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Computational Science
and Its Applications –
ICCSA 2018

18th International Conference
Melbourne, VIC, Australia, July 2–5, 2018
Proceedings, Part III

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Preface

These multiple volumes (LNCS volumes 10960–10964) consist of the peer-reviewed papers presented at the 2018 International Conference on Computational Science and Its Applications (ICCSA 2018) held in Melbourne, Australia, during July 2–5, 2018.

ICCSA 2018 was a successful event in the International Conferences on Computational Science and Its Applications (ICCSA) conference series, previously held in Trieste, Italy (2017), Beijing, China (2016), Banff, Canada (2015), Guimarães, Portugal (2014), Ho Chi Minh City, Vietnam (2013), Salvador, Brazil (2012), Santander, Spain (2011), Fukuoka, Japan (2010), Suwon, South Korea (2009), Perugia, Italy (2008), Kuala Lumpur, Malaysia (2007), Glasgow, UK (2006), Singapore (2005), Assisi, Italy (2004), Montreal, Canada (2003), and (as ICCS) Amsterdam, The Netherlands (2002) and San Francisco, USA (2001).

Computational science is a main pillar of most current research and industrial and commercial activities and it plays a unique role in exploiting ICT innovative technologies. The ICCSA conference series has been providing a venue to researchers and industry practitioners to discuss new ideas, to share complex problems and their solutions, and to shape new trends in computational science.

Apart from the general tracks, ICCSA 2018 also included 33 international workshops, in various areas of computational sciences, ranging from computational science technologies, to specific areas of computational sciences, such as computer graphics and virtual reality. The program also featured three keynote speeches.

The success of the ICCSA conference series, in general, and ICCSA 2018, in particular, is due to the support of many people: authors, presenters, participants, keynote speakers, session chairs, Organizing Committee members, student volunteers, Program Committee members, International Advisory Committee members, International Liaison chairs, and people in other various roles. We would like to thank them all. We would also like to thank Springer for their continuous support in publishing the ICCSA conference proceedings and for sponsoring some of the paper awards.

July 2018

David Taniar
Bernady O. Apduhan
Osvaldo Gervasi
Beniamino Murgante
Ana Maria A. C. Rocha
Welcome to Melbourne

Welcome to “The Most Liveable City”\textsuperscript{1}. Melbourne, Australia. ICCSA 2018 was held at Monash University, Caulfield Campus, during July 2–5, 2018.

Melbourne is the state capital of Victoria and is currently the second most populous city in Australia, behind Sydney. There are lots of things to do and experience while in Melbourne. Here is an incomplete list:

- Visit and experience Melbourne’s best coffee shops
- Discover Melbourne’s hidden laneways and rooftops
- Walk along the Yarra River
- Eat your favourite food (Chinese, Vietnamese, Malaysian, Italian, Greek, anything, … you name it)
- Buy souvenirs at the Queen Victoria Market
- Go up to the Eureka, the tallest building in Melbourne
- Visit Melbourne’s museums
- Walk and enjoy Melbourne’s gardens and parks
- Visit the heart-shape lake, Albert Park Lake, the home of the F1 Grand Prix
- Simply walk in the city to enjoy Melbourne experience
- Try Melbourne’s gelato ice cream

Basically, it is easy to live in and to explore Melbourne, and I do hope that you will have time to explore the city of Melbourne.

The venue of ICCSA 2018 was in Monash University. Monash University is a member of Go8, which is considered the top eight universities in Australia. Monash University has a number of campuses and centers. The two main campuses in Melbourne are Clayton and Caulfield. ICCSA 2018 was held on Caulfield Campus, which is only 12 minutes away from Melbourne CBD by train.

The Faculty of Information Technology is one of the ten faculties at Monash University. The faculty has more than 100 full-time academic staff (equivalent to the rank of Assistant Professor, Associate Professor, and Professor).

I do hope that you will enjoy not only the conference, but also Melbourne.

David Taniar

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ICCSA 2018 was organized by Monash University (Australia), University of Perugia (Italy), Kyushu Sangyo University (Japan), University of Basilicata (Italy), and University of Minho, (Portugal).

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How has Cagliari Changed Its Citizens in Smart Citizens? Exploring the Influence of ITS Technology on Urban Social Interactions

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Abstract. The main purpose of this article is to evaluate and to achieve a deeper understanding of the changing role of Intelligent Transport Systems (ITSs) not only in transport habits, but also in urban traditional lifestyles of citizens, by using the city of Cagliari (Italy) as a case study. In fact, ITSs play a significant role in determining innovative sustainable transport, for a better use of urban space and time, enhancing also the people quality of life. ITSs help people to move around more easily, safely and economically, in a more environmentally friendly manner. Traditionally, ITSs were used to improve traffic flow, cars speed, easy parking and therefore encouraging the use of the cars, by causing negative impact on social interactions. Nowadays, cities are changing and use technology in order to greatly improve public transport and smart mobility. Specifically, this study analyzes the city of Cagliari (Italy) and its transition toward a smart, sustainable and green mobility, by showing the successful steps from a scenario based on a car-used city to a new scenario based on a free cars-used city due to an integrated, environmental, smart approach.

Keywords: Smart cities · ITS technology · Sustainable mobility · Social interactions · Sustainable urban development · Smart mobility · Cagliari

1 Introduction

For a long time, the model of smart cities appears to be the frontier to which tend for interpreting and organizing our cities, due to monitoring, regulating and making sense of citizen data producing [1]. This revolution in urban and territorial planning strategies is leading local institutions to use social capital to improve city services [2]. These services are mainly related to energy, mobility, government, living, culture, commercial distributions and its activities, environment, communication between citizen and administrators, etc. Among these services, Pinna et al. [3] and Caragliu et al. [4]

F. Pinna—This paper is the result of the joint work of the authors.
consider mobility as a key factor, including urban accessibility, traditional transport communication infrastructures, availability of ICT infrastructures, sustainable, innovative and safe transport systems. Bellini et al. [5] argue that traffic/flow analysis is a major prerequisite for governing and planning a modern city. From this point of view, it can be useful the supportive role of the so called Intelligent Transportation Systems (ITSs) for transportation [5]. In fact, ITSs are able to manage in a smart way problems related to different transport systems, by achieving greater efficiency, productivity, safety and integration in transport networks [6]. Historically, ITS arises from the need to manage the problems caused by traffic congestion through a synergy of new computer techniques for simulation, real-time control and communication networks. Furthermore, government activity in the ITS area (particularly in the United States) has always been motivated by the perceived need for security. Many ITSs were proposed to include road surveillance in this field. Only recently the ITSs have evolved and today are part of today’s city dashboards, integrating information on mobility with other urban services (such as environmental conditions, security, clean, etc.) [5]. Some international rating shown that, over the last 15 years, ITSs have (i) reduced travel time by 20%; (ii) increased the network capacity by 5 to 10%; (iii) decreased the number of accidents of 10–15%; (iv) decreased congestion of 15%; (v) reduced pollutant emissions by 10%; and finally (vi) reduced energy consumption by 12% [7]; (vii) contributed in the energy efficiency of mobility [8].

In addition, literature also shows how ITSs have changed lifestyle, behaviors, increasing the sense of happiness and well-being [9, 10]. This happened also because the world’s population that live in urban areas is increased (54%) and by the 2050 this percentage will be 66% [11]. On September 25th 2015, countries adopted a set of goals, among which making cities inclusive, safe, resilient, and sustainable [12]. For these reasons, urban sustainability, green mobility, and, consequently, understanding the behavior of city users appear to be the most significant challenges of the last millennium.

Starting from these assumptions, the article initially focuses on how the transport and planning approach has changed in public administrations, giving greater emphasis to initiatives concerning green mobility. Subsequently, authors describe the Cagliari’s experience, by highlighting its evolution over time. Finally, the influence of ITS technology on urban social interactions is discussed, using the study’s findings. The paper concludes by underlining pros and cons of ITS technology under the case study of Cagliari.

2 Towards a Green Mobility: The Behavior Change in the City-Users

Over time, public administrators, urban planners, researchers, and transport experts understand that transportation systems and its networks—by what mode, for how long, and for what purpose—influence and affect human well-being [13, 14], also in term of long-term health outcomes [15]. Researchers show that automobile use can have negative effects on the quality of life. In fact, the invasive growth of private vehicles has restrict and degraded many aspects of urban life.
As underlined before, ITSs should be oriented not only to transfer people but also to encourage social interaction and they should be imagined as tools in order to improve the environmental, social and economic well-being of communities. Among all transport systems, a proper walkability improves equity and social inclusion especially regard to impaired citizens [16]. Walking and cycling are considered the best transport mode in densely inhabited areas to enhancing quality of life and, in addition, these transportation modes can compete with the motorized transport in short trips (up 10 min). Many European cities exhibit a progressive modal shift away from private transport towards public transport, walking and cycling. The trend characterized past decade continued in the latest years. For instance, London shows a decrease of 11% from 2000 to 2016 in private transport mode in terms of journey stages is equivalent to a decrease of 10.1% in terms of trips. Similarly, the public transport mode increased of 10.5% in terms of journey stages, and increased of 8.6% in terms of trips since 2000 [17]. In Barcelona the TMB Agency (Transports Metropolitans de Barcelona) – reports in 2016 a great and positive modal split of 29.6% public transport and 14.4%, while in 2001 the value were the opposite [18]. This same trend can be observed in many other European cities, such as Amsterdam, Bordeaux, etc.

On the basis of these assumptions, the road must be interpreted in a more complex and modern way: the functions of streets and squares must also have as its purpose the improvement of citizens needs and perceptions. In fact, they are born for pedestrian use and nowadays instead, are invaded by traffic. A new high-tech visions rethink these places as a relational spaces: interactions of pedestrians are not only a material or physical matter but are based on connected information environments. Literature recognises these environments as a “digital ecosystems” [19]. Communication, information and cognitive function have a crucial rule in distribution of pedestrian flow, considering urban space and the street reconstruction not exclusively as a physical frame [20].

To enhance a much pedestrian space, urban environment can satisfy human heterogeneity. All individuals can be a pedestrian but they have different abilities and purposes. The space occupied by one pedestrian are less than 0.5 m² and by one cyclist less 0.85 m². One car occupied 8.5 m² carrying 1.5 people (mean occupancy coefficient varies over the country between 1.3 to 1.7), while a bus of 25 m² carries 25 people (mean occupancy coefficient varies between 22 to 28).

Pedestrians do not only walk, but they stay in public space, to shopping, meeting, to have food, leisure entertainment spare. When condition for life on foot are improved, walking activities, health outcomes, social and recreational interaction grow.

More roads invite more traffic and better condition bicyclists invite more people to ride bikes, but by improving the condition for pedestrian, not only pedestrian traffic strengthen, grow the city life.

The case study of Cagliari is a significant example because starting from 2000 there has been a greater awareness on the pedestrian use of roads.
3 The Experience of Cagliari (Italy)

The city of Cagliari is the largest city in Sardinia and has the typical urban structure of a coastal city. In its territory it is possible to identify an historical centre, a wider urban area, a port and a airport.

Since the 60’s, people moves from rural areas towards the city, and now 1/4 of Sardinian population lives in the metropolitan city of Cagliari. Like many other cities, Cagliari had negative impact of quickly urbanisation and high traffic. In fact, Cagliari has about 154,000 inhabitants and because it is the leader of the metropolitan city of Cagliari (constituted by seventeen municipalities with about 432,000 inhabitants), it suffers of commuting problematic (Fig. 1).

![Regional access](image)

**Fig. 1.** Cagliari and its main access points

In recent years, the development of the metropolitan city of Cagliari led to an apparent benefit on the small city area. In fact, if in 2008 the incoming vehicles were 185,000, in the following years, a decrease could be observed: in 2013 were 173,000 the incoming vehicles and, in 2016 were 165,000 with a reduction of around 10.8% in less than 10 years [21].

Before 2010, Cagliari can be represented with these data: about 200,000 inhabitants and 300,000 in the metropolitan area. For this reason, it has suffered even more of commuting problematic, with high prevalence of private vehicles and a public transport with great difficulties. This was the result of the wrong transport policies of the 80’s when it was allowed cars to enter in the city occupying pedestrian areas and squares.
The result of these policies was that until 2010 Cagliari was characterized by no pedestrian areas, no limited traffic zone and no bike infrastructures. At the same time an important urban tramway network was dismissed. As results Cagliari registered loss of social relationship, culture and community peculiarities. Furthermore, an overview of the Metropolitan Area was totally lacking. This was shown because of the seventeen urban centers in the hinterland had seventeen different governance strategies and seventeen different strategic urban planning.

From 2011 a new strategic plan was assumed in cooperation with all the 17 municipalities. Briefly this new strategy plan can be summarized in:

- massive use of ITSs technologies to manages mobility and social interaction (financing granted: 65 M€);
- top priority for public transport (financing granted: 90 M€);
- no cars in the historical center, places and pedestrian areas (financing granted: 60 M€);
- development of a cycling line network, car-sharing, car-pooling, bike-sharing, electric mobility (cars, vans, scooters, bikes), the ‘Walk to school’ project, etc. (financing granted: 20 M€);
- completion and integration of tramway network (financing granted: 60 M€ + 250 M€ planned for 2016–2020);
- improvement of connectivity between city, port and airport (financing granted: 35 M€).

4 The Evolutionary Phases of Cagliari in Transport Sector

The local public transport network had important interventions aimed at improving its efficiency in terms of punctuality and travel time, thanks to the new strategic plan of 2011. This strategic plan was developed in partnership between the Municipality of Cagliari, the University of Cagliari and the CTM (Consortio Trasporti Mobilità), the Public Transport Company. Starting from 2011, many projects made the CTM as the top rated Public Transport Company in Italy and Europe, obtained also a large background in ITS technologies. The results obtained are the achievement of: (i) 30 Bus Lines; (ii) 1 Electric Bus Line; (iii) Fleet of 276 buses; (iv) Network length of 432 km. Thanks to this achievements, CTM had the newest fleet in Europe in 2014, and, from 2015, was the 2th Public Transport in Italy.

The strategic evolution of transport in Cagliari is basically developed in three phases, each of which is associated with important public funding. In particular: 1st Phase (2004–2008): Development and integration ITSs and Infomobility inside Cagliari Urban Area - Funding: 9.8 M€; 2nd Phase (2008–2014): Extension to seven suburban centers - Funding: 18.7 M€; 3rd Phase (2017–2020): Extension to all 17 centers of the Metropolitan Area - Funding: 15.0 M€. Figure 2 shows the areas involved in the three phases.
The growth of the CTM was not an isolated case. Even though Cagliari had a negative trend for the inhabitants (in 2010 the inhabitants were about 156,000, in 2016 about 154,000), it grows in terms of the mobility control and management. Figure 3 shows the comparison of the two growths. The time references show the synergies implemented by the CTM and by the municipality of Cagliari, in order to improve the mobility of the entire urban area.

![Image of the three areas](image1)

**Fig. 2.** Scheme of the three areas involved in the strategic plan of Cagliari

![Image of ITS systems](image2)

**Fig. 3.** Development of ITS systems in Cagliari [22]

The Fig. 4 compares and highlights what has been done by the Municipality of Cagliari and by the CTM in terms of ITS interventions and devices according to the two completed phases of the strategic plan.
Fig. 4. ITS interventions and devices of the two completed phases of the strategic plan [23]

Starting from 2015, the material and immaterial infrastructures of the two partners have been integrated into a single mobility management system, whose functioning and interconnections are represented in the block diagram of the telematic platform of mobility management (Fig. 5). With reference to the single block, the results obtained are as follows.

1. Remote traffic light Control Room: it is managed by Cagliari, in order to monitor all traffic lights located in 102 intersections (they were only 37 in 1996), integrated in a single remote control room.

2. Buses fleet Coordination: it is managed by CTM and allows to monitor and to control all buses fleet in real time, in order to coordinate all buses in a single remote control room.

3. Monetics and pricing: it is managed by CTM. It is the ticketing device and it allows to remotely control the on board ticket system. The intervention provided for the functional integration of the Monetics and pricing system (recharge and sale of contactless travel tickets), realised by ITS Area Vasta S.c.a.r.l. and currently in use by the CTM partner. Specifically, it is an integration and an update of the existing system, made through the purchase of 280 Pos Ingenico ICT250 model of latest generation and the purchase of new full contactless Obliterations BV500 equipped with the latest technologies (GPRS module/UMTS WIFI reader Bar Code network card TCP, RS232, 485) and fully compatible with existing bivalent validator.
(4) Communication CAGLIARI - CTM: it is an ITS system for the mobility management, called TETRA. First in Sardinia and second in Italy, after the project realized in Turin by the 5T Consortium. This integrated infomobility system was financed by the Sardinia Region under the ROP 2003–2006 funds, Axis VI Measure 6.2, for a total amount of 28.4 million Euros. The management of the project required the establishment of a consortium company between the various municipalities involved (Cagliari, Quartu S.Elena, Selargius, Elmas, Assemini, Decimomannu) and the CTM. This consortium is called “ITS Area Vasta Scarl”.

The system functioning is based on ITS use for the optimization of private traffic and for the public transport services. Two control rooms were created: the first one is the Mobility Control Room, which oversees the control of private traffic in collaboration with the Municipal Police radio room, and the second one is the AVM (Automatic Vehicle Monitoring) Room, which monitors the fleet on the road of the public transport.

The Mobility Control Room manages all the devices that allow to regulate and to control the traffic flow in the involved municipalities. Specifically, this Room manages 58 Variable Message Panels (VMP) for collective routing, 96 pivoting CCTV cameras for traffic monitoring, 102 centralized traffic light intersections with traffic lights priority. The connection of all these devices is realised through 32 km of optical fiber, added to the existing 80 km, with 14 km of secondary branches in 7 municipalities, 10 star centers. In total 80 devices are connected, and 77 are next to the connection.

The Automatic Vehicle Monitoring Room controls 264 buses in real time and 281 information points. For the users are also available App and dedicated services for real-time information to optimize the movement (SMS, IVR responder, mobility website, path calculation).

A Tetra Digital radio network was also set up to serve the seven municipal police and the CTM, with seven radio stations distributed throughout the territory, around 800 active terminals (between on board and portable) and eight fixed radio stations [25].
CTM Control Room: it is the Public Transport Company Control Room.

Cagliari Control Room: it is the Municipality Control Room.

CTM Mobility Website: in it, it is possible to find all information regarding user movement, a mobility planner, traffic information, statistics, and so on.

Parking management: it is managed by the CTM and covers all aspects, such as management and parking control, parking information and ticketing.

Air quality and pollution monitoring: it is managed by Cagliari, with environmental measurement stations, useful for air quality control and pollution monitoring.

Traffic Limited Area access control: it is managed by Cagliari and it is constituted by all devices designed to verify and to control access to all areas with limited traffic through car plate reading systems, directly connected to the municipal police station.

Variable Message Panels control: it is managed by Cagliari and it is constituted by all devices designed to inform users in real time on traffic conditions and on other news. It is directly connected to the municipal police headquarters.

Electronic screen poles.

CCTV cameras: as said above, the system manages in real time 93 CCTV traffic control cameras and 264 cameras on board for bus control.

Speed control and violations Radars: they are the devices useful to detect road infractions, such as overcoming of limited speed, crossing with red light or going through bus lane, and so on.

Therefore, the whole system allows integration, organization and process through two main control rooms, five remote control rooms, integration with police, and call center. This allows in real time to inform users (both private and public) on traffic data, on report roadblocks, on camera surveys, work in progress and on line diversions.

In this way, it is possible to control and roll 96 motorized cameras in real time, to detect interruptions and congestions, to inform on traffic level and distribution, speed, and so on. It is also possible to inform car drivers, bus drivers, pedestrian, to control and modify the traffic light plan during peak hour, and to simulate the transport network and traffic.

5 The Effects of ITS on Cagliari’s Urban Social Interactions

The improvements described represent the positive trend in the field of sustainable mobility in Cagliari. Qualitative and quantitative considerations can be made, in order to verify the effects of the implemented actions and how the citizens’ habits changed.

The qualitative considerations are based on the fruition of some redeveloped spaces and how these changes have affected the citizens’ behavior. In fact, the community started to walk, run, cycle and use the public transport (see Figs. 6, 7, 8 and 9), following an equation like this: closed to traffic = open for people.

On the other hand, the quantitative considerations are based on the variation of some indicators, before/after the interventions and the tangible and intangible infrastructures realized. The benefits obtained were distinguished in benefits for private traffic, benefits for public transport, benefits for safety, and benefits for users. These are listed below.
Fig. 6. Viale Poetto before 2015 and today

Fig. 7. Corso vittorio emanuele before 2015 and today

Fig. 8. Via Roma. Waterfront today and the future light rail metro system with its pedestrian area (22.5 M€, project under construction)
Fig. 9. Other areas of Cagliari are today became friendly for pedestrians

(a) Benefit for private traffic.

An analysis before and after 2015 was made on all municipality of Cagliari and on 5 main streets of Cagliari. The first analysis, conducted for the period 2011–2015 on the entire transport network of Cagliari, shows (i) a 4.5% increase in the number of public transport passengers, (ii) a reduction in inter-municipal private traffic of 8.2% (from 183,000 to 168,000), and (iii) a reduction in intra-municipal private traffic of 9.1% with an average distance of 25 km/day. In the same period (2011–2015), the general reduction of transport costs is estimated 30 M€/year, with a fuel cost saving of 1.7 M€/year. Regarding the environmental pollution, authors obtained for the same period a reduction of Hydrocarbons (−7.6%/year), of Particle pollution PM10 (−10.4%/year) and of Nitrogen oxides (−6.8%/year).

The second analysis (the one made on 5 main roads) shows the benefits on private car traffic. Significant variables for the life of a city have measured and the obtained results are in Table 1 and Fig. 10.

<table>
<thead>
<tr>
<th>Name of roads</th>
<th>Viale Poetto</th>
<th>Via Sonnino</th>
<th>Via Dante</th>
<th>Via Cadello</th>
<th>Viale Trieste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel time reduction (%)</td>
<td>14.8%</td>
<td>19.7%</td>
<td>44.6%</td>
<td>11.5%</td>
<td>11.3%</td>
</tr>
</tbody>
</table>
(b) Benefit for public traffic.

The interventions on the local public transport network and the digital infrastructures allowed an increase in passengers flows of 23% in 5 years (from 2010 to 2015). This was also possible thanks to the predisposition of friendly applications and devices, that attracted new users, especially among the younger ones. Nowadays, 2 apps for smartphones, real time information bus passing, information about bus stop, delay, ticketing are present. In addition, social networks have also used to improve the offer from 2010.

(c) Benefit for safety.

Traffic safety levels also improved thanks to the ITS and to public actions. In fact, the number of accidents has greatly decreased in recent years. This data was obtained from the accident database which has collected about 30,000 accidents and their characteristics in the last 10 years. Figure 11 shows how the accident rate has decreased by 32% in the period from 2010 to 2017 and Fig. 12 underlines traffic accidents costs in Cagliari.

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**Fig. 10.** Commercial speed before and after 2015

**Fig. 11.** Traffic accidents trend in Cagliari (From 2006 to 2017)
Fig. 12. Traffic accidents costs in Cagliari (From 2008 to 2017)

(d) Benefit for users.

The AVL (Automatic Vehicle Location) system produced a marked improvement in terms of punctuality and information on the service and this can be measured through customer satisfaction in terms of perceived quality, punctuality of the system, information received and travel time (Fig. 13).

Fig. 13. Customer satisfaction [26]
6 Conclusions

All efforts made by the administration of Cagliari have made possible to achieve important goals and improvements. They also made it possible to state how such ITS systems, combined with good urban policies aimed at sustainable mobility, allow residents to enjoy high quality of life and to improve the quality of their environment, and to appreciate walking, biking or taking public transportation, in order to go to the places they most frequently need to go every day, such as work, schools, grocery stores, shopping malls, parks, recreational areas and health facilities.

The goals described have also enabled the municipality of Cagliari to achieve important international and national awards. Among the many, in the past 5 years, authors highlight for example: its achievement of the top ten Italian rating for sustainable mobility; Cagliari is the 2nd best public transport in Italy, after Milan; Cagliari is also the 2nd largest pedestrian areas after Venice, and Cagliari won the first prize as best transit management in Europe. Cagliari has also a 30% reduction of car accident and the urban quality grow radically.

In addition, in few years the public transport company (CTM company) reaches the top quality in Italy, with the newest fleet in Europe and a constantly growing trend. In 2015 CTM starts with a first Italian full-pure-electric bus transport. Next to this, not of secondary importance, authors highlight the importance of the implementation of infrastructure interventions on urban public spaces with invested massive resources to restore squares, pedestrian and biking surfaces, improving public transport, car sharing, and mainly ITS technology.

Without these interventions, many of the results obtained would not have achieved demonstrating that the quality of the space contributes to the improvement of the quality of life, but that this must be accompanied by urban policies aimed at reducing vehicular traffic and therefore to strong policies on alternative and sustainable mobility.

The obtained and discussed results have also a strong national recognition regarding sustainable mobility. This can be found in the Eleventh Report of Euromobility on Sustainable Mobility in the main 50 Italian cities, carried out under the patronage of the Italian Ministry of the Environment.

Cagliari was in 38th place in 2011: the goal was to gain positions with the interventions scheduled until 2018. In the 2017 Report Cagliari climbed to twelfth place. The excellent position in the ranking is the consequence of the improvement of road safety, of the increase in demand for local public transport, of positive data on air quality, of the activities for the preparation of the Sustainable Urban Mobility Plan (SUMP).

Beyond the ranking, the confirmed objective is to further improve sustainable mobility in the city. In this sense, authors emphasize that the actions implemented in 2017 will be considered by Euromobility analysts only in the next 2018 Report. Among these: the increase in car sharing positions and the inclusion of electric cars in the fleet, the activation of the new bike sharing service, the funding obtained with the project presented under the national experimental program of sustainable mobility home-school and home-work, the allocation of incentives for the purchase of ecological means for taxis.
Scheduled in the coming months, then, the increase in pedestrian areas, the increase in the bike sharing and car sharing service with the inclusion of vehicles in “free flow” mode, the increase in kilometers of cycle paths currently being planned with the resources available on the 2014–2020 Metro PON, the assignment of the construction of a city network of charging stations for electric vehicles, the increase of road safety with the installation of devices such as raised pedestrian crossings and activation of the “30 Zones”.

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