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Journal of
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This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

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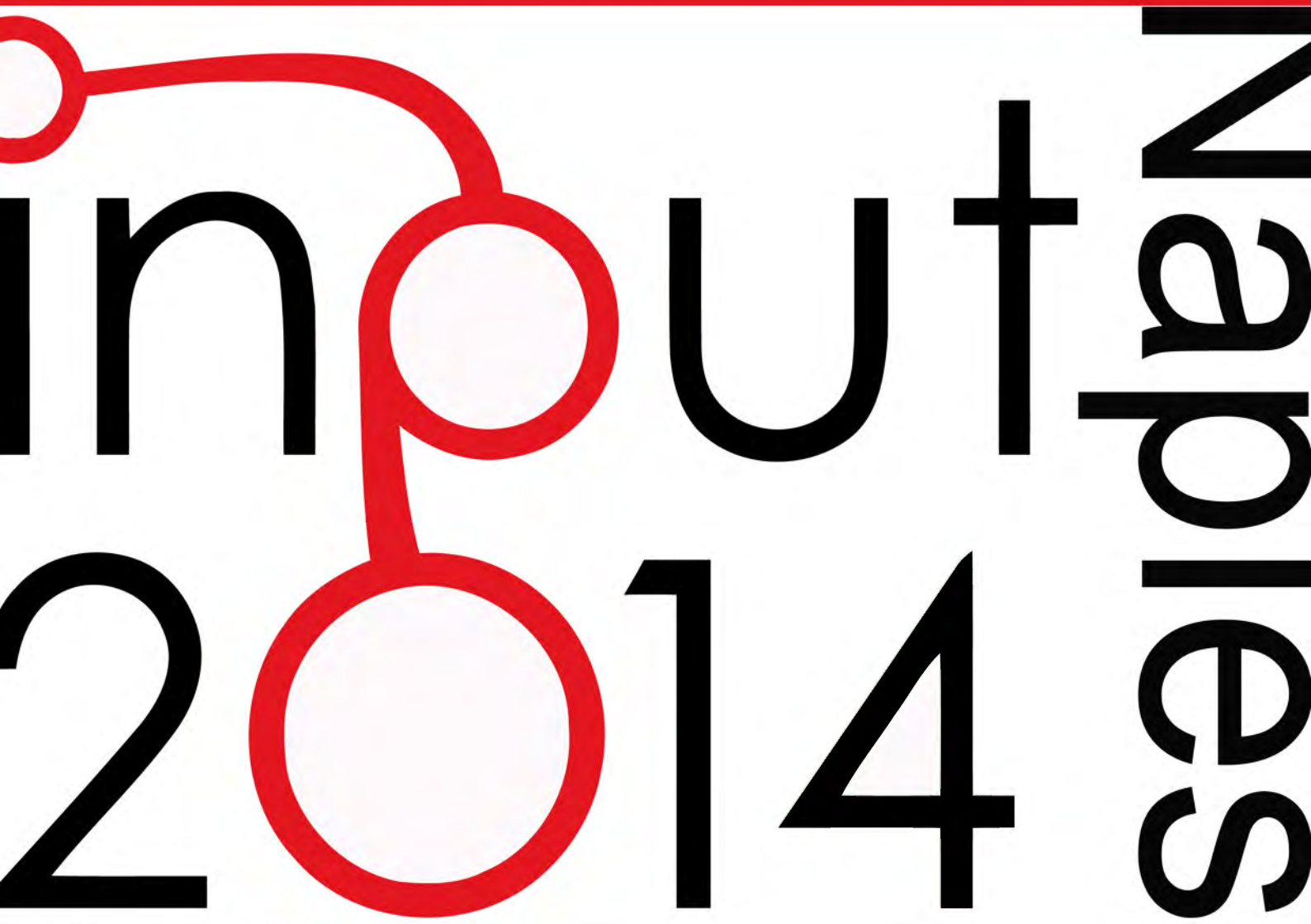

Smart City

planning for energy, transportation and sustainability of the urban system

Special issue, June 2014

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SMART CITY

PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

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TeMA Journal of Land Use, Mobility and Environment

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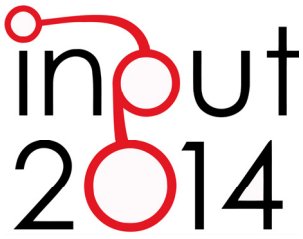
TeMA Journal of Land Use, Mobility and Environment

This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



TeMA Journal of Land Use, Mobility and Environment

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EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website www.input2014.it . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website (www.tema.unina.it). The codex is not present on the pdf version of the papers.

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Contents

TeMA Journal of Land Use, Mobility and Environment

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TeMA Journal of Land Use, Mobility and Environment

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SPECIAL ISSUE

Eighth International Conference INPUT
Smart City - Planning for Energy, Transportation and Sustainability of the Urban System

Naples, 4-6 June 2014

URBAN LAND USES AND SMART MOBILITY

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ABSTRACT

The object of this work consists of the will to define a renewed relationship between spatial planning and transport systems, which focuses attention on road safety, whereas to date the studies on this relationship have mainly examined the transport impacts on land use. Therefore, in addition to the analysis of the physical characteristics of road infrastructure, there is a need to examine which urban land uses can generate points of risk, both in terms of attraction of vehicles and pedestrian flows as well as in terms of concentration of vulnerable road users, in order to organize a complete information and telecommunication system for road safety.

In short, considering a specific testing ground, some urban land uses have been located, with relative dimensional analysis and characterization of access conditions in typological-functional terms: services (schools, healthcare structures, sports facilities); tertiary/production industry (wholesale, shopping centres, industrial sites); tourism sector (hotels, resorts, historical and cultural heritage).

The collection of information, corresponding to mapping of prospective risk factors, represented the basis for the entry of specific data within a wider reference database.

KEYWORDS

Smart City, Spatial planning, Transport systems

1 NEW TRANSPORT-SPATIAL INTERACTION PARAMETERS

The present research was conducted within the National Operational Programme for research and competitiveness for the convergence regions PON M2M[1] – "Mobile to Mobility Information systems and telecommunications for road safety".

The research programme, highlighting the lack of an analysis and intervention methodology which takes into account all the aspects that influence, or are influenced by accident rates (infrastructure, flow, landscape-environment, anthropy, etc.), aims to provide services based on access to a geo-referenced database, which is interoperable and predisposed to evolve towards new development scenarios, containing cartographic information associated with information on info-mobility and road-safety. The object of the research consists of the desire to define a renewed relationship between spatial planning and transports, which focuses on road-safety in the face of studies, which have mainly regarded the impact of transport in terms of land use and vice-versa.

Specifically, studies on transport-spatial interaction have been produced in North-American countries and were prevalently conducted in urban contexts or on a metropolitan scale. The possibility of extending the aforementioned research to a regional scale with empirical approaches and by means of models which are capable of reproducing the interaction between levels of accessibility and the location of residential and economic activities (Coppola & Nuzzolo, 2006), has been investigated.

Besides this experience, numerous models of microsimulation of spatial and transport use are applied (Wegener & Spiekermann, 1996; Landis & Zhang, 1998; Salomon et al., 2002), as well as complex models which, based on the theory of cellular dynamics (CA), consent the reproduction of the interactions which arise between spatial and transport systems (Batty, 1997; Ferrand, 2000).

Starting from these assumptions, the work develops concentrating on the study of the literature pertaining two cardinal concepts, namely road-safety and quality, in order to better understand the extent to which factors of an urban or architectural type can influence not only the articulation of mobility within specific contexts, but also safety, paying particular attention to the influence of the morphological-urban conformation of the reference context on determined components regarding mobility (traffic, public movement, public safety, movements of residents), as well as the importance of connected factors, for example, the lack of services and hygienic-sanitary conditions of buildings, public streets and spaces, the citizens' quality of life and the orientation of choices.

The starting objective consists of the need to select global urban, environmental and landscape indicators, or rather factors which are believed to be relevant for the evaluation of and the successive planning of choices within the analysis contexts. This is conducted through the acquisition of specific data that is useful for the discovery of their critical and strong points, also with the support of interviews/specific surveys. An objective which is essential in order to create a database of values and indices capable of providing guidelines which useful for: highlighting the parameters which mainly influence road safety and the articulation of mobility, even in proximity to the analysed urban contexts and, therefore the analysis of the selected data in order to generate reflections and possible solutions, highlighting the parameters which mainly influence the citizens' quality of life and their choices, and the analysis of data in order to generate technically sustainable solutions.

[1] The NOP is part of Action Line I "Support for structural changes" and of Operational objective 4.1.1.1." Scientific technological field generators of industry transformation processes and creators of new sectors" – Action Line II: "Support for innovation". Working group SSD ICAR 20: Research activity supervisor - prof. arch. Mauro Francini; Research grant holder - dott. ing. Annunziata Palermo, dott. ing. Maria Colucci and dott. ing. Myriam Ferrari; Research activity collaborator - dott. ing. Maria Francesca Viapiana.

Some pertinent national and international normatives were analysed to support the aforementioned reflections, in order to compare the Italian dynamics with other European countries.
The main objective indicated within the White Paper (2001) was to "reduce road victims by 50% by 2010". The only countries which met such an objective are Latvia (-55%), Spain (-51%), Portugal - Estonia (-50%). Italy lowered its accident rate by 33%, but still struggles to meet the set parameter.
Directive 2008/96/CE, which regards road safety management, marks new objectives in line with community expectations, highlighting a series of priority aspects to be addressed: improve the impact procedures on road safety; evaluate the possibility of extending the measures to road infrastructures of a different rank; carefully define orientations and guidelines.
From the study of European experiences conducted, the case of the Swedish government resulted as being particularly interesting. In 1997, by means of the *Vision Zero* Project, issued new guidelines in the field of road safety: the meeting of *zero* deaths in a decade; a new ethical approach, which views an accident as an unusual event and views safety as a moral value for society. A new approach which regards the study of the road environment, conceived not only as an infrastructure, but above all as a place of safety.
The spread of these guidelines influenced the research activities of many universities (including the University of Adelaide, the University of York and the University of Lulea), leading to the definition of suitable corrective factors – connected to the properties of the specific reference morphological contexts - in order to obtain a higher level of road safety.
In the specific case of Italy, from a normative viewpoint, it is necessary to highlight some steps, which were defined within the Road Safety National Plan guidelines, defined as a: "an articulated system of directions, of measures for the promotion and inducement of plans and instruments to improve safety levels by the owning and managing bodies, of infrastructural interventions, of measures for prevention and control, of normative and organisational tools, with the aim of improving safety according to community objectives".
The previously mentioned instrument highlights how the factors of *environmental conditions* of a territory – and therefore the type of infrastructure, the morphology, the relationship between a settlement structure and the road network, the properties of collective transport –"determine the number and seriousness of road accidents in a clearly prevalent manner compared to individual behaviours". Such data allows risk factors to be identified and therefore isolated, specifically, those that are called *environmental risk conditions*, stating that they do not regard driver behaviour nor the dynamics of the accident, but the *entire environment within which the accidents occur.*
The parameters which are highlighted in current regulations regard the mobility and evaluation of damage correlated to road accidents (road accident rate, average daily traffic; total entity of social damage), as well as the role of the functional furnishing of the road in the definition of its safety, encompassing a series of variables (from the choice of safety tools to the definition of lighting parameters).
Each of these aspects directly influences the management and maintenance of the road in its entirety, as well as influencing both the accident rate and the risk factor.
However, more specifically, concerning the relationship between road safety and the urban component, only within the regulations of some Northern European countries does the hierarchical classification of roads occur in two phases. The first phase considers the functional category of the road (as in Italy), based on the geometrical properties of the infrastructure, on the type of traffic components and on the relative role played in the spatial context. The second phase takes into account the allowed speed assigned in relation to the presence of particular urban elements (schools, shopping centres, residences, etc.)
Through such settings, it is possible to correlate the functional classification of the road to the urban context in which it is found, thus defining the allowed relative speed.

European Union guidance correlates more frequently the urban component of transport policy, in line with the concept of sustainable urban transport.
On the basis of results obtained through different initiatives and experiments, some fundamental principles were established within the Sustainable Urban Transport Plan, which constitutes the main instrument for the management and control of sustainable actions on mobility; these include: guaranteeing accessibility for different types of users (residents, commuters, pensioners, disabled people); guaranteeing the safety of citizens both in terms of mobility and of health; containing air pollution and increasing the use of clean energy sources, and contributing to the increase of urban quality.
Following a study of the abovementioned literature, the parameters useful in order to widen the transport-spatial interaction were defined. They generally coincide with the different physical properties of the road infrastructure and functional of the accessibility of an area of interest, or rather the presence of urban elements which "incentivise" life quality, which also belong to a "periurban" field. These, in turn, contribute to a variation of the princes of lend and, therefore, the definition of policies and of spatial design. However, most importantly they can play an important role in order to guarantee appropriate road safety standards, in that they are generators of dangerousness points if associated with, for example, a greater attraction of vehicular and pedestrian flow or a particular concentration of weak road users.
To summarise, after having identified the urban uses involved, considering a specific experimentation field, some of them were located, with relative dimensional analysis and characterisation of the access modes (compared to the main viability) in typological and functional terms (services –schools, healthcare structures, sports centres; tertiary/productive sector – wholesale, shopping centres, manufacturing establishments; touristic sector – hotels, resorts, historical-cultural heritage), with the aim of creating a preliminary mapping of the potential risk factors useful for the insertion of specific data within a more extensive reference database (DB).
The studies conducted come under the following operative objectives (OR) and the relative activities of the national operative plan: OR 2 *Study of factors and creation of risk chain* - Activity 2.2 "Contextualisation of risk factors and scenarios in real road settings"; OR 4 *Construction of multi-profile database* - Activity 4.1 "User profiles and associate functional requisites" and Activity 4.2 "Structure of the system and the DB"; OR 9 *Construction of the test site* - Activity 9.1 "Acquisition of the reference test site" and Activity 9.4 "Construction of GIS model and data input"; OR 10 *Experimentation and testing of prototype* - Activity 10.1 "Validation of the Mobile prototype" and Activity 10.2 "Verification of efficiency/usability of the web platform for professional users" (Palermo & Francini, 2013).

2 IDENTIFICATION OF SOME FACTORS OF THE RISK CHAIN

In terms of *contextualisation of risk factors and scenarios in real road settings*, attention was focused on the study of the interactions between urban use and road safety. This was in order to better understand how to use cartographic data in terms of road accident prevention and, consequently, define the relative risk factors and indicators and identify the interest variables to be inserted in the DB.
Many studies of the literature were analysed in order to define the factors and risk indicators, including that from the national Observatory on Italian autonomies for the coordination of communication and making the road network safe – born from an initiative of ANCI (*Associazione Nazionale Comuni italiani*) and UPI (*Unione delle Province d'Italia*) with the support of the Ministry of Infrastructures and Transport.
From the study, it emerges that road accidents seem to depend neither on the demographic dimension, nor on territorial density. Nor do they depend on the rate of motorisation of the cities. Instead, the correlation

between the "resident population", "territorial density" and "rate of motorisation" from the study emerges to be approximately zero, even with worthy clarifications.
While the rate of motorisation appears as an independent variable, it is correlated with neither territorial density nor the number of accidents. The geographical dimension resulted as being closely connected to the interpretation of data on the rate of accidents with particular attention to the urban sector.
Moreover, notwithstanding the difficulty of collecting particular links between the characterising elements the city attitude and the number of accidents, it is possible to discover other aspects, such as "urban morphology" and "commuting", which have both positive and negative effects on the urban accident rate, connecting the aforementioned elements.
Concerning urban morphology, starting from the classification of cities based on spatial density levels from Istat, which examines two types of cities; those that are "spread" and those that are "compact", characterised by different spatial structuring which affect mobility and the use of private modes in different ways. It emerges that: at the moment in which public transport cannot cover large territories, identifiable in the definition of "spread cities", the road network is extensive which can favour increased speed of vehicles with a greater risk of accidents. Instead, in "compact cities" extended public transport can cover the various areas of the city with increased efficiency, while the road network is less extensive, discouraging, in theory, vehicle speed with positive effects on the accident rate.
In spread cities, therefore, the number of vehicles is greater than that of compact cities, like the number of accidents, for this data it leads to the hypothesis of a correlation between urban morphology, rate of motorisation and accident rate.
Commuting is a phenomena undergoing rapid growth as people increasingly decide to live outside urban centres but continue to use them as their place of work. This has consequences for mobility and urban congestion, affecting cities with a high rate of attractiveness, since the infrastructures for viability and transport must be able to stand a greater flow of citizens, residents and commuters.
In order to integrated the aforementioned considerations and to complete them in each aspect, attention was concentrated on that indicated within Attachment II – "Road safety controls for infrastructural projects" from the previously mentioned Directive 2008/96/CE, which defines: the criteria to be applied in the preliminary project design phase; the applicable criteria in the detailed project design phase; the applicable criteria in the closing phase; criteria to be applied in the first functioning phase (evaluation of road safety in light of the effective behaviour of users).
Such criteria resulted as being useful in order to articulate, in overall terms, the elements to be considered as a priority for the definition of suitable levels of security.
The specific urban references originate from such general elements which allowed the identification of the potential risk factors representing the information to be inserted as a priority in the reference DB, as well as creating a hierarchy of viability, an analysis of the characteristics pertaining to dimensions and the conservative-functional state and the typological classification of road intersections (roundabouts, crossroads, intersections with traffic lights, etc.), with a dimensional and functional analysis of them (presence and properties of horizontal and vertical road signs, presence of critical structural elements, presence of elements of disturbance, etc.), or rather: the location of urban uses, with relative dimensional analysis of the access modes (compared to main viability) in typological and functional terms: *residence, services* (green public spaces, equipped green public spaces, schools, hospitals, private clinics, car parks, sports centres, etc.), *tertiary* (retail, wholesale, banks, post offices, chemist's, public offices, etc.); *productive sector* (Agricultural, artisanal and industrial activities); *tourist sector* (receiving and tourist

structures); *historical-cultural heritage* (important and/or protected buildings, castles, historical buildings, archaeological areas, etc.); *urban fittings.*

The collection of this information, coinciding with the mapping of potential risk factors, further synthesised in a data collection table, represented the starting base for the structuring of a Spatial Information System suitable for the needs of the M2M project and characterised by a high level of flexibility and openness towards the possible access and integration with existing databases, both geo-referenced and non geo-referenced, with main reference to the competences of the involved territorial bodies (public administrations).

3 GENERAL PARAMETERS OF THE MULTI-PROFILE DATABASE

In order to define appropriate *user profiles and associated functional requisites*, and therefore to render the system one which can be integrated and interoperated. The conducted studies highlight the need to refer to what are known today as new instruments of participation; these instruments, or rather social networks, result as being particularly useful in an active participation logic of the users as they are essentially based on *gaming* logic. More specifically, reference is made to a particular type of social network: *geo-social networks* or *location-based social networks*, which arose from the use of services offered by GIS systems within the social networks. The user, due to these systems, can provide and share information regarding their own geographical position with other network users. In the current case, it results as being useful for the definition of factors, indicators and standards of quality, as well as the control of performance requisites of specific urban functions. Furthermore, it is necessary to highlight how all this is possible, in *real time*, thanks to the use of mobile devices such as smartphones or tablets, equipped with GPS.

Particular attention was paid to the definition of some of the system functional requisites, connected to the delineation of a specific "user profile" potentially characterised by eventual categories of sub-users, for whom dedicated access with suitable privilege levels to specific DB areas must be made available.

All this is essential in order to ensure the supply and management of the service, whilst meeting a high level of personalisation of the system, as well as notable levels of loyalty and maximum satisfaction in its use.

The M2M project operated a first distinction between *professional users, non professional users* and *commercial users.*

Professional users are users who use the M2M platform for work reasons (e.g. road infrastructure management such as EELL, ANAS, Motorways, etc.; Police Forces and those who perform security control or emergency management, Accident and Emergency service management, general management of Insurance companies, etc.).

Non professional users are those who use the M2M platform exclusively for mobility purposes, or rather all those who have smartphone devices with M2M software, who collaborate in the production of data acquired by the platform and extract from it information relative to their mobility choices and with detailed information on road safety strategies.

Commercial users are users whoseM2M platform use is with the aim of offering paid services to share information relative to the selling of services linked to mobility (for example: hotels, restaurants; insurance services; other commercial activities; etc.)

With reference to this classification, attention was focused, within the "professional user" type, identifying a specific sub-category, that relative to local authority technicians (primarily public administrations), that fine themselves managing spatial information directly or indirectly connected to road safety on a daily basis.

For this user-profile, by means of face-to-face investigations, supported by semi-structured questionnaires, it resulted necessary to make dedicated access with suitable levels of privilege available to DB areas for processing sensitive data and that with direct impact on the info-mobility platform management system, in order to determine, codify (both quantitatively and qualitatively) and represent the interconnections between road accidents and the location of particular urban functions.

Concerning the work conducted in relation to *the DB system and structure*, an analysis was conducted that was pertinent to the identification of possible database architectures for the creation of the prototype, examining the hardware and software aspects and evaluating the advantages and limits in terms of cost, complexity and performance of the possible solutions identified.

In this regard, we highlight that from the bibliographic study conducted of the possible DB architectures, *two-tier client-server* and *multi-level client-server* emerged. The *client-server* architectures are organised in tiers, each tier corresponds to a node or group of calculation nodes on which the system is distributed. Each of these functions as the server for the preceding level and as the client for the successive level.

Starting from such suppositions, the specific Activities conducted regarded the design of a system for the archiving of data and for their successive extraction in order to be visualised.

In order to acquire the aforementioned information referring to the context chosen as the location of the test site, two specific data survey forms were structures, which present elements which were successively reflected on in terms both of vertical and horizontal integration as well as the streamlining of redundant information pertaining to the acquisition of data.

The survey forms created refer to two different types: *general form,* relating to the entire reference spatial area for the test site which in turn can be divided into investigation sub-areas, to facilitate data acquisition; *detailed form*, pertaining to each property subject of interest, in which it is possible to better specify valuable information.

4 TEST SITE REFERENCE AREA AND DATA LOADING

The test site reference area is situated in the province of Crotone and refers to a section of the SS 106 highway.

In order to analyse sufficiently, the municipal parameter was used as the preliminary parameter of spatial reading and of the relative urban uses, with specific reference to the Towns of Crotone, Cutro and Isola Capo Rizzuto, which are crossed by the road section being examined.

In the specific case of the Town of Crotone, in which the successive verification of theoretical assumptions was concentrated, situated on the east coast of Calabria, with a surface area of 179.83 km², at 8 m.a.s.l., bordering with: Cutro, Isola Capo Rizzuto, Rocca di Neto, Scandale, and Strongoli. These towns are linked to Crotone by an intense road network based on two main road axis, highway number "Ionica" and highway n. 107 "silana-crotonese". All the other arteries branch off from these two axis.

Cutro, in particular, is connected to the municiapl territory of Crotone by highway n. 106 and municipal road n. 44. The following are present in the borough: a provincial road, n. 43, and a highway, n. 109. Instead, Isola Capo Rizzuto is linked to Crotone by provincial road n. 50. Two other provincial roads are present in the borough (n. 48 and n. 45, which is connected to highway n. 106), as well as numerous municipal roads, the most important of which is n. 60.

Hereafter follows a summary of some captured data for the town of Crotone, which were also preliminarily synthesised by means of cartographic processing and in the aforementioned survey form.

For reasons of simplicity, the data analysis and restitution of the relative results, the municipal territory was divided into two parts: Crotone 1 (to the north); Crotone 2 (to the south).

Before describing the analysis, in order to better understand the typological and functional relation of urban uses with the spatial context, a brief analysis of the entire borough was conducted pertaining to the dimensional characterisation of the most interested viability and the access modes compared to the main viability. From the analysis, it emerges that the Town of Crotone, which is situated on the Ionian sea in at the mouth of the Esaro river and is part of the Authority of the inter-regional basin of the same river, whose southern part is entirely located in the "Capo Rizzuto" marine reserve. The aforementioned two main road arteries, which cover it entirely, and cross it are: from north to south, highway 106 "Ionica", from east to west, highway 107 "silana crotonese".

The two arteries, which play an important role in the viability of the municipal territory, are in fact the fundamental component of the viability of Crotone and permit the Town to communicate with the rest of the region and the nation.

SS106, followed in a southern direction, connects Crotone to Catanzaro (70 Km) and to Reggio Calabria (250 Km). Instead, following the same road in a northern direction, it is possible to arrive in Taranto (240 Km). Highway 106 also consents access to the A3 Salerno -Reggio Calabria motorway, by means of the aid of spur routes situated throughout Calabria. The road, therefore, forms one of the most important accesses to the town, however it does not result as being quite efficient. The dimensions of the road site and the radius of curvature create numerous problems for its users. Moreover, it has a very high accident rate as the road crosses the town and is the site of numerous pedestrian crossings and grade level crossings. Many improvement works have taken place over the years, which regarded a large part of the road, improving journey times. The aforementioned highway 106 is characterised by some extensions, which branch off in the Town of Crotone, acquiring the suffix "Bis".

Instead, highway SS107, if followed in a western direction connects Crotone to Cosenza (100 Km) and Paola (142 Km). This road also provides access to the A3 motorway, representing one of the most important means of crossing of the region. Furthermore, it allows for a rapid crossing of the Sila altiplane and connects the Ionian territory with the Tyrrhenian one, thus favouring the economic development of Crotone, and forms, the same as highway 106, one of the most important access routes to the town, notwithstanding that the user often experiences difficulties due to the lack of maintenance. The accident rate is very high due to the users' lack of care who, when using it, underestimates risks: the road crosses man built up centres, with the presence of grade level crossings (above all foothills).

Two provincial roads are present, SP52 and SP22, which cross the town from west to east and are respectively positioned to the south and north of the town. SS22 provides a connection between SS106 and SS107. The two provincial roads connect the various detached settlements of the town with the urban nucleus. However, even in this case conservation is not optimal due to a rather scarce level of maintenance.

The rest of the viability comprises of local roads of different dimensions. These roads branch off throughout the entire town territory, transforming into travelable mule tracks where it becomes more impervious, or rather in the west where it is in the vicinity of the Sila altiplane. Instead, the roads near the sea or the urban nucleus in the majority of cases connect to SS106.

With regards to urban uses, from the conducted analysis it emerges that the area identified as Crotone 1 is affected by limited elements representing services, the tertiary sector, the productive sector, the tourism sector and historical-cultural heritage. The *services* are characterised by the presence of a middle school (VII circle of Crotone), positioned in the area of Papanice; two parking areas (the first near Crotone train station, whose users are mainly commuters, the second situated along SS106 in correspondence with its intersection

with SS107, now decaying and practically totally unused); reduced space reserved for public parks, mainly concentrated to the north of the urban nucleus, near the coast, which is not entirely equipped; two sports centres which are situated quite close together, on the right bank of the Neto river and characterised by a discrete level of maintenance. Among the most interesting *public offices* present in the zone are: the Public Prosecutor of Crotone's Office; the Province of Crotone, INPDAP and the Tax Office (Agenzia delle entrate). A *Poste Italiane* sorting office is also present, which serves as a depot for vehicles and as a switchboard. Referring to the *tertiary sector*, there is a chemist's, a bank, and three limited companies, two of which are situated within the industrial area. In the industrial area, there has been a disappearance of the activities connected to it which occurred during the crisis which seriously affected this territory (taking "Pertusola Sud" as an example). Today, each *productive sector* (primary, secondary and tertiary) is characterised by different Activities mainly regarding the production of wine, the harvesting and pressing of olives, the production, even international, of hydrogen and oxygen, the rubbish disposal, with the presence of a zone for the collection of solid urban waste in the area of Papanice. Near the station, there is also a port terminal. The *receptive structures* consist of the presence of two Bed & Breakfasts, while the *places of worship,* which in part characterise the historical-cultural heritage, we recall the Parish of S.S. Isidoro contadino and the Parish of S.S. Salvatore.

From the analysis conducted in the area identified as Crotone 2, it emerges that, in reference to urban uses within the *services* category, numerous schools are present, the San Giovanni Dio hospital with more 300 beds, as well as four private clinics and several sports centres, all located and catalogued in detail. Instead, the *tertiary sector*, is represented by the presence of multiple credit institutes and numerous post offices, of which there are seven branches. There are also many pharmacies and the activities dedicated to retail in various reference sectors, with more than one hundred retail shops and restaurants. Finally, the *tourist sector*, is characterised by the presence of various hotels and seaside structures, which are also located and catalogued in detail.

In reference to the *Construction of the GIS model and relative dataloading,* with a view to integrating the collected information and above all in order to use the arranged cartographic data in terms of road accident prevention, as well as acquiring data, two preeminent directions were followed: control of correct data transfer, without losing information, but means of the arranging of an adequate implementation methodology useful for developing the programme properties, as well as its specific functions; explication of the interest variables to be inserted within the DB, in correlation with the defined risk factors and indicators.

Precisely in reference to the construction of the GIS model and the relative loading of data, work was conducted in order to insert data found for the town of Crotone in the reference GIS model, following studies conducted in terms of comparison of the alignment method and the manual method, from which it emerged that the alignment method [2] resulted as being more appropriate as it also permitted the

[2] The method of alignment is characterised by the following phases: loading of aerial photographs (this step occurs exploiting georeferenced aerial photographs in ecw format pertaining to a flight made in 2000, with Gauss – Boaga, Monte Mario Italy 2reference geographical coordinates); assigning of a system of Gauss-Boaga, Monte Mario Italy 2 geographical coordinates, to the dwg tables, setting the coordinates for some known points (such a step resulted as being necessary prior to data processing, since at the basis of loading data on a GIS system it is necessary to set a system of uniform geographical coordinates); overlapping of aerial photos with the dwg files; transformation of the product in shape file; product verification. The manual method initially thought of and described as an exclusive solution for the use of Quantum GIS 1.8.0 open source software. From a comparison with the analytical method, it resulted as being inappropriate, above all in terms of time necessary to reproduce the tables, which had already been processed and presented in dwg format, substantially conducting a new structuring of the same.

improvement of a series of information compared to that obtained using the graphic method (e.g. known point coordinates).
The procedure used a series of steps that are structured inserting a mixed procedure, which uses two methods: a graphic method and an analysis method.
In conclusion, with a view to integrating the collected information and above all in order to use the prepared cartographic data, also in terms of road accident prevention, work was therefore conducted in terms of verifying the correct transfer of data, without risking the possible loss of information, by means of the predisposal of an appropriate implementation methodology, useful in developing the programme properties, as well as some of its specific functions, in terms of explication of interest variables to be inserted in the DB in correlation with the defined risk indicators and factors.

5 INTEGRATION OF SPECIFIC DATE IN ORDER TO EXPERIMENT AND TEST THE GENERAL PROTOTYPE

In order to pursue the research objective, at this point, as already stated, since the studies on this subject belong to the theme of urban and spatial planning associated to that of road safety, starting from the formulation of the initial hypothesis according to which urban uses can generate points of dangerousness, in that they are connected, for example, to a greater attraction of vehicular and pedestrian flow and/or a particular concentration of weak road users (children, pensioners, disabled people), the following categories of urban uses were defined which were useful for the general aims of the programme: services; tertiary/manufacturing sector; tourism sector.
The initial subdivision presented other analysis categories, in terms of location of uses, as previously indicated, with relative dimensional analysis and characterisation of access modes (compared to the main viability) in incorporated typological and functional terms; subdivision which was synthesised in a last analysis of the three aforementioned reference categories.
Successive to data loading, the interrogation criteria, which are summarised in the following table, were defined through location controls.
The interrogation criteria refer to: *relative distance* (variable on variation of urban use in connection to its level of dangerousness in terms of proximity to the investigated section and to the possible exploitation of the same use by weak users); *distance from the notable point* (which sums the previously chosen interrogation buffer value, 250 m, to the relative distance); *concentration level* (variable, in terms of range, for each use category, based on a first control interrogation on the effective presence of a maximum value of concentration of the urban use category in the reference buffer).
In relation to the definition of the starting ranges, the minimum assigned value is equal to 1 in that it is intrinsic to the definition of dangerousness, therefore a starting value of 0 would have no significance.
Following the normalisation of values and the definition of the reference range of the Urban Dangerousness Index (UDI) (as indicated above in the analytical representation), the values in percentages of γ coherent with the general formulation of the M2M project were identified.
In terms of validation of the Mobile prototype, as well as the successive verification of the efficiency and usability of the web platform for professional users, it therefore arises that each urban use characterises, in terms of relevance of dangerousness, a similar weight as the differentiation criteria are connected, both to the relative distances and the effective concentration level of some categories compared to others that, according to the definition in literature of each single urban use, will result as generally having an almost constant proportional relationship, even referring to a different analysis site.

To this purpose, it should be remembered that the destination field can be deduced from multilevel OSM, applications, which are adaptable on a global level (Crotone is only a reference adopted for the test site).
The location and interrogation verifications of the GIS M2M model are summarised hereafter by means of explicative screenshots pertaining to the properties of the aforementioned urban use categories (selection elements, which are interconnected).

URBAN LAND USES	RELATIVE DISTANCE (m)			DISTANCE FROM THE NOTABLE POINT (m)			CONCENTRATION LEVEL		
	d1	d2	d3	D1	D2	D3	Basso	Medio	Alto
Services	125	250	500	375	500	750	1-2	3-4	>=5
Tertiary/manufacturing sector	250	500	1000	500	750	1250	1-9	10-19	>=20
Tourism sector	200	400	800	450	650	1050	1-5	6-10	>=10
yi							0,25	0,5	1
βi				1	0,5	0,25			

IPU=Σyi * βi	IPU		γ	IPT= IP + γ*IP
	0<IPU<0,3	Basso	10	
	0,3<IPU<0,6	Medio	20	
	0,6<IPU<1	Alto	30	

Tab.1 characterisation factors of the urban dangerousness index

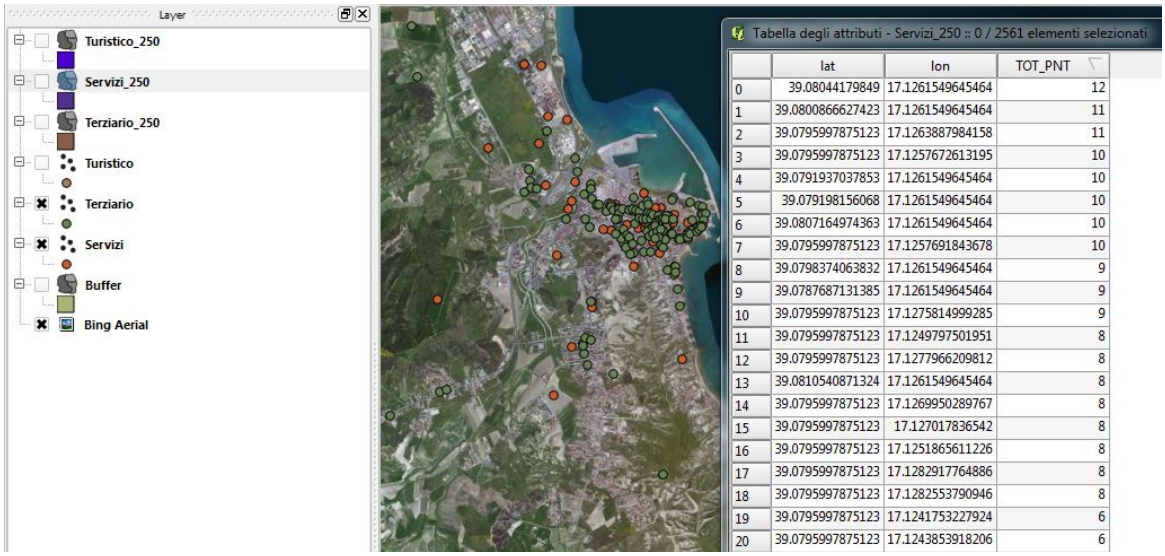

Fig. 1 location and interrogation verifications

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IMAGES SOURCES

Fig. 1: National Operational Programme for research and competitiveness for the convergence regions PON M2M.

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