- fur Strassenwesen / BAS (G).
- Kuratorium fur Verkehrssicherheit / KfV (Au).
- Transport Research Centre (Cz).
- Institute for Road Safety Research / SWOV (NL).
The “DUMAS” Town Studies

The last phase of the project, investigated urban traffic management and safety issues in the following 10 selected cities, one for each partner:

<table>
<thead>
<tr>
<th>Partner</th>
<th>Town</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Urban Community of Lille</td>
<td>1.100.000</td>
</tr>
<tr>
<td>Italy</td>
<td>Brescia</td>
<td>200.000</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Maastricht</td>
<td>150.000</td>
</tr>
<tr>
<td>Greece (DENCO)</td>
<td>Larissa</td>
<td>150.000</td>
</tr>
<tr>
<td>Germany</td>
<td>Cottbus</td>
<td>122.000</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Gloucester</td>
<td>105.000</td>
</tr>
<tr>
<td>Denmark</td>
<td>Gladsaxe</td>
<td>62.000</td>
</tr>
<tr>
<td>Greece (AUTH)</td>
<td>Katerini</td>
<td>60.000</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Kromeritz</td>
<td>26.000</td>
</tr>
<tr>
<td>Austria</td>
<td>Baden</td>
<td>23.500</td>
</tr>
</tbody>
</table>

Figure 5.1 Cities participated in the DUMAS project

An emphasis was given to the extensive pedestrianisations and to their effect in reducing pedestrian accidents in the two cities, Larissa and Katerini. Furthermore, the evolution (between years 1985 and 1995) of the percentage of pedestrian accidents in the two cities was examined. Finally, the results were compared with the respective results of other 20 Greek cities with the same population (30.000-150.000 inhabitants).

5.2 “On the Road 2001-2005, Road Safety Programme” (completed) [48]

The Hellenic Ministry of Transport and Communication assigned a research project for the development of a Road Safety Strategic Plan which was carried out by the Department of Transportation Planning and Engineering of the National Technical University of Athens (NTUA-DTPE). Additionally, six Ministries are involved in the Strategic Plan:

- Ministry of Transport and Communications.
- Ministry of Public Order.
- Ministry of Environment, Physical Planning and Public Works.
- Ministry of Health.
Ministry of Education
Ministry of Interior, Public Administration and Decentralization

“On the Road 2001-2005 Strategic Plan” is responsible for road safety and took into consideration, among other things, pedestrians and their difficulties on the road network. Plans’ target is the reduction of numbers of fatalities by 20% in the period 2001-2005 and by 40% until year 2015 compared to the year 2000 figures. It is an important first step towards the improvement of the road safety level and it sets the basis for dealing with the road safety problem in the country.

According to the results of the analysis of the road accident data, a reduction was noticed during years 2001-2005. Specifically, fatalities reduced by 15.1%, serious injuries reduced by 18.8% and light injuries reduced by 14.3% (comparing year 2002 with year 2001).

5.3 “Development of a Strategic Plan for the improvement of Road Safety in Greece, 2006-2010” (completed) [12]

After the completion of the first Strategic Plan, Greek State prepared the second strategic plan entitled “Development of a Strategic Plan for the improvement of Road Safety in Greece, 2006-2010”, which was carried out by the Department of Transportation Planning and Engineering of the National Technical University of Athens (NTUA-DTPE). The target of the new Plan is to decrease road accident fatalities in Greece in 2010 by 50% compared to the number of fatalities in year 2000.

5.4 “HEART, Health Effects and Risk of Transport systems” (on-going) [49]

“HEART” is a three-year, multi-partner research project funded by the European Commission within the 5th Framework Programme: “Energy, Environment and Sustainable Development – Quality of Life”. National Technical University of Athens, Greece (NTUA) is responsible about **Pedestrian behaviour.**
5.5 “Traffic Management Study for the Municipality of Stavroupoli” (completed) [50]
This short-term Traffic Management Study was carried out in the early’90s for the Municipality of Stavroupoli, Thessaloniki Metropolitan Area. The proposals of this study included measures for the improvement of the Public Transport System, parking management, road safety, pedestrian facilities, traffic lights, operation of the road network, signing etc.

5.6 “Traffic management study for the historical Thessaloniki city centre with emphasis on pedestrianisation”, (completed) [51]

This Traffic Management Study was carried out in the 90s for the Municipality of Thessaloniki. The study area was the historical city centre and the emphasis of the study proposals was put on the establishment of a safe and convenient environment for the pedestrians.

5.7 “Traffic Management Study for the Municipality of Neapoli”, (completed) [52]

This short-term Traffic Management Study was carried out in the early’90s for the Municipality of Neapoli, Thessaloniki Metropolitan Area. The proposals of this study included measures for the improvement of the Public Transport System, parking management, road safety, pedestrian facilities, traffic lights, operation of the road network, signing etc.

5.8 “Traffic Management Study for the eastern part of the Thessaloniki, city center”, (completed) [53]

This short-term Traffic Management Study was carried out in the early’90s for the eastern part of the Thessaloniki, city centre. The proposals of this study included measures for the improvement of the Public Transport System, parking Management, road safety, pedestrian facilities, traffic lights, operation of the road network, signing etc.
5.9 “General Transportation Study for the Thessaloniki Metropolitan Area”, Thessaloniki, 1997-2000, (completed) [54]

The General Transportation Study was initiated by the Organisation for the Master Plan and Environmental Protection of Thessaloniki (OMPEPT). This specific study had an initial phase in 1988 when an Origin-Destination survey was carried out throughout the city. The second phase was conducted in 1997-99 and included among other things a roadside survey (sample size of 33,836 vehicle drivers) and a home interview survey (sample size of 3,324 household heads). Various scenarios concerning transport infrastructure (i.e., metro lines, submerged tunnel) in the study area were examined through the use of the EMME/2 model. Moreover, the environmental impacts of these scenarios were calculated. The overall objective of this study was the provision of an efficient transport system, capable to meet current and future needs. In addition the promotion of Public Transport modes was a target in order to reduce traffic and associated environmental problems in the heavily congested areas.


This study has to do with the design of a Transport Master Plan for the city of Katerini, Northern Greece. One of the main proposals of this study was the implementation of a major pedestrianisation schemes in the city central area in order to improve the conditions for the pedestrians in terms of safety, convenience, etc. The effects of the pedestrianisation scheme to road safety were also estimated.

The following research projects (5.11 to 5.16) were carried out by the Department of Transportation & Hydraulic Engineering, Faculty of Rural & Surveying Engineering, Aristotle University of Thessaloniki (AUTh). At this point it should be mentioned that in project 5.11 the Faculty of Civil Engineering was also participated. These projects were assigned to AUTh by the Ministry of Transport and Communications. Research activities carried out within the projects include: Traffic education for pupils in elementary schools, design and operation of Traffic Education Centers (TECs) and training of the staff.
responsible for the operation of TECs. The overall target was the improvement of Road Safety in the country by affecting the behaviour of road users. The research projects are:

5.11 “Determination of structural and operational elements for Traffic Education Centers and Examination Centers for Candidate Drivers”, (completed), Project assigned by the Ministry of Transport and Communications, February 1998. [56]


5.13 “Design of a Guide for the educational activities at the Traffic Education Centers”, (completed), Project assigned by the Ministry of Transport and Communications, July 2002. [58]


5.15 “Training of coordinators and teachers of Traffic Education Centers in road safety and traffic education issues”, (completed), Project assigned by the Ministry of Transport and Communications, July 2002. [60]

5.16 “Assistance, Monitoring and Evaluation of the project concerning the construction and operation of Traffic Education Centers in Greek Municipalities”, (completed), Project assigned by the Ministry of Transport and Communications, March 2003. [61]

5.17 “Integrated drivers’ educational and examination system with emphasis on road safety issues”, (completed), Project assigned by the Ministry of Transport and Communications, July 2003. [62]
5.18 “Assistance, Monitoring and Evaluation of the project concerning the construction and operation of Traffic Education Centers in Greek Municipalities”, (completed), Project assigned by the Ministry of Transport and Communications, March 2004. [63]
Chapter 6: Policy Statements

6.1 General

The necessary prerequisite for the improvement of road safety in Greece led to the development and implementation of a Strategic Plan as mentioned in previous chapter. Within the above context, the Hellenic Ministry of Transport and Communication assigned a research project for the development of a Road Safety Strategic Plan which was carried out by the Department of Transportation Planning and Engineering of the National Technical University of Athens (NTUA-DTPE) in collaboration with the Australian Road Research Board (ARRB Transport Research).


In Road Safety Programme [48], a number of priority areas were set covering all accident related factors. Actions and measures addressing these priority areas were also chosen. The strategic plan has a target to reduce the numbers of fatalities by 20% in the period 2001-2005 and by 40% until year 2015 compared to figures of 2000.

The four main Road Safety Programmes (RSP) are:

- The safe road environment (Ministry of Environment, Physical Planning and Public Works – MEPPPW).
- The safety of the road user and safe vehicles (Ministry of Transport and Communications – MTC).
- Effective road safety enforcement (Ministry of Public Order – MPO).

Special consideration is given to vulnerable road users such as children and elderly people. Specifically, many factors are taken into consideration such as:
• Improvement of *signaling* and safety because signals help drivers to predict their movements, and this results to the reduction of accidents with pedestrians.

• Improvement of *lighting* especially near pedestrian crossings. National and international research shows that the improvement of lighting near crossings can reduce the accidents.

• Implementation of *pedestrianisation schemes*.

• *Road Safety Audit*.

• *Traffic education* at schools.

• *Black spot* treatments.

• Driver and pedestrian *friendly infrastructure* [64].

### 6.3 Road Safety Strategic Plan “2006-2010”

During the implementation of the first Strategic Plan a reduction was noticed concerning the total amount of road accidents. The Greek State prepare the second strategic plan entitled “*Development of a Strategic Plan for the improvement of Road Safety in Greece, 2006-2010*”, which was carried out by the Department of Transportation Planning and Engineering of the National Technical University of Athens (NTUA-DTPE)[12].

Taking into account the European Union Road Safety Target, the target of the second Strategic Plan is: “the decrease of road accident fatalities in Greece in 2010 by 50% compared to the number of fatalities in 2000 (see Figure 6.1).

![Figure 6.1 Road Safety targets in Greece according to the Second Strategic Plan](image)
The basic factors which will be taken into consideration for the improvement of pedestrians’ level of service and safety are:

- **Maintenance** and improvement of road network
- **Road safety measures**
- Implementation of Road Safety Audits
- **Road Safety Education**
- Teachers’ training on road safety and elaboration of educational material
- Measures for promoting Road Safety Education and improving students’ road safety
- Improvement of school transport safety

The results from the analysis of road accident factors constitute a good base of knowledge for road accidents which will be helpful for the respective Authorities to improve road safety in Greece and to meet the European Union Target.

### 6.4 Pedestrians Association

Recently (in year 2003), a Non Governmental Organisation (NGO) is established in Greece with the name: “PEZH” aiming at the protection of pedestrian rights. PEZH (which means “on foot” in Greek language) is a member of world carfree network and inspired by The Pedestrians' rights charter (European Parliament 1988) and The Copenhagen declaration (Eurocities - Carfree cities network 1996) [1]. The team group of “PEZH” tries to inform pedestrians about their rights and spread opinions about the new way of Transportation system in cities. PEZH believes that “walking” is not only a way of entertainment and recreational activity but is a main characteristic of the Transportation system. Increase of Walking, Bicycling and use of Modes of Public Transport could change the image of cities; making a city friendlier to its population.
For this reason, PEZH starts a campaign in order to block drivers to violate sidewalks and walking areas. PEZH defends of pedestrians’ rights and promote “walking” with different ways such as happening events. PEZH also promotes leaflets in order help people to realize that some day will need free space for their movements more than ever.

Figure 6.2 Promotion of pedestrians’ rights: “Respect to Pedestrians” Source [1]
Chapter 7: Legal Position of Pedestrians, National Highway Code

7.1 Signaling for Pedestrians

Pedestrians must obey to the existing signaling system except the case where traffic is controlled by police staff. There are three types of signals for pedestrians:

- Green light (Greenman)
- Red light (Redman)
- Vibrant greenman, where pedestrians should cross the road with special attention.

Pedestrians, who violate the redman, pay fine for their violation according to the Greek Highway Code.

7.2 Special Signing, Signaling and Traffic Infrastructure for Handicapped

Handicapped need special attention for their safety [65]. This is the reason why different types of signing, signaling and infrastructure implemented in order to increase their level of service. Thus, sound signs and textile infrastructure are used for blinds in order to understand when to cross the road (sound sign) and from which way they will move. Additionally, the implementation of ramps (grade up to 5%) allows people with wheelchairs to comfortably cross the road. In particular, according to Hellenic Ministry of Environment, Physical Planning and Public Works [6] the minimum width of pavements should be 2.05 meter where 0.20 meter is for architectural tips, 1.5 meter for pedestrians’ movements and 0.35 for signings and wayside. Additionally the minimum free height for pedestrians’ movements should be 2.20 meter while the height of pavement should be less than 10 centimeter.
7.3 Signing for Pedestrians and Handicapped

There are different types of signs about Pedestrians and Handicapped. These signs are presented below (see Appendix).

Signs which warn drivers to reduce their speed on time due to pedestrian’s volumes:
- K-15, danger due to pedestrian crossing.
- K-16, danger due to high volume of children (schools, playgrounds, etc).

Signs with P warn road users on specific roads about their special obligations. As far as pedestrians are concerned, the signs which are used are the following:

- P-15, no entry for pedestrians.
- P-55, street only for pedestrians (pedestrian zone, entry is prohibited in all categories of vehicles except emergency cars).
- P-57, maximum speed 30 km/h.
- P-65, each user (bicyclist, pedestrian) should use its own side.
- P-66, each group (pedestrians, bicyclists) can use the same corridor.
- P-71, parking space only for handicapped.
- P-72, parking space only vehicles carrying handicapped.

Signs with Pi are characterised as information signs. Such signs related to pedestrians and handicapped are presented below:

- Pi-21, pedestrian crossing.
- Pi-40, start of “walking”.
- Pi-45, Information.
- Pi-47, Toilets.
- Pi-58, start of residential area.
- Pi-59, end of residential area.
- Pi-60, handicapped.
- Pi-61, pedestrian crossing above the ground.
- Pi-62, underground pedestrian crossing with stairs.
- Pi-63, underpass pedestrian crossing without stairs.
- Pi-71, toilets for handicapped.
- Pi-92, start of Traffic Calming Areas.
- Pi-92a, end of Traffic Calming Areas.
- Pi-93, school traffic policeman.
- Pir-4d, only for cars carrying handicapped.
- Pir-4e, exception only for handicapped.

Pedestrian crossings are characterised by white parallel lines (zebra crossing). Grid of yellow lines near junctions warns drivers that they can not enter in the specific area.

### 7.4 Regulations for Pedestrians

1. Pedestrians should use pedestrians’ zones and crosswalks. They can continue walking on road in case of:
   - Pedestrians who need to move objects of big dimensions and thus cause problems to other people who walk on the pedestrian facilities.
   - Groups of pedestrians who have a specific reason i.e. pageant.
   - Handicapped that use wheelchairs.

2. When the use of pavements is impossible or there are not any pavements, pedestrians can walk on the road surface carefully without causing problems to traffic. In case of being lanes for bicycles, pedestrians can use them. Pedestrians should not violate the barriers aiming at the separation of pavement from vehicular traffic.

3. Pedestrians who move on road surface should have the opposite direction of the vehicular traffic. They are obliged to use the right side of road as possible.
4. If there are pedestrian crossings and pedestrian signals, pedestrians should use them. In case of absence of pedestrian signals, pedestrians should be conformed to vehicles’ signals or traffic policeman. Additionally in case of absence of signaling, pedestrian should take into consideration the distance and speed of vehicles. When there is not a crossing, pedestrian should carefully cross the road taking into consideration the general traffic.

7.5 Regulations about Driver’s Behaviour towards the Pedestrians

1. All drivers should be very careful with pedestrians in order to avoid injuring them. Especially, where there is an appropriate signaling and signing system at pedestrian crossings, all the drivers should:

   - Stop and give priority to pedestrians. It must be mentioned that blind people and handicapped can cross the road even in case of the green light for the drivers.
   - Left and right turns of drivers (in case of the presence of pedestrian crossing) should be made carefully and slowly in order to avoid unsafe situations.

2. At pedestrian crossing where there is no signaling for vehicles, drivers should be very careful, move with low speed and give priority to pedestrians. In case of absence of pavements, drivers should leave one (1) meter width from the end of the road surface in order to protect the pedestrians. According to pedestrian zones, where entry only for special vehicles (i.e. emergency vehicles) is permitted, the drivers of these specific vehicles should drive very slowly.

3. The regulations about pedestrians in residential areas, specifically in Traffic Calming areas, are:

   - Free movements on the road surface and playing games are permitted to pedestrians and children.
   - Drivers’ speed should not exceed 20 km/hour.
• Drivers should be very careful with pedestrians and they should stop when they see a pedestrian on the road surface.
• Parking is prohibited apart from places where there is a sign which permit it.
• Drivers exiting a Traffic Calming area should give priority to the other users of the road.

4. Drivers who turn left or right should give priority to pedestrians. Simultaneously, drivers should be very careful near bus stops.

5. Right overtaking is strictly prohibited in case of bus which stops for alighting or boarding passengers.

7.6 Regulations about Movement of Pedestrians, Handicapped with wheelchairs and people carrying babies

1. Drivers should stop in case of high pedestrian volumes (i.e. pageant, etc).
2. The use of pavements apart from pedestrians is permitted to handicapped with wheelchairs and people carrying babies.

7.7 General Rules concerning the behaviour of road users

- Drivers must take into consideration pedestrians and especially vulnerable users (children, people carrying babies, elderly, handicapped) making theirs’ movements more safe and comfortable.
- Pollution of the road environment is prohibited (quite often drivers throw things on the road) because it results to an unfriendly environment for the pedestrians. Vehicle emissions and traffic noise levels must be kept to a minimum since they seriously affect people’s health.
- Traffic Education lectures should be included in the syllabus of schools.
The overtaking of school bus is prohibited when the school bus stops for alighting and boarding students.

The overtaking of vehicles is prohibited before or in the area of the pedestrian crossings.

Public Transport modes should alight and board passengers as nearly to pavement as possible.

Stop and parking of vehicles is prohibited on pedestrian crossings, allowed only five (5) meters far from the pedestrian crossing.

Stop and parking of vehicles is prohibited on pedestrian zones, as well as their entries and exits.

Stop and parking of vehicles is prohibited on ramps for handicapped.

Stop and parking of vehicles is prohibited on parking places specially marked for the needs of handicapped.

The driver of school bus or bus for handicapped should have the alarm lights switched on during lighting or boarding.

Finally, it should be mentioned that violators pay a fine for their offence according to the Highway Code.
Chapter 8: Innovations

General

Campaigns are very important elements of the road safety strategic plans. Hellenic Institute of Transport [66] prepared ways for increasing road safety in Greece during the period 2001–2010. The proposed innovations can be presented under the following five headings [12, 48]:

- Training of drivers and driver-trainers
- Education campaigns
- Publicity campaigns
- Targeted research and demonstration actions
- Providing input for policy formulation

Campaigns are also proposed and supported by the “Strategic Plans” and also by the Road Safety Institute “Panos Mylonas” [67].

Researches all over the world accept the fact that road safety and especially road users would be improved in case of Traffic Education. For this reason the transport team of the Faulty of Rural and Surveying Engineering of Aristotle University of Thessaloniki carried out a research about the necessity of Traffic Education and to provide innovations concerning the improvement of road safety in Greece. The team proposed a series of measures [68]:

Introduction of Traffic Education as a separate course to schools. The target group consists of three subgroups: parents, teachers, and students [69, 70]. The overall objective is to sensitize students about their behaviour and also about road safety. The messages need to be categorised according to the age of the students.
Design of *Traffic Education Centers* (T.E.Cs.), which are nowadays being constructed or are under construction in 130 Greek municipalities, according to an initiative project originated in 1999 by the Greek Ministry of Transport and Telecommunications. The project aims at the improvement of road safety level.

The creation of *educational material* for the operation of T.E.Cs. The material includes appropriate handbooks and workbooks for students, teachers and parents. There is also provision for other types of materials such as posters, leaflets, pamphlets and brochures [71, 72].

*Television programmes* and *videotapes* can also be used while *Internet* and *email messages* can play an important role [73].

The target group of drivers and other road users (pedestrians, cyclists, etc.) has not homogeneity and therefore all possible means of communication must be used in the framework of a campaign in order to promote the importance of “Walking” among other things. A campaign should be organised by the Public Authorities and can be supported by various organisations, unions, etc.
References


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[69] Department for Road Safety Transport, United Kingdom. Campaign THINK, Road Safety Campaign THINK available at: www.think.dft.gov.uk

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APPENDIX

Greek Highway Code Signs

Warning Signs

K-15, dangerous due to pedestrian crossing

Prohibitive Signs

P-15, no entry for pedestrians

P-55, street only for pedestrians (pedestrian zone, entry is prohibited to all type of vehicles except emergency cars)
**P-57**, maximum speed 30 km/h

**P-65**, each user (bicyclist, pedestrian) should use its own side

**P-66**, each group (pedestrians, bicyclists) can use the same corridor

**P-71**, parking space only for handicapped

**P-72**, parking space for special vehicle which is used only from handicapped
Information signs

**Pi-21**, pedestrian crossing

**Pi-40**, start of “walking”

**Pi-45**, Information

**Pi-47**, Toilets

**Pi-58**, start of residential area
**Pi-59**, end of residential area

**Pi-60**, handicapped

**Pi-61**, pedestrian crossing above the ground

**Pi-62**, underground pedestrian crossing

**Pi-63**, underpass pedestrian crossing without stairs
Pi-71, toilets only for handicapped

Pi-92, start of traffic calming areas

Pi-92a, end of traffic calming areas

Pi-93, school traffic policeman

Pir-4d, only for handicapped cars

Pir-4e, exception only for handicapped