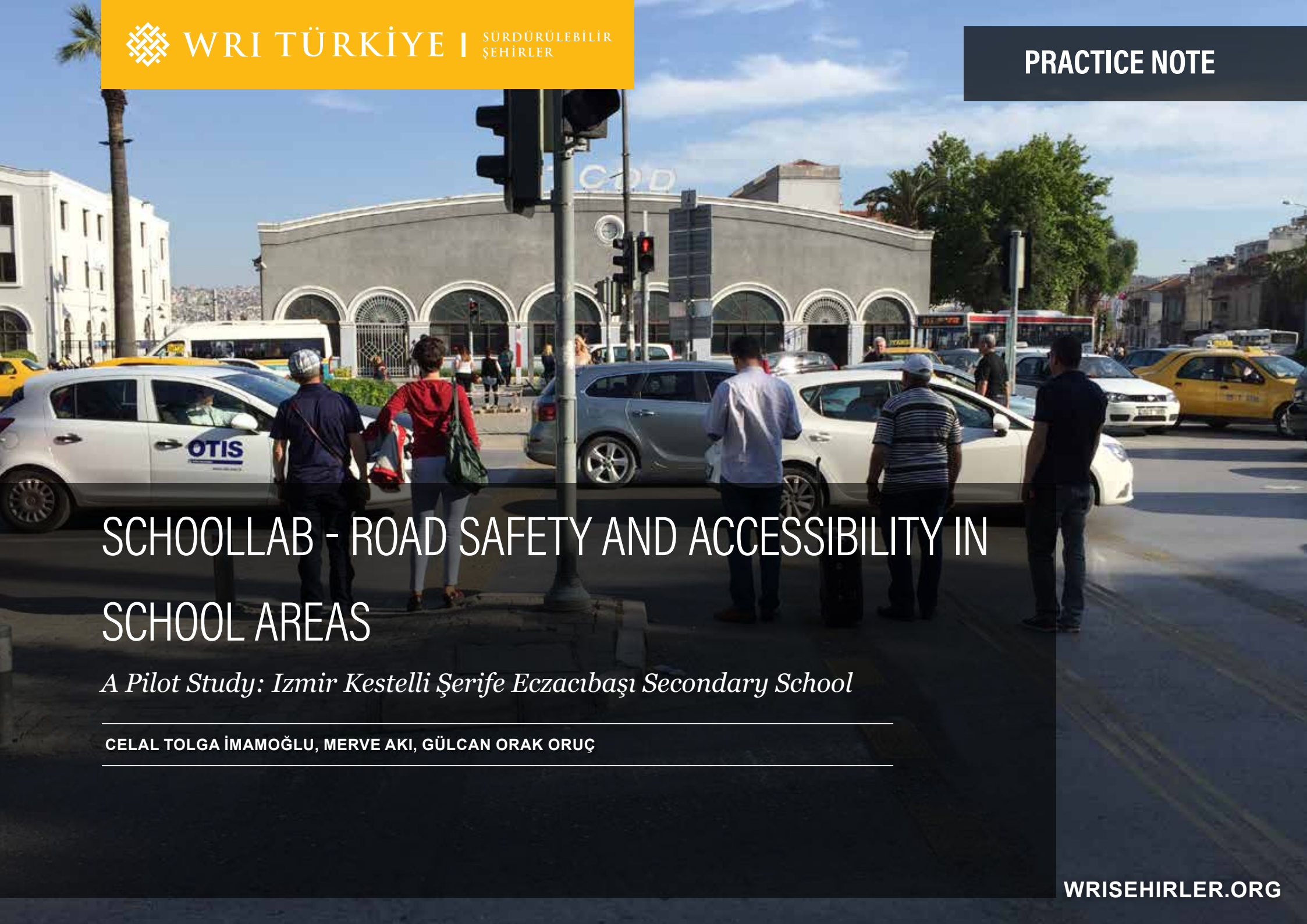

WRI TÜRKİYE | SÜRDÜRÜLEBİLİR ŞEHİRLER

PRACTICE NOTE

SCHOOLLAB - ROAD SAFETY AND ACCESSIBILITY IN SCHOOL AREAS

A Pilot Study: Izmir Kestelli Şerife Eczacıbaşı Secondary School

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CONTENTS

INTRODUCTION

According to the World Health Organization (WHO) "Global Status Report on Road Safety 2015", 1.25 million people died as a result of road traffic crashes globally in 2013. Road traffic crashes that are currently the ninth leading cause of death globally are predicted to become the seventh leading cause of death by 2030 unless necessary measures are taken. Globally, road traffic crashes are a leading cause of death among young people, and the main cause of death among those aged 15–29 years. (WHO, 2015).

There are other indirect consequences as well as the above mentioned primary results of traffic crashes involving death or personal injuries. Traffic crashes also exact an economic toll representing a significant burden on health systems. Estimates of the economic cost of road traffic crashes range from 1-5% of gross domestic product (GDP), varying by country (WRI Ross Center for Sustainable Cities, 2015, p. 1). Deaths due to traffic crashes amount to 3 percent of gross domestic product (GDP) in India and Indonesia, 1.7 percent in Mexico, 1.2 percent in Brazil, and 1.1 percent in Turkey (WHO, 2013, p. 76;126; 127; 157; 221).

The greater part of traffic crashes occurs in low- and middle-income countries[1]. In these countries, in line with their emerging economies, motor vehicle ownership is increasing at a galloping pace. In the cities of these countries, the demand for new housing due to population growth also leads to the establishment of new road infrastructures. In the arrangements for both new residential areas and new road infrastructure, the organization of space should be done in a balanced manner. (WRI Ross Center for Sustainable Cities, 2015). Furthermore, developed countries, which have more motor vehicles than developing countries, have succeeded in solving these problems with a human-oriented planning approach rather than a motor vehicle-oriented approach. For instance, Gehl Architects has created an approach called cities for people. The approach is implemented in many cities to emphasize pedestrian priority such as Istanbul, Moscow, New York, Sao Paulo, Melbourne, San Francisco[2].

Cities with human-oriented planning also support transportation types such as pedestrians and bicycles, thereby integrating these types of transportation with public transportation systems. However, all these efforts are incomplete without road safety. Securely implemented urban transport systems increase daily physical activity rates by encouraging people to walk and bike. Air quality is also expected to increase by means of that the use of motor vehicles producing about 17% of total greenhouse gas emissions turn towards public transportation (FIA Foundation, 2015, p. 2). As a result, an improvement is observed in the quality of life of people living in cities.

The fact that traffic crashes can be predicted and prevented as well as the best practice examples of road safety by different institutions and organizations have brought decision makers

around the world into action to generate a solution to this problem. In this context, “Global Plan for the Decade of Action for Road Safety 2011-2020” has been published by the United Nations to guide national actions on road safety. In addition, within the scope of the “2030 Agenda for Sustainable Development Goals”, a target was set to halve the number of traffic crashes by 2020 in order to support the activities of Goal 3: Good Health and Well-Being and Goal 11: Sustainable Cities and Communities (UNDP, n.d.). At the same time, the contribution of road safety to the goals and actions on health, development, and environment has been recognized internationally (WHO, 2015, p. Vİİ).

Safe Routes to School

Since 1970s, ‘Safe Routes to School’ has become a recognized part of the recommended portfolio of sustainable transport and road safety policies[3]. Given the fact that most of the deaths due to traffic crashes occur in the 15-17 age range, the road safety of children[4] who are the future of society emerges as an issue that needs to be paid much more attention (WHO, 2015, p. 4). It is possible to minimize traffic crashes by improving the roads between the places where children spend most of their time such as home, school, parks or playgrounds, and thus, creating both safer and more enjoyable journeys.

School districts are the places where children are the most active in the city. School trips are expected to be done by walking or cycling, considering that the school districts are usually located within the neighbourhood texture. Walking or cycling to the school is a good exercise for children, and it has a significant positive impact on their health as well. Moreover, physical activity affects the academic performance of the students and their concentration on the lectures positively. Experts advise that children over the age of 5 years should do 60 minutes of physical activity every day. Providing safe roads in urban transport systems encourages children to prefer transportation types such as walking and cycling. At the same time, it plays an important role in raising happy, healthy, curious and independent children (OECD, 2004).

Road Safety and Accessibility in School Districts Pilot Study

This “Road Safety and Accessibility in School Districts Pilot Study” aims to provide guidance for local authorities in Izmir, and a potential model to inspire other cities in Turkey. This report is not only children-specific but also aims to improve the quality of life for their families, teachers and all the residents of the region. Kestelli Şerife Eczacıbaşı Secondary School located in Konak District of İzmir was selected as a pilot location for this study as seen in Figure 1.

This study has the feature of being a detailed pilot project of the “Izmir-Tarih Sustainable Transportation Project” performed by WRI Turkey Sustainable Cities in 2016-2017 with the cooperation of İzmir-Tarih, affiliated to Izmir Metropolitan Municipality.

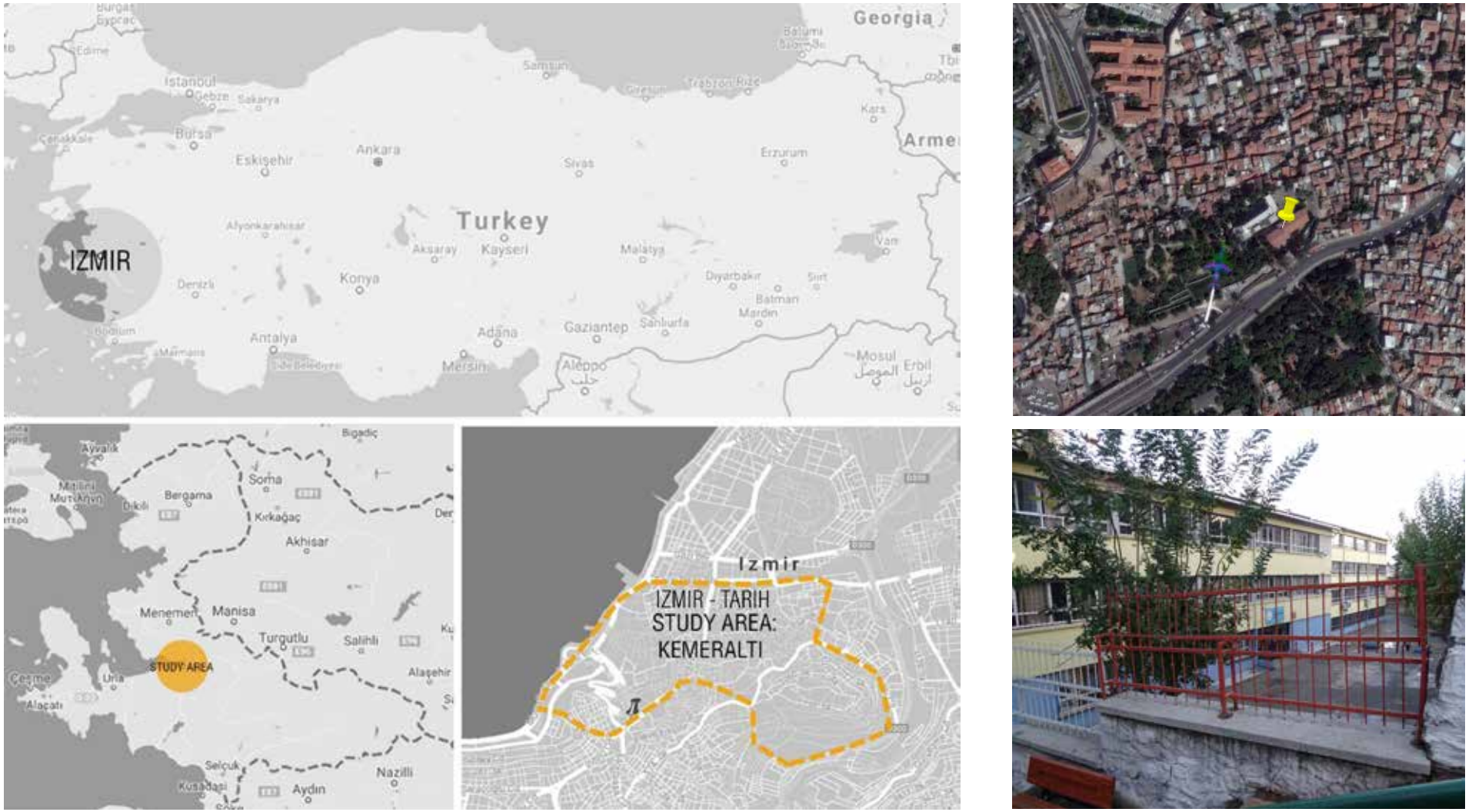
Within the scope of the İzmir-Tarih Sustainable Transportation Project carried out together with Izmir Metropolitan Municipality in 2016, WRI Turkey Sustainable Cities performed pedestrian transportation and bicycle transportation planning, and presented road safety assessments and recommendations on the main axis within the study area and proposals on the access to public spaces and urban facilities, in order to implement a sustainable transport approach in the Kemeralti Region. Referring to this study, “Road Safety and Accessibility in School Districts Pilot Study” was carried out. Road safety and accessibility studies were performed in the vicinity of Kestelli Şerife Eczacıbaşı Secondary School which was selected by according to the preliminary field study.

This report develops a new approach for the road safety around school zones. The first part of the report draws the current status of Turkey and Izmir and the road safety map by statistics, while the second part presents the road safety inspection study carried out in and around Kestelli Şerife Eczacıbaşı Secondary School which is the pilot study area. In the last part, under the heading of evaluations and suggestions, steps to be followed are shared by offering suggestions developed according to the worldwide best practice examples and local needs and shortcomings in Turkey.

Method

European Union Directive 2008/96/EC Road Safety Studies are specified under five headings (Diagram 1). Road Safety Audit work is carried out by teams of road safety experts who work independently from the planning and design

Figure 1 | **The Location of Izmir Tarih Sustainable Transportation Project and Kestelli Şerife Eczacıbaşı Secondary School**

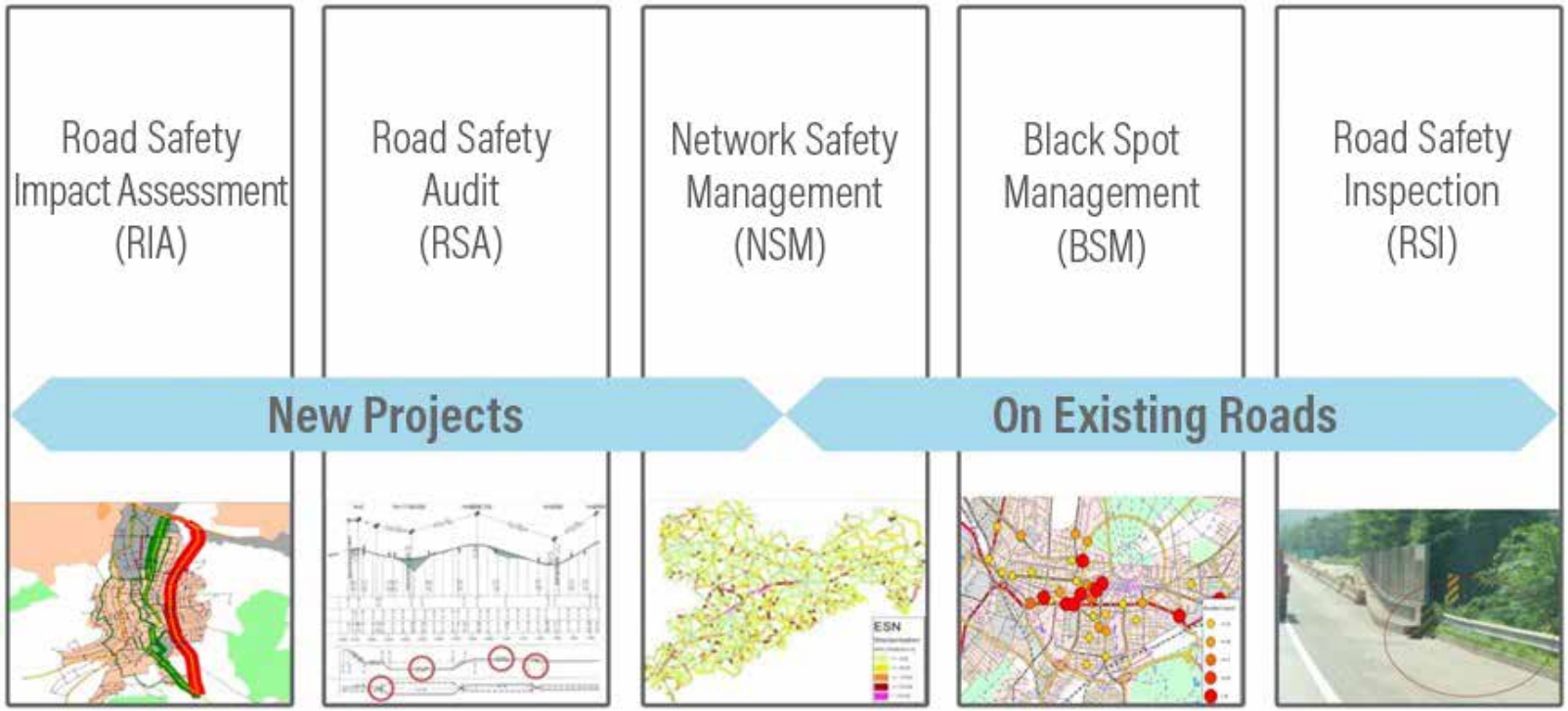


teams at the planning and design phases of the projects, but in coordination with them and with the contractors who will put the project into practice. In these studies involving re-planning and redesign of the projects, road safety elements for all types of users are covered. Road Safety Inspection covers improving road safety elements on currently used roads and works carried out by crews of road safety experts to reduce traffic crashes in these areas.

ROAD SAFETY BY STATISTICS

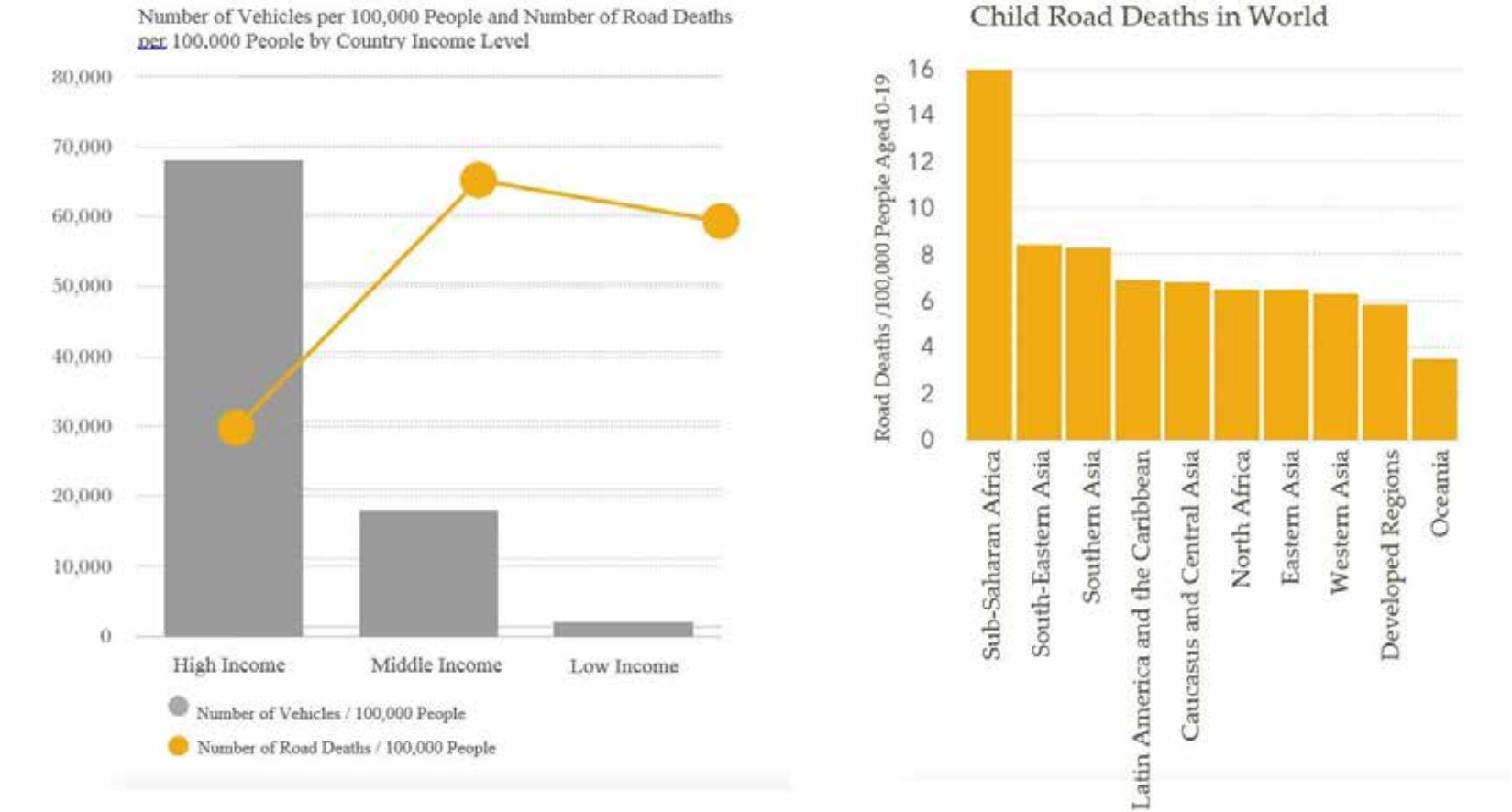
Even though the proportion of children losing their lives in traffic crashes varies according to the country, the city, or a certain region of the city, these rates are usually at a critical level. The fact that the physical, cognitive and social development of children is more limited than adults makes them more vulnerable in the traffic. Shorter stature of children obstructs their peripheral vision to see the traffic around them, to perceive vehicle speeds to a certain extent, and makes it difficult for other road users to see them. It may be more difficult for children to comment on the different sounds and lights which might affect their judgments about the proximity, direction, and speed of moving vehicles (Akdur & Sungur, 2016, p. 26). Furthermore, the smaller physical stature of children and their tendency to make sudden moves make it difficult for children to be perceived by other road users and raises the risk of road safety. (Department of Transport and Main Roads, 2011, p. 3).

Figure 2 | **Road Safety Studies Specified by the Directive 2008/96/EC of the European Union**



The Global Status report on road safety published by World Health Organization in 2015 indicates that worldwide the total number of road traffic deaths has plateaued at 1.25 million in the year 2013[5]. The African and Eastern Mediterranean regions have the highest road traffic fatality rate. Traffic crashes and road traffic injury-related deaths are more common in low- and middle-income countries than in developed countries. Developed countries have a higher number of vehicles and traffic density. However, the fact that low and middle-income countries are not able to implement infrastructure and security systems adequately enough to cope with increasing vehicle ownership in parallel with their emerging economies lead to further traffic crashes. As for the child mortality rate resulting from traffic crashes, low and middle-income countries again have the largest share. Especially, Sub-Saharan region of Africa suffers a significantly high rate of child road deaths (FIA Foundation & Unicef, 2015, p. 7).

Figure 3 | **Number of Vehicles and Traffic Crash-Related Deaths by Country Income Level and Child Road Deaths**



Source: This diagram was prepared by authors in accordance with the information and graphics contained in the "Safe to Learn" report by the FIA Foundation & Unicef

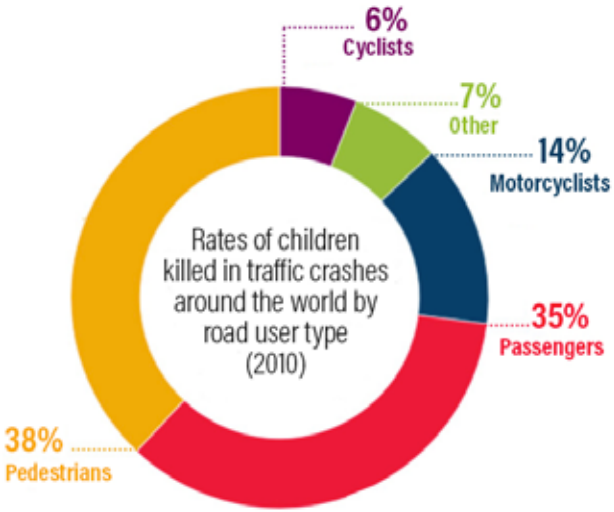
Children account for 21% of all road traffic injury-related deaths worldwide (FIA Foundation & Unicef, 2015). Every day nearly 500 children lose their lives on the world's roads where more than 3,000 people are killed or injured every day. Road traffic injuries rank among the main causes of death for children. Globally, road traffic injuries are the leading cause of death among 15–19-year-olds and among the five main causes of death for other age groups. (WHO, 2015, p. 8).

Children up to the age of nine years are accompanied by parents when they travel, either in vehicles or as pedestrians. Children older than nine years old tend to travel more independently, as road users like pedestrians, 8 cyclists, motorcyclists and finally drivers based on countries' age limits for getting driver's license or unlicensed (WHO & Unicef, 2008, p. 32). Schools are the primary places where children spend most of their time. During the school period, students travel to and from school at least twice a day. A large part of the traffic crashes occurs on the journey to or from school. The number of children losing their lives every day due to traffic crashes while walking to their daily lessons is high enough to be the equivalent to two large secondary schools. (FIA Foundation & Unicef, 2015, p. 2).

Figure 4 | **Traffic Crashes and Child Population**

Source: This diagram was prepared by authors compiling the information and images in the "Make Roads Safe: Action on Global Road Traffic Injuries" reports

Figure 5 | **Rates of Children Killed in Traffic Crashes around the World by Road User Type**



Source: FIA Foundation & Unicef, 2015

It is possible to reduce traffic crash risks and create safe living environments with the improvements made in the roads between home-school, where children travel daily. By the "Cities Safer by Design" approach, street and avenue improvements through urban design aim to make cities safer. It is possible to provide safe spaces for the pedestrians and cyclists from all age groups by reducing the speed of vehicles via applied traffic calming measures such as speed bumps. (WRI Ross Center for Sustainable Cities, 2015, p. 8). As mentioned above, because children can hardly notice traffic due to their short stature and due to their tendency to act suddenly with weak decision-making mechanisms, they are very vulnerable to traffic. Therefore, solutions aimed at minimizing traffic crash risk by reducing the speeds of vehicles are an important practice, especially in the areas where children mainly spend time, such as school regions (Adriazola, Li, & Welle , 2015).

The term "Safe Routes to School" was first coined in Denmark in the 1970s and since that time, it has spread throughout developed countries such as Europe, Australia, New Zealand, Canada, and the United States of America.

The first practices on this subject in the United States were implemented in 1997 in the Bronx County under the name "Safe Routes to School Program". In 2005, the program increased the

number of schools by spreading to 50 states, strengthening the investment of 612 million dollars. With this funding, new bike lanes were built in school districts and the pedestrian infrastructure were improved. In the United States, with the "Safe Routes to Schools (SRTS) Program, funded by the U.S. Department of Transportation, nearly 15,000 schools and their environment have been improved since 2005. A study of initial pilot SRTS sites in California showed a 38% increase in students walking to school following the investment (FIA Foundation & Unicef, 2015, p. 25).

In the United Kingdom, the first works were initiated by the Environmental Transportation Association in 1997 with the "20's Plenty" movement. Within this scope, a maximum speed limit of 20 miles per hour have been introduced around school zones. These secure areas created in the school districts have been supported by speed humps. Since the introduction of the "20's Plenty" program, mortality rates among children aged 0-15 were reduced by 46% among pedestrians and by 28% among cyclists. Nearly no children, pedestrians, and cyclists were injured in these safe zones created by speed limit (FIA Foundation, 2017, p. 18).

Road safety studies in these countries are supported by international organizations. In 2002, WHO, UNEP and UNICEF together published policy on the environmental risks to children, and promoted the concept of the 'Safe School'. In collaboration with several organizations such as FIA Foundation, the number of children lost their lives in traffic crashes in Tanzania, Kenya, and South Africa has been significantly reduced (FIA Foundation & Unicef, 2015, p. 16).

The United Nations Sustainable Development Goals emphasize the necessity of halving the number of deaths and injuries caused by road traffic crashes worldwide for safer roads and safer, healthier communities for the 2015-2030 period. (FIA Foundation, 2017, p. 8).

Within the context of the "Global Plan for the Decade of Action for Road Safety 2011-2020" prepared by the United Nations to cover the whole world, Turkey aims to reduce road deaths by 50% by 2020. In an attempt to achieve this goal, the Road Traffic Safety Strategy and Action Plan were published as the Prime Ministerial Circular. The Road Traffic Safety Strategy Coordination Board was established under the chairmanship of the Minister of Interior to ensure interinstitutional cooperation and coordination on traffic safety. Senior representatives from the related ministries, the Directorate General of Security, and the Turkish Standards Institute serve on the Board. In addition to this, it was aimed to carry out activities to raise awareness in the field of traffic safety throughout the country via the Traffic Safety Platform, which was established on April 3, 2013, with the participation of the business world, the media, and non-governmental organizations (WRI Turkey Sustainable Cities, 2015, p. 10).

BOX 1 | GÜVENLİ BİR ULAŞIM SİSTEMİ: "SHARE THE ROAD"

To achieve a sustainable transport system, there are three main topics to focus on, namely "road safety", "accessibility" and "environment". The targets of these titles are:

- Prevent traffic crashes involving death or personal injury,
- Reduce the risks associated with road safety, providing safe journey to children who travel between home and school,
- Increase and improve the access throughout school and business trips and trips made for other daily activities, via an integrated public transport system,
- Increase the number of pedestrians and cyclists by offering a safer road infrastructure for these users,
- Reduce air pollution and CO2 emissions (FIA Foundation, 2017, p. 8).

Accordingly, the FIA Foundation published the "Share the Road" report together with UN Environment. "Share the Road" aims to direct the attention of global agenda to transport means of walking and biking, and to guide street level improvement works. Another aim of the report is to provide benefits to the children, their families, the community and the environment, and to increase the proportion of individuals walking and cycling in a cleaner environment.

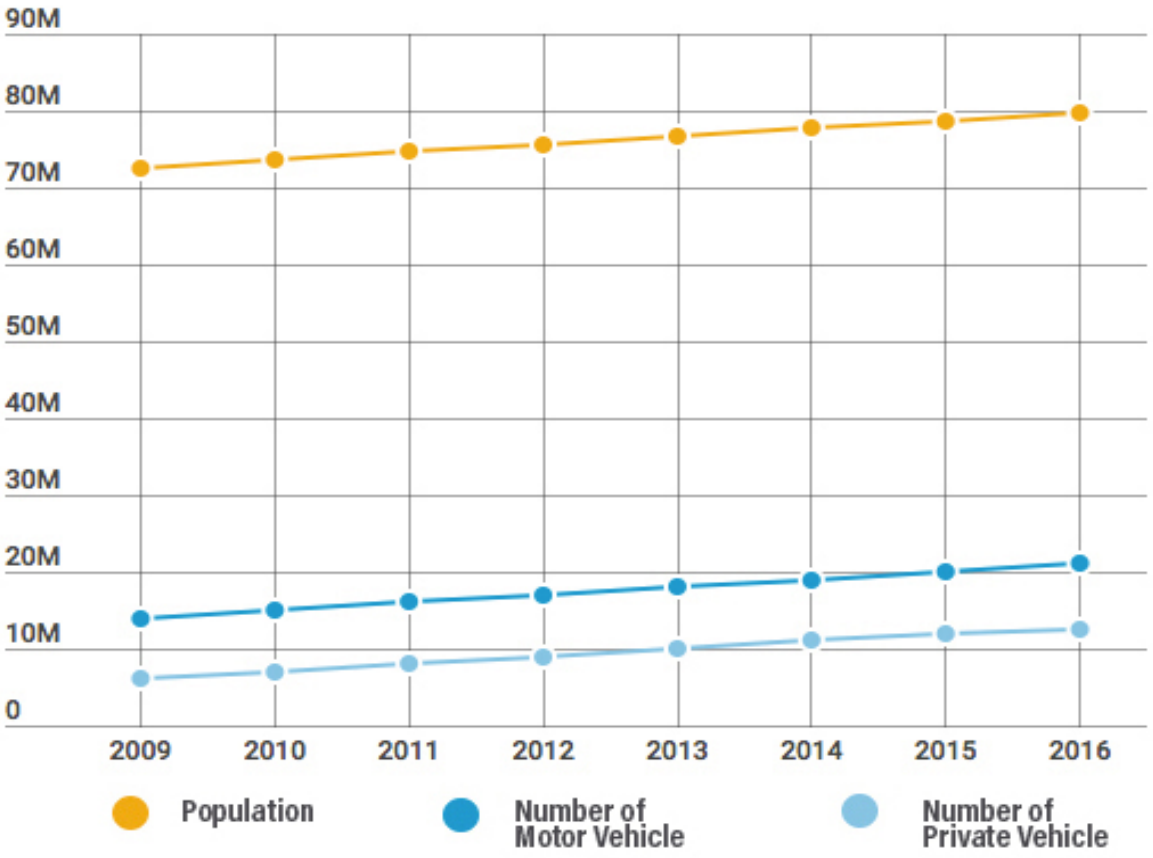
In addition to the above developments, within the scope of the 10-Year Action Plan, with the support of the FIA Foundation, in the light of the data and indicators, WRI Turkey Sustainable Cities decided to carry out a “Road Safety and Accessibility in School Areas” pilot project which aimed at improving road safety and accessibility in the school areas that should be one of the first implementation points in the city for sustainable and safe urban mobility.

TURKEY: RAPID URBANIZATION, CHILD POPULATION, TRAFFIC CRASHES

Urbanization leads to the expansion of cities in terms of physical boundaries due to the increase in population density. The expansion of urban area changes the scope and scale of public services. This situation reduces the effectiveness and efficiency of transportation services while increasing the duration and cost of urban travel (Akbulut, 2016, pp. 336-355).

In parallel with the development of economic activities with the growth of urban population and area, demands for transportation within the city are also increasing rapidly. There is an increase in private vehicle ownership with the improvement of living conditions, economic development and increase in income level; the increase in vehicle ownership is added to the difficulties in implementing the infrastructure system that will meet the transportation demand; which creates traffic congestion in urban spaces (Cirit, 2014, p. 3). This leads to extra costs and losses in the country's economy due to adverse effects such as excessive fuel consumption, waste of time, air pollution and noise, inefficient use of urban areas (Kös, 2015, p. 6).

Graph 1 | **Population, Number of Registered Motor Vehicles and Number of Private Vehicles Across Turkey**[6]



Numerous cities in Turkey have encountered rapid urbanization and problems related to this process. Turkey began to experience the urbanization process most prominently and quickly after the 1950s. The country population, which shows a large increase every year, reached 79 million as of 2016 (TÜİK-d, 2016).

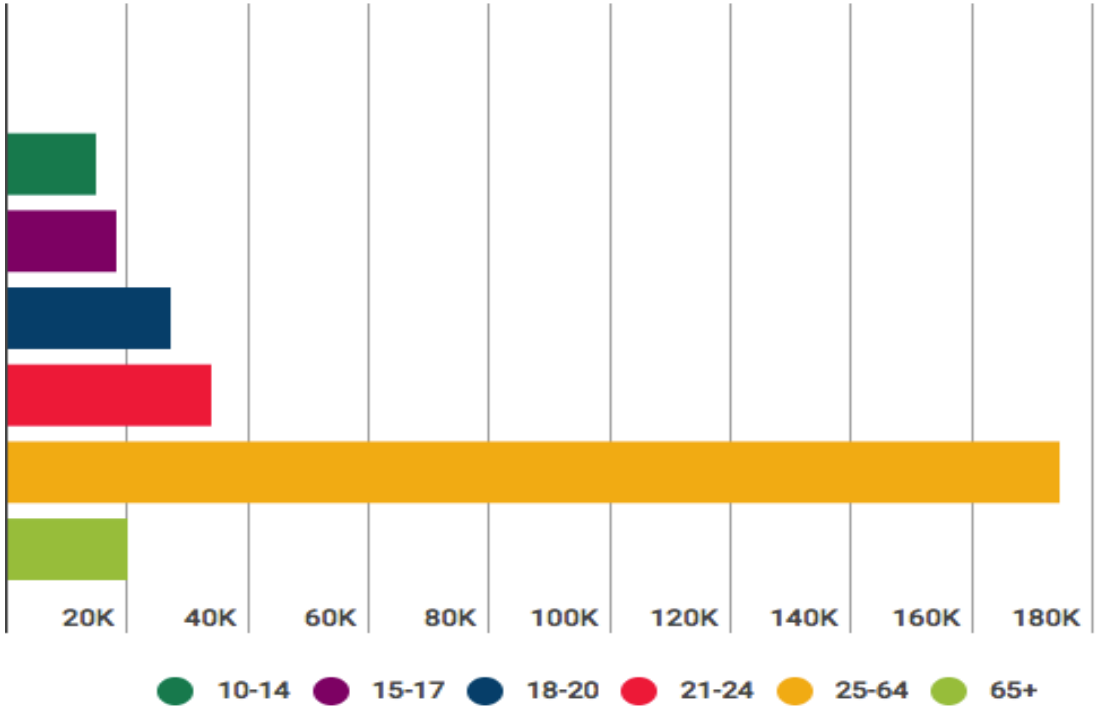
Between 2009 and 2016, the population increased by 7.3 million and the number of motor vehicles showed an increase of 7.5 million. The balance between the increases deteriorated when the number of motor vehicles increased by more than the population after 2015. According to TURKSTAT data released in March 2017, the number of motor vehicles increased by 7.5 million and reached to 21 million (TÜİK, 2017). Private vehicles constitute a portion of nearly 5 million of this increase of 7.5 million. These statistics on the number of motorized and private vehicles show that the most important problems of the cities are transportation and transportation-related problems due to rapid urbanization.

Throughout Turkey, it is seen that the transportation infrastructure and road safety in the cities don't develop at the same rate and speed as rapidly increasing motor vehicle ownership. Millions of vehicles joining traffic lead to disruptions in urban transportation, traffic congestion, and traffic crashes causing financial and emotional damages. One of the most important transport-related problems in the city is inadequate road safety. 75% of traffic crashes involving death or personal injury that occurred in Turkey in 2016 occurred in the residential areas, and 25% occurred outside the residential areas. The fact that 75% of traffic crashes occurred in the residential areas shows the inadequacy of road safety in urban mobility.

The number of traffic crashes that occurred on the road network of Turkey in 2016 totalled 1,182,491. 997,363 of these crashes involved material damage, while 185,128 crashes involved death and personal injury. According to TURKSTAT data for 2009-2016, the total number of deaths and injuries in traffic crashes is around 2 million. In 2009, the number of dead and wounded was 165,000, of which 27,000 were children ages 0-17. In 2016, 56,000 of total 311,000 death and injury constitute the 0-17 age group. During these years, the number of vehicles increased by about 50%, while the number of children who were killed and injured increased by 110% accordingly TURKSTAT (TÜİK-a, 2016).

In Turkey, the number of children involved in traffic crashes involving death or personal injury has increased about %110 in the last 7 years.

Graph 2 | **Number of Deaths and Injuries in Traffic Crashes by Age Groups in Turkey**



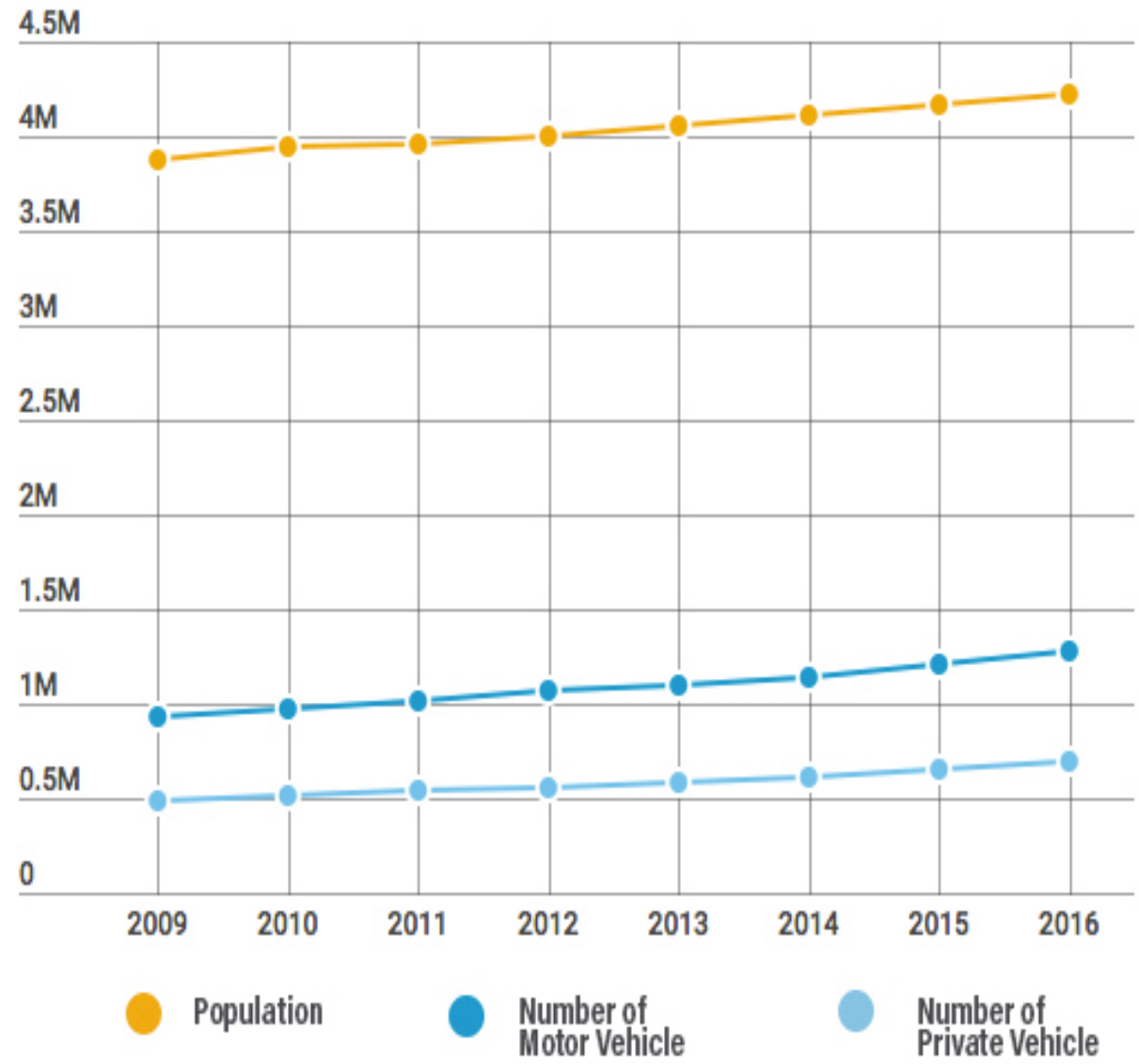
Source: TUIK-a, 2016

URBANIZATION, NUMBER OF MOTOR VEHICLES, AND TRAFFIC CRASHES IN IZMIR

Izmir is Turkey's third most important metropolis in terms of demographic attributes and socio-economic development level. Being a seaport has created continuity in Izmir's commercial and economic activities.
By putting Law dated 2012 and number 6360 on "Amendments in Some Laws and Decree Law to Establish Metropolitan Municipality in Fourteen Provinces and Twenty Seven Districts" into force, legal entity of villages and town municipality within possession borders of relevant provinces are revoked, and villages and towns are rejoined to the relevant district municipality as neighbourhood and as municipalities – respectively- under one neighbourhood, and the borders of the province became the provincial possession borders. Accordingly, while the total urban population increase was 15,8% between 2000-2010, urban population increase became 27,5% after 2012 and the number of total urban population was registered as 4,005,459 in 2012.

Urban planning aspects in terms of infrastructure could not meet the needs of growing population that should meet as primary requirement of urban planning. Various problems in İzmir due to the increase in both the rapid population growth and the increase in vehicle numbers. Having a population of 3.9 million in 2009, Izmir

Graph 3 | **Izmir Population, Registered Motor Vehicle and Private Vehicle Data**

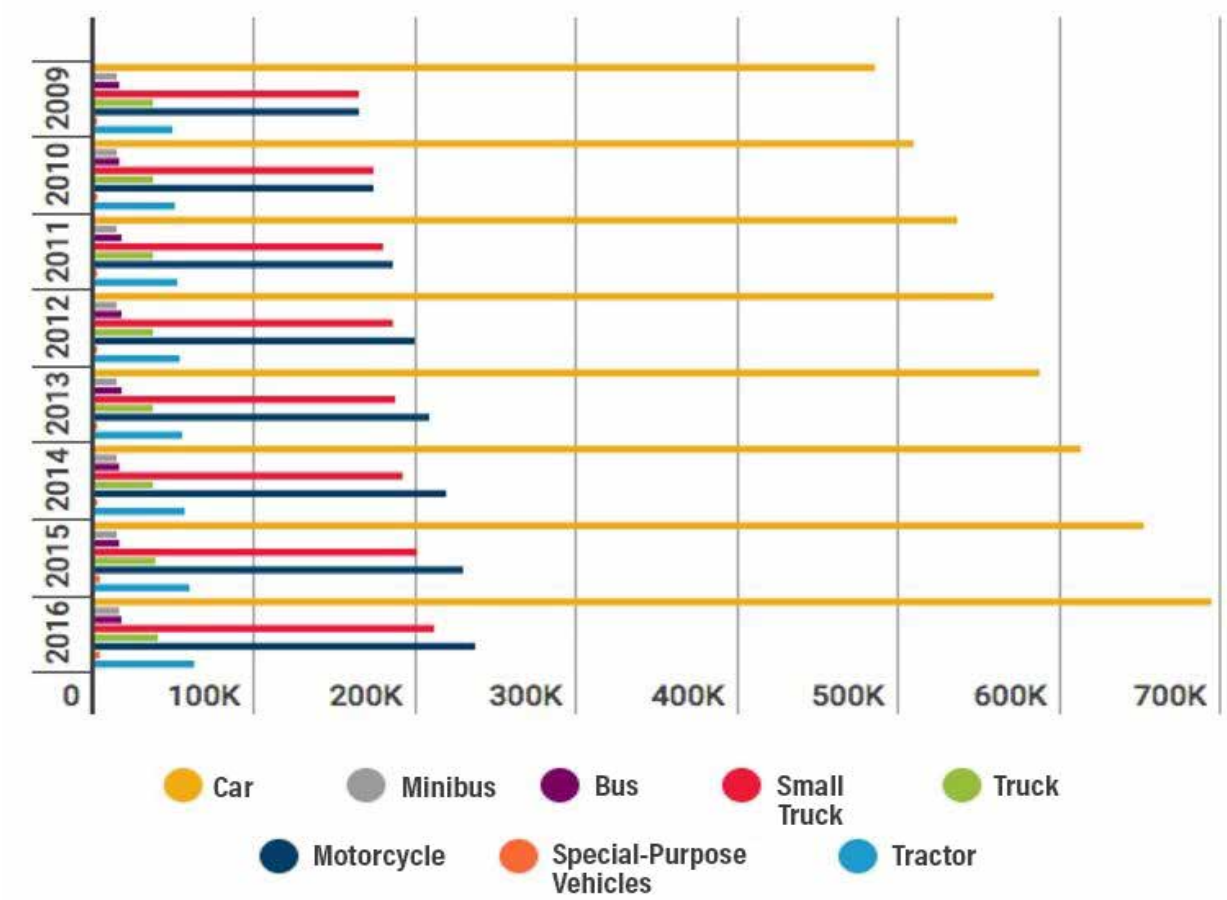


Source: TUIK, 2016

grew by 11% in 2016 and reached approximately 4.3 million. Due to this increase in population, the total number of motor vehicles, which was around 930,000 in 2009, increased by 37.6% and reached 1.3 million in 2016.

When the ratios of motor vehicles registered in İzmir were examined, an increase of 43.14% was detected in the number of automobiles among motor vehicles registered in İzmir province, and the biggest change in the graph was seen in the automobile for the last eight years.

Graph 4 | **Rates of Motor Vehicle Types Registered in Izmir**



Source: This graph was derived from TUIK 2013, 2014, 2015, 2016 by authors

Graph 5 shows the changes occurred in the increase rates of the numbers of registered motor vehicles in Izmir and in Turkey between 2009 and 2016. The rate of increase in the number of motor vehicles in Izmir was most prominent between 2014 and 2015. Since the reduction in the rate of increase in the number of motor vehicles in Turkey was realized more compared to İzmir between the years 2015-2016, Turkey remained below Izmir in 2016.

Traffic crashes occur with the effects of factors such as people, vehicles, roads, environment, and inspection. In cases where effective and adequate road safety measures are not taken in transport, there will be an increase in traffic crashes resulting in death and injuries, due to the increasing population and accordingly unplanned urbanization, and deficiencies in the transport infrastructure (Gökkaya, 2003, p. 1).

Graph 5 | **Comparison of Registered Motor Vehicles in Izmir and Turkey**[7]

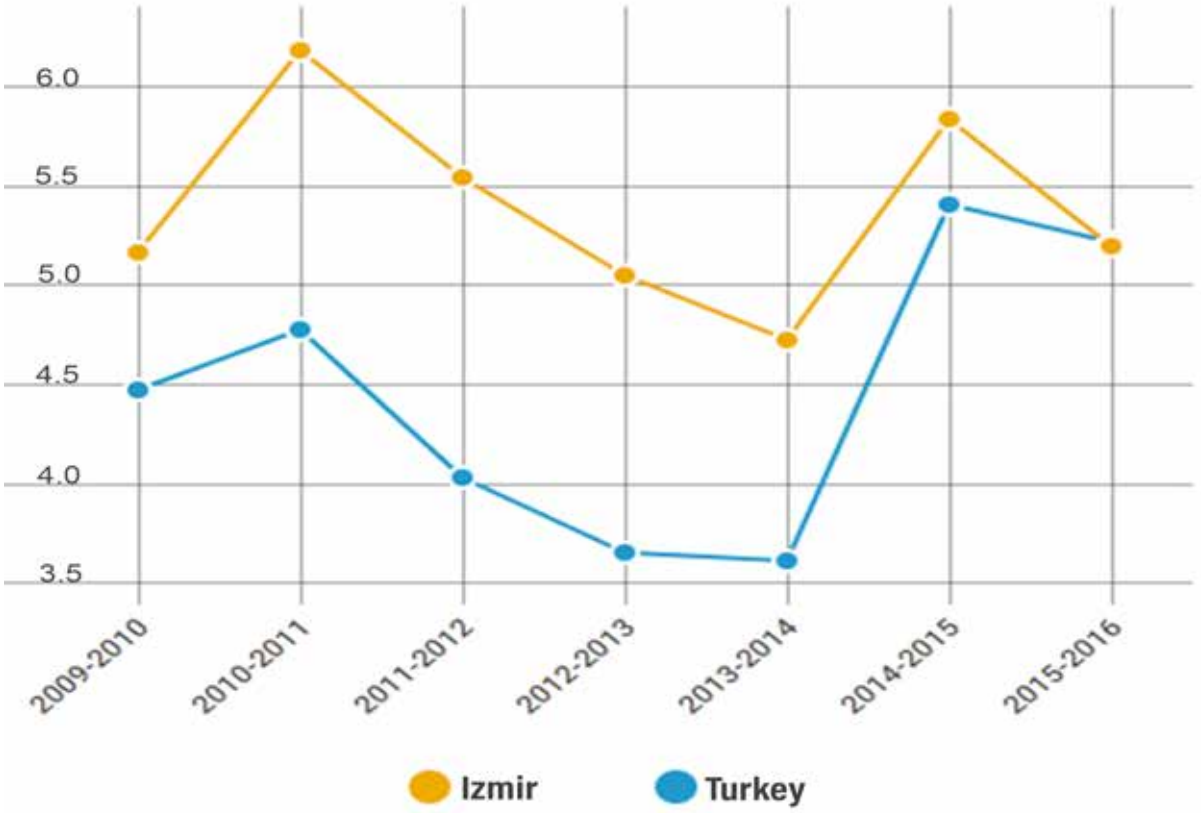


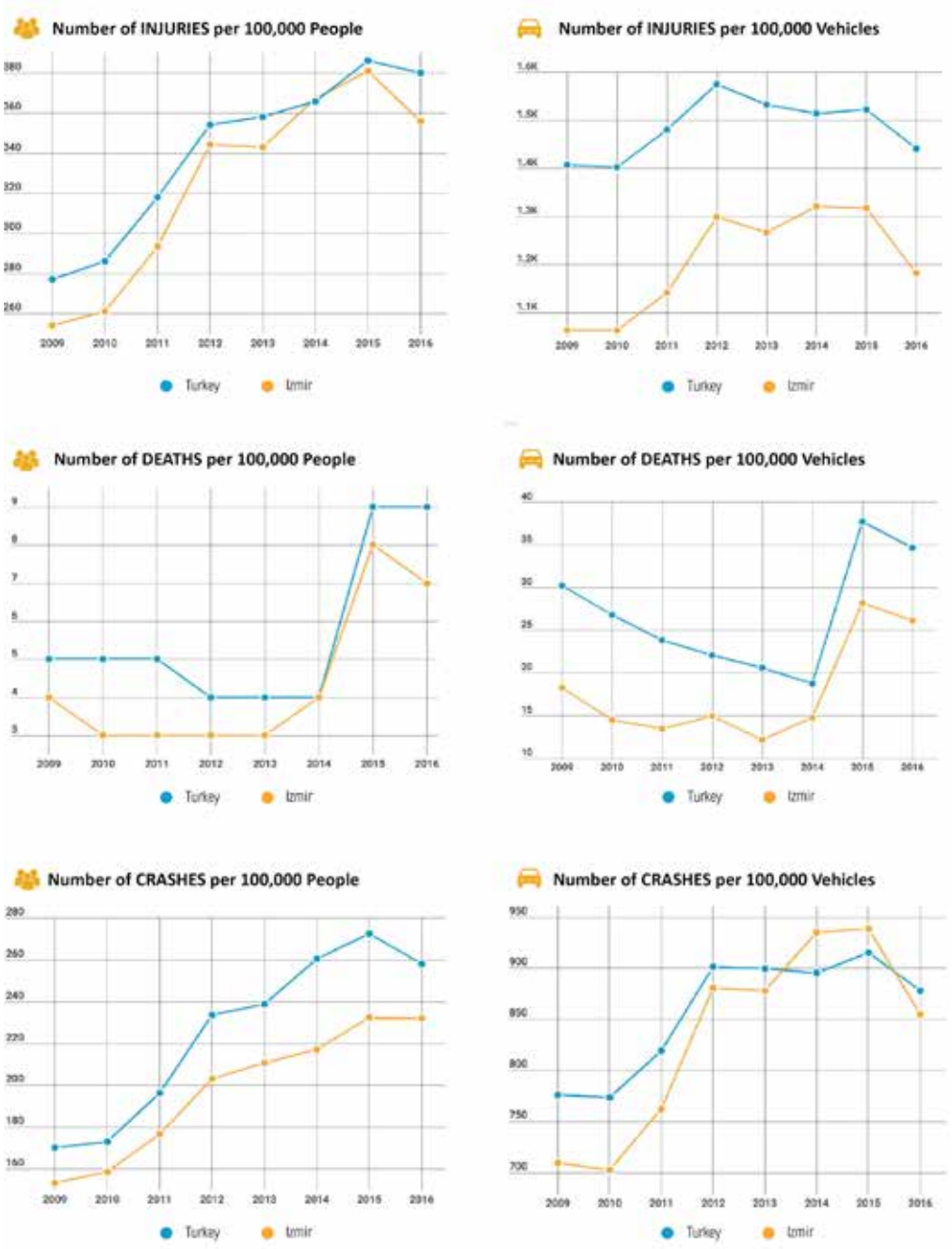
Table 1 | **Turkey and Izmir Crash Data by Year**[8]

Years	Turkey Total Number of Vehicles	Turkey Number of Crashes Involving Death or Injuries	Izmir Total Number of Vehicles	Izmir Number of Crashes Involving Death or Injuries
2009	14,316,700	111,121	927,899	6,581
2010	15,095,603	116,804	971,366	6,827
2011	16,089,528	131,845	1,020,070	7,770
2012	17,033,413	153,552	1,062,946	9,358
2013	17,939,447	161,306	1,103,176	9,687
2014	18,828,721	168,512	1,144,430	10,703
2015	19,994,472	183,011	1,209,788	11,356
2016	21,090,424	185,128	1,276,347	10,902

In Graph 6, per person and per vehicle crash rates and deaths and injury rates resulting from these crashes are given comparatively to cover Izmir and whole Turkey. When the number of crashes per 100,000 people is examined, it can be said that Izmir shows trends parallel to whole Turkey. The noticeable trend in this graph is that between the years 2015-2016, the overall number of traffic crashes in Izmir remained the same while there was a decrease in overall traffic crashes in Turkey. On the other hand, the greatest increase is observed between 2014 and 2015 when the number of crashes peaked. After this period, Izmir did not show any change in the number of deaths despite the decrease in the number of crashes.

When the number of crashes per 100,000 vehicles is examined; it is seen that the number of crashes occurred in Izmir until 2013 is over Turkey numbers. This situation changed in the years 2013-2015, and Izmir had lower numbers than Turkey during these years.

Graph 6 | **Crash Data by Year, Throughout Turkey and Izmir[9]**



ANALYSIS ON ROAD SAFETY INSPECTIONS AND ACCESSIBILITY IN SCHOOL AREAS IN IZMIR: KESTELLI SERIFE ECZACIBASI SECONDARY SCHOOL

Kestelli Şerife Eczacıbaşı Secondary School is located on Eşrefpaşa Avenue in Namık Kemal Quarter, about 1 km away from Konak district center. In the immediate vicinity of the school, Cici Park and Damlacık Park covering the historical Silk Road, are located within the 1st Degree Archaeological Conservation Site.

Access to Kestelli Şerife Eczacıbaşı Secondary School is provided by rubber-tired public transport systems operated on Eşrefpaşa Avenue. The name of the school stop is Koruluk. In the school, full-time training is provided between 08.45 - 15.10 hours. According to the 2017 data of the Ministry of Education, the number of students in Kestelli Şerife Eczacıbaşı Secondary School is 407 and the number of teachers is 39 (Ministry of Education, 2017).

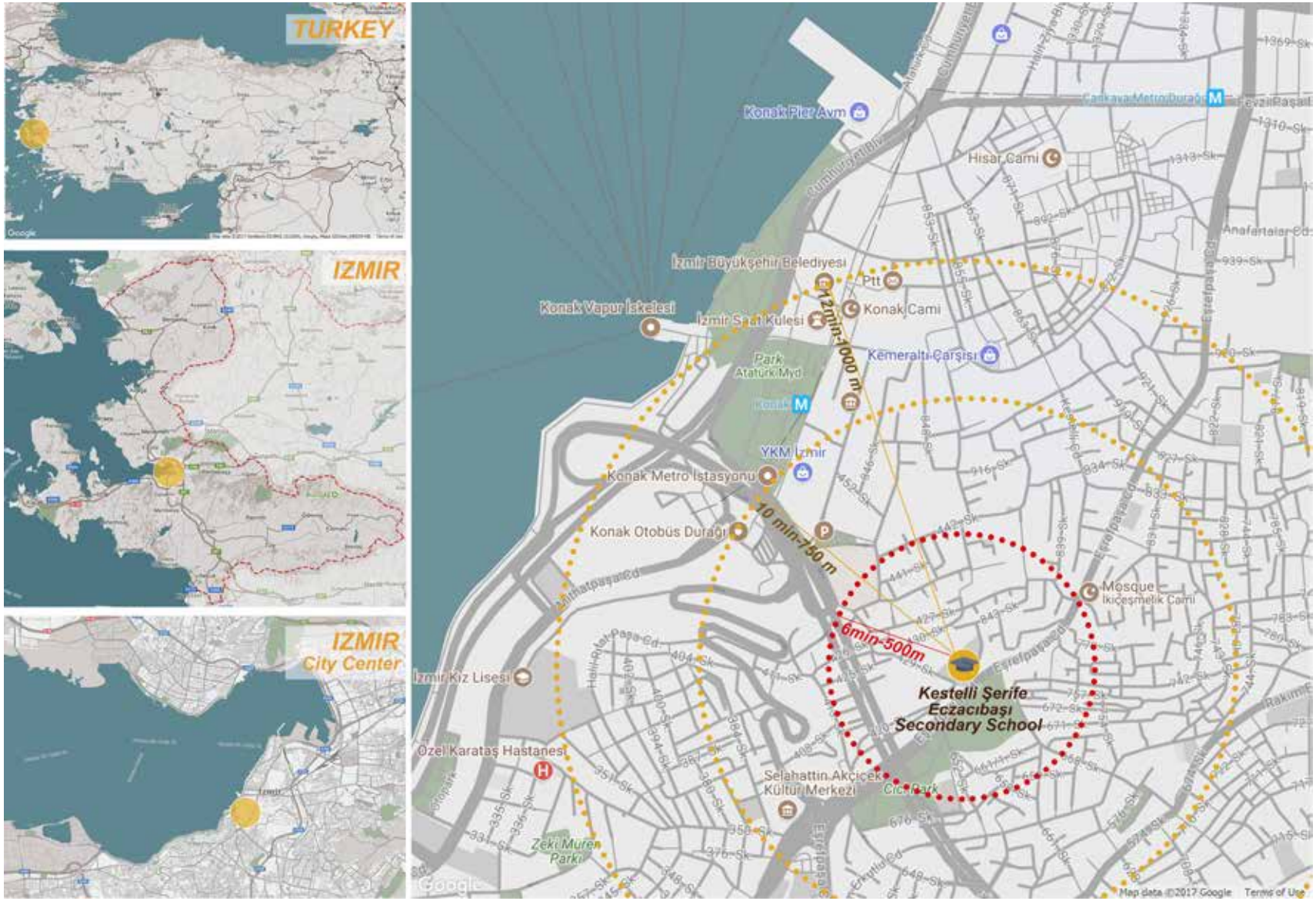
The Eşrefpaşa Avenue-Inonu Avenue corridor, on which Kestelli Şerife Eczacıbaşı Secondary School is situated, is an important center line providing continuous access between Konak and Balçova districts. The corridor starts with Eşrefpaşa Avenue from north-east towards south-west. As the continuation of Gazi Osman Paşa Avenue on the southern side, at about 1.3 km distance from its starting point, Eşrefpaşa Avenue creates a multi-storey intersection with Inonu Avenue. While one leg of this multi-storey intersection continues as Inonu Avenue, which is part of the corridor, one other leg goes towards Birleşmiş Milletler Avenue, and its final leg continues as Eşrefpaşa Avenue. Eşrefpaşa Avenue is a divided road consisting of 2x2 lanes and is separated by a median.

At the point where Kestelli Serife Eczacıbası Secondary School is situated, Esrefpasa Avenue is carrying the load of 2x2 motorized traffic from south to north and from north to south.

This section gives place to problems stemming from road safety in the school area and to the solutions brought forth to these specific issues within the framework of road safety inspections.

Photo 1 | **Kestelli Şerife Eczacıbaşı Secondary School and Around**

Figure 6 | **Kestelli Şerife Eczacıbaşı Secondary School – Location Map**



SPEED MANAGEMENT

Problem

The speed limit on Eşrefpaşa Avenue is 50 km/h. According to field observations between 7 am and 9 am, it has been determined that, in the southern direction where Kestelli Şerife Eczacıbaşı Secondary School is located, the operational traffic flow of the avenue is above the limit of 50km/h and reaches approximately 65-70 km/h. On the other hand, the operational speed in the northern direction is about 12-19 km/h. It has also been detected that the operational speed of the traffic flow on the opposite directions of the same platform shows differences according to the time of the day. This situation affects the safety of road users in the school area, most specifically children.

Motorized users across Eşrefpaşa Avenue are warned about speed limits by means of horizontal markings situated on the sides of the road. The fact that the speed limit in the school area is 50 km/h affects road safety for unguarded mobile road users, most specifically children. The lack of any management of speed in the school area may cause safety problems depending on the operational speed that changes according to the time of the day. Road safety inspections have shown that the average operational speed may reach 70 km/h on Eşrefpaşa Avenue at certain times of the day. Moreover, it has been observed that many students were trying to cross the road in front of the school. This situation demonstrates that deadly collisions involving both students and motorized vehicles may occur.

Photo 2 | **A Student Trying to Cross the Road in the School Area When the Average Operational Speed is 70 km/h**

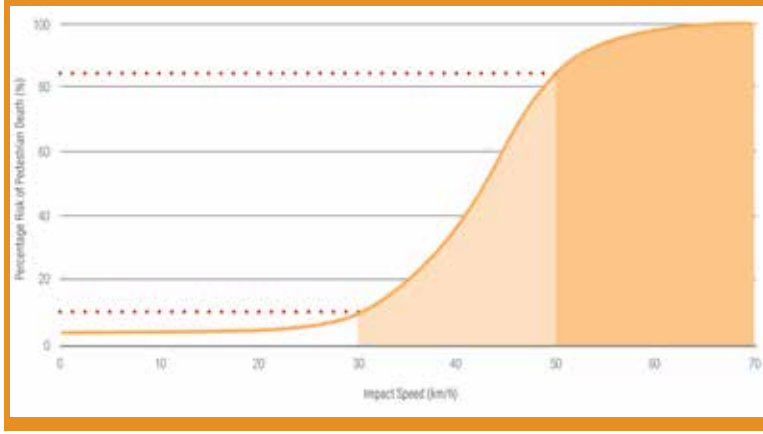
Photo 3 | **Road Markings Showing Speed Limits on Esrefpasa Avenue**

BOX 2 | SAFER SPEED LIMITS FOR VEHICLES

The increase in urban transport safety is closely linked with the decrease of speed limits for vehicles as well as the decrease of conflicts among users. It is well known that lower speed limits for vehicles, specifically under 30 km/h, diminishes significantly the risk regarding loss of lives (Rosen and Sander, 2009, p. 540). A pedestrian's risk to lose his/her life when he/she is hit by a vehicle travelling at 50 km/h is twice as much as a vehicle travelling at 40 km/h; and five times more than a vehicle travelling at 30 km/h. (WRI Ross Center for Sustainable Cities, 2015, p. 15).

Rather than being built for the quick movement and flow of vehicles, putting pedestrians and bicyclists at high risk, cities can ensure safer design of complex intersections that involve multiple modes of transport and limit motor vehicle speeds to 40 km/hr, especially in mixed land use areas. Roads with higher speeds ought to be separated entirely from pedestrians, cyclists, and corresponding mixed land uses.

Influence of Motorized Vehicles' Speed on Pedestrian Deaths



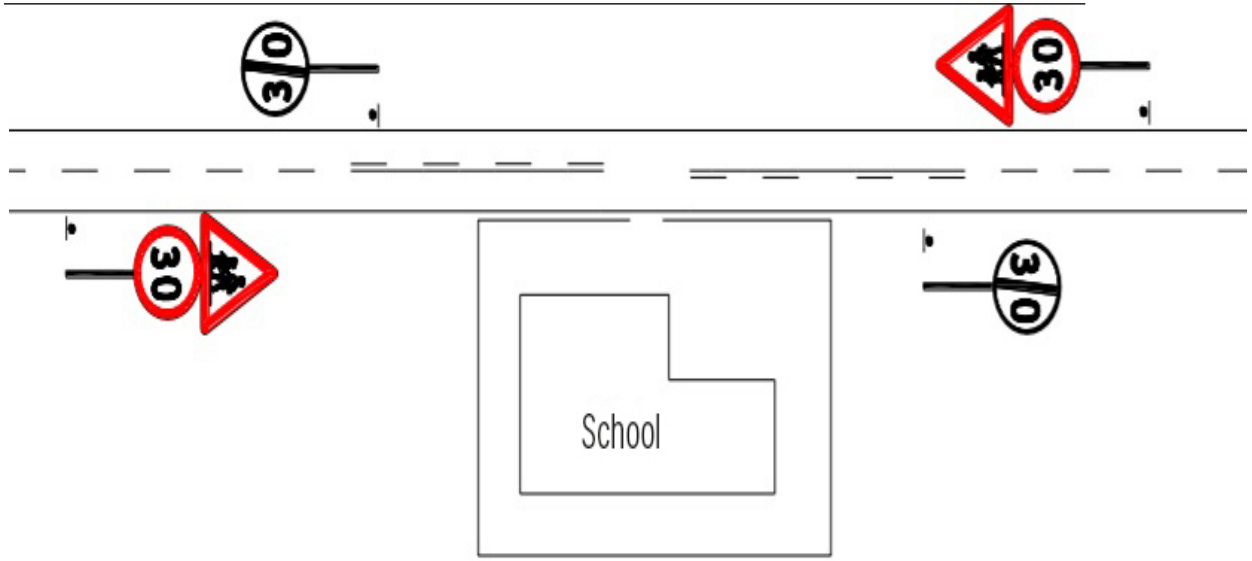
Recommendation

It is necessary to identify the point on Eşrefpaşa Avenue where Kestelli Şerife Eczacıbaşı Secondary School is located as a "school area". As a result, it is recommended to decrease the speed limit to 30 km/h, which is currently 50 km/h. It is also necessary to place road markings and signs showing to motorized users that they are approaching a school area and that the speed limit is 30 km/h. Eşrefpaşa Caddesi üzerinde hareketlilik gösteren motorlu taşıt kullanıcıları için okul bölgesine yaklaştıklarını ve hız limitinin 30km/s olduğunu gösteren yatay ve düşey trafik işaretlemeleri yerleştirilmesi önerilmektedir.

Deemed necessary, the signboards near the school, TT-29 numbered "Maximum Speed Restriction" and TT-12 numbered "Children May Cross", can also be used on the left side of the road.

Figure 8 | **Maximum Speed in the School Area**

Figure 7 | **An Example for the Position of Speed Limit Signs Outside a School Area**



This signboard is used to indicate to the drivers that they are about to pass through a school area and that children may cross the road at any time; therefore, they need to decrease their speed in accordance with the speed limit of 30 km/h. Under this signboard, A PL-9 duration panel should be added in order to specify that the abovementioned speed restriction is valid for specific time periods. An alternative solution consists in adding a "School hours only" panel indicating the time period. Taking the traffic volume on Eşrefpaşa Avenue into consideration, it would be appropriate to arrange the speed limit according to class hours by putting a duration panel on the signboard. Time limitation for speed limits will have minimum impact on the existing traffic flow of the main arterial road.

The signboard indicating the maximum speed in the school area must be used on all the roads enabling access to the selected school and the roads should preferably show similar properties. Deemed necessary, the speed limit used in the school area can be increased to 40 km/h or decreased to 20 km/h.

At the heart of road safety lies the problem of speed. Children's perception of speed, distance and danger is not as developed as adults.

In order to manage the speed, an alternative method consists in giving place to a markings placed at the beginning of the school area speed limit, on which "SCHOOL" is written (Figure 10).

In addition to road markings and signs, it is necessary to take traffic calming measures in order to balance and equate the speed limit in the school area with the operational speed.

Because the school area is situated on a main arterial road and carries the traffic flow of 2x2 lanes in opposite sides, it is necessary to implement a specific traffic calming method and to diminish the motorized traffic speed to 30 km/h.

At this point, a "raised table"[10] should be built in order to diminish the mixed motorized traffic to 30 km/h. This application was presented as a solution within the framework of the study on road safety carried out by WRI Turkey Sustainable Cities for the second BRT (Bus Rapid System) of Turkey which was realized in Şanlıurfa in 2015 and has been implemented by the Şanlıurfa Transportation Department (EMBARQ Türkiye, 2015).

Figure 9 | **Letter Sizes (OKUL/SCHOOL) on the Roads, Whose Speed Limit in 50 km/h or Less**

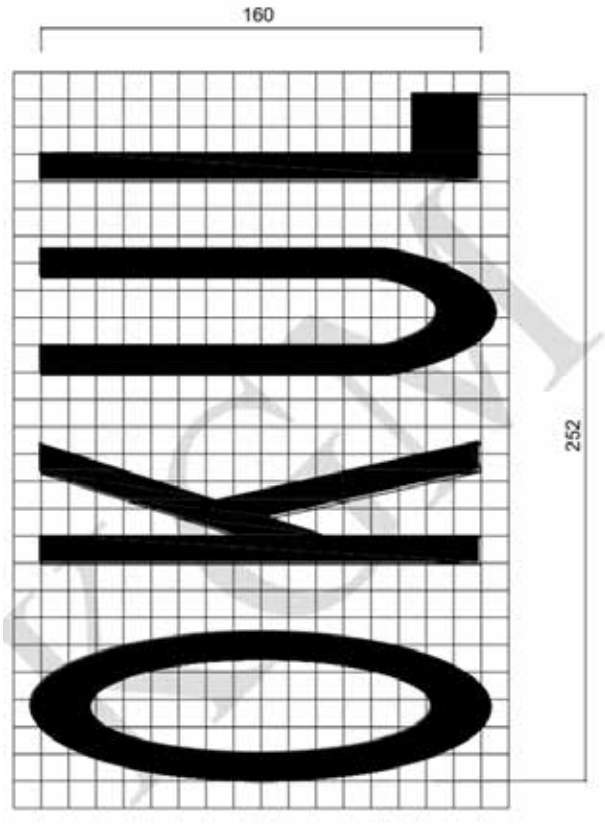


Photo 4 | **Construction of the Raised Table Suggested by WRI Turkey Sustainable Cities for the BRT System in Şanlıurfa**

A raised table is a special equipment designed for decreasing the speed of motorized vehicles in traffic. In accordance with the school area definition, figure 11 shows technical details regarding the example of raised table, necessary for decreasing the operational motorized speed limit to 30 km/h on the section of Eşrefpaşa Avenue situated in front of Kestelli Şerife Eczacıbaşı Secondary School.

In addition to the application of raised tables, safe passage can be ensured with the help of the B-14 coded signboard which refers to "School Crossing". An alternative solution could be the application of a pedestrian border wall across Esrefpaşa Avenue.

Figure 10 | **The Design of Speed Retarder Bump Decreasing the Operational Speed to 30 km/h for Mixed Traffic Lanes**

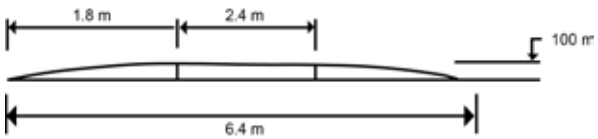
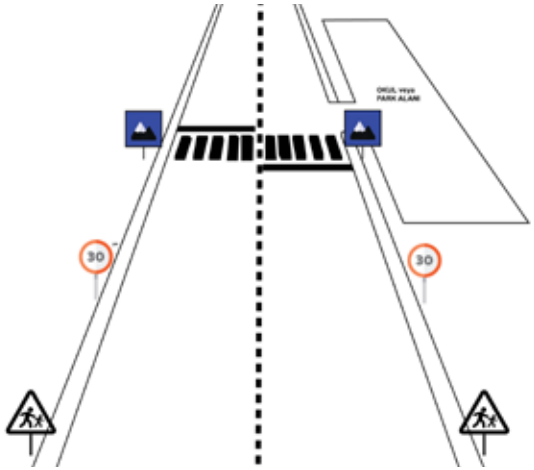


Figure 11 | **Example of School Passage Sign, Manual of Traffic Signs**



INTELLIGENT TRANSPORTATION SYSTEMS

Problem

During the studies on road safety, it has been detected that electronic screens expected to function as intelligent transportation systems already exist in front of Kestelli Serife Eczacıbası Secondary School. During the field work, it has been observed that the screens do not function and do not publish any message targeted for road users who are mobile on Esrefpasa Avenue. Also, they do not survey motorized vehicles' real time operational speed on the road.

Recommendation

First of all, in order to make the intelligent transportation system function properly, which does not work, the electronic screens should be fixed or calibrated. Besides, the system should warn the motorized drivers who are mobile on Eşrefpaşa Avenue that they are approaching a school area and should signal the speed limit.

Photo 5 | **Non-Functional Intelligent Transportation Systems in the School Area**

BOX 3 | INTELLIGENT TRANSPORTATION SYSTEMS

Intelligent Transportation Systems ensure that violations from the part of motorized drivers are detected by means of sensors, that their registration number are recorded, and that drivers are subjected to the penalty predicted by the relevant law. One of the most frequent infringements in school areas is illegal parking. Illegal parking in front of schools constitutes an important risk for unguarded road users who are mobile in the area and constitutes a problem of access for children. In addition, it is also dangerous in terms of traffic collisions. Crossing the road among parked vehicles may cause crashes involving death or personal injury for both drivers and pedestrians.

The Flexible Message System (FMS) should demonstrate real time warnings that motorized drivers need to decrease their speed as they are approaching a school area. The FMS is the optimal solution because it will be able to arrange the speed limits for the school area according to the school's class hours during weekdays. The existing system should be calibrated according to these criteria.

The Pedestrian Audit System takes record of vehicles violating the pedestrian priority rule and not giving way to pedestrians when they start walking on uncontrolled crosswalks. It is an audit system that strives to create awareness regarding pedestrian priority in traffic.
By accentuating pedestrians' crossing priority, the Pedestrian Audit System has been designed in order to enable pedestrian crossings safely at points where the pedestrian traffic is dense, such as shopping centers, and thus the signalization system is active.

PARKING

Problem

During the fieldwork carried out within the framework of road safety inspections, it has been detected that motorized vehicles tend to stop in the school area, a problem that is observed more frequently than that of parking. The vehicles generally stop in front of the school in order to drop off or pick up students. These manoeuvres taken for rest stops on the motorized vehicle platform may result in collisions involving death or personal injury.

Recommendation

As a solution to the problem of rest stop in the whereabouts of the school, it is suggested that a "Kiss and Ride" for maximum 2 vehicles should be constructed across the bus stop pocket at about 50 meters away from the school.

A "Kiss and Ride", where 2 vehicles would be able to drop off and pick up passengers, can be established across Koruluk bus stop pocket. This application can be arranged according to the beginning and end of classes during weekdays. Outside class days and time periods, the pocket should be used for the storage of buses. This application's audit can be performed by means of intelligent transportation systems as suggested above. The pocket can only be used for 2 minutes by motorized vehicles which are in the school area during the beginning and end of classes. Long term parking should be followed by the suggested audit system and should be subjected to penalty.

Photo 6 | **Koruluk Bus Stop**

Photo 7 | **Kiss&Ride Examples**

Source: Kuba Atys / Agencja Gazeta

Source: Midcoast, 2016

BICYCLE TRANSPORTATION

Problem

In the school area, there is no infrastructure supporting safe travel by bike.

Recommendation

In school areas, bicycle transportation is one of the most important components of sustainable transportation for students. It is therefore crucial to design a safe infrastructure integrated with other common transportation systems for students who would prefer cycling between their home and their school.

ACCESSIBILITY FOR THE DISABLED

Problem

Since the school is located on a sloping area, access is provided via stairs or quite steep hills. Nevertheless, the absence of any ramp implementation in the school zone makes it difficult for disabled people to access. In addition, pedestrian crossings are solved by underpass method, yet this limits the mobility of a disabled person. In the school zone, there are tactile surfaces only on the main street. It is observed that these tactile surfaces are not applied until the entrance of the school.

Recommendation

Continuity of the tactile surfaces should be ensured and designed to cover the school entrances. In addition to the pedestrian subway, pedestrian crossing should be applied and access should be facilitated for the persons with disabilities. Stair roads should be considered together with ramps.

RECOMMENDED DESIGN

In accordance with the road safety inspection and literature survey, improvements that prioritize road safety and increase pedestrian access levels are proposed for the problems identified in the school district.

Within the scope of the project site design proposals, a series of suggestions that can be performed in the short term is offered to increase pedestrian accessibility with a people-oriented design approach. In this respect,

- Priority is to ensure safe crossing, in other words, to reduce the speed of vehicles and ensure that the pedestrian crossing demand in front of the school is made safe.
- Continuity of the sidewalks on Eşrefpaşa Avenue must be maintained in accordance with the sidewalk standards.
- Road distortions should be removed at the intersection of 431st Street and Eşrefpaşa Avenue, which defines the school entrance.
- The pedestrian path should be made more defined by adding casting road bollards to the curb sides.
- Continuity of the tactile surfaces which are interrupted on the pavement must be ensured.
- In order to increase the mobility of the pedestrians, a pedestrian grade crossing should be applied on the Eşrefpaşa Avenue in addition to the existing pedestrian subway. In this way, the access can be facilitated, for the children and families reaching the school by public transportation.
- The proposals made in the context of road safety are intended to support pedestrian safety, thus providing a balance in the interaction of other road users. While the current speed limit is reduced to 30 km/h, speed reduction bumps must be applied before the pedestrian crossing on the coming and going directions of the road.
- The existing intelligent transport system should be calibrated and integrated with the variable message signs system. With this system, in addition to speed management, drivers should be sent warnings that they have entered the school district.
- A kiss & ride zone should be designed in the bus lay-by which is located on the traffic axis of Esrefpaşa Avenue flowing towards Üçyol direction.

BOX 4 | BIKING FRIEND

The City of Odense which was selected as one of the Take-Up Cities within the scope of the Horizon 2020 Empower research project, Odense hope to convert 36,000 daily short car trips to either walking or cycling trips, resulting in a decrease of 15% of car trips on distances under 5km. Accordingly, Odense developed an incentive scheme for all their citizens by employing a gamification method that tracks the trips with the mobile application "Go Bike Denmark" (Ta' Cyklen Danmark).

The mobile application and campaign 'Biking Friend' which targets school children, encourages cycling among school children through a gamification cycling app with prize competition. There are many giveaway prizes and rewards in the project such as bike helmets, rain ponchos, bikes, gift cards to the cinema, which aims to make the behavior change permanent by means of the reward system. The "Biking Friend" campaign started in August 2016, and as a result of visits to 34 schools throughout September, there was a noticeable increase in the number of children who came to school with bicycles instead of their parents' cars (EMPOWER, 2016, p. 3).

Figure 12 | **Recommended Design**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RECOMMENDATIONS AND EVALUATIONS

As a result of the literature research and fieldwork performed, recommendations were made to improve road safety and accessibility in school districts and make home-school and school-home journeys safer. In this context, the proposed approach to focus on safe, sustainable transportation systems as the center of the design is summarized under 4 main titles:

- Planning process,
- Legislative arrangements and policies,
- Road safety and street design,
- Awareness and communication activities.

PLANNING PROCESS

The first step in ensuring road safety in school districts is the proper management of the planning process. The planning process should cover four steps: data collection, planning, implementation, and follow-up.

- As a first step, **starting with a pilot project** can create an opportunity to gain experience for faster feedback, planning, implementation and monitoring efforts.

- **Road safety problems in school districts should be detected with regular and sustainable data collection**. The expected basic data for the selected school district are: the number of students, the record of traffic crashes involving children in the selected school district, the type of transportation preferred by students, the distance between the school district and the residential areas, the distance between the areas where the families work and the school district. The pilot project serves as a basis, especially for the data collection step.

- **The planning process should start with the principle of participation.** During the planning process of the study to be carried out in the whole city or district-oriented as a tier, the opinions of the people who travel to the relevant schools (students, parents, teachers) and the opinions of the relevant units in local administration and central government should be taken and various negotiations should be held. Meetings, which should be realized with the participation of stakeholders included from different disciplines, will enrich the implementation outcome by enabling the consideration of the matter with different viewpoints (Department of Transport and Main Roads, 2011, p. 4).

- **Prior to the implementation work, the transportation infrastructure systems present in the school district should be evaluated and road safety inspections should be conducted.** The strengths and weaknesses of the school region and its surroundings should be identified. Surveys to be conducted within the area provide a good opportunity to see the problems which the users encounter in daily life and the practices that they consider missing. In line with these studies, area-specific designs should be developed in order to ensure the road safety of the school district. Road safety review studies and accessibility studies should be implemented. After all the analysis and evaluation work, approaches that can be implemented in and around school districts (traffic calming measures, maps, horizontal and vertical markings) should be shared and implemented. Besides, pedestrian and bicycle travel routes suitable for school trips should be defined. School routes where children can travel on foot and by bicycle should be supported with various activity venues such as parks, meeting points, bicycle workshops (Belgian Road Safety Institute, 2009, p. 59).

- **Measuring the success of the implementation during follow-up stage and giving feedback concerning the results is important for the decision-makers and users.** Follow-up studies can be performed by different methods such

BOX 5 | ROAD SAFETY PROJECT

WRI Turkey Sustainable Cities conducted the "Road Safety Laboratory (RSLab) Project" between 2013 and 2014 in five cities, Antalya, Eskişehir, Kayseri, Kocaeli, and Konya, with the aim of reducing traffic-related deaths and injuries and making urban sustainable transportation safer. 3 to 5-year traffic crash retrospective data were provided from the cities selected within the project, and crash black spots based on these data were determined.
If a regular and sustainable road safety approach is requested for all school districts in our cities and zero death and injury is aimed in these areas, firstly regular data collection and analysis methods should be developed, and in accordance with these methods, the causes of traffic crashes involving death or personal injury should be identified. The method followed in determining the crash black spots in the cities, within the RSLab Project, can also be used to improve the road safety of the school districts in our cities.

Identification of Crash Black Spots by Software over Traffic Crash Density Maps

as satisfaction surveys, crash data. The change in the crash data and preferred mode of transport can provide information on the success of the implementation. Other than these indicators, larger scale effects of the implementation performed can also be measured. The number of crashes decreasing by traffic calming measures can reduce costs in the fields of health and economy. Transportation habits changing by safe routes can lead to improved air quality by allowing the use of motor vehicles less frequently (Department of Transport and Main Roads, 2011).

LEGISLATIVE ARRANGEMENTS AND POLICIES

Decisions should be made at the levels of central government and local administration to ensure road safety in school districts, and decisions on this issue should be reflected in the legislation and plans.

- **It is required to incorporate specialized school districts road safety and accessibility studies in Turkey's mainstream road safety work such as Development Plans, Road Safety Strategy Plan, EU-funded road safety projects, and to develop this area.** In development plans, creating cities which prioritize public transportation and pedestrians and decisions to be taken for that is mentioned. It is aimed to provide road safety, to reduce environmental pollution and to prevent the problems that may occur in rapidly growing cities while establishing pedestrian priority cities. In this direction, pedestrians and cyclists came to the forefront in convenient cities, and it was decided to encourage urbanites to use these alternative transportation systems. In the 10th Development Plan, under the heading Logistics and Transportation, the following statement is included: "In line with the goal of reducing the deaths due to traffic crash by 50% as stated in the Road Traffic Safety Strategy and Action Plan, the use of Traffic Electronic Control Systems will be expanded being integrated with Intelligent Transportation Systems." (Ministry of Development, 2013, p 111). In future plans, road safety and accessibility in school districts may be discussed in more detail.

- **Article 125 of the Traffic Law No. 2918 obliges the Ministry of National Education to provide traffic education for primary and secondary schools.** The curriculum should be constantly reviewed and the problems seen in traffic education should be eliminated and a hands-on traffic education should be provided by providing necessary equipment for traffic education in schools.

- **Municipalities might prepare action plans for school regions.** The Road Traffic Legislation defines the duties and authorities of the municipalities as follows: To keep the municipal traffic service units on the relevant roads so as to maintain road structure, traffic scheme, and security; making road and intersection arrangements; organize traffic sign boards, traffic signals with light and sound, and informatory signs, with the purpose of traffic regulation. However, municipalities, in addition to these responsibilities, may prepare plan notes specific to road safety for school districts within their planning works or may formulate a separate action plan for school districts.

ROAD SAFETY AND STREET DESIGN

- **City-specific traffic crash density maps focusing on school districts can be drawn up.** For the city, it can be determined which school district is a crash black spot. Crash types in the school area designated as collision black spot, road user information involved in the collision, time zone information such as the month, day, hour of crash provide an analysis of the cause behind the traffic crash involving death or personal injury. Based on the analyses, the EU Directive 2008/96/EC Road Safety Studies can be conducted in the identified school districts.

- **First of all, by taking children into consideration, it is necessary to design streets with safe pedestrian and bicycle route infrastructure.** Investment and coordination should be ensured in order to change the current situation in the streets of the school district where vehicle traffic is predominant. In particular, safe crossings on streets and wide pavements with

BOX 6 | SAFETYLAB 17K, 18K, 19E CODE IETT BUS LINES ROAD SAFETY INSPECTION AND SAFE DRIVING TRAINING PILOT PROJECT

WRI Turkey Sustainable Cities has provided road safety and safe driving training consisting of theoretical and practical stages for 250 staff of Istanbul Public Bus Authority (IETT), within "SAFETYLAB" carried out jointly with the İETT. The training program was prepared by WRI Turkey Sustainable Cities and shared with participants upon approval by IETT.

Within the scope of the project, road safety inspections were carried out by WRI Turkey Sustainable Cities on the bus routes where the staff participating in the training worked, in addition to safe driving training. With an average of 450 km of road safety inspection, several problems were identified that would be included in the content of the training. During the course of the road safety inspections, especially the behaviors that threaten children, put road safety and driving safety in danger were explained to the staff in detail within the scope of the training.

Safe driving training must primarily begin with the school bus and public transport drivers carrying children who are our future. With the SafetyLab Project Approach, training programs must be provided by customizing to the demands, needs and current mistakes of school bus drivers who transport children from home to school and from school to home. In addition to this, the staff working as assistants in the services should also be trained.

high service level should be provided (FIA Foundation, 2017, p. 16). Along with these, design elements must be applied properly, especially traffic calming measures, elevated pedestrian crossings, well-designed intersections and well-implemented street lightings (WHO, 2015, p. 13).

- **Participation should be provided in the design process of the streets in the school regions. In this process, children can also be included in the decisions to be made for design.** Different parties can be involved in the process. Both as a job opportunity and an ethical necessity, it is necessary to encourage actors from different sectors, especially the public and private sectors, to make an effort to protect all road users. Museums, theatres, greengrocers, banks, pharmacies, places of worship and neighbourhood associations can be the pioneers in creating safe and livable cities (WRI Ross Center for Sustainable Cities, 2015, p. 91). In the meantime, it may be possible that children designate safe, appealing, interesting or greener routes in the design process, and thus determine the routes to or from the school. The routes visually made more attractive by street designs can also be designed in connection with public spaces.

- **The "safety for all" approach should be adopted when planning and designing cities and school districts.** Accessibility to opportunities promoting healthy living and socialization should be increased. Works should be extended to parks, walking trails, swimming pools, beaches, recreation and activity areas that address all groups and accessible for everyone (WRI Ross Center for Sustainable Cities, 2015, p. 91).

AWARENESS AND COMMUNICATION ACTIVITIES

Although traffic crashes result from various interacting factors, research has demonstrated that most crashes are caused by human factors. According to WHO report published in 2015, human factors are implicated in 96% of road crashes. It is known that only 2% of traffic crashes are originated from road and vehicle factors (Belgian Road Safety Institute, 2009, p. 40). Among the human-related factors, behaviours such as excessive speeding, alcohol use, careless driving, falling asleep at the wheel, not using seatbelts also increase the severity of traffic crashes (WHO, 2015, p. 8). However, the fact that human behaviour is changeable presents an important opportunity. Awareness and communication activities are among the most effective tools that must be used to realize this change. Road safety awareness and communication activities are being carried out to change the perspective of users in order to change the human behaviour that causes traffic crashes. These activities, which are implemented by different methods such as informing, motivating, persuading, have a specific target audience. The steps that need to be followed in the awareness and communication activities can be listed as time period, target audience survey, campaigns, monitoring, and evaluation.

- **Time Period:** Awareness and communication activities cover a certain period of time, and this is recommended to be carried out at all stages of the project (before, during, after). Thus, any misunderstandings or suspicions can be responded promptly, and all project participants can be provided with clear and sufficient information.

- **Target Audience Survey:** Each project has different objectives and setup. Accordingly, due care should be taken to ensure that the target group is selected correctly and that the activities directly reaching that group are carried out. Target audience's characteristics and comprehension capacity must be investigated. By this way, different solutions can be developed about the way through which the desired information can be transferred. It should be clearly stated what the problem with road safety is and what institutions are involved in the solution.

- **Campaigns:** Awareness and communication activities should be carried out with the professionals such as a well-selected coordinator, advertising agency or research agency. Thus, management of the activities and enrichment of contents will be facilitated.

- **Monitoring and Evaluation:** Eventually, monitoring and evaluation of the activities should be conducted by measuring whether the desired purpose has been achieved, whether it has created the expected level of impact.

BOX 7 | TRAFFIC DETECTIVES PROJECT (TRAFFIC EDUCATION FOR CHILDREN) - OPET

As a support to the works conducted by public institutions throughout the country, the Traffic Detectives Project aims to carry out activities for raising awareness in respect of traffic safety among children and young people aged 3-17 years and presenting traffic-conscious young people to the future.

Parties to the Traffic Detectives Project:
- Ministry of Family and Social Policies, Turkey
- Ministry of Interior, Turkey (Directorate General of Security),
- Ministry of National Education, Turkey,
- Religious Affairs Administration, Turkey,
- Police Wives Association, Turkey (PEKAY).

With the Traffic Detectives Project, the objective is to reach 1,500,000 children and young people aged 3-17 years within 3 years, and to make them aware of the following nine main issues, thus helping prevent traffic crashes:

- Traffic sign boards
- Safety belts and child protection systems
- Use of pedestrian crossing, bridge, and subway
- Safe cycling
- Pedestrian safety
- Visibility
- Safe journey in vehicles
- Crossing streets

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ENDNOTES

1. World Health Organization. (2013). World health statistics 2013. World Health Organization.

2. For further details, the following website can be visited http://gehlpeople.com/work/cases/

3. Silverman, A., & Billingsley, S. (2015). Safe to learn: safe journeys to school are a child's right. Available at: https://www.unicef.org/education/files/Safe_to_Learn_report.pdf

4. The term "child" used in the project "SchoolLab - Road Safety and Accessibility in School Regions Pilot Study: İzmir Kestelli Şerife Eczacıbaşı Secondary School" covers the 0-17 age group, which is based on the United Nations definition and also accepted by TURKSTAT (TÜİK, 2015).

5. The report can be find at: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/

6. Based on the data published by TURKSTAT dated 2016, "Registered motor vehicles and motor vehicles involved in traffic accidents by type of the motor vehicle" and "Address-Based Population Registration System Results".

7. This graph is based on the data from the reports published by TURKSTAT, "Selected Indicators of Izmir" dated 2013, "Road Motor Vehicles, December 2014" dated 2014, "Road Motor Vehicles, December 2015" dated 2015, and "Road Motor Vehicles, December 2016" dated 2016.

8. This table is based on the data from the reports published by TURKSTAT, "Selected Indicators of Izmir" dated 2013, "Road Motor Vehicles, December 2014" dated 2014, "Road Motor Vehicles, December 2015" dated 2015, "Road Motor Vehicles, December 2016" dated 2016, and "Traffic Accident Statistics".

9. This graph is based on the data from the reports published by TURKSTAT, "Selected Indicators of Izmir" dated 2013, "Road Motor Vehicles, December 2014" dated 2014, "Road Motor Vehicles, December 2015" dated 2015, "Road Motor Vehicles, December 2016" dated 2016, "Traffic Accident Statistics" and "Address-Based Population".

10. Raised tables, which can be defined as elevated passages, are not frequently used in Turkey; we can mostly see them in airports.

ACKNOWLEDGMENT

This report was prepared with the FIA Foundation's support. For their valuable contribution to the realization of the project, we would like to thank: Claudia Adriazola Steil, Director, Health and Road Safety; WRI Ross Center For Sustainable Cities, Benjamin Welle, Global Health & Road Safety Manager, WRI Ross Center For Sustainable Cities; and Avi Silverman, Deputy Director, FIA Foundation; and Emine Atalay, Batuhan Fındık, Yunus Emre Yılmaz, and Ela Akdoğan who supported the WRI Turkey Sustainable Cities technical team during the reporting period.

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ABOUT WRI TURKEY SUSTAINABLE CITIES

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WRI Turkey Sustainable Cities enable cities both reap economic opportunities and preserve natural resources. It develops solutions and works to create sustainable cities with its deep technical expertise, cutting-edge research and partnerships.

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