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Selected Papers

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A R T I C L E I N F O

TeMA*Lab* journal

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Department of Urban and Regional Planning
University of Naples Federico II

This special number is a selection of papers published in TeMA 2009 volume and is the first item completely in English. The selected papers are works previously published in Italian in volume n. 3 and now presented in a different layout collected into a unique item.
This new effort of the TeMA Editorial Board seek to give to the journal a broader visibility in the international scientific community and to encourage the debate about the integration of urban and mobility planning to constantly more readers and authors. This number has a new graphic layout, but follows the classic structure of TeMA items, with the articulation into four sections: researches, applications, focuses, reviews.
The aim of the journal is to contribute at the founding of new scientific and at the same time professional competences, than could integrate spatial analysis and planning studies with mobility planning studies. In other words TeMA objective is to give a input to the growing corpus of theory and methodological knowledge that, overcoming the separation – entirely vague – between these two subjects, can formulate new solutions at the topics we are still facing with the old tools of the past century scientific culture. I am confident that the TeMA journal diffusion could contribute at a confront with the national and international scientific community. TeMA is a free open access journal and provides immediate open access to its content on the principle that making research freely available to the public (researchers, technicians, professionals) supports a greater global exchange of knowledge.
TeMA is a young journal. It is youthful because of the average age of the Editorial Board members, that not including the editor-in-chief, is under the average age of Italian Universities researchers.
A special thanks goes to whom support this challenge. First to the Scientific Board colleagues, that emblazon this scientific initiative with their commitment and disposability. The Scientific Board

gives representation to five national scientific communities that are mostly involved in the journal interest themes: Italy, The Netherlands, United Kingdom, Spain and USA. Gratitude goes to the Federico II University and in particular to the Digital Resources University Commission (Commissione Permanente d'Ateneo per le Risorse Digitali) which encourages our work and to the Digital Library (Sire – Lib) for the technical support in the execution phase and in the Web site implementation.

The researches section is constituted by seven articles. Giuseppe Mazzeo article carries out a reading/analysis of hierarchies in the European urban system and analyses the role of the communication infrastructures on cities hierarchies, focusing on the impact of the European high speed network on the fluctuations in the cities hierarchy. The paper asserts that the hierarchy is influenced by the growing of this infrastructure only for the second level positions, while the head positions are not influenced by it. Romano Fistola's article if focused on the new connections, which high speed train allows to activate among the metropolitan systems and that give life to new urban macro-structures: the Joint City.

Adriana Galderisi and Andrea Ceudech present two articles. The first one analyzes the multiple roles played by roads and squares within the cities: "axes" supporting different mobility flows, including the pedestrian ones, and in the meanwhile urban places in which different activities take place. The article provides some guidelines and methodological elements, both for planning pedestrian networks and designing their elements taking into account the correspondence between foreseen uses and spatial features of each element, testing it in an application on historical and suburban areas of the city of Naples. The second article of Adriana Galderisi and Andrea Ceudech propose and in-depth investigation of the concept of mobility network vulnerability, in order to highlight the aspects mostly investigated and more recent research perspectives, with a focus on a case study in the Campania Region.

Giovanni Circella work discusses the role of parking as part of the policy packages for strategic planning aimed at increasing the sustainability of urban and metropolitan areas with an application at the city of Bari, starting from the hypothesis that the integration of parking strategies in a comprehensive vision for the future of a city may significantly improve the allocation of resources and the reduction of the overall environmental externalities. Roberto Busi article discusses issue of the safety of mobility in the urban environment with supporting elements and examples, also referring to the implications on the urban landscape.

Orianna Giovinazzi and Marta Moretti article is focused on waterfront revitalisation, trought a selection of case-studies at international level, according to the main 'ingredients' for a sustainable cohabitation between ports and cities and for a lasting success in waterfront regeneration processes.

The application section proposes two article. The Carmela Gargiulo and Fiorella de Ciutiis article aims at reading and interpreting the positive externalities, especially in terms of urban redevelopment, connected to the building of node/station of the High Speed railway network. Rosa Anna La Rocca article examines some European cases referred to promotion of soft mobility as a new lifestyle aimed to improve benefits on environment and urban livability.

The Focuses section is articulated into three article. The Carmela Gargiulo article aims at setting up a supporting tool for the public decision-maker for the location of parking areas within urban areas. The construction of this tool is guided by criteria referring more to urban and regional planning choices than to transport ones and concerning mostly the integration among environmental safeguard, activities distribution and need for mobility.

Massimo Pannacciulli and Giuseppe Trieste article focuses on the Mobility and Safety theme. Finally, in Mariano Gallo article simplified methods for estimating the external costs due to transportation in regional areas are proposed. The methods are based on data available by national and regional statistical sources and do not need specific surveys; they allow obtaining approximate estimates useful for a preliminary evaluation of transportation plans, policies and projects.

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Researches

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Impact of the High Speed Train on the European Cities Hierarchy

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ABSTRACT

The European space is marked by the recent beginning of the dualism nation-region. In it the cities take on a fundamental role because their success becomes the success of the territories around. Manuel Castell has maintained that the city is the social structure in which any territorial phenomena (from the economical development processes to the relations between classes or ethnic groups, from the public intervention to the financial accumulation) takes on its bigger strength because in it are concentrated the focusing in the territorial transformations. Obvious the cities are not the same, for physical or functional dimension; besides every innovation adds and modifies the relational system previously created. Aim of the paper is to analyse the factors generating the urban hierarchies to the European level and the impact on it of the new high velocity nets. In the first section it is carried out a reading/analysis of the hierarchies in the urban European system, as outlined in a series of studies. The second section analyses the role of the communication infrastructures in the building of the hierarchies and, in the third, is deepen the impact of the building of European high speed network on the fluctuations in the cities hierarchy. The paper asserts that the hierarchy is influenced by the growing of this infrastructure only for the second level positions, while the head positions are not influenced by it. One of the possible conclusion is that in a mature situation as the European territorial system, the urban structure seems to be well organized around poles with a strong persistence. This does not mean that a city could not climb the hierarchies, although this is possible only if a number of preconditions and of support policies are verified and with the remarks that this does not seem to affect the head positions, characterized by large stability.

City and territorial systems

The dualism between nation and region characterizes the European area since the Community policies have assumed the regional entities as reference entities like States and since the federalist (or separatist) pressures in some nations have, at the same time, widened; in this dualism the cities don't play an incidental role but, paradoxically, increase their importance because their success tends to become the success of the surrounding territories.

In 1983 Manuel Castell argued that the city, among the anthropic organized structures, is that where any spatial phenomenon (from the processes of economic development to the relations among classes or ethnic groups, from the public action to the capital accumulation) takes its greatest strength; moreover, just in the "urban arena", to borrow from Kirby (1995), the more polarized spatial transformations are concentrated.

The transformations of the world economic sphere after the 1960s have caused substantial changes in the relations between institutional actors. The focus has shifted from the leading role of national states to new relations characterized by concerted actions and partnerships; they have seen other players to assume an important role in the economic processes (Sassen 1997, Jacobs 2003), because the expansion of the free trade and the support of new communications technologies have accelerated the trend towards a greater liberalization and have led to a new geo-economic order where the centrality of the States is strongly disputed (Hill and Fujita 2003).

This new geography – and the resulting new form of the global economy – has created a global network based primarily (but not exclusively) on economic exchanges and focused on cities established as global cities (Friedmann 1998, Castells 1997, Sassen 1997), that are the places with the highest concentration of specific urban poles, as for knowledge, for management and for control of the production processes.

This repositioning was also aided by a reorganization of the States in order to increase the competitiveness of their cities (Brenner 1999), also at risk to reduce their role and their political importance.

Obviously, cities are not equal, both for physical size than for functional dimension; every innovation, moreover, adds and alters the relationship's system characterizing one moment of their history.

This paper want to analyze the factors that generate and measure the urban European hierarchies and to identify the impact on them of new high-speed networks. The first part of the paper is based on the analysis of a series of studies centred on the compilation of hierarchies in the European urban system; then the paper analyzes the role of communication infrastructures in the construction of the hierarchies and, finally, it deepens the impact of the European high-speed network on the cities and on their hierarchical position.

The urban hierarchies in Europe

The concept of hierarchy within a system of cities has been addressed by many studies both in America and Europe. It is universally accepted that it is in the nature of cities that they form hierarchies.

The "central place theory", for example, uses this assumption; Bourne in 1975 argued that the diffusion of innovations could be modeled as an expansion's process starting from the national cities and arriving at the less important centers. This theory is closely connected with the concept of "world cities": in the 1980s the researchers began to analyze it and to apply the model with special attention to the effective dynamics, asserting that they are not imposed by national and continental boundaries (Friedman 1986).

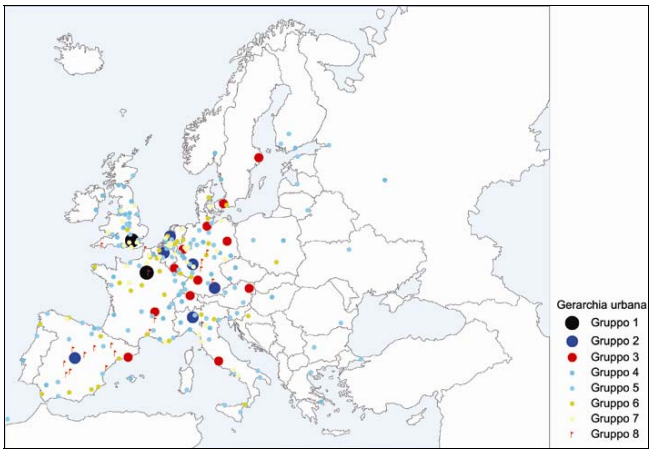
Previously, in 1966, Lukermann had stressed one of the critical factors of these researches: it is not possible to understand the relational complexity and the hierarchies among cities simply by considering the population and the contained functions; it is necessary, on the contrary, to extend the analysis identifying and measuring flows, exchanges, connections and relationships. In other words to determine a hierarchy it is necessary to go beyond a summary function or a system of measurable indicators and to introduce in the analysis also the network system, in order to highlight dependencies and relationships.

A lot of studies have analyzed the cities on the basis of the notion of "urban hierarchy". In general these classifications are based on measurable factors chosen to a certain result even if, overall, the variability of the underlying assumptions don't seem to affect too much the final result (Taylor 1997).

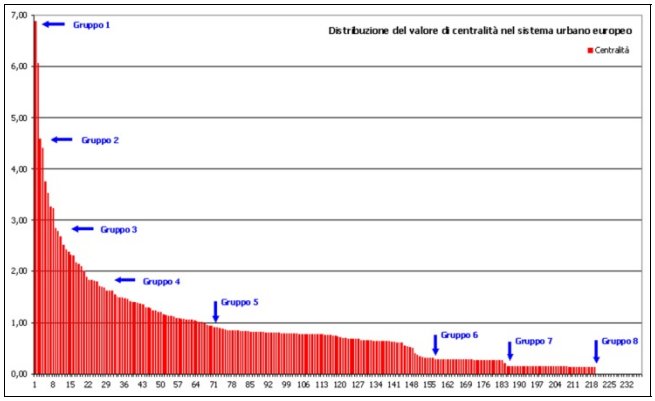
For example, Friedmann (1996) has produced a hierarchy of the world cities where the main factor is the presence of control and command functions of economic leader companies, namely the location of their head offices, deriving more than a hierarchy among cities, a hierarchy among economic systems.

Another very common factor for defining the hierarchy among world cities is the relevance of the infrastructure system, in particular related to air transport. This analysis generally provides an interesting state of the connections among the cities, able to highlight the economic and social development's mechanisms.

A third factor is the location of innovative service's production systems characterized as one of the strengths of the new global economy (Sassen 2000): all cities are service's centers, but in the new globalized economic system there are particular types of services able to meet new needs for a globalized system of activities. To carry out their activities, the global companies must locate where these activities exist and where information flows are continuous and reliable.



The synthesis of the analyzed researches defines a system of European urban centers that presents a stable hierarchy in the upper level. This hierarchy is less stable in the central and final positions



The distribution of the hierarchy's value in the European urban system . The table is the transposition of the Table 1

The studies on the hierarchy between the city have focused two key aspects:

1. the system of indicators needed to better delineate the hierarchies;

2. the hierarchy itself, namely the determination of the relevance degree of the city.

For the purposes of this paper the first step is the choice of a set of researches on the urban hierarchical cities, as follow. The aim of this step is to compile a framework of the choices made in the research sector.

a. DATAR, 1989. The research identifies 8 hierarchical classes and it is implemented on a series of economic variables, as the presence of multinational companies, the infrastructure's typology, the quality of workforce and a number of variables connected to the cultural economy, as special structures, exhibitions or production of information. The hierarchy is very influenced by the population. The classes are built by distributing the cities on the basis of scores from 16 to 90; the main three classes are well defined (the first includes only Paris and London), while the other four seem to have a somewhat arbitrary division (Lever 1993).

b. Beaverstock, Taylor, Smith, 1999. The study is organized in two parts. The first summarizes the result of 15 studies performed from 1972 to 1999, all focused on developing lists and hierarchies of world cities; are reported the cities considered in each list and the total of references in a range from 1 to 15. On these data our paper has founded a parameterization in 5 classes of the number of references: 1. 15 references, 2. 13 references; 3. 7 to 10 references; 4. 3 to 4 references; 5. 1 to 2 references. In the second part of the work Beaverstock and others propose a classification of world cities based on the presence of global services for business (accounting, advertising, finance, legal services). The list is consistent with the GaWC inventory of world cities and the breakdown of the 122 centers (the European are 53) in 6 classes has performed using a series of logical criteria (http://www.lboro.ac.uk/gawc/). The 6 classes are defined as follows: 1. world cities class alfa; 2. world cities class beta; 3. world cities class gamma; 4. cities with relative capability of transformation in world cities; 5. city with some capability of transformation in world cities; 6. city with minimal capability of transformation in world cities.

c. DATAR, 2003. The analysis involves the European cities with more than 200,000 inhabitants. DATAR researchers create the ranking with indicators related to some activities of international level (headquarters of large groups, port's moving, airport's passengers, international conferences, museums, universities and other) and with indicators related to productive activities, to economic diversification and to specialization. Cities are classified into 7 categories, namely: 1. world-class metropolis; 2. major European cities; 3. European cities; 4. cities of European importance; 5. potentially large cities of European importance; 6. cities of recognized national importance; 7. other cities of national importance (Rozenblat and Cecille 2003).

d. Taylor, Derudder, 2004. The paper focuses on the concept of "permeability". It identifies and determines the importance of the centers in relation to their ability to affect the system of connections between Europe and rest of the world. While the global route urban arenas are in strong connection with other territorial of the world, the city urban arenas are isolated into their geographic location, but they have good potentialities to connect with the European and the global levels. The resulting hierarchical levels are 5: 1. global route arenas with high levels of global connectivity (1A); 2. global route arenas with average levels of global connectivity (1B); 3. global route arenas with low average levels of global connectivity (1C); 4. European urban arenas (D2), 5. Trans-regional urban arenas (J3).

e. Hall, 2005. The paper is based on researches carried out as part of the European Space Development Project (ESDP). The hierarchy is formed by 3 classes of cities: 1. cities with high level of central services: it includes the main cities, whether or not national capitals, and the major centers belonging to the "European Pentagon".

   Within the European Union, these cities have the highest multimodal accessibility, are linked by large air corridors and are connected by high-speed rail lines. 2. gateway city or sub-continental capital: they are national capitals and major commercial centers outside the "European Pentagon". They usually are the hubs of the national airlines and the center of the high-speed rail system; they are not yet connected with the system of the Pentagon, although in many cases they are very close. 3. little capitals of provincial level. They are comparable to the former category but they are characterized by smaller cities affecting territorial spaces more limited for population and economic output. In many cases they are situated in the European periphery.

Each research analyzes a specific list of cities and proposes a specific hierarchical structure of the European urban system. In particular:

– DATAR, 1989: 159 centers divided into 8 hierarchical levels;
– Beaverstok et alia, 1989 (a): 29 centers divided into 5 hierarchical levels;
– Beaverstok et alia, 1989 (b): 122 centers divided into 6 hierarchical levels;
– DATAR, 2003: 180 centers divided into 7 hierarchical levels;
– Taylor et alia, 2004: 79 centers divided into 5 hierarchical levels;
– Hall, 2005: 39 centers in 3 hierarchical levels.

On the basis of the above-mentioned studies the paper has built a derived hierarchy based on the position occupied by a city in the mentioned works.

The first passage is the assignment for every K city and for every research of a score (n_K) ranging from 1 (highest hierarchical level) to z (minimum hierarchical level). The second passage is the standardization of the data using the reciprocal of the score ($1/n_K$) and bringing the scores in the scale 0÷1. In this scale, if the result tends to 1, the city is in a lead position, if it tends to 0 is in queue. The obtained results reveal the existence of three main groups of cities:

a. a group of European driving cities, with strong connections and ascendancies at the world level;
b. a middle group of cities, of international level but less uniform in their performances;
c. a group of national and over-regional level, very changeable and unstable.

It also shows the strong influence of advanced services and communications in the definition of hierarchies. For this reason the following passage has interested the analysis of the European high-speed network and the distribution of the stations. To this aim it has been necessary to insert in the list of the cities a certain number of centers with high speed nodes (in activity or planned) but not present in any of the six analyzed hierarchies. These centers have been added with a score of 0 in the cities data-base.

The role of communication infrastructures for the construction of hierarchies

The second part of the study focuses its attention on the role of communication's infrastructures in the construction of urban hierarchies. This aspect it has already been analyzed previously by a series of studies; the "growth-pole theory", destined to the analysis of the development poles, and other similar, highlights the benefits of agglomeration associated with the spatial concentration of people and activities. According to these theories, economic development in the geographic space doesn't distributed evenly and the imbalance, which is the normal state in the development, it is strictly related to the existence of differences among territorial poles, some of which present a greater development than others.

The phenomenon is related with the presence, the quality and the extent of the infrastructural system. Back in 1957 Myrdal had analyzed in his researches the polarization's effect of the most important infrastructures (ports, airports and railway junctions), arguing that they can change the existing hierarchies and that the most important transport nodes have, with greater capability, the makings of creating economic development and new regional disparities.

The existence of the disparities is accompanied by the evidence that an urban system is an interdependent structure of cities or other agglomerations related each other and connected on the basis of spatial and functional relationships that can be of two types:

– hierarchical, if the relationships are vertical and based on relationships usually one-directional (central places model);
– reticular, if the relationships are based on network of cities collaborating in multi-directional but horizontal ways (van den Berg and van Klink 1992).

The European urban system has structures referable both to the hierarchical model that to the reticular model. There are predominant cities (for example, London and Paris), but also independent networks of cities; in addition, the European urban system is continually changing and for its close interdependency the development of a center influences positively or negatively the other. Fundamental is the action of the subjects working in the cities, better if encouraged by the parallel actions of the local governments in terms of strategic policy and strengthening of economical positions. Also the impact of new infrastructures – in the case in point the high-speed railways – depends significantly on how the urban players react to the new opportunities offered by their construction and by the rising of external accessibility (Pol 2003); their action is important for to improve the position of the centers that cannot be changed by the simple creation of the infrastructure.

The increasing of type and quality of infrastructure means to improve the accessibility to that place. The accessibility is a key indicator to determine the advantage's increase of a localization over another; it is usually assumed that areas with better access could be more competitive, more productive and more appetizing than others (Spiekermann 2005). Due to their characteristics the accessibility's indicator is one of the most analyzed in the territorial studies and it is often a "border" element among different sectors, such as urban and regional studies and mobility studies.

Long-distance infrastructures connect the towns and increases the possibilities of interconnections and exchanges. It is possible that the building of high-speed networks influences the development and the transformation of the European cities system because it act in three main directions:

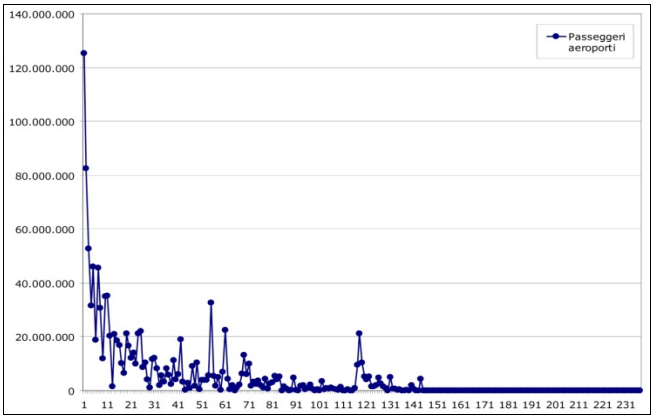
– strengthening of the existing hierarchy among the cities, especially as regards the positions of head, namely those of greatest importance;
– promotion and improvement of the position of intermediate cities;
– inclusion in the European hierarchy of new centers, with the final result of strengthening the urban grid system.

If one considers the high-speed network it easily verifies as the first European cities connected has been the well positioned cities in the continental hierarchy.The cause is simple: a significant number of inhabitants and a rich supply of industrial and tertiary activities ensure greater use of transport services and less time to return on investment.

The realization of the European high-speed network and its impact on the cities hierarchy

The above mentioned studies was the start point for structuring a database concerned 238 centers, each associated with the following data:

– population;
– hierarchical position of the center in the above studies;
– presence of high-speed railway in operation or planned;
– presence of one o more airport;
– number of passengers in transit in the airports.



Distribution of the passenger traffic in the European airports using the same urban hierarchy of the table 2. It is to notice the likeness of the two results

Aim of the analysis is the definition of a synthetic hierarchy to associate with the presence of high-speed railways nodes, used as a discriminating control's factor.

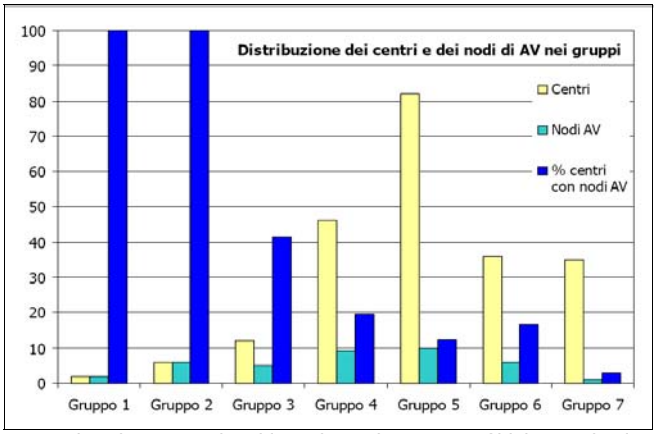
To this end, the data on the population and on the partial hierarchies have been standardized in the scale 0÷1.

The level of centrality of the city was used for the standardization of the data on passenger traffic in the airports, using an algebraic measurement's way: the calculation of centrality has been applied only to this data, using the total population and the total number of passengers as reference values. The used formula is the following:

$$C = S_i\text{-}P_i*(S_t/P_t),$$

where S_i indicates passenger traffic in the i_{th} center; S_t shows the passenger traffic in all the 238 centers; P_i indicates the population for the i_{th} center and P_t denotes the population in all the 238 centers. The results have been standardized in the range 0÷1, using the following formula:

$$x_s = (x_i\text{-}x_{max}) / (x_{max}\text{-}x_{min}).$$



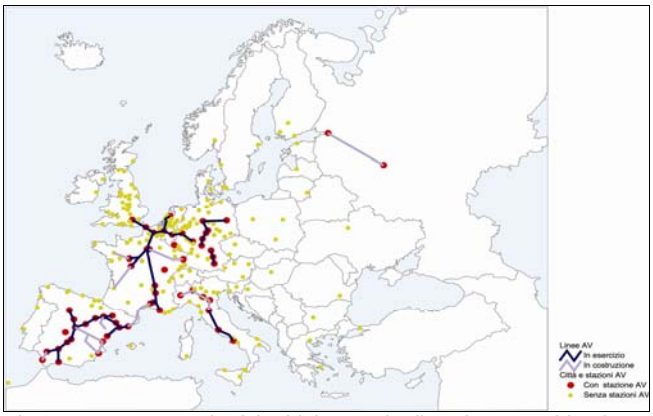
Comparison between urban hierarchy and presence of high speed train stations. The higher levels are totally equipped, but descending in the classes the number of centers with this infrastructure decreases

The final results show a hierarchy of centers in which it is possible to identify a sequence of 8 groups having homogeneous values (for the list of the cities see the note at the end):

– Group 1 (from 6.87 to 6.06): 2 centers, London and Paris, both nodes of high speed (100%).
– Group 2 (from 4.58 to 3.23): 6 centers (Frankfurt am Main, Milan, Amsterdam, Brussels, Madrid, Munich), all nodes of high speed (100%).
– Group 3 (from 2.84 to 2.00): 12 centers, of which 5 nodes of high speed (41.6%).
– Group 4 (from 1.89 to 1.01): 46 centers, of which 9 nodes of high speed (19.6%).
– Group 5 (from 0.98 to 0.50): 82 centers, of which 10 nodes of high speed (12.2%).
– Group 6 (0.39 to 0.20): 36 centers, of which 6 nodes of high speed (16.7%).
– Group 7 (from 0.14 to 0.13): 35 centers, including 1 high-speed node (2.9%).
– Group 8 (0.00): 18 centers that do not belong into any of the hierarchies analyzed at the start, but have the characteristic of being all high speed nodes.

The reading of the results clearly shows the persistence of the European hierarchical system and a very high correlation between

position in hierarchy and equipment of high-speed nodes.The cities belonging to the upper two groups in fact have nodes of high speed, while, proceeding from third to seventh group, the percentage of centers with high-speed nodes reduces with a fairly regular pattern.



The European network of the high speed rails. It is to consider that a train for the high speed can also run on normal railways lines

It's therefore manifest the need to shift the focus towards the hierarchical intermediate and lower positions because it is exactly within these that major changes will occur.

If the driving-cities are favoured in the maintenance of their positions, what happens to the intermediate cities? Are they hopelessly doomed to be still or can they assume positive evolutionary processes? The results suggest as probable that the cities positioned in the central and closing positions are deeply interested by the potential changing processes descending from the inclusion of new infrastructure, as that connected with high speed railways.

On this question it is necessary a reasoning more deep.

A first consideration derives from the comparison between the hierarchies discussed in the first part of the paper and the hierarchy above built. From this comparison happens a different instability between the lead and the secondary positions: while the former are seized by the same cities in all the classifications (low flexibility), the latter are highly variable and the position differs considerably in a lot of cases (high flexibility).

Which are the causes of the phenomenon? The possible answer is that the presence of marked differences between two centers in relation to the supply of a function tends to grow or, at least, to stabilize the differences; this happens moreover always to advantage of the stronger city.

Moving to the mid-low position of the hierarchy the fluidity is due, probably, to the indicators used in the research but it also depends by an objective factor, namely the ability of these centers to throw their presence on the international scene after the inclusion of new functions and new poles of attraction including the creation of nodes of high-speed networks.

A second consideration is that the connection with high-speed networks makes the cities more attractive to those activities in which national and international interactions are essential; besides, the activities located in a more or less extensive area around a node of this type can gain strong positional benefits influencing also their hierarchical position of the host city and increasing the gap to disadvantage of the empty cities.

This means that the node can create a polarizing force on the regional economy, making stronger the urban areas that already have a leading position and encouraging others that are equipped of new infrastructures.

A third consideration interests the relations between urban center and nearby areas because the carrying out of an high-speed node represents a factor establishing new centralities and influencing with some effects the location's preferences of economic activities. The more dynamic of them tend to move to the new centralities to take advantage of the connection's speed; others, more traditionalist, refuse to move thinking that to maintain a peripheral position helps them better manage their market areas for less rivalry.

If this is true, it is equally true that the possibility of scaling the urban hierarchies depends on two factors:

1. the temporal distance between a center and the nearest with an higher level (ability of the lower center to become a support pole of the bigger);
2. the overall policies attending the action on the high-speed node with diversified operations, such as the construction of intermodal networks reaching the local node and encouraging its use and sustainability (European Commission 2001) or the plugging in of innovative and qualitative functions for making attractive a center and a territory.

Conclusions

The paper has analyzed the urban hierarchies and the factors influencing them; it has assumed that these hierarchies can be changed more easily in the central and final positions.

In a mature situation as the European territorial system, the urban structure seems to be well organized around poles with a strong persistence. This does not mean that a city could not climb the hierarchies, although this is possible only if a number of preconditions and of support policies are verified and with the remarks that this does not seem to affect the head positions, characterized, as said, by large stability.

In the past the urban research said that the electronic communication and the dematerialization of the work's location would have a disruptive impact on cities. We have seen that this has not happened, as the example of a lot of cities apparently going to an irreversible decline shows.

This has led to revisit the starting assumptions, and to argue that the current information's and electronic society acts on the cities as well as in the past all the economic activities have acted, i.e. emphasizing the leadership role of cities: in addiction the current economy's structure tends to encourage even more the existing hierarchies, given the high concentration of knowledge and skills necessary for its running.

Is it possible to suppose that this it also happen with regard to mobility and that new infrastructures (including those for high-speed) can only act supporting the prominence urban positions rather than to go against them.

Notes

Group 1: London, Paris

Group 2: Frankfurt am Main, Milan, Amsterdam, Bruxelles, Madrid, Munchen

Group 3: Hamburg, Barcelona, Rome, Zurich, Luxembourg, Copenhagen, Berlin, Wien, Stuttgart, Lyon, Stockholm, Dusseldorf

Group 4: Lisbon, Athens, Geneva, Dublin, Manchester, Edinburg, Cologne, Bologna, Rotterdam, Prague, Helsinki, Budapest, Strasbourg, Hannover, Bordeaux, Warsaw, Bristol, Leipzig, Glasgow, Basel, Marseilles, Oslo, Turin, Antwerp, Leeds, Lille, Birmingham, Bratislava, Bonn, Grenoble, Seville, Bilbao, Nuremberg, Goteborg, Moscow, Newcastle upon Tyne, Dresden, Liverpool, Bern, Belfast, Palma, Nottingham, Rennes, Southampton, The Hague, Genoa

Group 5: Sofia, Venice, Malaga, Toulouse, Nice, Florence, Aberdeen, Nantes, Thessaloniki, Bari, Eindhoven, Palermo, Trieste, Cagliari, Verona, Catania, Freiburg im Breisgau, Kiev, Utrecht, Munster, Clermont-Ferrand, Rouen, Liège, Leicester, Aachen, Mannheim, Bremen, Cardiff, Nancy, Graz, Charleroi, Poznan, Taranto, Valladolid, Augusta, Oporto, Zaragoza, Linz, Santander, La Coruna, Hanseatic city of Lubeck, Metz, San Sebastian, Bielefeld, Saint Etienne, Le Havre, Kingston upon Hull, Plymouth, Cordova, Sheffield, Luton, Istanbul, Las Palmas de Gran Canaria, Neaples, Mulhouse, Bergamo, Vilnius, Tallin, Salzburg, Derby, Riga, Osnabruck, Bournemouth, Valencia, Saint Petersburg, Blackpool, Tampere, Turku, Erfurt, Southend on sea, Parma, Vitoria Gasteiz, Magdeburg, Dortmund, Reggio Calabria, Essen, Mönchengladbach, Bucarest, Lausanne, Ljubljana, Wiesbaden, Avignon

Group 6: Malmö, Montpellier, Granada, Cracovia, Cadice, Angers, Padova, Gand, Aarhus, Cannes, Tarragona, Brest, Pamplona, Digione, Gijon, Alicante, Orleans, Tours, Arnhem, Nimega, Reims, Brunswick, Karlsruhe, Lens, Valenciennes, Haarlem, Enschede, Saarbrucken, Brescia, Kassel, Kiel, Messina, Vigo, Coventry, Murcia, Zagabria

Group 7: Groninga, Bochum, Swansea, Chemnitz, Stocke on Trent, Halle sul Saale, Rostock, Portsmouth, Breda, Tolone, Brighton, Salerno, Middlesbrough, Darmstadt, Preston, Leida, Coblenza, Mons, Heerlen, Caserta, Chatham, Carrara, Aldershot, Bethune, Dordrecht, Le Mans, Livorno, Modena, Odense, Tilburg, Oviedo, Amiens, Wuppertal, Caen, Duisburg

Group 8: Marne-la-Vallée, Nimes, Castellon de la Plana, Reggio Emilia, Wurzburg, Lerida, Ingolstadt, Gottinga, Guadalajara, Toledo, Calais, Ciudad Real, Valence, Fulda, Segovia, Puertollano, Huesca, Calatayud

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The Joint City

High Speed Train, New Urban Proximity and Macro-Functional Urban Systems Generation

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ABSTRACT

The new connections, which high speed train allows to activate among the metropolitan systems, seem to be able to give life to new urban macro-structures for which the transfer time, among the main poles of the railway segment, becomes comparable to an inside moving into the city and therefore considered as an inter-functional mobility. The tunnel effect generated by the high speed connection seems to be able to allow a new temporal and functional joint among the metropolitan systems consequently supporting the possibility, for the users, to move themselves among the different urban functions belonging to the different cities. The birth of these urban aggregations seems to drive towards new megalopolis, which we can define for the first time with the term: *joint-city*. For this new metropolitan settlement it seems to be very interesting to investigate the constitutive peculiarities, the systemic articulation, its relational structures, the evolutionary scenerios, and so on. The urban functions (activities) can be considered as structures of relationships between people that allows to define "organizational links" inside the community; the urban functions are located in specific places inside urban container or in open spaces.The urban functions represent the urban engines and the functional system can be thought as the “soul of the city", abstract but essential to its survival. In the definition set out here the analysis is carried out for many interconnected urban functional system points (specifically those in Rome and Naples). The new high speed railway has to be considered not only as a new channel of mobility between cities, but as a real possibility of joint between the functional systems of the two centres. A final consideration can be carried out in relation to the possibility of implementing new measures of governance of urban transformations considering the new macro-city: the "Joint City".

Introduction

This article starts the discussion on new configurations that urban systems, linked by the High Speed Train (HST), will have in the future.

The formulation is based on the systemic interpretation of the city which, in the Seventies, has seen many scholars theorize the possibility of a new approach to the study of urban phenomena. In the early Nineties some urban economists theorized the possibility of halting the decline of large urban systems by considering new possibilities of phisical and immaterial connections between them (with particular reference to high-speed railway and low cost air travel) which will be able to support the emergence of new metropolitan integrated “organizations”.

Objective of the paper is to catalyze a research interest on new urban structures, suggesting some first thoughts on potential relationships that arise in cities connected by HST and foreshadowing a future development of the study based on the deepening of a new function of integrated "accessibility” to urban activities.

High speed train and the birth of the "joint-city"

New connections, new link between the metropolitan areas allowed by the HST, seem to be able to create new macro-urban structures for which the transfer time between the poles of the rail track becomes comparable to a transfer inside the city and then accepted as a basic functional mobility.

In other words getting a site in the center of Rome from the center of Naples, where the central station is located can cost, in terms of time to Naples city-user (Martinotti 1993), just over 60 minutes, which becomes a time comparable to an urban transfer considering a couple of modal interchange and the related waiting times. The tunnel effect created by high-speed connection tends to produce a temporal/functional junction between metropolitan systems thus supporting the possibility for the user to move between urban functions belonging to different cities.

The birth of these junctions seems to lead towards new urban mega-cities, defined “joint-city”.

For these new macro-cities t is very interesting to investigate the constituent characteristics, composition system, the relational

structure, the evolutionary scenarios, and so on. Moreover, the new possibilities of interconnection between the cities, partly due to joint-city, have already been analyzed on a larger scale, considering the increasingly frequent intercontinental travel among the global cities (Sassen 2001). This phenomenon is particularly considerable for New York and London giving life to a SuperCity named: “NyLon" by Colum McCann.

A new functional system

The systemic approach goes back to the theoretical definitions that von Bertanlaffy developed in the General Systems Theory and other scholars took up adapting to different scientific fields (von Bertanlaffy, 1971).

A conceptual scheme of the the two urban subsystems

Within the study of urban phenomena contributions, Mc Loughlin and Gibson are two of the main references still useful for reflection on the city. The systemic approach, also understood as a conceptual framework (Palermo 1992), still appears among the paradigms for the interpretation of urban complexity (with different interpretations, adaptations and evolutions) that allow effective analysis studies and propositions of Government's procedures of urban transformation and planning. Derived from this approach there are interesting ideas and propositions of new urban models among which it seems useful to mention the "Fractal city" (Batty and Longman 1994).

Using this approach, also considering the contribution of Regulski in the early eighties, it is possible to think the city as a system composed of elements between which there is a structure of interactions or as a set of nodes and links between them.

Among the various properties of the system it should be considered, in particular, the one pointing out sub-systems components and according which each system is contained in a larger system (meta) and its parts are themselves systems (sub-system) (Regulski 1981).

Starting from that assumption, we can say that among the various sub-components of the urban system especially two can be identified: the functional system and the physical system, which Regulski describes as "space structures".

This conceptual distinction is not reflected in reality where the two systems are inside an indivisible one, but the abstraction is required to build the systemic interpretative model. The system on which it's interesting to draw attention is the functional one. The functional system (FS) made by urban activities (functions) and by the relationships among them (interactions). The FS is characterized by particularly dynamic evolution primarily attributable to an internal characteristic of the system concerning the internal relationships. The "structure" of the functional system (made by the interactions) consists of the relationships between the parts.

It is therefore easily to understand how the system evolution produces changes in the structure of the parts and then changes the status in the sub-systems which, consequently, generate changes inside the urban system as a whole.

The FS, as mentioned before, is composed by a set of related interacting elements. In the interpretive model it represents the cornerstone of the whole conceptualization, contains as constituent parts, the principles of operation and development of a city: the urban functions.

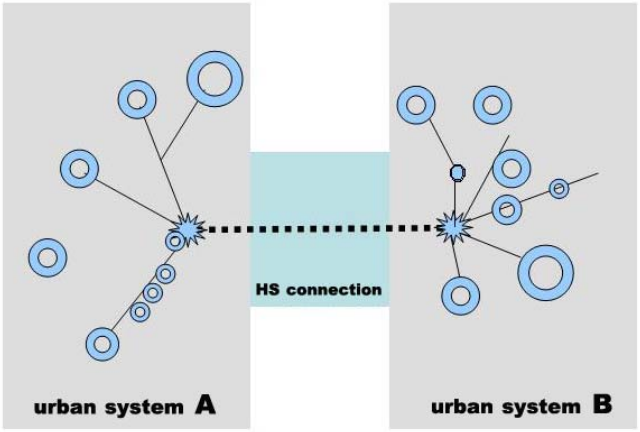
At this point it seems necessary to defined primarily the concept of "urban functions" or otherwise to specify the meaning that this study wants to adopt.

The definitions of urban function are numerous and generally "reflect" the disciplinary fields in which they were developed and adopted. However, it’s possible to say that we can reconduct the different definitions towards two basic formulations: the sociological/geographical matrix and the systemic interpretation of urban phenomena.

The first formulation assumes that: "urban functions can be understood as any activity that in any historical period were carried out in places where the population was densely concentrated" (Gottmann 1988); other authors consider the urban function as a city activity (such as residence, mobility, trade, manufacturing, education, etc.). "which meets the needs of the city, both internal and external to it, and thus justifies the very existence of the city as an organized social unit in its dealing with larger regional entities, national entities, international entities" (Dematteis 1993).

The second type of definitions refers more closely to the specific urban functions capability to transform a place into a city; this assumption would emphasize the existence of the link between functional and physical system. In this sense it becomes crucial to

understand the nature of urban activities in relation to their potential to convert a site into a city.
The functions are therefore the main reasons for urban existence and in some cases are specific generating element of the city (think for example to the holy-cities).
Again, to make the concept better, it is possible to think to a city without urban activities (and therefore no functional system and in which there is only the physical system) like a "ghost town"; basically a city without functions is a non-city. As such it can be concluded that the city is the: "place of urban functions" (Fistola 1993). They can be thought of as structured and organized collective actions in space (education, healthcare, production, etc..) that are essential to city living and are located on specific places of the physical system. Mobility is the only urban function which is developed trough the urban space.



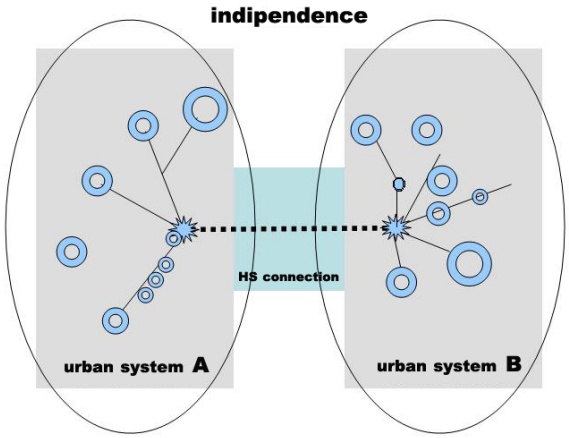
The high speed connection between the two urban systems

Finally, and reflecting in part a definition already provided elsewhere, we say that the urban functions can be considered as relationships structure allowing to define the "organizational links" of the community.
The functions are located in specific areas and physical containers inside the physical system (eccept for mobility) and represent the urban engines (Fistola 1993); the functional system is "the soul of the city", abstract but essential to its survival.
When creating new connections between previously separated functional systems, supported by the deployment of physical infrastructure (such as HST), it's possible to envisage the emergence of new urban organizations, multi-urban areas, macro-functional resettlement of "joint-city" whose features and charateristics are all to be explored further and offer an interesting field of reflection for the research in urban planning.

Functional relationships between two metropolitan contexts (a taxonomy)

The birth of the joint-city seems to open up new perspectives in the analysis of systemic features of these innovative urban settlement. To start the new in-depth study it is necessary to outline the phenomenon and to carry out a new taxonomy for the different types of relationships established by the cities.
As already highlighted by interesting contributions (Urena 2005) it is possible to propose a taxonomy of the functional behaviors of urban systems connected by HST lines, focusing on the reciprocal role that urban systems can play. Trying to develop further reflection it seems possible to observe that the HST connection can generate, in a first approximation, five main types of relationships:

Independence
The two systems are connected by the high speed connection (HS), but the link does not produce any appreciable effect on urban externalities or even on the frame and functional extension of each one. The HST plays a role of mere support to the physical transfer, but does not affect the functional composition of cities.



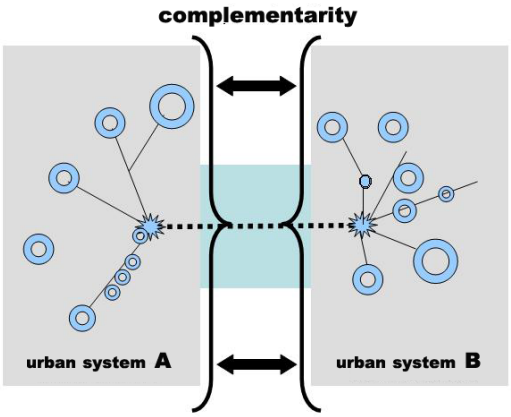
The two cities are functionally independent

Complementarity
The two systems join their functional structure but there should be no real cooperation between them. This type is due to the union of two sets that do not produce, however, a new structure of relations and therefore a new system.
Anyway it seems interesting to consider the large size and variety of functions that the "merge" of the two systems is able to offer to urban users.

Subsidiarity

The two systems share and establish cooperative relationships supported by new administrative procedures, government processes, protocols, good communicators, etc..

The two systems also cooperate mutually and can promote a common functional development.

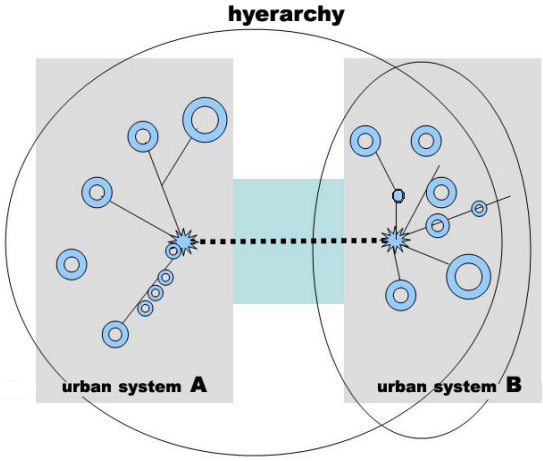


The two urban systems are complementary and integrated

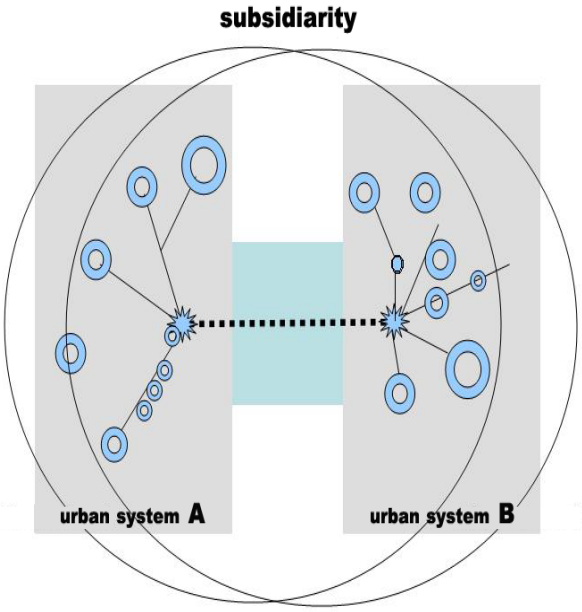
Hierarchy

The two systems establish a hierarchical relationship of cooperation between them.

This kind of relationship designates a dominant system over another (or several) that, in reference to the first, acts at a functional lower level. The level of action, however, is subsidiary of synergy than the main reference.



The two cities are hyerarchically connected



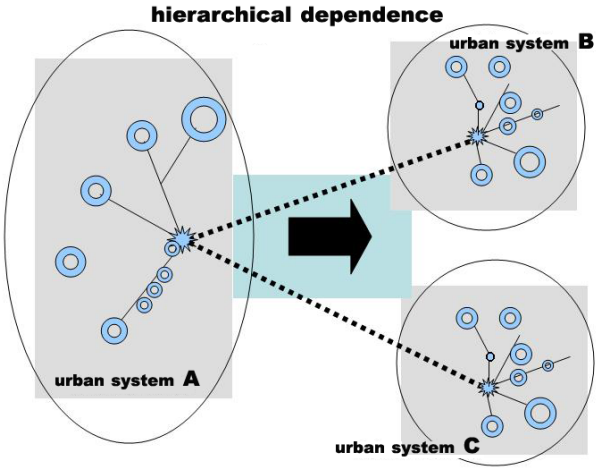
The two cities generate cooperative and synergistic relationships

Dependence

The system establishes, in this case, a hierarchical relationship in which the dependent system (one or more) is subordinated (as regards few functions) to the first and receives almost "passive" streams of users without obtaining a benefit (development effect) thanks to the interconnection.

If that functional type is determined, the dependent system (or systems) may loose its metropolitan role.

By adopting the proposed classification for the joint city: RoNa, made by Rome and Naples, it's possible to see that the absolutely dominant role that the Italian capital is able to play in many functional aspects (administration, travel, residence, culture, etc..) could set up a hierarchical relationship of dependency expressed by Naples, which is undergoing a pervasive functional crisis (administrative and management) at present. A reflection set according to these patterns may support the development of new policies and measures to develop functional Neapolitan urban centers that could be implemented even considering the new rail infrastructure.



The urban systems are in a hyerarchical relationship and the urban systems B and C are in a passive state

Interconnected functional centers: a study of accessibility

As just shown, the joint-city is generated when the two interconnected cities join their functional structures; such connection generates a relationship that becomes a harbinger of new urban development. It is anyway important to consider the mobility choice, taken by the city user, in order to get an urban function located inside the other city. Overturning the concept it is possible to say that a joint-city is generated when there is an high level of reliability, comfort and punctuality of trains and the possibility to work on-board (due to presence of fast Internet connection); but above when all the urban functions, allocated in the two cities, are able to produce an high polarization. This can be measured by functional specialization, the rarity of the activity provided but above all by the physical accessibility to the place of function allocation in relation to the railway station. It is not an objective of this paper to propose a specific focus on accessibility to urban functions but to provide a first indication, which could lead towards future researches, about the estimation of the potential polarization of urban functions (Schönfelder and Axhausen 2002), through a redefinition of the classic formula of the accessibility which considers the relationship between attractiveness and impedance. The elements proposed and listed below could therefore be also distinguished between the quantity to be included in the accessibility numerator (attractiveness) and the quantity to be considered in the accessibility denominator (impedance), for a function that should be reached by a city user located inside the joint urban system. In a first approximation it seems useful to envisage a linear function, not weighed, enabling it to assess the effectiveness of the formulation. Among the variables to consider, in qualitative way as well, you might consider the following:

A) direct connection with the final pole through a subway station;
B) distance from the pole of HST (station);
C) number of connections (possible);
D) quality of the connections;
E) accessibility of the cluster (total stops to reach the pole);
F) number of interchanges on railway;
G) number of intermodal trade;
H) average distance between stops on railway;
I) interchange times in the the pole (accessibility to the metro);
K) average wait for metro interchange.

The variables shown may be settled inside indicators or given directly to the accessibility function after appropriate standardization. In this case the numerator contains the standardized sum (with the introduction of enentual weights) of the variables A, C, and D and the denominator contain the sum of the remaining standardized. That indicator expresses also a measure of the network connection of the various functions located inside the territory. In the final paragraph we will attempt an estimation of the function for a single urban activity by identifying the origin and destination activity respectively in the two centers interconnected. Finally it should be noted that the urban functions can have a different interconnection capability and effect of interrelation. For example, health, tourism, research, etc.., leading to a strong functional junction between the joint systems, while other activities such as: residence, finance, etc.. leaves the system in a substantial independence. A special focus on these polarizations may offer interesting perspectives for the definition of urban government policies.

Health function

In this final section it's proposed an example of a functional connection analyzed for the health function. This analysis could be further developed by distinguishing among different relationship typologies that can be generated between the functional centers (patients, doctors, medicines rare, blood, organs, etc.). It also possible to consider the eventuality that during the transfer, in case of of a medical team with the possibility of Internet access on-board, a tele-meeting can take place before the medical intervention. Health is an activity that must be articulated according to a widespread attitude in the metropolis but, in large cities it is concentrated in specific poles (polyclinics). In the city of Rome and in Naples there are such macro-functional poles characterized by different location peculiarities: in the case of the roman general

hospital, the complex is located in an area close to the rail terminal and is immediately reached by the metro line B through a specific stop. The estimated time to reach the main hospital stop (called: Policlinico) from the Termini central station is about 3 minutes. The case of Naples is substantially different, where the macro-functional medical pole is located on the hills of the city and is reached by the metro line 1; the line climbs over the hill of "Vomero" and, in the next few years, will be directly connected with the Naples central station. At the moment it is necessary to make an interchange at the station "Cavour" where it is possible to switch from line 1 to line 2, which connects the central station with the area of "Campi Flegrei", the west part of Naples. The total displacement between the two macro-functions may require, in terms of average time, about 2 hours, which can, in any case, be acceptable for patients who require medical consultations, specific diagnostic tests or treatments. To support the link between medical facilities and, hopefully, the birth of a "network" between the health units of the two joint cities, you may create an information system (data-base) for common access, able to manage the patients between Rome and Naples. It should also be given the opportunity to propose administrative protocols connection between the functional systems so as to support the transfer from one to another immediately.

Conclusions

The aim of this paper was to offer some thoughts that could catalyze a research interest on the new interconnected metropolis (joint-city), which have been created thanks to new connections between the functional systems of two or more urban centers linked by HST. At the end it is possible to observe that, firstly, the possibility of creating a joint-city is heavily influenced by travel time in HST, between the metropolitan centers and, consequently, between urban functions inside of them. Some recent studies indicate that the isochronous drawing the boundary of the potential users area of urban functions is 1.5 h.. It should however be noted that these studies make an analysis being centripetal and not interconnected. In other words, the catchment area that is generated as a result of travel time that a user is willing to employ to reach the site of the function, which acts as central node within the urban system. In the definition set out here the analysis is conducted for multiple interconnected systems (specifically those in Rome and Naples); the HST must not be considered as a new channel of mobility between cities, but as a real possibility of union between the functional systems the two centers. However the time of 1.5h./2h. appears useful for the establishment of the interconnection. A further observation can be carried out in relation to the possibility of putting in place new measures of governance of urban transformations considering the "joint-city".

Interesting synergies and relationships of subsidiarity between functions could arise by allowing a new, more efficient and specialized service supply.

To fully understand how to articulate government action it might be interesting to construct an array: activity/type of relationship showing, for each urban function, what type of interconnection (including those listed, but probably it can also identify other sub-categories), is to establish.

We could therefore generate a joint-city in which some functions tend to settle in virtuous cooperative ties and other relationships that tend to strongly hierarchy or dependency.

In this sense, the result would be that of a joint-city functionally characterized for the health, tourism, etc., which represent the new macro-centres of the new territorial structure.

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Soft Mobility and Pedestrian Networks in Urban Areas[1]

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ABSTRACT

By referring to the wider strategies set up, starting from the middle of the Nineties, by the European cities to promote a sustainable urban mobility and to the more recent concept of soft mobility, which generally includes pedestrian and cycling mobility, this contribution focuses on pedestrian mobility in urban areas, outlining criteria and methods for planning and designing networks of urban public open spaces, such as roads and squares, devoted to an exclusive or prevailing pedestrian use. First of all, the paper analyzes the multiple roles played by roads and squares within the cities: "axes" supporting different mobility flows, including the pedestrian ones, and in the meanwhile urban places in which different activities (commercial activities, meeting, and so on) take place. Grounding on that, the main reasons driving toward an organization of such spaces as urban networks have been outlined. Then, some guidelines and methodological elements, both for planning pedestrian networks and designing their elements taking into account the correspondence between foreseen uses and spatial features of each element, have been provided. Furthermore, the links between the pedestrian networks and the main junctions of other urban mobility networks, as well as between the first ones and the urban contexts have been stressed. Suggested guidelines and methodological elements have been applied and tested both on historical and suburban areas of the city of Naples; nevertheless they represent only a first step towards the setting up of a method for pedestrian networks planning and design in urban areas.

Sustainability and pedestrian mobility

The improvement of the pedestrian and cycling mobility, especially in urban areas, is a key action to reduce the huge environmental costs of the motorized transport which is still today the main transport mode for urban and regional travels.

This action constitutes a segment, even though remarkable, of wider strategies targeted to promote sustainable mobility, especially in urban areas.

By the mid Nineties, the Aalborg Charter (1994), signed by many European cities to promote a sustainable urban development, singled out, among the key principles for re-directing urban development, the improvement of sustainable mobility, especially walking, cycling and public transport, and assigning priority to environmentally friendly means of transport. Starting from the end of the Nineties, many initiatives took place in Europe with the aim of opposing to the spread of the cars favoring a sustainable urban mobility, through policies aimed at innovating modes and means of urban transport, strengthening public transport, especially rail transport, and encouraging walking and cycling (Galderisi 2007).

In 2004, during the Fourth European Conference on Sustainable Cities, the Aalborg Commitments have been approved. Among the strategic commitments of European local governments, the followings are identified:

– the reduction of the need for private motorized transport and the improvement of effective and accessible alternatives;
– the increase of the amount of travels through public transport, walking or cycling;
– the spreading of low-carbon emission vehicles;
– the development of integrated and sustainable urban mobility plans;
– the reduction of the impacts of the transport sector on the environment and the public health.

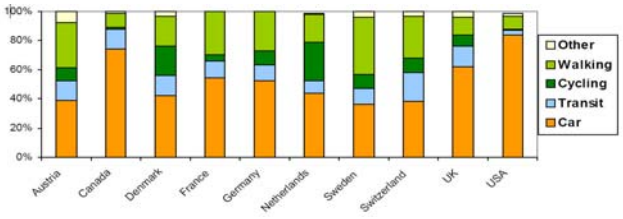
All the mentioned documents underline therefore that, beginning from the second half the Nineties, the need of steering urban mobility toward sustainability had been progressively established in Europe, assigning centrality to the pedestrian and cycling mobility, increasingly identified as key components of the so-called "soft mobility", which imply the exclusive use of the human physical capacity (Ministère des transports, Ministère des Travaux Publics, Ministère de l'Intérieur et de l'Aménagement du territoire 2008).

This is a relevant step toward a sustainable urban development: pedestrian mobility, although representing a remarkable part of urban mobility, has never been considered, indeed, as a transport

mode with autonomous dignity. Grounding on an approach to urban mobility mainly developed into the filed of transportations studies, pedestrian travels have been neglected for a long time or considered as spontaneous movements which do not require specific plans or design rules: for long time, walking has not been interpreted as one of the transport modes, perhaps because it doesn't involve the use of vehicles or because it represents the basic mean of movement. However, walking is the most vital mean of transport, the one on which all the activities of a community depend. On the other hand, the relevance of walking into the transportation system of any city was already recognized in the Sixties by the Buchanan Report (Ministry of Transport 1963). The lack of consideration of pedestrian movements is also evident in traditional surveys related to the subdivision for transport modes of the whole of urban travels. In these surveys, in fact, the only travels generally considered are those exclusively made on foot, by cycle, by public transport or by car: short or connecting different transport modes travels – which are generally made on foot – are generally neglected (Litman 2006).

Moreover, the close dependency of soft mobility on the ways of organization of the urban spaces clearly emerges comparing data related to the diffusion of walking or cycling in European and American cities. European cities are characterized by historical fabrics built up before the spread of the car, by high residential density and by the presence of many heterogeneous activities, while American cities, often built up according to a car-based transport model, are largely characterized by low residential densities and by mono-functional urban areas.

At the end of the Fifties, indeed, Lewis Mumford invited to reorganize the city centers for the pedestrian movement: a careful quantitative analysis showed the inefficiency of the private transport in comparison with both the public and the pedestrian transport, asking for assigning to pedestrian travels a key role in the wider urban transport system. "But to bring the pedestrian back into the picture, one must treat him with the respect and honor we now accord only to the automobile." Mumford stressed the need to revitalize the pedestrian movement, rethinking the overall organization of the city: "(...) if we are to make walking attractive, we must not limit provide trees and wide pavements and benches, beds of flowers and outdoor cafés (...): we must also scrap the monotonous uniformities of American zoning practice, which turns vast areas, too spread out for pedestrian movements, into single-district zones, for commerce, industry, or residential purposes. (...) Where urban facilities are compact, walking still delights the American. Nothing would do more to give life back to our blighted urban cores than to re-instate the pedestrian, in malls and pleasances designed to make circulation a delight. And what an opportunity for architecture!" (Mumford 1956). It seems clear, therefore, that encouraging the urban pedestrian mobility requires not only the recognition of the pedestrian travels as primary mode of transport inside the city but, above all, the reorganization of urban places that, both in the historical town and in the peripherical areas, are devoted to an exclusively or prevailing pedestrian use: particularly, streets and squares. These latter, in fact, although not exclusively devoted to pedestrians, represent the key places for pedestrian travels, even the short ones, inside the city. It is clear, in fact, that while the exclusive pedestrian use is the distinctive factor of the green urban open spaces (parks, gardens), the public open spaces such as streets and squares, also when they was built-up for pedestrians as in the case of historical towns and characterized by the presence of activities strictly connected to such use (commercial activities, touristic activities, etc.), are currently mainly characterized by a mixed use pedestrian-vehicle or, more generally, by the coexistence of different transport modes, including the pedestrian one. Very often, however, mixed uses often clash each other: the coexistence of cars and pedestrians has become, with the increasing growth, since the last century, of the car flows, more and more difficult, although the conflict among pedestrians and vehicles was already present in ancient Rome: for example, the first restrictions to the passage of vehicles inside the city were imposed by the Lex Julia Municipalis in 45 a. C. that prohibited the movement of wagons within the city from the dawn to the sunset, except for the transport of materials for public works or resulting from public demolition (Hass-Klau 1990). Despite the growing conflict among transport modes not always compatible one with each other, streets and squares still play multiple roles within the city: such spaces, in fact, not only represent places which support different types of travels but they are also required to partially satisfy the whole urban demand for leisure and social aggregation. As very well described by Gehl (2003), in fact, these spaces are the main support to different types of activities that the author distinguishes in necessary, optional and social.



The graph shows the high heterogeneity in the distribution of urban travels by mode of transport among European and not European countries. In particular, it is possible to note that the "walking" has very little relevance in countries such as the United States and Canada, where the cities had a car oriented development.

The first ones are those that take place every day without taking into account weather conditions or quality of the surrounding environment, such as to go to school, to go shopping, to wait for a bus, etc.
The second ones can be instead favored or promoted by the place features, since these optional activities are freely chosen, such as walking or sunbathing.
The third group of activities refers to those activities essentially addressed to social aggregation in public spaces, such as playing, meeting, chatting etc., but also the whole of passive contacts among people like to simply look each other.
It is quite evident that the quality and the attractiveness of public open spaces largely depend on the interlacement and the combination of these different activities: according to Gehl (2203), life among buildings is not only characterized by pedestrian flows but it includes the entire spectrum of the mentioned activities. Public open spaces are, therefore, certainly devoted to mobility but, above all, they represent urban places characterized by multiple uses, from walking to meeting and shopping; moreover, they can usefully contribute to promote social relationships but also, on the opposite, to increase the sense of insecurity and exclusion in the city.
In relation to the multiple roles played by these spaces in urban areas, it is clear that in order to promote soft mobility and, more specifically, pedestrian mobility, there is the need to look at them not only as channels supporting different types of travels, including the pedestrian ones but, above all, as urban places, included in specific urban contexts, and devoted to support a plurality of activities.
Until today, in fact, the numerous interventions of pedestrianisation on individual streets or squares have had heterogeneous results, depending on the different starting conditions. In many cases, their implementation was not capable to trigger a process of effective improvement of pedestrian travels in the urban area. Moreover, pedestrian spaces are often interested by uses scarcely respondent to or coherent with the primary purposes (Gabellini and Bonfantini 2005).
Grounding on these considerations, in the following paragraphs methodological guidelines for singling out networks of urban open spaces devoted to the pedestrian mobility – focusing on the reasons that favor their organization as a network – will be provided. Moreover, some guidelines driving the "project of use" of each element of pedestrian networks in order to achieve a better coexistence among the different activities that public open spaces have to support and to improve, in the meanwhile, the congruence between foreseen uses and spatial features of each element, will be presented.

From planning to design urban pedestrian networks

The need for organizing public open spaces as a network is at present widely shared, at least in reference to particular categories of open spaces such as green areas that, although located in urban areas, are primarily characterized as natural areas.
In relation to the latter areas, indeed, it is largely recognized in scientific literature that the resilience of natural systems essentially depends on the "continuity" of the individual natural areas; therefore, these areas have to be not isolated or marginalized but linked one to each other through green (natural or artificial) corridors, creating a green or ecological network. Of course, when public open spaces devoted to a prevailing pedestrian use, such as streets and squares, are concerned the continuity among these spaces is not strictly required: in these cases, indeed, the network is not indispensable for the survival of its components even though "continuity" can be certainly useful to enhance the effectiveness of each element.
However, it is worth mentioning that, since the Nineties, the traditional concept of ecological network, specifically related to the links among natural areas, has been significantly widened.
Gambino (2003) highlighted, for instance, that both in the Italian and in the European context, it is difficult to identify networks only devoted to purely biological functions, since the density of cultural, social and economic relationships that have historically shaped the territory, affecting its ecological dynamics. Hence, broader and comprehensive concepts have increasingly spread as that one of "environmental network", reminding of the multifunctional character of such networks.
Therefore, the concept of environmental network with multiple features and uses seems to anticipate an holistic approach to public urban open spaces – which have also driven some quite recent experiences of land use planning, such as that ones of Rome and Bergamo – aimed at including both green open spaces and urban open spaces, such as streets and squares. Grounding on this approach, to each element of the network, in according to their specific features and locations, an active role in the improvement of the quality of the urban environment can be assigned. Thus, according to the principles affirmed by the Aalborg Charter, the urban open spaces devoted to a prevailing pedestrian use will ensure a more suitable answer to the demand for places devoted to leisure and social aggregation, increasing the quality of urban life and reducing the demand for social activities in natural areas. Therefore, the organization as a network of urban open spaces can ensure not only a more balanced distribution of the opportunities for pedestrian movement within the city, but also a more spread quality both of urban and natural environment. Finally, it has to be

considered that, also in this case, the isolation of pedestrian spaces will likely produce an excessive load of use on some parts of city or on single roads or squares, reducing their efficiency and attractiveness.

Pedestrian networks may largely contribute to the requalification of urban areas; nevertheless, to pursue this aim, the plan of such networks should be framed in the wider strategies of evolution/ transformation of the whole cities in which they are included. For example, in the historical city the implementation of a pedestrian network can represent a key action within a wider strategy of requalification, addressed to improve tourism too, of the urban area. Likewise, in the central urban areas, characterized by the presence of relevant urban facilities (universities, hospitals, leisure facilities, etc.), this implementation can support strategies aimed at increasing the accessibility to the urban activities reducing, at the same time, the car flows. In peripherical or decayed urban contexts, pedestrian networks – meant as a key component of a wider regeneration strategies aimed at recovering the building stock and at integrating new relevant urban activities to ensure its revitalization – can provide new places for social aggregation, often completely lacking, contributing to the pursuing of wider social aims. Once clarified the reasons that lead to favor the organization as a network of urban open spaces mainly devoted to a prevailing pedestrian use and the role that, in different urban contexts, such networks can play, there is the need for explaining that, in reference to these spaces, the concept of network has an high degree of abstraction. Unlike ecological networks, which require physical connections among their elements, pedestrian networks can be continuous and totally based on pedestrian travels, or multi-modal, characterized by small pedestrian networks developed over different areas of the city, linked one to each other through public transports. The latter is clearly the most widespread model of network, mainly in large urban areas, where it is hard to ensure the continuity of the pedestrian network both for the travel distances and for the difficulty to create large car-free areas. Thus, urban pedestrian network are often characterized as systems of local networks, devoted to an exclusive or prevailing pedestrian use, linked through rail transport.

Summing up, urban pedestrian network can be shaped both as a network of public open spaces devoted to an exclusive or prevailing pedestrian use extended to the whole city and linked to the urban or regional ecological network, or as a web of local networks, developed over more or less extended partition of a city, linked through public transports. However, the opportunities for defining and implementing "unitarily" pedestrian networks extended to the whole city are not very frequent, also due to the difficulties generally related to the implementation of such networks (car-free roads and squares, widespread interventions of street furniture, etc.). More frequently, pedestrian networks are implemented through an incremental approach, that is through the progressive implementation of local networks or, sometimes, also of individual pedestrianizations. In many cases, the realization of new railway stations represents the starting point for promoting local pedestrian networks. In designing networks of open spaces devoted to a prevailing pedestrian use, time plays, therefore, a relevant role. Generally, in medium or small sized cities, the whole urban network can be designed and the single interventions can be carried out over the time according to the project.

On the opposite, in the big cities, the starting point for the pedestrian network development is generally represented by single interventions, due to specific needs or opportunities, which are subsequently expanded and linked through public transport. Finally, some guidelines addressed to identify pedestrian networks and to design their elements can be provided. In relation to the heterogeneous activities that such networks have to support, the choice of their elements and of the "level" of pedestrianisation (exclusively pedestrian or mixed) of each element depends, first of all, on the features of the urban context in which these elements are included. The demand not only for mobility but also for the many optional and social activities that, according to Gehl (2003), pedestrian networks can support depends, indeed, on the localization and on the features of their urban context which they belong to (historical city or periphery), on the characteristics of the population, on the existing activities, on the physical peculiarities of the urban area and of the elements of the network. Moreover, it is useful to take into account the likely transformations of the urban area at stake, issuing from the future scenarios outlined by urban planning tools according to a given temporal span.

Furthermore, the role played by each potential element of the network within the whole urban mobility system, has to be considered in relation both to the current situation and to the development scenarios provided by the urban mobility planning tools. The elements of the network will be therefore singled out and designed taking into account the congruence between the present and future role of these elements in the urban mobility system and the current and future demand for different uses arising from the urban context. Moreover, the role of each element of the pedestrian network will also depend both on the features of the element itself (slope, size, etc.), and on the potential impact that a change in the current role might have on the whole system of urban mobility. Once all the elements of the network have been identified and the multiple uses (pedestrian and car flows, heterogeneous activities etc.) that each element have to support have been defined, a "project of use" for each element can be outlined. Such a project

will be addressed to manage the different practices of movement and rest, often clashing each other or not immediately compatible, that in a synchronic or diachronic way run over the spaces and to which an answer in terms of spatial organization, choice of adequate building materials and so on has to be provided (Gabellini 2001). Therefore, the project of use of each element of the network will depend on the demand for different uses arising from the context, on the physical features of the element at stake and on the relationships that each element has with all the others. In the meanwhile, the project of use will influence the physical features of each element: such features have to be defined grounding on the congruence between them and the multiple uses that each element has to support.

Summing up, promoting soft mobility in urban areas requires first of all a spatial and functional reorganization of urban spaces devoted to the pedestrian mobility: restrictions to car flows in some urban areas, indeed, do not automatically favor pedestrian mobility. On the opposite, criteria, methods and techniques to define or to recovery the attractiveness of the pedestrian spaces are required, promoting different practices of use of such spaces and designing them as urban places as well as "channels" supporting heterogeneous, also vehicular, flows.

Guidelines for pedestrian networks planning

According to the criteria for planning and designing pedestrian networks outlined in the previous paragraph, first of all, the general plan of the pedestrian network and the detailed project of its elements require different types of surveys developed at least at two different scales: surveys at urban scale aimed at defining the scheme of the whole network, that is the elements of the network and their main roles; surveys at local scale aimed at defining the functional organization and the spatial features of each element of the network. In the first group of surveys, present and planned features of the city have to be taken into account in order to bring out existing and future demand not only for mobility, but also for places for leisure and/or for social aggregation. Analyses focused on the functional and social role of the urban area and on the features of existing and potential users are therefore useful. The role of the urban area at stake can be defined according both to its history (development and role of the area over time) and to its functional features, determined for instance by the presence of relevant urban activities or of historical buildings attracting large amount of tourists, or of tertiary and commercial activities, etc. These surveys provide first items for the singling out of the network, supporting the definition of the main aims that the network itself is planned for.

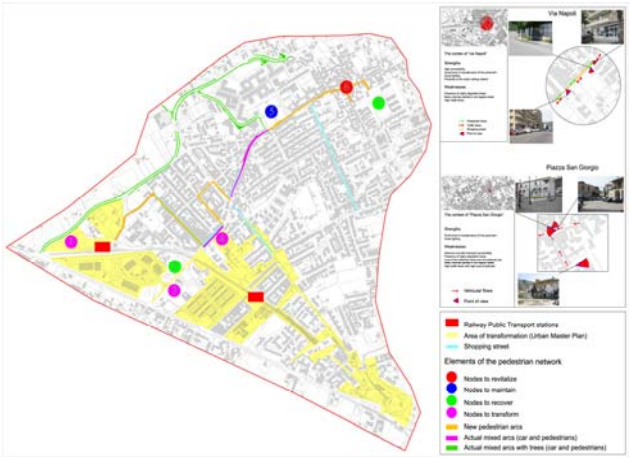
As noted above, indeed, pedestrian networks are generally framed in wider requalification strategies of urban areas, addressed to different aims according to the different features of the area at stake. For instance, the aims will significantly differ if the network is part of a historical core of a large metropolitan area or of a medium or small sized town, or, again, in a new suburb or in a consolidated peripherical settlement.

These type of surveys provide planners also with an essential support for planning the whole network. For example, the knowledge of the historical growth of the urban area can drive planners to steer the pedestrian network plan toward the recovery of a lost historical memory or identity. The knowledge of the functional role of the urban context can suggest to counterbalance or, on the opposite, to emphasize the current role through the implementation of the network, promoting, for instance, the revitalization of commercial activities or improving the accessibility to the existing activities. As mentioned above, the development scenarios of the urban area, with reference both to the ongoing transformation processes and to the forecasts of land use planning tools, have to be taken into account.

The surveys related to the users allow planners to single out different categories that, in relation to their different needs and expectations, lay down heterogeneous, sometimes conflicting, mobility demands. In many cases, not only the population living in the urban area at stake but even daily or temporary users – due to the presence of relevant urban activities or of tourist attractions – have to be taken into account.

Therefore, the structure of residents and the different typologies of not-resident users have to be investigated. In particular, it is useful to distinguish the amount of daily users, spending a remarkable part of the day in the area working or studying, from that one of temporary or occasional users, such as tourists. These surveys can be carried out through indirect and qualitative evaluations, based for example on the level of attractiveness of the existing activities or, in other cases, through quantitative assessments: the number of users of existing activities can be generally measured, although approximately.

Finally, the surveys related to the urban area in which the pedestrian network has to be developed have to highlight the current and future levels of accessibility of the area and, in particular, the existing or potential linkages between the pedestrian network and other mobility networks, such as railway stations, parking areas, etc. In order to define the role of the elements of the pedestrian network within the wider network of urban mobility, the elements which have already been totally or partially devote to a pedestrian use (squares and pedestrian roads, car free areas, etc.) have to be identified.



The identification of the scheme of the network is based on the assessment of the congruence among the role, current or potential, of the element and the demands of use, actual or potential, arising from the context. The image shows the scheme of pedestrian network developed for the Pianura district in the western periphery of Naples.

These elements represent the current supply of spaces for pedestrian mobility. All the others have to be classified taking into account their current role (primary roads, neighborhood roads, etc.), their future one, according to the forecasts of the mobility plans, and their physical features (size, slopes, etc.).

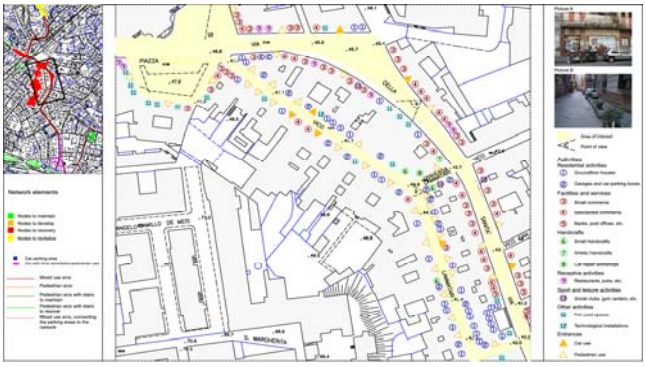
Then, once defined the current and future features of the urban area and the role of each element of the pedestrian network, the scheme of the network itself can be worked out basing on the assessment of the congruence between the role, current or future, of its elements and the demands of use, current or future, arising from the urban context. Since pedestrian networks represent one of the multiple urban equipments, the sizing and the design of these facilities can be effectively carried out only on the basis of criteria aimed at assessing the correspondence of the available facilities, or in other words of all the roads and squares, to the heterogeneous demands of use to which these elements are required to answer. In particular, the inclusion or the exclusion of each element (road or square) as component of the pedestrian network has to be defined following criteria essentially referred to the features of the urban area, to the typology of the element itself and to its role in the urban mobility network: generally primary roads, roads characterized by a high slope, etc. have to be excluded, at least from a total pedestrianisation. Moreover, it will be possible to define some criteria for selecting, among all the elements that could be part of the pedestrian network, those exhibiting a stronger "propensity" to a total or partial pedestrianisation. For instance, such criteria should be referred to the features of the urban context as the presence of commercial activities, traditional or “typical” handicraft activities, relevant historical buildings, etc. Finally, according to the correspondence, evaluated with respect to current and future conditions, between the role of the elements and the demand for their usage arising from the urban context, the different elements to be included in the network and the design objectives to be achieved for each of them, will be identified. In some cases, in fact (for instance existing roads or pedestrian squares in historical urban contexts), the congruence among the role of the elements and the demands for usage arising from the context is already verified; therefore, such elements will be included in the network and the design objectives will be conservation and maintenance. In other cases, some elements could be part of the pedestrian network, even though a lack of correspondence between their current role and the demands for their usage arising from the context might be identified (for instance pedestrian roads or squares in peripherical urban areas where the demand of use is at present very low): for such elements interventions addressing a revitalization through the location of attractive urban activities along the road should be defined. Again, the opposite could even happen, in that a high demand for pedestrian usage, due to the presence of relevant urban activities or touristic destinations, should concern elements currently showing a strategic functional role in the urban mobility network. In these cases, it is possible to decide whether to change the functional role of the considered road or to shift the demand of use toward other roads.

Summing up, the surveys at urban scale allow to outline the scheme of the pedestrian network and to define, for each component, the objectives to be achieved in terms of conservation, recovery, revitalization, transformation. As mentioned above, the identification of the scheme of the network also requires a careful consideration of the potential links among pedestrian network and all the other transport networks (road, railway networks). In detail, the design of scheme of the network has to take into account the location of railway stations, bus stops, parking areas, etc. The presence of terminals and stops of other transport networks allows, in fact, pedestrians to access to the network and planners to outline multi-modal networks, or “networks of pedestrian networks”, located in different urban areas and linked through the public transport networks, mainly the railway ones. The pedestrian network will include roads and squares which might be pedestrian or characterized by a mixed use. Along the elements of the network exclusively devoted to a pedestrian use, access for residents, emergency transit, loading and unloading of goods have to be anyway allowed. Along the elements of the network devoted to a mixed use, the rules for an effective "coexistence" between cars and pedestrians have to be defined, such as low speed areas combined with protected pedestrian paths. Coexistence among pedestrians

and cars can also be interpreted in a "diachronic" way, providing areas totally pedestrian in some hours of the day or in some days of the week. Both roads and squares included in the pedestrian network can be further classified into primary, secondary, etc. The scheme of the network has to be also specified according to the different types of users which the elements of the network are devoted to. For example, in case of heterogeneous demands for usages (slow and fast pedestrian movements, car and pedestrian transit) by different types of users (tourists or users of urban facilities) along the some element, alternative and specifically targeted to a particular type of user pathways can be designed too.
Moreover, in case of elements of the network not accessible by all types of users, such as stairs, the identification of alternative and enjoyable by everybody paths or even, in absence of alternatives, connections through public transport, have to be defined.

Guidelines for designing the components of a pedestrian network

According to the plan of the whole pedestrian network, detailed surveys addressed to design each component of the network itself, have to be carried out. In detail, for each component, a “design by use”, meant as a tool for defining the best organization of the different demands of use, and to ensure the congruence among the different uses and spatial features of each element, has to be defined. To this aim, current uses and physical features of each element have to be investigated and the congruence among current demands of use and physical organization of each element has to be assessed in order to single out the required interventions.
Surveys related to the current uses should be addressed to provide a detailed knowledge, mainly based on the direct observations of places and of people’s behaviors, for example how places are adapted to the needs of different groups of users or which kind of activities users play in different times of the day. Moreover, these surveys will be aimed at pointing out all the existing activities along the elements of the network, with particular attention to that ones at the ground floors. Surveys will be, however, primarily addressed to identify historical and architectural features of the building stock and the state of maintenance of building facades, features of the paving, street furniture (benches bollards, lamps, etc.), with particular attention to their maintenance level as well as to the location and distribution of furniture. Such surveys, combined with the knowledge of the urban context and of the functional role played by the element in the urban mobility network, achieved through the first level analyses, will allow to specify the “design by use” of each element, or in other words to organize the different demands of use, the current and future ones, which might coexist in each element of the pedestrian network. Therefore, it will be possible, for each element of the network, to verify the congruence between the functional organization and the spatial features of the spaces, in order to highlight inconsistencies and problems to be faced. Such a phase is particularly important because it could also lead to a revision of the scheme of the whole network based on the first level surveys. The congruence assessment can be structured through matrixes and it can provide congruence judgments with reference to specific performance dimensions articulated in requirements which have to be achieved through the spatial organization of the network and the physical features of each element. The congruence judgments for each element of the pedestrian network can be both qualitative and quantitative and can lead, through aggregation and normalization procedures, to synthetic judgments for each performance dimension expressed through quality levels. There are numerous performance dimensions that can be considered in the congruence assessment. Among these, for instance, the attractiveness related not only the aesthetic quality of each element, but also as a result of different factors: from the historical and artistic value of the building facades to the presence of commercial or touristic activities at the ground floors. Among the performance dimensions a remarkable role is played by the accessibility, or the possibility to reach the element thanks to the closeness of stations, bus stops, parking areas. Moreover, the possibility for different typologies of users to easily use a space (usability) – which usually depend on the presence/absence of obstacles along the path, such as cars parked out of the parking spaces – and the presence of street furniture designed as barriers for pedestrian flows (flower pots, shop windows, etc.) have to be also considered. The scarce usability of a network element can be also related to the state of maintenance of paving and sidewalks.



The definition of the project of use of each element of the pedestrian network requires detailed surveys aimed at outlining, for each of them, the physical characteristics and the actual uses of each element, such as activities at the ground floor.

Again, among the performance dimensions, safety has to be carefully considered in that, along the different elements of the pedestrian network, any possible danger perceived by the user – which might depend on several factors, such as poor lighting, coexistence between cars and pedestrians, etc. – has to be taken into account and removed. Thus, the design by use and the performance analysis of each element will be targeted to specify the different uses, to define the spatial organization and, also, to guarantee the congruence among current and planned uses and spatial features of the elements of the network. In this phase, detailed actions aimed at promoting or discouraging ground floor activities, creating new attractions along the network, reorganizing car flows and parking areas, recovering building facades or historical heritage, integrating or reorganizing street furniture have to be defined. To support such a definition, matrixes showing for each element of the network the current performance levels, types of planned uses, performances to be achieved and actions to be implemented for their achievements, can be set up.

Conclusions

The criteria and the methodological elements outlined for the planning and designing pedestrian urban networks represent only a first step toward a new approach to the pedestrian use of urban areas. Despite a more and more diffused awareness of the need for promoting soft mobility, particularly pedestrian mobility, in cities, a shared toolkit of criteria, methods and techniques to support the definition of pedestrian networks, of their uses and of their spatial features is still not available. Very often the decisions about the pedestrianisation of roads, squares or also of large areas within the city, have been exclusively due to specific circumstances or opportunities, in absence of integrated plans aimed at driving pedestrianisation choices with reference to the wider strategies of evolution/transformation of the urban context and of the whole mobility network. This is due both to the lack of consideration of pedestrian travels as one of the mobility modes having equal dignity in comparison with the mechanized one, and to the double role that roads and squares play both as elements of the mobility network and urban places characterized by heterogeneous and often conflicting uses. The methodological guidelines come out from a theoretical and operative experience carried out within the Teaching Courses of Recovery and Development of Open Spaces held by the Authors at the Faculty of Engineering of Naples from 2003 to the 2006. In detail, according to the presented methodological guidelines, over these years the students have developed numerous project works, referred both to central and peripherical areas of the city of Naples, which allowed us to test and improve criteria and guidelines for planning and design pedestrian networks. Such criteria and guidelines do not represent, anyway, a consolidated and shared methodological framework, but only a first step toward their definition.

Notes

[1] Even though this paper is based on a common research work, the first, the second and the fifth paragraphs have been edited by Adriana Galderisi; the third and the fourth paragraphs have been edited by Andrea Ceudech.

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Envisioning Parking Strategies for the Post-Automobile City

The Role of Parking in a Framework for Sustainable Urban Transport

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ABSTRACT

Parking policies and regulations are important tools in planning for the governance of urban mobility. The proper design and location of parking facilities, in fact, contributes to an efficient use of the transportation system (or it may reduce its efficiency, when these infrastructures are not properly planned). This paper discusses the role of parking as part of the policy packages for strategic planning aimed at increasing the sustainability of urban and metropolitan areas. In particular, the integration of parking strategies in a comprehensive vision for the future of a city may significantly improve the allocation of resources and the reduction of the overall environmental externalities.
The role of parking in the strategic planning of cities is discussed through the analysis of several recent projects in the city of Bari (Italy). The paper discusses the way these projects are linked (or eventually not linked) to broader strategies for urban mobility, and how they might be coordinated into policy packages that promote more sustainable transportation. The use of an integrated land use transportation modeling approach to simulate the long-term evolution of the urban area may significantly contribute to estimate the long-term effects of the proposed policies. This approach may successfully support the process of policy evaluation and the selection of the optimal strategies to implement.

Parking facilities in a car-dependant society

Parking is an important element of the transportation system of any urban area, and its organization is an important task for transportation engineers and planners. If properly planned and managed, parking facilities may considerably increase the accessibility of urban settlements and contribute to reduce congestion in most central areas. However, defining efficient parking strategies is not a simple task. Parking strategies and regulations deeply affect the use of cars and more generally of transportation: when correctly located, parking facilities may efficiently support the use of the road network, and reduce the number of vehicle miles travelled by private vehicles. Besides, parking strategies may be often useful to promote public transportation, when designed in coordination with the development of mass transit. However, if not properly designed and built, or if not provided in the right amount, parking can easily become a critical element of the transportation system.

At the beginning of the 21st century, there is sufficient evidence that parking facilities cannot be designed separately from the remaining components of transportation. The development of parking facilities entails important issues related to their interactions with the other elements of the transportation system. Besides, their construction requires huge investments, both in terms of financial instruments and in terms of consumption of natural capital (developable land), which is often a very scarce resource in higher density areas. For these reasons, in a time of increasing environmental concerns, it becomes extremely important to link the design of parking facilities to the development of sustainable transportation solutions for urban and suburban areas.

Parking facilities are land intensive infrastructures that stimulate in the medium run the demand for trips by private vehicles. Thus, an increase in parking capacity usually leads to additional vehicles traveling on the road network, and to a stronger car dependence of transportation. This phenomenon makes the increase in parking capacity desirable only for rather limited quantities. Once the *optimal* amount of parking is available, the provision of additional parking space makes the environmental quality of the system gradually worsen. It generates demand for additional trips by private car, and stimulates the demand for additional road capacity and even more parking. This may not always be satisfied due to land availability constraints, and is unacceptable from the perspective of the conservation of natural resources.

Moreover, there is cause for additional concerns regarding the adoption of common land use patterns associated with huge parking facilities. These facilities contribute to shape new developments

oriented to a more car-dependent mobility, in particular in low-density suburban areas. They often make the use of public transportation less convenient, and reduce the physical accessibility by alternative (non-motorized) travel options, as walking and biking. The process determines a pattern of energy-intensive (and *energy wasting*) urban settlements, with lower quality of life and increasing environmental decay. Indeed, parking regulations and strategies are an important tool for governing travel demand. They deeply affect the use of the transportation system, and the selection of the travel mode, as an effect of the transportation costs associated with the use of parking facilities and the time required to access them. Pricing policies significantly affect the mode share and the use of the transportation system: most users are sensitive to parking costs, especially when other valuable transportation options are also available. Moreover, the financial instruments for the regulation of parking are a powerful tool for local administrations to collect additional revenues, and raise flows of capital to cover the management costs of parking facilities or finance other investments in transportation. The policies for the regulation of parking play a significant role in the governance of the urban mobility. As elements of a comprehensive strategy to address more sustainable mobility, they may contribute to meet the goals of a more balanced mode share, and of reduced environmental externalities from transportation. In this paper, the issue of the coordination of parking strategies with the development of transportation is discussed vis-à-vis their potential to support more environmental-friendly travel solutions. The issue is discussed with several examples from the implementation of recent projects in the city of Bari (Italy). The paper discusses the way these projects are linked (or are not linked) to broader strategies for urban mobility, and how they might be coordinated into policy packages to pursue more sustainable transportation. The way in which the effects of parking strategies can be forecasted in the long-term strategic modeling of the development of the city is then presented with reference to the use of an integrated land use transportation modeling approach. Some conclusions on the role of parking as part of long-term strategies for transportation in urban and metropolitan areas can be accordingly drawn.

Parking facilities and the strategies for sustainable cities

Parking facilities are an important element of the transportation system of a city. Nevertheless, the complexity of their design and organization is often under-evaluated, and most of the attention usually focuses on the construction of other elements of the transportation system and of the road network. Somehow, the existence of sufficient space dedicated to the parking of motor vehicles is assumed in the design of cities and neighborhoods. As a result, the importance of the role of parking, either along public roads or on private areas, is usually underestimated (with a few limited exceptions), and not thoroughly studied.

According to the dictionary definition, a parking lot is simply “an area used for the parking of motor vehicles”. The definition itself is vague, and many different ways for organizing parking facilities actually exist. The choice of the best solution should be carefully made in each context in conjunction with the overall objectives leading to the definition of parking policies in a municipality and/or other local administrations. Many times, however, and especially in those cities and regions that do not have strong planning authorities and agencies, parking facilities are located arbitrarily, providing additional capacity to the existing on-street parking where possible, and gradually occupying the remaining developable areas that have not been used for other purposes yet. This inevitably leads to a lack in the efficiency of the parking solutions, and in their ability to solve transportation needs.

Nowadays, there is the need to integrate the development of parking facilities into a wider perspective, and within the framework of more comprehensive planning strategies for urban mobility. This need is even more urgent due to the necessity of reducing the environmental externalities of transportation, and of making transportation systems more sustainable. The environmental impact of transportation is in fact mainly associated with the use (or often misuse) of cars and other private vehicles. As already mentioned, the design of parking facilities greatly affects the use of cars in urban and suburban areas. Hence, the development of more thoughtful and carefully designed strategies for planning may actively contribute to rebalance the use of transportation in most congested areas, and contribute to an overall improvement of the performances of the transportation system.

Since the first definition of sustainable development by the Brundtland Commission (World Commission on the Environment and Development, 1987), many have called for urgent measures to reduce the environmental impact of human activities. A huge debate has followed (Daly, 1990), but small efforts have been made so far to design operational and logically consistent plans to “green” the society, and to reduce the impact of mankind on the ecosystem. The issue highly regards transportation projects: transportation is nowadays responsible for about one third of the total energy consumption (U.S. Department of Energy, 2006) and emissions of greenhouse gases in the atmosphere, and its share of energy consumption and pollutant emissions is increasing (U.S. Department of Transportation, 2007). Moreover, at least in most developed countries, transportation of passengers is disproportionately

directed toward the use of automobiles (Chapman, 2007), with an almost total dependence of private mobility on the combustion of fossil fuels (oil and/or natural gas). The dominant use of cars is the cause of the depletion of natural resources and of soil degradation and increasing urbanization, due to the construction of new roads and highways, and the increase in the capacity of other transportation facilities (Crawford, 2000).

From this perspective, the redefinition of policies for transportation in urban and metropolitan areas assumes immediate priority among the objectives for a reduction of the environmental impact of transportation. This relates to the definition of global strategies to green our cities, which must include interventions on both the land use and the transportation system. Their objectives must match an equilibrated and smart growth of new developments with the adoption of mass transit solutions, and the construction of roads and other transportation facilities in the already built areas.

Although several studies have investigated the relationships between land use and transportation, to date there is still little evidence concerning what the ideal settlement structure from the point of view of sustainable transportation would be (Greene and Wegener, 1997). The idea of linking the development of land use with an equilibrated development of transportation that is not dominated by the use of cars has inspired several movements in planning that aim e.g. to a *smart growth* (Handy, 2005) of the urban system, or to forms of *New Urbanism* (CNU, 1998). The common background is the awareness that urban areas featuring mixed land use and higher density, if properly designed in coordination with transportation, usually lead to higher efficiency in transportation and they reduce urban sprawl and environmental externalities (Newman and Kenworthy, 1999). The concept is similarly developed in the transit oriented development (TOD) of neighborhoods (Cervero, 1998; Dunphy *et al.*, 2005), in which many efforts are made to promote the use of transit. In the short term, TOD solutions maximize the benefits of the investments in public transportation, and support the increase in density, mixed land use and urban quality along the transportation corridors. In the long run, they cooperate in transferring travelers to public transportation, and they significantly limit the urban sprawl.

In these processes, the overall strategies for establishing less car-dependent settlements involve interventions to promote both public transportation and other environmental-friendly travel options, i.e. the non-motorized "soft mobility". Besides, they require the adoption of dedicated design for road and parking infrastructures. Some projects in many areas of Europe, North American and Asia have already achieved successful strides toward this objective.

An additional contribution to these successful projects may derive from the adoption of travel demand management (TDM) solutions, which reduce the demand for traveling by private vehicles (especially if directed towards "driving alone", i.e. the most energy intensive travel option), and traffic calming measures, which actively contribute to reshape the road network and the overall transportation infrastructures. With these objectives, efforts should be made to integrate major interventions on the transportation system, and coordinate the development of public transportation, i.e. subways, local and urban railways, light rail systems/tramways and bus services, with the development of the road network and of parking facilities. The design of parking facilities is expected to match these overall goals, to support the use of public transportation with an increase in the demand for transit, and to improve the efficiency of transportation (Black, 1981; Meyer and Miller, 2001). In such a multimodal system, the supply of the optimal amount of parking space is important. The right location and design of parking lots allows the proper development of the road network, and supports proper access for private vehicles and door-to-door service. However, oversupply of parking facilities negatively affects the use of transportation, increasing the attractiveness of the use of private vehicles, and increasing the modal share for cars in spite of the use of alternative means of transportation, and in particular of mass transit. Besides, an incorrect design of parking facilities concurs to an excessive consumption of the available land (either from natural undeveloped land, or subtracted from alternative uses), and weakens the geographical cohesion of the urban structure. Urban patterns with broad avenues and large parking facilities facilitate the use of cars, and reduce the accessibility for pedestrians and bicycles (as a result of the larger distances among blocks and facilities). They reduce the density of the settlements depowering the implementation of transit solutions. Moreover, overcapacity is often quickly absorbed by the market, through an increase in the number of cars on the road network, as an effect of the increased accessibility by car caused by the additional parking space, and as a consequence of the reduced accessibility with the other means of transportation.

Parking facilities in congested areas

Parking facilities include various solutions, ranging from the on-street parking (common in low-density residential areas and suburban neighborhoods) to conventional or underground multi-store parking facilities. These facilities can facilitate the access of users to terrestrial infrastructures (railway stations and bus terminals) if properly planned in a framework of multimodal transportation. Public transportation solutions often benefit from the presence of park and ride (P&R) facilities, in which the traditional

"walk-in" access of transit is complemented (if not completely substituted in suburban areas), by a "drive-to" access, increasing the area of influence of transportation terminals and local transit stops.

On-street parking, the easiest and cheapest way to provide parking space, is indeed land intensive. It subtracts important surface area from other uses, reducing the road capacity or narrowing pedestrian sidewalks and bike lanes. It is not well suited to provide sufficient parking space in high-density areas. Surface parking may be a good solution for suburban areas, where land is cheap and available in large amounts, and it allows creating surface parking lots close to the locations that originate the travel demand.

Structured parking is a more expensive solution, often chosen in central areas of the cities, where land is more expensive and scarce (Dunphy *et al.*, 2003). Structured parking facilities, either underground or in multi-store dedicated buildings, are significantly more expensive than surface parking, although their cost is often more than compensated by the reduced amount of land required for their construction, and by the potential revenues derived from the exploitation of the parking facilities. These parking solutions are usually located in the central areas of larger cities, in proximity of the Central Business District (CBD), or of important points of attraction as fairs, important transportation nodes (e.g. railway stations and airports), amusement parks, etc. They require huge financial investments, which are seldom justified by local demand in lower density areas, where cheap undeveloped land is available.

Time and costs associated with parking (generally collapsed into a comprehensive term, i.e. the generalized cost of transportation) relevantly affect users' behavior and the choice of travel options in the short run, and they contribute to the formation of long term preferences of travelers. From this perspective, the use of financial tools to regulate the access to parking may significantly affect the use of cars in urban areas: these tools can be used as part of an overall strategy to organize the transportation system, and their effects must be taken into account in the evaluation of the impact of transportation policies in the urban area.

Parking strategies in the city of Bari

The discussion on the implementation of parking strategies will now focus on some recent projects that were designed, and later developed, in the city of Bari (Italy). The interventions were part of various strategies pursued by the local administrations over a time span of almost 15 years (starting in the 1990s), in order to reorganize transportation in the central area of the city. Different strategies were proposed for this area, according to different visions of the future development of the city and of the surrounding metropolitan region. Such differences are revealed in the way parking facilities have been planned and designed.

Some elements of the organization of transportation and parking, which were mainly designed as traffic calming measures with a short-term horizon, are common to all packages of policies designed in this time span. However, a significant change in the policies to enforce was recorded because of a change in the actions of the local government, and as a consequence of a change of the political coalition leading the city council of the main center of the area, Bari, in 2004. The possibility of merging some of the different projects into a whole strategy that envisions a more integrated development of the transportation system is presented at the end of this section, when the topic of the definition of long-term strategies for the metropolitan area of Bari is discussed.

The use of structured parking at the end of 1990s

According to the 2001 census data, about 320,000 inhabitants live inside the administrative boundaries of the city of Bari. The total population of the metropolitan area of Bari, however, sums up to almost one million residents, with a total population of the province that exceeds 1.5 million. Important changes are registered in the demographics of the area: while the population of the central city of Bari has been mainly stable, if not even decreasing over the last 40 years, the smaller settlements surrounding the city have experienced a sharp increase in their population. Nowadays, many of the residents of the smaller towns in the metropolitan area commute to the central area of the city, with additional relevant traffic flows directed to other destinations, e.g. the industrial areas surrounding the city, and several commercial areas in the immediate proximities. The transportation system serving the area has not grown with the same pace though, and this has determined a significant increase of the congestion on the main roads and freeways of the region. Various local bus companies operate regular scheduled services connecting several destinations in the metropolitan area, while a publicly owned company runs the urban bus services in the city of Bari. National and local railways connect many centers, too, even if they do not serve the whole population of the region. However, the services provided on many secondary railway lines have lower quality of service than those offered in the municipalities served by the main railway parallel to the sea cost.

In order to reduce congestion and provide enough parking space to commuters, at the end of the 1990s the city hall of Bari promoted a huge plan of investments that involved the construction of several structured parking facilities in the city.

The plan was supported by the requests of the population for additional parking in the central area of the city, and supported by the lobbies of storeowners and retailers of the area worried about the declining revenues of their activities associated with the reduced accessibility by car and the difficulties of parking in downtown Bari.

The parking plan was developed as part of a global vision for transportation. This included parking fees for on-street parking in the central business district, the reduction or even elimination of on-street parking on the main branches of the road network, in order to reduce traffic congestion, and to increase the road capacity and commercial speed of vehicles to/from downtown. A sophisticated road pricing system regulating the access to a rather small central area of the city was designed, but never fully enforced. In the proposed solution, the access to a restricted area of downtown should have been regulated by the payment of a toll, similarly to the congestion charge projects developed in other areas (e.g. London and many other Italian cities) in the previous years. This would have generated additional revenues to finance transportation, and would have reduced the number of cars accessing the area.

Apart from the construction of some structured parking facilities in other areas (the most significant one serves the largest hospital of the city), the parking strategy focused on the central area of the city. It included the development of three main underground parking structures located under the main squares of the city. Two of these parking facilities were to be developed in the downtown, while another one should have been located under Giulio Cesare Square, in a semi-central residential and commercial area, which had faced increasing congestion in the previous decades.

The strategy behind the interventions was clear: the planning offices of the city hall aimed at reducing surface traffic congestion through the construction of a relevant number of parking spaces in the center of the city and relocating street parking in underground facilities. Part of the on-street parking on the avenues to access the area was eliminated, increasing the accessibility by car to the central area. The adoption of road pricing would have limited the access to a restricted area (almost one half of historic downtown), further reducing the traffic flows to this area, and making traveling to downtown more expensive (for the combined effects of the road pricing and the parking tolls). It would have reduced the volume of cars accessing the very central area of downtown, but caused additional congestion on the boundaries of the restricted area.

The plan relied on the use of car as the central element of the transportation system, with a calming effect on traffic due to the increased capacity of the road network and of the parking system, and the adoption of road pricing. Long-term interventions on transportation were poor or completely missing, thus undermining the stability of the plan in a long-term perspective. In the authorities' plans, the adoption of parking fees for on-street parking in downtown would have reduced the average duration of stands in downtown, thus further increasing the capacity for short-term parking. This should have stimulated shopping activities and the whole economic vitality of the area.

Indeed, the plan lacked of a comprehensive vision to the problem of transportation, and of sufficient support to the development of transit. Mass transit solutions were encouraged through the enhancement of the railway services on the north-south corridor, and the provision of additional local services on the same shared railway tracks run by the national railway company for intercity services. A new metropolitan railway line was designed for connecting the peripheral neighborhood of San Paolo. However, this would have entered into service only several years later.

Bus services remained almost unmodified. Unfortunately, a few dedicated bus lanes were converted into regular car lanes in the effort to speed up private traffic flows, with consequent reductions in bus speeds on some routes. Alternative non-motorized travel solutions, bikes and pedestrians, did not receive enough support, if not only marginally through the reduction of the on-street traffic volumes in the downtown.

The only exception to this trend was the complete closure of the medieval center of the city to private traffic. Even if more significant on a symbolic level than for its practical effects, due to the small traffic volume in the area, this project was a successful story of urban requalification, and it contributed to reshape the attitude of pedestrians and to revitalize the narrow streets and squares of this historic neighborhood. No other projects for the development of a bike lane network or for the enlargement of pedestrian areas in the other parts of the city were enforced.

The transportation and parking strategy designed during these years failed to meet their goals. In part due to some delays in the implementation of the system, and to the opposition of important groups of stakeholders among the population, the road pricing system never got into operation. However, most facilities for the collection of tolls and for the control of traffic flows in the area had been actually built before the project was abandoned. This caused a large waste of funds in a time of financial constraints for public investments, which further reduced the opportunities to develop alternative projects in the region.

Several technical issues in the construction of the underground parking facilities delayed their completion. This was mainly due to severe design flaws, in particular for the diversion of the underground water. Of the three main underground facilities that were planned, only one entered into service in the following years. The construction of a second one was significantly delayed, and its date of delivery was still uncertain at the time this paper was

published. The construction of the third large underground parking facility was never approved. This means that several years after the design of the facilities, only one third of the originally planned parking spaces were provided. In the meantime, the transportation strategies of city of Bari had been drastically modified.

An unpopular truth stands behind the failure of these plans. As in many other European cities, largely built in a time in which car ownership was quite limited, the road network of Bari was not able to support heavy traffic volumes. It was planned for small amounts of public transportation vehicles and pedestrians flows. No later interventions have significantly modified these conditions. Ironically, projects carried out in the second half of the 20th century even tried to reduce the width of sidewalks in order to increase road capacities. However, the city was never really able to substantially reduce its road congestion from car traffic. The ambition of the transportation and parking strategy developed at the end of the 1990s did not escape this trend. Bari was not supposed to become a totally car-dependent city.

Traffic calming measures at the beginning of the 21st century

A modification in the objectives of transportation planning took place few years later. This became more evident after the political elections of 2004, as a result of the change in the political majority leading the city council of Bari. This significantly modified the political agenda at the local level, and brought new priorities in transportation strategies.

The new course of local planning agencies developed a different strategy to address transportation issues in these years. This mainly related to the combination of private travel solutions with public transportation. The aim was pursued through the introduction of three new bus lines on radial routes to/from the downtown, which today serve “park and ride” facilities for inter-modal trips. Three large parking facilities were integrated in the network. A new surface parking lot was inaugurated near the city park Due Giugno in the southwestern part of the city. The plan included the use of two already existing parking lots on the North and on the South side of the city. The new lines were operated with modern buses (with a level of service above the average standards of the local bus company), and on a regular schedule with high frequencies on all three routes. A competitive fare allowed combined access to parking facilities and the bus service, with a resulting transportation cost far below the average of the other solutions to access downtown.

At the same time, the local government promoted the integration of alternative travel option solutions. They promoted the construction of new bike lanes, which were the first branches of a future bike network, and that connected the neighborhood of Carrassi, a semi-central high-density neighborhood, with the downtown area. Moreover, an ambitious plan of bike sharing (inspired by similar projects in cities like Vienna and Paris) started with a limited number of bikes available for local commuting trips at several locations.

Some of the solutions designed in the previous period were also confirmed. This is the case of the parking fee policies, which were extended to additional areas and now cover the entire city center. The fees make long term parking particularly expensive, in order to discourage the use of car for regular commuters.

Additional efforts were made to reduce congestion and deal with the scarcity of parking spaces in the central area of the city, with an increase in parking capacity. This goal was achieved through the completion of one of the underground structured parking facilities designed in the previous years. It included the design of another big surface parking lot not far from the main railway station of the city. This additional parking lot was quickly turned into operation to face the increased demand for parking in the central area of the city. The parking lot was built as a temporary facility on the land made available by the dismissal of a large military area (Rossani), located in a very central location. After the Army had dismissed the area, many projects for its redevelopment were proposed. Proposals included a large bus terminal, which would have increased the strategic role of the adjacent train station as the main multimodal transportation hub of the city. According to another proposal, the area was supposed to be converted to green areas and public space. This proposal received high interest also due to the location of the military area in a neighborhood with very limited amount of green areas.

Therefore, the construction of the parking lot on this portion of land determined a change in the plans for the future destination of use for the area. It was a (supposedly) temporary disruption to its redevelopment. This was only one of the issues arising in the transportation policies of recent years. An endemic bug appeared again: the focus on mid-term oriented actions in planning, with a dramatic lack of long term objectives for the future development of the city. This was evident in the transportation planning during the years 2004-2009: the case of the ex-military base was only an example of an area available for green areas and city parks (or, at least, for the construction of an important bus terminal) that was quickly converted, under contingent conditions, into a surface parking area.

The same lack of coherent choices occurred in the definition of mass transit priorities, particularly for one of the park and ride lines. The parking lot at the end of this line was located in the immediate proximity of a city park, on a portion of land that should have been

designated to an expansion of the existing park, in the semi-central neighborhood of Carrassi. This demonstrates a lack of forethought from the point of view of the efficiency of the system. It attracts additional private vehicles in a semi-central area, and causes more congestion in this neighborhood. Also in this case, the long-term impact of the new line was not carefully explored. A future extension of the line with the relocation of the park and ride facility far from the central areas was not envisioned. Similarly, the substitution of this congested bus line with a high capacity transit solution - a light rail system (*tramway* in Europe) to connect the neighborhoods of Carrassi and Carbonara with the downtown - has not been planned yet.

Although the planning offices have addressed the issue of the coordination with alternative mobility networks (in particular, the construction of bike lanes), these interventions to date remain very limited. In particular, the safety and the quality of the design of the bike network and of the bike intersections are still not enhanced enough. Technological and operational difficulties severely limited the success of the local bike sharing program: the lack of an efficient system to manage the access to the bike rental (e.g. a credit-card based system, as implemented in other European cities), has so far deprived this experiment from any success, failing to provide a steady source of revenues from the service, and limiting the access to the service to a very restricted group of registered users. All these elements of criticality reduced the quality of the adopted solutions. This was even more unexpected if taking into account the contemporary institution of the metropolitan planning organization (MPO) of the Metropoli Terra di Bari, with the duty of envisioning the future development of the metropolitan area, and of inspiring the planning process with strategic visions inspired by the principles of sustainability and of reduced environmental impacts of human activities. The non-linearity of planning actions is somehow also mirrored by the apparent confusion in the definition of the projects for the improvement of the road network. Behind the approval of several road construction projects, the overlap between primary and secondary links of the road network is often confusing. Some recent projects that duplicate not very useful road links, without eliminating the existing bottlenecks on the network, were witness to this. In summary, the planning process of these years resulted in a rather contradictory process. On one side, it worked on taking cars out of the central areas, and on reducing the travel dependence from private vehicles. On the other hand, it did not provide long-term solutions for urban mobility, in particular for commuters who do not want to commute by car, and who are not conveniently served by the new park and ride lines. The construction of the new surface parking facilities close to the central area has contributed to provide additional parking capacity in the immediate surroundings of the downtown. Thus, it encouraged traveling by car, and an even more car-dependent travel behavior.

Overall, still limited efforts to promote alternative mobility and to support mass transit have been produced. The proposed interventions, even if entailing a new era in the direction of the integration of private and public transportation policies, lacked of long term willingness to create lasting solutions, as part of an integrated strategy for steady sustainable transportation.

Long-term strategies for Bari

The experience of the last fifteen years of transportation and parking policies has demonstrated a general failure in dealing with the problem of reducing traffic congestion systematically. One feature is indeed missing in both approaches to transportation planning that have been described: the lack of a strategic vision for the development of transportation.

Many interventions have been proposed, and some of them have been developed, with contradictory orientations on the way to reshape the local transportation system. Even in the most recent years, in which a number of apparently connected projects have inspired the process of transportation planning, elements of contradiction still exist. The establishment of a metropolitan planning organization that should inspire strategic solutions for the growth of the city has not completely solved the problem. The first interventions proposed by the new strategic MPO have in fact not always gone in the same direction of the objectives that officially inspired them. The new authority for strategic planning has highlighted several interventions to implement in the future years. The need for further development of light rail projects and subway lines has been voiced. However, there is still an urgent need for consistent strategies aimed at a more sustainable mobility in the urban and metropolitan area, including several packages of policies as part of a unique vision for a modern, efficient and sustainable city. Among the priorities of such a plan is the upgrade of public transportation, with the investment in new mass transit solutions, e.g. subways and light rail systems. This could attract an increasing share of travelers, with frequent and reliable services that reach most destinations in the metropolitan area. However, the improvement of transportation also means a coordinated effort to support alternative mobility, with the extension and upgrade of pedestrian areas and bicycle paths, and their protection in designated intersection, and the eventual use of barriers to separate them from motorized flows. Additional efforts to make urban mobility more sustainable can be reached through the adoption of specific regulatory and financial policies, to support more

environmental friendly solutions, and make the "drive alone" travel solution less attractive. Parking policies play an important role as part of all these integrated strategies. Apart from providing the access to transit solutions, through the construction of dedicated parking facilities in the proximity of transit terminals, they can be used as a flexible tool to reduce the access of cars to specific areas. The choice of the location and the size of parking facilities, together with the policies with which parking lots are managed, become therefore extremely relevant for the success of the whole transportation strategy.

The simulation of parking policies through the use of integrated land use transportation modeling

The availability of advanced tools for modeling the evolution of the transportation system, and the interactions with the other activities in the urban area, provides important advancements in the evaluation of the outcomes from parking policies and strategies. Integrated approaches for land use and transportation modeling help to support the development of the planning strategies, through the estimation of the long-term results that derive from their implementation. The use of strategic models is particularly useful to simulate the joint development of land use and transportation in the metropolitan area. Land use transportation interaction models can conveniently simulate the interactions among the different subsystems of the territorial system, and their use has been successfully applied to test the long-term impacts of interventions on transportation infrastructure and services. In particular, the use of these models may be an important support for planning, in the definition of the strategies for the future governance of the city.

The development of the transportation and parking strategies for the city of Bari, presented in the previous paragraphs, for example, could be successfully assisted by the use of an integrated model, as the model MARS-Bari. MARS-Bari is a fast land use transportation interaction (LUTI) model that has been developed on the assumptions of the Metropolitan Activity Relocation Simulator (MARS) modeling system (Pfaffenbichler, 2003). The model was developed for applications on the metropolitan area of Bari, and it was applied to test several scenarios of development in the area (Circella, 2008). It is designed as a support tool for applications in strategic planning, and its simulations allow forecasting the future development of the city and of its metropolitan area with a time horizon of 30 years (in the current version of the model). The model is based on the assumptions of systems dynamics, and it works at a high level of spatial aggregation. It includes a transportation model and a land use model. The latter simulates the relocation of economic activities and of residences in the area of study. Feedback loops among the sub-models allow taking into account the interactions among the changes in land use and the modifications in the transportation system and in travel behavior (and vice versa). The transportation sub-model of MARS-Bari was designed in order to allow various tests of interventions on the transportation system. It simulates the travel behavior of the users and their mode share among all relevant means of transportation in the region (cars, motorcycles, public transport-railway, bus services, and "soft mobility" represented by pedestrians and bicyclists). Different scenarios involving the development of transportation can be tested in MARS-Bari. In particular, the long-term effects of transportation projects can be estimated in terms of their impacts on travel behavior, and the other modifications they induce in the system of the economic activities and residences.

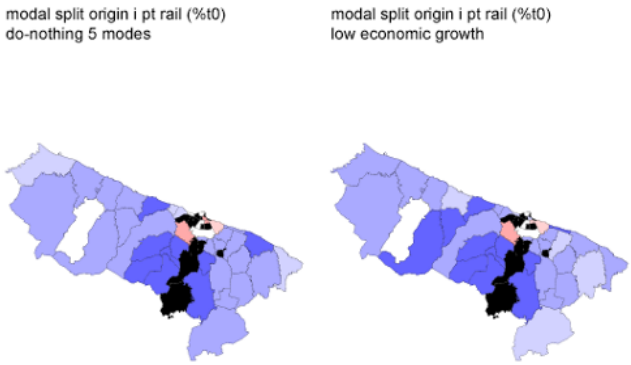
The transportation model of MARS-Bari is particularly suited to study the development of integrated strategies for transportation, designed according to a global vision of the future development of the city. The application of the model may assist planners in the fine tuning of such strategies: it would allow testing the results of their implementation, and checking the consistency of the proposed solutions with the aim of reducing pollutant emissions and the overall impact of transportation on the environment.

The transportation model of MARS-Bari allows evaluating the impact of such strategies on the travel behavior of users: it estimates the mode choice of travelers depending on the availability of private vehicles in each household. It identifies four main travelers' groups, depending on their access to private vehicles, which is defined in terms of possession of a valid driving license, and respectively of a car and/or of a motorcycle.

The effects of parking policies can be tested in the system through their impact on the friction factor for the use of car in the transportation and mode share sub-models. Specific projects of development in this field can be tested. Parking fee policies can be studied through the modification they determine on the attractiveness for the use of car for a specific trip from an origin *i* to a destination *j* in the metropolitan area.

The availability of parking in each zone of the system of analysis affects the use of car through the total parking capacity in the area, and the time needed to access a parking spot in the specific time of the day. The model allows testing specific parking policies, as the adoption of differentiated parking fee schemes for different parts of the day (e.g. for peak/off-peak), and differentiated fares for long term/short term parking. A subjective valuation factor is used in the model to correct the different amounts of time associated with the use of cars for the subjective perception e.g. of the walking time to access the car, the time spent in the vehicle, and the time spent to

find a parking lot. This allows a more realistic simulation of the choice behavior of travelers, and of the perception of the actual features of the choice alternatives. A similar factor measures the perception of costs for the use of car.



MARS-Bari forecasts of mode share under specific policies on the development of the transportation system

Similar functions are adopted for the use of motorcycles, with the important difference that parking is usually free for motorcycles (at least in the region of Bari), and that parking time is usually shorter.
The flexible cost structure adopted in the model allows testing several policies affecting the use of cars, as road pricing or the development of additional transit links in the region. Therefore the application of a similar model may considerably contribute to the development of transportation strategies in the area, as a way to test the outcomes from their implementation and from their future interactions with the other elements of the system.

Difference in the use of public transport in two future scenarios according the forecasts of the model

The model MARS-Bari was applied to several scenarios involving the adoption of specific interventions on transportation. The GIS interface of the model (shown in the figures) allows the users to represent the outcomes from the simulation graphically, e.g. in terms of numbers of trips originated from each zone, mode share, etc. Additional modules of MARS-Bari allow estimating traffic congestion in the different areas, and the levels of pollutant emissions due to transportation activities, in order to support the analysis of the environmental impacts and the level of (un)sustainability of the system.
The application of the model to specific scenarios that test transportation strategies with relevant modifications on the parking system is currently under development. The availability of the results of these simulations will contribute to the formulation of comprehensive transportation strategies, in order to integrate the local interventions on parking with the development of mass transit and the other interventions on the system, in a framework of improved and more environmental-friendly future transportation.

The role of parking in the future development of cities

This paper discusses the role of parking facilities in urban and metropolitan areas with the aim of analyzing how parking facilities can nowadays play an important role in the definition of packages of policies for sustainable transportation.
Parking infrastructure is an important element of the transportation system: they are a necessary support for private mobility, and a major element of more complex multimodal systems of transportation. In this paper, the organization of parking facilities is discussed from the viewpoint of the enhancement of sustainable transportation solutions. The contribution is based on the awareness that the determination of the optimal amount of parking space for an urban settlement is not a trivial task. The supply of insufficient parking space has negative effects on the environment, especially in presence of poor services offered by mass transportation, due to the increase in congestion on the road network, and the consequent increase in pollutant emissions.
An overcapacity of parking facilities contributes to increase congestion, since it induces additional travel demand and increase the attractiveness of the use of private vehicles. Moreover, in the long run, low density settlements with large parking space produce less pedestrian- and transit-friendly environments, with an overall decrease of environmental quality.
In the paper, the topic of the definition of parking policies in high-density urban areas is outlined with reference to some recent projects implemented in the city of Bari (Italy). From the analysis of the outcomes of such projects, the discussion moves to the

potential integration of parking policies into more comprehensive strategies for urban transportation.
The possibility of estimating the results of the implementation of such integrated strategies in long-term scenarios is then presented with regard to the use of a land use integrated model, MARS-Bari. This offers the possibility to estimate the long-term outcomes of the implementation of such policies, and to support the definition of the best suited interventions to include in such strategy.

Note

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For a Safer City. A Friendlier City. And a More Beautiful City.

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ABSTRACT

The issue of the safety of mobility in the urban environment has been emerging as a primary social topic for some time now due to the number of casualties and, more generally, due to the impact on living conditions in the city.
If correctly formulated, in fact, this subject has implications primarily and fundamentally with regard to the quality of urban life, as the citizen, and the vulnerable road user in particular, is severely restricted in their use of urban public spaces.
Consequently, an increasingly greater focus is being placed on acquiring methods, techniques and strategies for addressing the issue of planning, constructing and managing roads, squares and urban green spaces (and above all, applying the logic of reclaiming the historic and consolidated city) in order that the city can be used to its full potential by the citizen.
The subject itself therefore presents an opportunity to re-establish urban planning regulations (and, more generally, city regulations) in accordance with the renewed interest in public spaces.
The article discusses this matter and includes supporting elements and examples, also referring to the implications on the urban landscape.

Over fifteen years of scientific activity in the area of safety of the vulnerable road user in the city[1] have resulted in the forming of certain methodological considerations aimed at changing the regulatory culture.

The aim here, therefore, is to propose some ideas and thoughts in this regard, which may be of help in adopting a better approach to urban planning[2], whilst not claiming that these are by any means exhaustive or systematic.

First of all, it is only right to set the theme conceptually in terms of the attention that needs to be paid to the issue of accident rates. The following summary of references should suffice in this regard[3].

In Europe alone, road traffic accidents play a major role in the causes of mortality, leading to over 120,000 deaths every year. On a worldwide scale, over one million fatalities per year are estimated to have been caused by road traffic accidents. This is, in fact, equivalent respectively to a catastrophic event every year destroying a major town in Europe or a small metropolis in the world . Around two thirds of these victims occur in an urban environment, particularly in the case of pedestrians.

These events tend to escape public opinion as they are not newsworthy; it is generally, in fact, a case of a constant trickle of micro-accidents, each involving perhaps one victim only, normally occurring on urban streets and of which even the bystanders are only slightly, if at all, aware, often only becoming apparent when the silence is interrupted by the arrival of a police car or an ambulance[4].

One of the first points to consider, then, is that of becoming aware of the phenomenology and knowledge, both quantitatively speaking (in terms of the large numbers at stake) and, above all, qualitatively speaking (in terms of the ways in which the accidents are manifested[5]).

The next step, in line with the substantially interventionist culture of the engineer and the architect, is then to identify methods, techniques and policies to reduce the accident rate[6]. To this end, it is of course necessary to avoid certain expert points of view which are now dated and obsolete, even if on occasion they are still proposed and implemented whilst lacking any reason other than supposed common sense, with no theoretical basis and completely contradicted by established practices.

Thus, when implementing urban and land planning and design, it is necessary to lean with conviction towards approaches to the issue which are informed by what, for decades now, has been produced and established in the scientific and operational fields in terms of safety in mobility.

For the purposes - and within the space restrictions - of the scientific article, the summary references shown below should suffice in this respect[7].

Having established, first of all, the primary interest in the vulnerable road user and in the urban environment, it must also be noted that a similarly primary objective is to improve the performance level of spaces for mobility. However, the measures that have been implemented in relation to the individual causes of accidents have a negative impact, as they are in fact clumsy measures.

The performance level of spaces for mobility is, in turn, raised by the use of appropriate techniques for equipping these spaces; this involves a fascinating and fruitful field of research and operation which has seen progress on an unexpected scale over recent years (and which continues to be seen today!), where the field of urban planning finds the appropriate opportunity to collaborate and cooperate with those of transport, road construction and urban street furniture. Excellent results, which go by the name of "traffic calming[8]", have been achieved, and continue to be achieved! Traffic calming can be achieved with the maximum benefit, as we know, by operating on the horizontal and vertical geometry of the road, as well as with construction materials and urban street furniture so as to enable on the one hand the drivers of a motorised vehicles to perceive the characteristics of the urban environment within which they are moving, and consequently to adjust their style of driving to these characteristics (maximum speed being an essential factor); and on the other hand to provide the vulnerable road user with attractive environmental characteristics, allowing them easy access to various different parts of a street or square, thus making them the actual owner of the urban space.

Without claiming to be systematic, here is a possible initial list of good measures for calming traffic:

– reducing the section of carriageways and lanes[9];
– reducing the length of the straight stretches[10], also through the introduction of chicanes[11];
– regulating traffic at intersections by means of physical structures (such as raised crossings or roundabouts[12]), avoiding traffic lights[13];
– enabling the carriageway to be crossed from one side to the other by means of raised crossings[14];
– using suitably rough surfaces for the carriageway[15];
– alternating painted backgrounds and colourings in the road environment (particularly on the carriageway) in order to vary what the driver sees[16];
– introducing urban areas that are equally and methodically equipped for traffic calming, to ensure that the level of infrastructure provided is uniform and to meet relevant expectations with regard to safety[17].

The aim of achieving suitably high levels of road safety, however, does not provide a solution to the complexity of the issues relating to urban mobility.

Safety, particularly that of the vulnerable road user, is in fact just one (albeit totally defining and absolutely essential) step in attaining higher levels of quality of urban life[18].

The analysis of road traffic accidents in the urban environment, with a particular focus on the vulnerable road user, provides a distinct cue as to how the road traffic accident effectively represents a tragic instance, fortunately rare or indeed exceptional, of a more general phenomenology of urban hardship which is widespread and experienced on a daily basis by so many: that of the low level of usability (or, indeed total lack of usability) of urban public spaces on the part of the vulnerable citizen.

This is the case with children as well as the elderly or the disabled; the city and the land are too often designed in such a way as to prevent them being used easily and calmly by the more vulnerable citizens. The city is therefore seen by them to be inaccessible and even hostile.

The issue of safety in mobility in the city is thus referred to the more general issue, of which it forms part, of the quality of urban public spaces. This is, in fact, an absolutely central and defining topic in the field of urban planning which has sadly been overlooked in recent decades. Urban planning must now take possession once again of the themed spaces that were once its own, establishing, among other things, regulatory basics for these.

It may be useful at this point to mention the effect on the observer of the charming image of the graphic reconstruction of Ancient Rome, that we so often come across, even unintentionally, hanging in the capital's bookshops or newsagents. We are actually struck, if not astonished, by how a large number of the urban areas, systematically organised, were made up of urban public spaces, of an open nature. The nature of the urban planning functions of what was the city par excellence was in fact defined by the masterly selection of areas of this kind, whilst living spaces performed a minor role and were even wedged in between the urban public spaces of roads, squares, forums, etc.

The reality is that even living spaces derive functional benefit and a higher quality, less from the focus on the internal elements than from the functional level that the urban public areas -and in particular the open ones- are capable of achieving and then instilling in them. That is how it was for Ancient Rome. That is how it was for the cities that, over time, at best knew how to put the stones that formed them to the use of the society that had created them and is expressed in these.

But this is not how it was, sadly, for the urban expansion activities that shaped Italy (and not only Italy, but Italy especially) after the

Second World War, when areas of housing began to emerge[19] and open urban public spaces were, if provided at all, relegated to a residual role.

Starting out from the focus on the vulnerable road user as the greatest victim of urban accidents, we then come to the point of highlighting how the future of the city is at stake according to its ability or inability to define itself primarily by its open public spaces[20], and of how this attitude is formed in the way of re-establishing city regulations aimed at restoration (in the consolidated city), in the appropriate design and implementation (through expansion and new projects), and in the proper management and (continued) appreciation of these spaces. In each case with specific consideration and with every intervention targeted at the vulnerable citizen.

What virtuous logic can delay the achievement of these results?

First of all the pursuit, wherever possible, of soft mobility. In this regard, there is a need to reserve and equip as many spaces as possible for pedestrian and cycle access and to ensure that they are adapted to these needs through their very nature and equipment. And so, primarily, to create pedestrian areas.

Critical analysis of ongoing experiments, over the length and breadth of the land, since the experiment of pedestrianisation of urban areas began over recent decades, has however shown beyond any doubt that it is idealistic to believe that, in the contemporary city, large parts, or a significant number of sections of the urban area can be reserved for pedestrian areas pure and simple[21]. The reality of the situation demonstrates, in fact, that we are so dependent upon motorised vehicles, and the car in particular[22], that only modest parts of the extent of the urban settlement can be fully pedestrianised even with the best intentions in this regard.

It is useful to note the following: as we know, the pedestrian prefers to move in straight lines. From this observation, we come to the "axis of life[23]" concept, which refers to urban linearity with a view to making the best use of services aimed at socialising[24]; the axis of life is essentially characterised by pedestrian movement, whether with purpose or just strolling.

Therefore, realistically speaking, forced pedestrianisation may be most advantageously restricted to the axes of life; and to little else.

Meanwhile, in the rest of the city a prevailing role in making pedestrian movement safe and free can be provided by the widespread use of traffic calming techniques at a suitable level of severity,on a case-to-case basis, to allow for extensive expansion of spaces which can be calmly and positively used by the pedestrian in harmony with motorised vehicles which are adequately regulated in terms of their movement by the appropriate traffic calming measures.

The issue of cycling access can then be properly addressed on the basis of the result now obtained. The extensive recovery of public areas by implementing traffic calming techniques also grants full access to the cyclist, who is then able to move safely within the most diverse urban environments, without being restricted in their routes and paths. Cycle paths can thus be restricted to the smaller urban areas where the need to allow motorised vehicles to move quickly makes it necessary to separate the traffic elements.

It is appropriate, at this point, to stress the important theoretical and operational role (which is often sadly ignored or unacknowledged!) adopted by the "functional classification of roads", an essential document of the Urban Traffic Plan[25]. This is in fact the document that adopts the determining role of linking urban planning with mobility planning. In this area, based on the zoning of city environments as defined in the urban planning instrument, there is a requirement to define the consequent suitable physical layout of public spaces for roadways. It is, in short, the moment of choice, on a case-by-case basis, between total pedestrianisation, the integration provided by traffic calming measures, and the separation of the traffic elements. There is, thus, an incentive to focus on the cautious drafting of the functional classification of roads, moving away from seeing this as a tedious official obligation, as often happens, unfortunately.

It is, incidentally, also worth mentioning here that the availability of a suitable collective mobility system which is efficient due to its reliability is of help to the cause with which we are concerned: this is, in fact, the most effective means of containing and indeed reducing individual motorised mobility.

This, in turn, must not be the object of preconceived rejection; it is in fact a generally useful way of moving around, which is even indispensable on routes which would otherwise be impossible with shared transport because they would lack carriers or because too many carriers would be involved. The problems created for the city and the land by individual motorised mobility are not, in fact, due to its structural causes, but rather to the inappropriate use made of it by so many, particularly in the urban environment, whenever they are used indiscriminately when one should resort, even in a combined way, to walking, cycling and to shared transport systems. And thus helping to make the movement of the vulnerable road user unsafe or even impossible – exactly what we have provided some contributions to overcome[26].

Finally, I would like to outline the landscape implications of soft mobility.

First of all, we must remember the acquisitions already available on the subject with regard to the use of the landscape through pedestrian and cycle access.

This is a plentiful mix of opportunities, especially in relation to the area of tourism or leisure. In any case, we must be aware on the one hand of the wealth of results created by otherwise impossible opportunities to appreciate the assets of the landscape as we move slowly within it[27]. On the other hand, we must highlight the opportunity resulting from creating greenway systems particularly in regional networks , restoring and using historical roads, as in the case of Roman or medieval roads, river and canal towpaths, sheep tracks and herd trails, disused railway lines and military roads dating back to the last century[28].

And it is also worth saying a few words about the impact on the urban landscape of the restoration of open urban public areas. The traffic calming measures mentioned earlier have the effect of enhancing the visual elements that make up the urban fabric by introducing greenery, artwork, street furniture and technological components for the diversification (micro-environment by micro-environment) of spaces for pedestrians and of roadways. In other words, useful factors for differentiating one space from another, in order to create personalised and pleasant places[29]. In itself, then, the operation contains the seeds for the aesthetic improvement of the city in terms of those parts of it (the open public spaces, specifically), which, by their very nature, are the urban sections most subject to the regular use of people and where, therefore, investments produce the greatest synergy.

It goes without saying that projects in these kind of areas must enjoy priority of investment in order to maximise the positive results.

Also because, in a mature society, the focus on the aesthetic quality of the city has to be positively considered among the top priorities of the administration as it bears results which are particularly enjoyed and appreciated by citizens and by city users.

Notes

[1] The concept of the vulnerable road user is important in every approach to the subject under discussion.
As we know, the issue can be addressed primarily with a comparative criterion: from this viewpoint, the vulnerable road user is the person who, in the event of a collision, suffers the most damage; so, for example, the car is vulnerable in relation to the truck, the motorcycle in relation to the car, the bicycle in relation to the motorcycle, and the pedestrian in relation to every other road user.
It is, however, with a focus on the absolute value of the entities involved that the concept of the vulnerable road user demonstrates the conceptual potential appropriate to it, establishing new and determining regulatory conceptualisations for the city context; it is, in fact, the focus on pedestrians and, in particular, on the most vulnerable of these , such as children, the elderly and the disabled, that needs to be the absolute priority when revisiting urban spaces, especially public spaces, with a view to meeting the requirements of these users.

[2] Specific in-depth analysis is possible due to the vast amount of scientific literature produced on the subject over recent decades. Of particular significance are the Proceedings of the International Conference Living and walking in cities (and the extremely extensive bibliography included therein), which has been held regularly on the initiative of the University of Brescia since 1994, always in the month of June. The Conference, maintaining continuity of the dominant, defining theme, effectively and strongly illustrated by its title, centres every year on a significant and contemporary interpretation of “living and walking in cities”, as demonstrated by the subtitles of the various conferences: Town planning and infrastructure project for safety in city life (1st edition, 1994), Ripensare vie e piazze per la serenità e la sicurezza (2nd edition, 1995), Going to school (3rd edition, 1996), Handicap in mobility (4th edition, 1997), Elderly people’s mobility and safety (5th edition, 1998), Policies for safety in mobility: from the community level to the municipal one (6th edition, 1999), Pedestrian mobility and public transport (7th edition, 2000), Town and infrastructure planning for safety and urban quality for pedestrians (8th edition, 2001), The place of bicycle (9th edition, 2002), Non motorized mobility and land resources (10th edition, 2003), Historical centers (11th edition, 2004), The outskirts (12th edition, 2005), The place of green (13th edition, 2006), Space for public shows and trade fairs (14th edition, 2007), Minor communities: renewal and valorization (15th edition, 2008), Young peoples and urban spaces (16th edition, 2009). Each Conference is held over a period of one to three days in Brescia and other venues (Bergamo, Cremona, Milan, Parma, Piacenza), also in collaboration with other universities (Polytechnic of Milan, Catholic University of the Sacred Heart, University of Bergamo, University of Milan, University of Parma) and with the involvement of the city councils, of professional associations, municipal bodies and interested local institutions and associations. The Conference Proceedings, all regularly published, each contain the texts of around forty or so reports, sometimes by various authors. The editors of the relevant volumes have been: R.BUSI and V.VENTURA (I, II, III and IV), R.BUSI and M.PEZZAGNO (V, VI, VII and VIII), M.PEZZAGNO and K.SANDRINI (IX, X and XI),

M.PEZZAGNO and E.CHIAF (XII, XIII, XIV, XV and XVI). For the scientific purposes of this article, please see in particular the Introduction to the single volume, also edited by the Chairman of the Conference, R.BUSI.

[3] The order of magnitude that follows is taken from the following online publications relating to World Health Day, 7 April 2006, edited by the World Health Organization and by the World Bank: World report on road traffic injury prevention and Preventing road traffic injury: a public health perspective for Europe. These sources can be referred to for an in-depth study of the quantitative values of the phenomenology.

[4] Public opinion is, however, sometimes effectively aroused by the mass media with regard to events which are catastrophic because they involve several vehicles, typical of non-urban and motorway accidents in particular. In these cases, in fact, the number of victims resulting from the same accident, combined with the horrific images of crushed vehicles, are factors which lead to a strong and, rightly so, appropriate awareness of the dangers of mobility. Whilst it is always helpful for people to become involved in these issues, it is essential to remember that, as stated above, the urban environment is where the issues relating to lack of safety on the roads is prevalent.

[5] Of particular significance in relation to this aspect is the approach taken to the issue through studying "accident scenarios", according to a useful technique that we owe to the Institut National de Récherche sul les Transports et leur Sécurité (INRETS). For a systematic view of the subject, cf. D.FLEURY, Sécurité et urbanisme. La prise en compte de la sécurité ruotière dans l'aménagement, Editions Presses de l'Ecole Nationale del Ponts et Chaussées, Paris, 1998. An interesting methodological approach, also rigorously applied in some representative case work, can be found in: G.MATERNINI, La sicurezza del pedone in città. Il caso di Brescia, Sintesi editrice, Brescia, 1994.

[6] Specific in-depth analysis is also possible in this case due to the vast amount of scientific literature produced on the subject over recent decades. Of particular significance are the Proceedings of the Refresher Course on Tecniche per la sicurezza in ambito urbano (and the extremely extensive bibliography included therein), which has been held regularly on the initiative of the University of Brescia since 1997, published in a specific series by Egaf Edizioni of Forlì, edited by R.BUSI. The Refresher Course, maintaining continuity of the dominant, defining theme, effectively and strongly illustrated by its title, centres every year on a significant and contemporary interpretation of safety in the urban environment, and on the relevant techniques which need to be applied in order to achieve it, as demonstrated by the titles of the various courses: La protezione del pedone negli attraversamenti stradali (1st edition, 1997), La classificazione funzionale delle strade (2nd edition, 1998), Le normative europee per la moderazione del traffico (3rd edition, 1999), Intersezioni stradali: le normative europee (4th edition, 2000), Integrazione tra autoveicoli e traffico non motorizzato (5th edition, 2001), Le normative sulla progettazione stradale e l'analisi di sicurezza (6th edition, 2002), Elementi per la redazione del regolamento viario (7th edition, 2003), Gestione delle strade in presenza di cantieri (8th edition, 2004), Interventi per incentivare la mobilità non motorizzata (9th edition, 2005), Le intersezioni stradali a raso (10th edition, 2006), Criteri per una corretta segnaletica stradale (11th edition, 2007), Progettazione e gestione degli spazi esterni alla carreggiata (12th edition, 2008), Linee guida per la realizzazione delle fermate del trasporto pubblico locale (13th edition, 2009). Each Refresher Course is held over a period of two days in Brescia (the first three courses) or in Desenzano del Garda (all subsequent courses), with the involvement of the Province of Brescia, the Municipality of Brescia or of Desenzano del Garda, the Association of Engineers of the Province of Brescia, of Stradamica (Association for the Safety of Vulnerable Road Users), of the AIIT (Italian Association for Traffic and Transport Engineering), of ASM (Municipal Services Company) Brescia S.p.a., and of ACB (Automobile Club of Brescia). The Proceedings of the Refresher Course, all regularly published and sometimes the subject of future courses, each contain the texts of around a dozen reports, generally by various authors. The editors of the relevant volumes have been: R.BUSI and L.ZAVANELLA (I, II and III), G.MATERNINI and L.ZAVANELLA (IV), R.BUSI and M.TIBONI (V), G.MATERNINI and S.FOINI (VI, VII, VIII, IX, X, XI, XII and XIII). The director of the Refresher Course is R. BUSI and the vice-director G. MATERNINI.

[7] The issue, whilst now in fact of great importance in its own right, must of course always be seen as an integral part of the broader subject of the relationships between technological components of the city and the quality of urban life (cf. G.DUPUY, Urban networks, network urbanism, Techne Press, Amsterdam, 2008.

[8] The following essential bibliographical references should suffice on this topic, which is the subject of major scientific studies and of significant international application: R.TOLLEY, Calming traffic in residential areas, Brefi Press, Brefi, 1990; C.HASS-KLAU et al., Civilised streets. A guide to traffic calming, Environment and transport planning, Brighton, 1992; L.HERRSTEDT et al., An improved traffic environment. A catalogue of ideas, Danish road directorate, Copenhagen, 1993; COUNTY SURVEYORS SOCIETY, Traffic calming in practice, Landor Publishing, London, 1994; P.NOYES, Traffic calming primer, Pat Noyes and associates, Boulder, 1998; R.EWING, Traffic calming. State of the practice, Institute of transportation engineers, Washington, 1999.

[9] As we know, the increased width of the carriageway or lane is a factor, all other things being equal, in increasing the speed of the

vehicle. The proximity of the edges of the road to the vehicle, on the other hand, leads the driver to moderate their driving. The driver, in fact, sees the increased road width as reassuring; this characteristic is moreover typical of non-urban fast roads and the driver therefore tends towards the style of driving corresponding to these type of road conditions.

[10] As we also know, the increased length of the straight stretch is a factor, all other things being equal, in increasing the speed of the vehicle. The presence, however, of a nearby feature causes the driver to moderate their driving. The driver's field of vision, in fact, as soon it can focus on a nearby background, tends to widen, thus perceiving features in the surrounding (urban) environment and causing the driver to adapt to the style of driving in keeping with the location.

[11] The chicane, well known as a means of slowing down vehicles in motor sports, also has a beneficial role in calming traffic. Rather than simply using horizontal signs, it can take the form of background features aimed at diverting the path of the traffic. These background features can consist of physical and visual obstacles made up of urban greenery (trees, shrubs, etc.), parking spaces (in line, herringbone), monuments and, more generally, elements of urban street furniture.

[12] Raised crossings and roundabouts, as well as being important and effective mechanisms for reducing speed (breaking the continuous path of the vehicle by interrupting the horizontal and vertical lay of the land), are also highly efficient at dividing traffic as they enable flows to be self-regulated.

[13] Traffic lights, in fact, are notorious for making traffic less safe as they cause vehicles to speed without creating any means of mitigating the outcome of accidents. Traffic-light-controlled crossings are, in truth, generally the scene of very serious accidents. Furthermore, traffic lights have a modest capacity for self-regulation as the size of the traffic flow varies along the different routes. Neither has fitting traffic lights with all the more complicated mechanisms ever achieved significant effects in terms of increasing the safety of the crossing equipped in this way or in terms of improving the regulation of the traffic flow at different times of the day, week, season or year. Incidentally, one can appreciate the groundlessness and indeed the oddness of attributing the adjective "intelligent" to traffic lights when, as has unfortunately been the bad practice for decades now, some inventor expresses his creativity from time to time by fitting them with some device. Intelligence, far from being displayed by traffic lights, is in fact an aptitude exclusive to the human species, consisting of exercising one's critical capacity.

[14] The focus on the vulnerable road user is effectively illustrated by removing the need for them to deal with variations in level. This objective can best be achieved, when possible, by maintaining the same level for both the carriageway designed for vehicles and for the pedestrian areas. In order for them to be able to move around easily, it is necessary in these cases, firstly to ensure that the traffic is calmed significantly (so as to achieve perfect harmony between vulnerable users and motorized vehicles without the former being disturbed in the slightest), and secondly to ensure that the areas strictly reserved for pedestrians are bordered by vertical elements (posts or similar). When, however, it is necessary (or appropriate) to resort to the conventional solution of a pavement, the crossings must be appropriately raised to the level of the pavement to which they are to be linked, both to enable the crossing to be at the level of the vulnerable user from one side of the road to the other, and to form an additional significant means of calming the traffic, consisting of interrupting the vertical layout of the carriageway by raising the height to that of the pavement.

[15] Which transmit sufficient micro vibrations to the vehicle when it exceeds speeds which are incompatible with the urban environment. Stone paving with a suitably rough top surface can generally be used effectively for this purpose.

[16] In fact, it is advisable to avoid, in particular, bitumen or asphalt surfaces , which with their monotonous coloring suggest to the driver a non-urban road, causing them to adopt styles of driving which are inappropriate to the urban environment. It can, however, be advantageous to make (ample) use of appropriately emphatic horizontal signs; or, better still, to paint the carriageway in suitable alternating colors or with designs. One excellent technique is to use stone surfaces with various different sizes of stone and colorings.

[17] A typical case is that of "30 Zones", especially identified and their borders defined not only by means of signs but above all, by means of "gates" which are physically constructed in order to convey as well as possible to both the vulnerable road user and to the vehicle driver the message of the presence of a spacious urban surface characterized by traffic calming elements aimed at preventing the speed limit of 30 km/h from ever being exceeded. However, the 30 Zone concept is much more complex (and beneficial, due to the wide range of possibilities available), than is suggested by reference to the upper speed limit effectively permitted for vehicles. In effect, a 30 Zone corresponds to a district, as has been established for some time by urban planning regulations, thanks also to the studies of Vincenzo COLUMBO (cf. V.COLUMBO, La ricerca urbanistica. Organica urbanistica, Giuffrè, Milan, 1966). The 30 Zone corresponds, in fact, to the most appropriate mechanism in urban public spaces for mobility in a district. For an in-depth analysis of the technical implications of 30

Zones, cf.: CERTU, Guida alla "Zona 30". Metodologia e raccomandazioni, translation by V.VENTURA, Editoriale Bios, Cosenza, 1999; C.SOCCO and C.MONTALDO (edited by), Linee guida Zone 30, Regione Piemonte, Turin, 2007. See also the bibliographies listed therein. Another example of a type of urban zone that has been equally and methodically equipped for traffic calming is the Dutch woonerf, from which the English term "home zone" derives. This is an urban zone, the road network of which is moderated by stricter means than the 30 Zone. Focusing on the basics of urban planning regulations and on the contributions we owe to COLUMBO, we can confirm that the woonerf corresponds to the most appropriate mechanism in urban public spaces for the mobility of a neighborhood. For an in-depth analysis of the technical implications of the woonerf, cf.: M.SOUTHWORTH and E.BEN-JOSEPH, Streets and the shaping of towns and cities, Island Press, Washington D.C., 2003.

[18] On this subject cf. R.BUSI, Sicurezza è bellezza, in F.BRONZINI, A.BEDINI, S.SAMPAOLESI (edited by) , Il profumo della città, Il lavoro editoriale, Ancona, 2009.

[19] Often (sadly!) on a speculative basis.

[20] Of primary scientific and operational interest to this subject in relation to accessibility (cf. M.TIRA, *Accessibilità e sicurezza degli spazi pubblici urbani*, in A.ARENGHI (edited by), *Design for all. Progettare senza barriere architettoniche*, UTET, Milan, 2008.

[21] In all cases it must be remembered that the pedestrianisation of an urban area can never be absolute. There is in fact a need, at any time, for access on the part of public safety services (the various police forces) and emergency services (fire brigade, ambulances, etc.), and during particular hours, for supply vehicles (for shops, etc.), refuse collection and works vehicles (road works, underground services, construction, etc.). It may also be appropriate to grant access to taxis and other means of shared surface transport. On the whole, the presence of vehicles is not negligible.

[22] Cf. G.DUPUY, Automobile e città, Il saggiatore, Milan, 1997; G.DUPUY, La dépendance automobile: symptomes, analyses, diagnostic, traitements, Anthropos, Paris, 1999.

[23] Among other things, we are indebted to COLUMBO for having systematised the "axis of life" concept, which is essential, as we know, for urban planning and design. He conceived and formulated this concept by developing certain ingenious intuitions of Giovanni MUZIO. Cf. (in addition to the aforementioned source, of 1966): V.COLUMBO, *L'organizzazione dell'abitazione nella comunità. L'unità residenziale elementare (unità quartiere)*, L'ingegnere, Milan, 1950, n. 6; V.COLUMBO, *La città articolata*, Atti del XIV Congresso internazionale di sociologia, società italiana di sociologia, Rome, 1950; V.COLUMBO, *I servizi pubblici nel quadro urbanistico. Ricerche sulle attrezzature sociali dei quartieri organici*, Atti del IV Convegno nazionale degli ingegneri italiani, Collegio degli ingegneri in Milano, Milan, 1951; V.COLUMBO, *La comunità, cellula umana del piano regionale, nell'organizzazione urbanistica sociale*, Rivista di ingegneria, Milan, 1953, n. 12; V.COLUMBO, *Il quartiere e la comunità*, Atti del VII Congresso nazionale di urbanistica, Bologna, 1958; V.COLUMBO, *Sulle ricerche sociali in urbanistica*, Atti del I Congresso nazionale di scienze sociali, Stresa, 1960; V.COLUMBO, *Ricerche sui quartieri coordinati*, Il corriere amministrativo, Empoli, 1960, n. 15 and 16; V.COLUMBO, *I quartieri CEP e il tema sociale*, Il giornale dell'ingegnere, Milan, 1960, n. 14; V.COLUMBO, *L'equivoco dei quartieri detti autosufficienti: Quartieri CEP o new towns?*, Il giornale dell'ingegnere, Milan, 1961, n. 6; V.COLUMBO*, Problemi economico-sociali di attualità urbanistica: i quartieri residenziali e la funzione lavoro*, Il giornale dei costruttori, Milan, 1961, n. 19 and V.COLUMBO, *L'equivoco delle unità urbanistiche autosufficienti: quartieri semiautonomi e comunità autosufficienti*, Rivista di ingegneria, Milan, 1964, n. 4. The subject was subsequently developed by those who continued his work and, in particular, by the Scuola di Brescia; among the many references, cf.: R.BUSI, *Le isole pedonali: l'aspetto ecologico-geoambientale*, Atti del Convegno "La pedonalizzazione delle aree urbane", CRSUL, Milan, 1974; R.BUSI, *Le funzioni della piazza nell'organismo urbanistico: il caso di Piazza del Duomo in Milano*, Atti del Convegno "Piazza del Duomo e dintorni", Università Cattolica del Sacro Cuore, Milan, 1984 in Arte lombarda, Milan, 1984 n. 70/71; G.MATERNINI, S.FOINI, *Proposta di classificazione ambientale delle strade*, Le strade, Milan, 2008 n. 7/8.

[24] Most significantly known by the term "life centres", as in the case (referring to the characteristic functions) of the "civil" life centre, the "religious" life centre and "commercial" life centre. Not every life centre of course is a single, specific structure, but rather a combination of elements (sometimes complex and intricate) aimed at making possible the moments of civil, religious and commercial living respectively, particularly in view of their associative implications. Life centres tend to align themselves along an axis (the axis of life) and, at the same time, generate and are enhanced by pedestrian movement, whether motivated by the actual need to go from one place to another or by the enjoyment of "passing the time" in an attractive environment designed for this purpose.

Incidentally, we must remember that a useful role of cities is also to allow the citizen to identify with the urban environment as much as possible through easy and free pedestrian movement (cf. D.DEMETRIO, *Filosofia del camminare*, Raffaello Cortina Editore, Milan, 2005). We are also indebted to COLUMBO for having

systematised the "life centre" concept (cf. the aforementioned extensive bibliography).

[25] Cf. G.PROTOSPATARO, *Codice della strada commentato*, Egaf Edizioni, Forlì, 2009.

[26] In order to systematise the absolute and reciprocal roles, in a land and urban environment of pedestrians, cycle access, shared transport systems and the individual motorised transport system, cf. R.BUSI, *Vivere e camminare sull'Adriatico*, Atti del Convegno "Mare nostrum: turismo e mobilità", Comune di Senigallia, Senigallia, 2007 (in the process of being published); R.BUSI, *Muoversi nella città amica*, Atti del Convegno "I "perché" di una metropolitana sotterranea in aree di media dimensione", CTM, Cagliari, 2008 (in the process of being published).

[27] "*...in automobile si traversa, non si conosce una terra. A piedi ...vai veramente in campagna, prendi i sentieri, costeggi le vigne, vedi tutto. C'è la stessa differenza che guardare un'acqua o saltarci dentro...*" by C.PAVESE, *Il diavolo sulle colline*, in C.PAVESE, *La bella estate*, Einaudi Editore, Turin, 1949.

[28] Cf. R.BUSI, M.PEZZAGNO (edited by), *Mobilità dolce e turismo sostenibile. Un approccio interdisciplinare*, Gangemi Editore, Rome, 2006; R.BUSI, M.PEZZAGNO (edited by), *Camminare sull'Adda. Un sistema di percorsi per la mobilità dolce*, Gangemi Editore, Rome, 2007.

[29] Cf. A.TOCCOLINI, *Progettare i luoghi piacevoli*, Maggioli Editore, Rimini, 2009.

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Mobility Network and Safety[1]

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ABSTRACT

Mobility network is crucial for ensuring territorial safety with respect to natural and technological hazards. They represent a basic support to community's everyday life although being exposed elements often characterized by high vulnerability to different hazards and, in the meanwhile, strategic equipments for emergency management. Physical damages or the lack in functioning of those networks may greatly increase the loss of human lives caused by hazardous events as well as produce relevant economic damages at medium and long term. Although the relevance of the mobility networks in assuring territorial safety is at present largely recognized, risk analyses have been long focused on buildings' vulnerability or, even where they have paid attention to mobility network, they have been mainly focused on the physical damages that a given hazard could may induce on individual elements of such network. It is recent the awareness that mobility network represents a system, characterized by relevant interdependences both among its elements and among network infrastructures and urban systems. Based on these assumptions, this paper points out the heterogeneous aspects of the mobility network vulnerability and their relevance in increasing the overall territorial or urban vulnerability to hazardous events. Therefore, an in-depth investigation of the concept of mobility network vulnerability is provided, in order to highlight the aspects mostly investigated and more recent research perspectives. Finally, a case study in the Campania Region is presented in order to point out how traditional risk analyses, generally referred to individual hazards, can sometimes led to invest in the mobility network improvement or development which, targeted to increase the security of a territory result, on the opposite, in an increase of the territorial vulnerability.

A key point to explore the relationship between mobility and security is the role of mobility network for ensuring territorial safety with respect to natural and man-made hazards. For many years, increasing the security of settled communities against hazards has represented one of the main target of the strategies addressing a sustainable urban and territorial development: a community, indeed, can be defined as sustainable and resilient when it is organized in such a way to minimize the effects of a disaster and to assure a fast process of recovery (Tobin 1999). The mobility network plays, in this context, a crucial role in that it represents one of the basic elements of the wider system of lifelines, which supply the communities with essential services for everyday life – on which health, comfort and socio-economic welfare depend – allowing in the meanwhile an effective response in case of emergency (Paton and Johnston 2006). Therefore, mobility network represents, on the one hand, exposed elements often characterized by high vulnerability levels to different hazardous events and, in the same time, strategic equipments both for everyday life of a community and for emergency management, being crucial elements to guarantee the access and the exodus from the hit areas in the immediate post event. Physical damages or failures affecting the functioning of mobility network may increase, also significantly, the loss of human lives caused by a hazard as well as induce relevant economic damages on medium-long term too.

Besides, by shifting the attention from the mobility network itself toward the relevant flows of people and goods they generally support, the impact of a given hazard may even trigger secondary, even remarkable, events such as explosions or toxic releases: transportation means carrying dangerous substances or hazardous plants placed along the network should be directly affected by the hazard itself or by its consequences on the network.

Although the relevance of the mobility network in assuring territorial safety is nowadays largely recognized, risk analyses have been long focused on physical vulnerability of building stock; even when more attention has been paid to road infrastructures, physical damages that a given event may induce on individual elements have been mainly investigated.

It is still quite recent the awareness that mobility network represents a system, characterized by relevant interdependences: either because each element of the network is linked to all the others, or because there are several interdependences not only among the different typologies of network infrastructures, but also

among network infrastructures and urban systems. Road and railway networks, for example, should be not directly damaged by a hazard, but suffer indirect damages due to the direct ones affecting other network infrastructures, such as the electric or the sewerage ones. In the same way, inside urban areas, road and railway networks could suffer functional damages due to obstructions caused by the partial or total collapse of buildings. Starting from the above assumptions and grounding on several past disasters, in the following pages, the numerous facets of mobility network vulnerability and their influence on the vulnerability of a territorial or an urban system to hazardous events will be analyzed. Therefore, an in-depth review of the concept of vulnerability in relation to mobility network will be provided, in order to point out the most investigated aspects up to now. Finally, the last part of the paper will be focused on a case study in the Campania Region aimed at pointing out how traditional risk analyses, usually based on single hazardous events, can led to invest into the improvement and adjustment of mobility network which, targeted to increase the security of a territory result, on the contrary, in an increase of the territorial vulnerability. The case study is part of a wider study developed by the authors within the Italian Research Project (PRIN) 2006-2008 entitled "Early Warning Systems: technical, urban planning and communication aspects".

Hazardous events and mobility network: which impacts?

The impacts of natural and technological hazards on mobility network are numerous and include not only direct physical damages to networks themselves, but also indirect or secondary damages such as loss of accessibility to hit areas, often with dramatic consequences on the rescue operations and/or economic damages at local and regional scale over long temporal span.

The most common damages, and the most investigated ones in current literature too, are the physical ones caused by different natural and, to a lesser extent, technological hazards: in particular physical damages caused by earthquakes, landslides and floods on road and railway networks.

Earthquakes may affect road networks in several ways. Very often a hit road, although damaged, still performs its purpose: in many cases, after an earthquake minor cracks appear on the road surface; such minor damages do not directly affect the road functioning but may induce faster degradation phenomena of the road quality over time, as highlighted by the Hokkaido Tocachi-Oki earthquake occurred in 2003. Nevertheless, very frequently physical damages to the road networks are so relevant that they severely affect also the functionality of the roads. Such damages, often due to the ground shaking or to site effects, produce a total loss in road functioning, because of the physical damage to the road itself or, in some cases, to the collapse of critical elements of the network such as bridges, viaducts, tunnels. The Japanese and North-American earthquakes provide relevant examples of those types of damages. The Hokkaido Toho-Oki Earthquake occurred in 1994 caused relevant damages to road infrastructures, with relevant cracks due to local liquefaction phenomena; the Kobe earthquake in 1995 severely affected the road network, by dividing the road surface into big plates and causing the collapse of important road axes (Tung 2004).

Besides, it should be considered that road infrastructures often play a crucial role in the wider mobility system: the interruption of a road can have repercussions on the overall mobility system at both local and regional scale producing, sometimes, relevant consequences also in terms of loss of human lives.

The total or partial collapse of viaducts and bridges represents one of the most typical damage due to seismic events as highlighted by several past events: during the Northridge earthquake in California occurred in 1994, 6 bridges collapsed and 157 elements among bridges and viaducts were seriously damaged; the Loma Prieta earthquake in 1989 caused relevant damages to more than 80 road infrastructures; the earthquake occurred in Alaska in 1964 caused the collapse of the Cooper River Highway; the San Ferdinando earthquake in California in 1951 caused the partial destruction of the bridges on the Golden State Freeway[2].

Losses in functioning of the road networks might also occur without relevant physical damages to the roads themselves, as a consequence of secondary events triggered by the earthquake or due to the obstruction of the road by debris materials. Sometimes, damages to mobility network may be due to secondary hazard, such as landslides induced by earthquakes, floods caused by breaks in not seismic-resistant dykes and embankments, fires or technological accidents. The obstruction of the roads due to triggered landslides are very frequent in mountain areas outside urban centers, whereas in the urban centers, mainly in the historical areas, one of the main problem to deal with during the emergency phase is the obstruction of numerous roads due to building collapses.

In the first case, the induced landslides, although not causing relevant damages to the road, can determine loss of functioning which can be quickly restored, as it occurred after the Miyagiken-Hokubu earthquake in Japan in 2003.

Roads interrupted by building debris are very frequent in urban areas: in these cases, damages to the road surface might be light, but consequences in terms of accessibility or efficacy of rescue activities might be very relevant. Several examples of such types of damages have been recorded in past earthquakes, even not severe

ones, which hit historic urban areas characterized by a compact morphology. This kind of urban settlements is very common in Italian cities but also in numerous other Mediterranean areas, such as Greece, or east areas such as Japan and Taiwan. Hence, relevant obstructions along the road networks due to building total or partial collapses have been largely recorded during the earthquake which has recently hit the Abruzzo Region in Italy, or in other events, such as the one occurred in 1997 in the Umbria and Marche Regions or the ones which hit Friuli (1976) and Irpinia (1980).

Apart from earthquakes, landslides, volcanic phenomena such as lava and pyroclastic flows, other hazardous phenomena, such as tsunami, hurricanes or floods may induce relevant direct damages to the road network too. Such phenomena may cause physical damages to the road surfaces or induce obstructions which interrupt the links among different territorial areas and require relevant interventions to restore road functionality. During the 2008 flood in Piemonte, for example, relevant damages and interruptions of road networks occurred, also with the collapse of bridges and supporting walls caused by lateral erosions and mud and debris flows (Provincia di Torino 2008).

Many examples of different types of damages which may affect road networks in case of hazardous events are provided by the Katrina hurricane. The latter represents an emblematic case for showing how chains of events, being apparently "improbable", can be more frequent than it could be thought: from a "large aircraft fuel tank transported by storm surge to freeway roadside", to boats "dragged inland by storm surge until finally colliding with Interstate Highway Bridge", with the consequent closure of road for repairing the bridge that "sustained many similar collisions along its span" (Wyndham Partners 2005). When rail networks are involved, the damages caused by hazardous events are very similar to those described for the road networks, with the addition of the likely running off of the trains conveying hazardous substances. That is what happened in the dramatic accident occurred in 2009 in Viareggio (Italy), where a freight train carrying GPL went off the rails very close to the railway station, in a densely built up area where numerous buildings were located along the railroad: the explosion of the GPL spilt out the tank wagon provoked 20 dead, 50 injured people and the collapse of two buildings close to the station. Furthermore, there was the need for evacuating other buildings damaged by the explosion and consequent fire. Generally speaking, as concerns technological accident, it is possible to distinguish those occurring along the mobility network, because of the transport of hazardous materials, and those that, occurring in hazardous plants located nearby mobility network, hit elements of the networks themselves. In relation to the first typology of events, it is possible to remind, apart from the above-mentioned Viareggio disaster, the accident occurred in San Carlos de la Rapita (Spain), in 1978, where a fireball due to the overfilling of a tanker carrying 22 tons of propylene, provoked 200 dead in a camping, or that occurred in Houston in 1976, when a tanker carrying 19 tons of ammonia fell from a height of 10m. producing a toxic cloud which killed 6 people. In Italy it can be mentioned the event of Capannori, occurred along the Firenze-Mare Highway in 1982 where 4 people died and 2 were injured because of a pile-up caused by fog[3] or the disaster of Casalguidi in 1985[4] in which 2 people died and 4 people were seriously injured.

Among the most well-known technological accidents occurred along railway networks, the one occurred in San Luis Potosi (Mexico) in 1981 – when a train went off the rails into an urban area causing the break of a rail tank carrying 100 tons of chlorine which, in turn, provoked a toxic cloud which killed 20 people – and the one occurred in Georgia (USA) in 1959 – when the break of a rail tank carrying 18 tons of GPL as a consequence of a derailment caused an explosion in a pic-nic area killing 23 people – can be mentioned.

There are also several examples of disasters caused by sea transports, like the one occurred in Bantry Bay (Ireland) in 1979, when a French oil tanker burnt during the unloading, causing the explosion of an oil terminal, in which 50 people died.

Roads and railways are not the only targets of hazardous events. Also the damages to port infrastructure and navigable channels due to seismic events are relevant, even though less investigated. Not surprisingly, the several damages to port infrastructures caused by the Kobe (1995) and the Tokachi-Oki (2003) earthquakes in Japan and the Lefkada earthquake (1999) in Greece have led to work out technical advices and guidelines for port seismic safety.

Other relevant seismic targets are the airports; in detail, whereas the main airport structures are generally built up according to high safety standards, some vulnerable elements are often located within the airports, such as control towers or fuel tanks. Other natural phenomena have also affected air mobility: it is worth mentioning, for example, the consequences of the 1944 Vesuvius' eruption, which produced damages and delays to the Anglo-American air forces or, more recently, the closure of important Sicilian airports due to the Etna eruptions in 2001 and 2007.

As already said, even if there are no important physical damages, losses in functioning of the road networks may occur, causing a reduction in the accessibility to some areas with consequent delays in rescue operations and relevant difficulties in emergency management. The Katrina hurricane showed that also in case of floods, the main problem is the evacuation of population both in alert phase – before the occurrence of the phenomenon – and in post event phase, when the mobility network is seriously damaged or completely interrupted or where, as in New Orleans, most of people depend on public transport. In New Orleans, indeed, the

evacuation plan was largely based on private cars, whereas "hundreds of thousands of residents were unable to evacuate because they lacked transportation" (Litman 2006). Also in case of earthquakes, the lack of accessibility causes relevant failures, mostly when the hazardous event involves big urban centres, like the earthquake occurred in 1980 in the Campania Region (Galderisi and Ceudech 2005).

Physical and functional damages suffered by the mobility network may also induce relevant socio-economic medium and long term consequences, involving both the block of the travels from the working places to residential areas and the freight flows to and from the hit area. Moreover, when the network infrastructures link distant places crossing the area hit by a hazardous event, the consequences of the disaster might reverberate on areas very far from the disaster core, with social and economic consequences too (systemic damages). These types of consequences have been largely stressed in relation to some disasters: in Kobe earthquake, the damages to port infrastructures, mainly due to the liquefaction of the soil, had big repercussions on the national and international trade (Kajitani et al. 2000). Also the Midwest flood in 1993 highlighted the relevance of economic damages caused by the block of port activities (Tierney et al. 1996): 5000 river cargo ships were hit and the cost of the delay in the freight traffic was estimated in several million dollars per day. An in-depth study on the economic impacts of the Northridge earthquake (Tierney 1997) has shown the importance of medium and long term damages to the economic activities and the central role that the interruption of transport networks can play (Gordon et al. 1998).

Analyzing networks vulnerability: approaches and methods

Methods and techniques addressed at analyzing vulnerability of mobility networks have been mainly developed in the field of seismic hazard studies. Furthermore, many European research projects aimed at deepening network infrastructures vulnerability (Risk-UE, LessLoss) have been mostly focused on earthquakes too. Nevertheless, starting from the Nineties, the investigation field has been progressively widened not only in relation to the typology of the considered hazards, but also in relation to the types of vulnerability which are taken into account.

In respect to the first of the two mentioned points, first of all it is worth underlining that in the mid-Nineties, in Australia, USA and New Zeeland, the methodologies used to analyze lifelines vulnerability to earthquakes were applied to investigate vulnerability toward other hazard factors, such as wind storms, floods and tsunami. In Europe, among the recent projects based on a multi-risk approach, the following should be mentioned: the ESPON project – which, although dealing with exposure and vulnerability of mobility network, did not provide any indicators to evaluate them – and the Armonia project – which, grounding on the knowledge-base already available in scientific literature, pointed out some vulnerability indicators, both on regional and local scale, with reference both to the physical vulnerability of mobility infrastructures and to the crucial role they play in the capacity of settled communities to cope with hazardous events (*copying capacity*) (Galderisi and Menoni 2007). Moreover, even the research studies focused on individual hazard factors are more and more taking into account the impacts caused by the likely chains of hazardous events that can issue from a triggering event. An interesting study on vulnerability of transport systems to seismic events in the USA central area, questioning about the typologies of impacts that such events may cause on infrastructures, takes into account not only those directly produced by the earthquake, but also those due to all likely – natural and technological – hazards that the earthquake might cause (such as landslides or toxic releases) (Central U.S. Earthquake Consortium 2000). In respect to the second point, related to the shift of the research focus from physical to other typologies of vulnerability, the widening of the investigation field can be attributed to several factors. The first one is undoubtedly related to the widespread awareness that vulnerability analyses have a crucial role in the knowledge of the risk features of a given area.

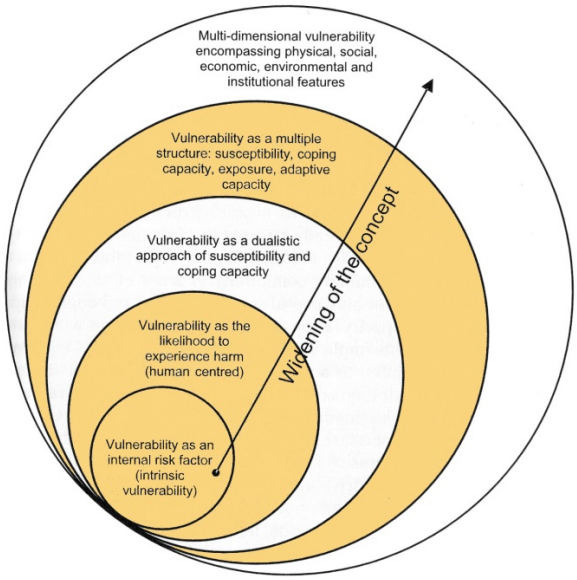

Fig.1 - The widening of vulnerability concept has largely influenced method and techniques for vulnerability analysis, shifting the focus from physical toward functional and systemic damages.

Depends on	Water Supply	Gas Supply	Sewerage	Storm Water	Mains Electricity	Standby Electricity	VHF Radio	Telephones	Roads	Rail	Air transport	Fuel Supply	Fire Fighting	Air-conditioning	Total Importance
Water Supply		*	1	*	*	*	*	*	*	*	*	*	3	2	6
Gas Supply	*		*	*	*	*	*	*	*	*	*	*	*	*	0
Sewerage	*	*		*	*	*	*	*	*	*	*	*	*	*	0
Storm Water	*	*	*		*	*	*	*	*	*	*	*	*	*	0
Mains Electricity	2	1	2	2		*	2	3	*	1	3	2	*	3	21
Standby Electricity	3	1	3	3	*		1	3	*	*	3	2	*	2	21
VHF Radio	3	3	3	2	3	*		2	2	2	3	*	3	*	26
Telephones	2	1	1	*	1	1	2		*	1	1	1	2	*	13
Roads	2	2	2	2	3	2	1	2		2	3	2	3	1	27
Rail	*	*	*	*	*	*	*	*	*		*	*	*	*	0
Air Transport	*	*	*	*	*	*	*	*	*	*		*	*	*	0
Fuel Supply	3	1	1	1	*	3	1	2	3	2	3		3	*	23
Fire Fighting	*	*	*	*	*	*	*	*	*	*	2	1		*	3
Air-conditioning	*	*	*	*	2	2	*	3	*	*	2	*	*		9
Equipment	3	3	3	2	3	3	3	3	3	3	3	2	3	3	40
Total Dependence	18	12	16	12	12	11	10	18	8	11	23	10	17	11	
Priority Factor	24	12	16	12	33	32	36	31	35	11	23	33	20	20	

Note: 3 = High Dependence
2 = Moderate Dependence
1 = Low Dependence
* = No Dependence

Fig.2 - The acknowledgement of the interdependences among network infrastructures has driven several scholars to focus on the multiple cascade effects that the impact of a hazard on each element may trigger on all the others.

In the current international literature, it is nowadays widely acknowledged that the measurement of vulnerability features is a key step toward an effective prevention and mitigation of natural and technological risks (Birkmann 2006).

The second factor is mainly related to the widening of the vulnerability concept itself, largely due to the relevant changes in scientific paradigms in the field of vulnerability and risk analysis too which started in the Seventies. In detail, vulnerability analysis, traditionally focused on the knowledge of the vulnerability features of individual exposed elements (buildings, roads, etc.), grounding on a systemic approach, have moved their focus toward the relationships among the elements and mainly toward the behaviors of complex systems in face of hazardous events.

Although the numerous and heterogeneous meanings of vulnerability in scientific literature, it is largely shared the idea that vulnerability of an urban or a territorial system to a given hazard is something more than the sum of the vulnerability of all their elements. Finally, a further factor can be identified in the growing importance of mobility network in current socio-economic context, characterized by economic macro-regions where interdependences among cities or economic activities are due, more than to spatial contiguity, to the presence of relevant material and immaterial communication networks (Sassen 2001).

Thus, mobility network – apart from being itself a system characterized by relevant interdependences among its elements – represents the basic support to those relationships. Therefore, it can be described as a network of different networks (road network, rail network, etc.): each network is constituted by linked elements and is characterized by mutual interdependences with all the others. Hence, in case of hazardous event, damages to the road network might cause, as above mentioned, a loss of accessibility to elements of other networks, such as railway stations, airport, with relevant consequences, for example, on the distribution of first aids in the immediate post-event. Besides, mobility network represents the basic support of people, goods, freight flows both inside a given territorial context and between it and the outside. Hence, the impact of a hazardous event on the elements of the mobility network at local scale (railway stations, airports, ports, highways, etc.) might reverberate on a global scale too, according to the level of "centrality" of the hit area in the wider regional, national or global context. Those assumptions point out the complexity of the spatial dimension of vulnerability: such an aspect has been largely emphasized in the European Project "Scenario" that, grounding on qualitative-quantitative scenarios of events, impacts and damages, has explored the "systemic" component of vulnerability, often neglected in the traditional risk analyses, because of its difficult quantification and modeling. As highlighted in the mentioned Project, systemic vulnerability has to be referred to the interrelationships, or better the interdependences, among elements or systems even located very far one from the other, which may influence their capacity to adequately perform their purposes. The concept of "systemic vulnerability" has been crucial for the improvement of the networks vulnerability analyses: the awareness of the interdependences among the networks, and between them and the territorial systems they belong to, leads to move the investigation field toward concepts and topics different from physical vulnerability. At present, great attention is devoted either to the interdependences between mobility network and the other network infrastructures (electric power, gas, etc.) or, mostly in urban areas, between network infrastructures and the overall urban tissue. Due to the broadening of the vulnerability concept, new investigation categories and, accordingly, new methods have come out. Besides the most traditional analyses on physical vulnerability of individual elements of each network, vulnerability analyses are currently mainly focused on the interdependences and cascade effects between the different elements of mobility network, the elements of different network infrastructures (Moselhi et al. 2005; Paton and Johnston 2006; O'Rourke 2007; Tang and Wen 2009) and between mobility network and urban areas they cross (Goreti and Sarli 2006).

Very often, indeed, the reduced functionality of road network in the emergency phase is due more to indirect damages (total or partial collapses of buildings and consequent obstructions of the roads) than to direct damages to the network itself (Hazus 1997).
Furthermore, damages to road network, apart from representing a damage per se, may cause losses of accessibility to other strategic equipments in the emergency phase (hospitals, barracks, etc.) or may isolate some urban areas from others. The strong emphasis on interdependences inside the network infrastructures and among them and territorial contexts has driven to assign a key role, in vulnerability analysis, to the concept of redundancy, interpreted as the availability of different components within a systems playing the same role so that, in case of damages to one component, the others can continue to perform their purposes (Berdica 2002, Bruneau et al. 2003). Thus, if an element of the road network which guarantees the access to strategic equipments in emergency is damaged, the availability of alternative links or, in other words, the replaceability of such an element is crucial. In this case, although a direct damage to a single element occurs, relevant consequences, such as the potential loss of human lives due to the lack of accessibility to hospital services, can be avoided.
It is worth noting that although the concept of redundancy is very useful to analyze road or railway network vulnerability in face of localized hazardous events, it is less effective when relevant nodes of mobility network (such as airports or ports) or widespread hazards affecting numerous elements of the mobility network are at stake: "a serious snow storm may", for example, "disable all alternative routes in a large area" (Berdica 2002).
Finally, other relevant concepts that, issuing from transportation field, are more and more frequently applied in network infrastructures vulnerability analysis are those concerning "serviceability" and "reliability" (Berdica 2000, Jenelius 2009) of such networks. In detail, if vulnerability of an element or a network generally refers to the propensity of such element or network to be damaged, in the case of network infrastructures, and especially of mobility network, such a damage has to be mainly referred to the loss of usability ("serviceability") of individual elements or of the whole network in a given time span, which can also depend on obstructions of network elements that, although not being strictly as a physical damage, yet compromise the use.
In a similar way, the concept of "reliability" refers to the regular functioning of mobility network in a given time span. In case of hazardous event, such a regular functioning can be compromised, also without any physical damage to the network, because of congestion phenomena, for example, which can depend on several factors: such as network features, type of facilities served by the network, people and activities' density in the crossed areas (etc.).

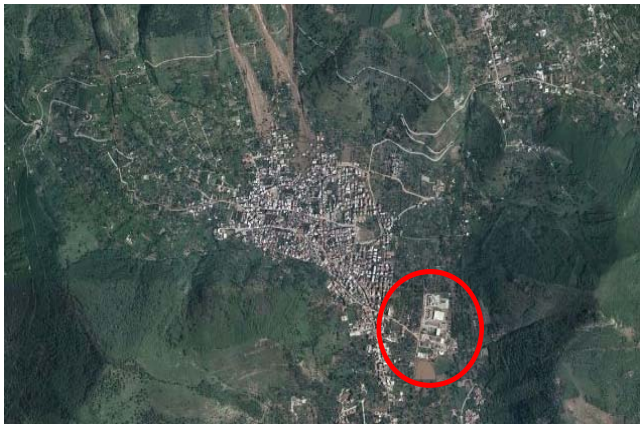

Fig.3 - The case-study area within the Siano Municipality in the Campania Region. The area is characterized by a slope potentially affected by mudflows at whose base an LPG plant is located.

Finally, the growing importance of the resilience concept in the disaster field open the floor to new research perspectives. Despite the several meanings of the word resilience, according to different disciplinary fields, in the disaster field, it can be defined as "the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure" (UN/ISDR 2004). From the above assumptions, it clearly issues that the resistance of mobility infrastructure, or its more or less quick recovery to functionality in the post event phase, greatly affects the overall capacity of a community to cope with a calamitous event (O'Rourke 2007).
In particular, some scholars have suggested quantitative approaches to assess the resilience of network infrastructures, essentially based on the loss of quality/functionality of those systems and on the time necessary for their recovery (Bruneau et al. 2003).

Mobility network vulnerability and territorial safety: the case of Siano in Campania Region

Based on the above-said assumptions on mobility network vulnerability to natural and technological hazards, this paragraph focuses on the inadequacy of traditional vulnerability and risk analyses, highlighting through a case-study, how such analyses – usually referred to individual hazards neglecting both the likely synergies among different typologies of hazardous events and the likely chains of impacts and damages that those synergies can trigger – can often lead to investments on mobility network which,

originally targeted to improve territorial safety, result on the contrary in an increase of the overall vulnerability.

In detail, the case-study is the Municipality of Siano in the Campania Region: the area is periodically affected by relevant hydro geological phenomena; it is classified as seismic zone 2 by the Decree 3274/2003 and it is included in the yellow zone of the Vesuvius National Emergency Plan. Actually, the municipality of Siano, together with Sarno and Bracigliano, was severely hit by the multi-site mudflow occurred in May 1998: the phenomena affected different hill slopes, running over the settlements and causing 160 victims. After those events, warning systems linked to the monitoring of rainfall levels and the attainment of critical thresholds have been set up. Furthermore, numerous measures aimed at preventing future events and mitigating their impacts have been implemented. Those measures can be divided into four groups: structural mitigation measures on the hill slopes, recovery of the building stock, recovery of the hit facilities, recovery and improvement of network infrastructures and, mainly, of the lifelines.

As the last group of measures is concerned, a main road has been built in the Siano Municipality in order to facilitate the exodus from the built-up area of Siano, escaping the built-up area of the surrounding Municipality of Castel San Giorgio. Such a road has been built on a previous route and it is located out of the "red zone", namely the area characterized by the highest hazard levels, according to the Decree 4816 of the Government Commission for Hydro Geological Emergency in Campania Region.

Therefore, since the strategic role of the road in case of emergency, the location of the road has been correctly defined according to an individual hazard factors, the hydro-geological one. Nevertheless, very close to the lifeline, a Liquefied Petroleum Gas (LPG) plant is located. The latter, according to the law in force (art.8, D. Lgs. 334/99) is classified as a plant with major potential for the quantity and the quality of handled substances. That plant covers an overall area of 6,690 sqm which, apart from a small area in the Castel San Giorgio Municipality, is mostly included in the Municipality of Siano. It is placed at the base of one of the slopes potentially affected by mudflows and is part of the "red zone" and, specifically, it is included in the sector A, where the above-said Decree, because of its high hazard levels, laid down strict rules for civil protection management and rigid limitations for future land uses.

At present, The Municipality of Siano is provided with an Interprovincial Emergency Plan – which, approved by the Decree 2586 issued in 2002, lays down the procedures for the warning, evacuating and safety sheltering the population in the risky areas – and with the Municipal Plan for Landslide Emergency, updated in 2007. Besides, in June 2006, the Prefecture of Salerno has worked out the Emergency External Plan for the LPG plant.

It should be noticed, that the likely trigger of a technological accident due to a mudflow has not been mentioned neither in the Interprovincial Plan nor in the Municipal one, both dealing only with landslides. Moreover, it is worth even noting that, following the current national legislation, the Emergency External Plan for the LPG plant defines the most probable major accident scenarios only in relation to "ordinary" conditions. Hence, it does not take into account mudflows as a likely triggering factor for technological accidents. The case study has been deepened within the Italian Research Project (PRIN) 2006-2008 entitled "Early Warning Systems: technical, urban planning and communication aspects" .

In detail the research work, focused on an area placed inside the Municipality of Siano which includes one of the slopes potentially affected by mudflows phenomena and the LPG plant, was addressed at setting up a comprehensive scenario of hazardous events, impacts and damages. In detail, the likely chains of natural hazardous events (mudflows) and technological accidents (due to the impact of a mudflow on the plant itself) and the consequences of such coupled events on the area surrounding the plant have been analysed[5]. Although it can be assumed that the examined chains of natural and technological (na-tech) events have a low probability of occurrence, there are numerous studies showing the constant growth, in number and severity, of coupled or chained na-tech events in the last decades. By referring to the above-considered case-study, the scenario techniques have been applied to grasp the dynamic features of hazardous events over time, the complex network of relationships between the damages suffered by some elements and the trigger of likely further hazards, the mutual influences between physical and functional damages, etc.

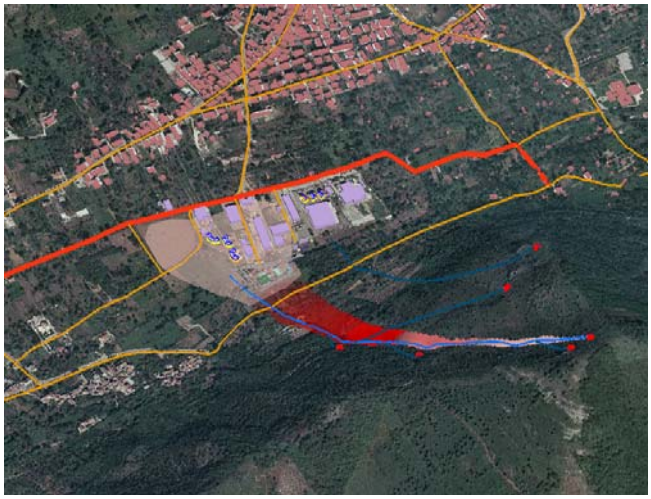

Fig.4 - Based on a 3D data animation in GIS environment a comprehensive scenario of hazards, impacts and damages has been developed.

Nevertheless, the difficulties in carrying out comprehensive scenarios are numerous, especially in the case of coupled natural and technological hazards: not only the description of such complex chains of events, impacts and damages requires indeed heterogeneous competences, but the scarce availability of data related to past events, which the necessary back-analyses should be based on, increases the uncertainties in defining the numerous and heterogeneous types of likely damages.

In order to outline the comprehensive scenario, first of all a likely hazardous event has been defined: grounding on in-depth geo-environmental investigations, the potential triggering points of the likely mudflows have been identified on the considered slope.

Moreover, according to the slope morphology and features, two typologies of likely mudflows have been singled out: the first one occurring on a plane slope; the second one that could be canalized into the gulley dominating the LPG plant.

Furthermore, the temporal span which the scenario is referred to has been chosen, starting from the triggering of the mudflow to the first emergency phase.

Due to the relevant dependence of the mudflows' trigger and evolution on the morphological characteristics of the slopes, a 3D model of the site can be very useful to better understand the dynamic evolution of the phenomenon at stake, according to the local peculiarities (scarps, gullies, and so forth).

Moreover, the physical damages due to the investigated phenomena largely depend, apart from the hazard features, on the features of the exposed settlements.

Therefore, a 3D model both for site and settlement has been developed into a GIS environment, which has been arranged to support the different steps of the comprehensive scenario: from the trigger of mudflows up to the different impacts and damages due the hazardous event.

In detail, the GIS includes different data-bases related to numerous themes, such as site morphology, buildings, population, activities and so forth. Based on these data-bases, the 3D model of site and settlement has been created.

Furthermore, the model represents also the preventative structural measures built up after the 1998 disaster along the investigated slope (e.g. drainage channels, check dams, etc.). Then, the building up of a 3D data animation in GIS environment allowed us to provide a simulation of the dynamic evolution of the mudflows starting from the selected triggering points, identifying the affected area, the involved territorial targets and the main impacts and damages due to the mudflows.

In detail, the scenario dynamic simulation shows, according to the features of the exposed targets, the likely physical damages (to buildings and infrastructures), the consequent damages to people, the potential functional and systemic damages (loss of accessibility to emergency facilities, unemployment due to the temporary block of industries, and so on).

Besides, since among the exposed targets the LPG plant is included, physical damages to the plant as a consequence of the mudflow and the likely accident scenarios, which those damages might induce, have been identified. In detail, due to the physical damages to the plant, an immediate release of LPG (in a quantity which might vary from 200 to 600 cubic meters according to the number of the involved tanks) warehoused in the tanks located just below the hill slope. That release can produce, because of the specific morphological conditions of the site, a gas concentration until reaching the inflammability threshold: when that threshold is reached, any triggering factor may cause the explosion, involving the area surrounding the plant in which residential buildings, other industries and, above all, the main escape route within the municipal territory are located.

The explosion would cause not only the temporary lack of road serviceability but, more seriously, since such an event represents an un-expected one in the present emergency planning, it should greatly increase the damages produced by the triggering natural hazard – the mudflows – by hitting flows of people and emergency vehicles passing along the road.

As already mentioned, in fact, mudflows are a typical example of likely multi-site event, which could start firstly along one slope, bringing into action the emergency procedures, and then hit that one dominating the LPG plant.

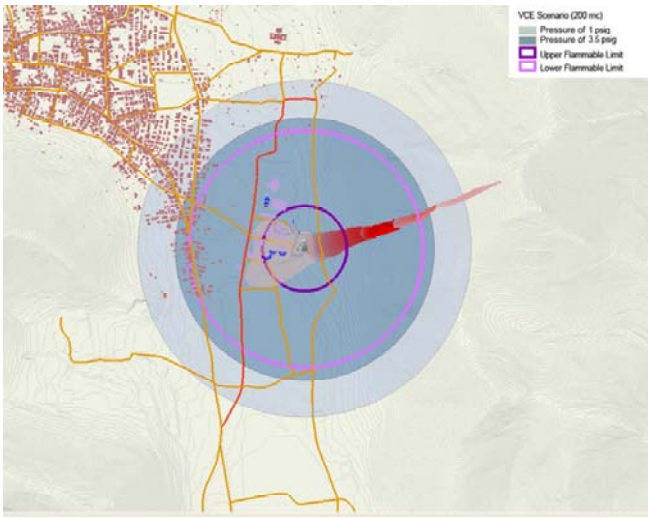

Fig.5 - The likely accident scenario due to the impact of the mudflow on the LPG plant might involve a wide area, in which not only residential buildings and other industrial activities but even the main escaping road in case of emergency are located.

Therefore, this study aims at highlighting that – since the improbability of chained events is only apparent, as the numerous examples mentioned above largely show – in order to support effective prevention and mitigation measures and mainly to improve the efficacy of the emergency management, it should very useful to combine traditional risk analyses with comprehensive scenarios of events, impacts and damages. They represent, indeed, an essential support for a better understanding and communication of the likely dynamic evolutions and the synergies among different hazard factors and of the complex chains of consequences that each factor and their coupled effects may induce in a given time span and in a given area.

Those scenarios can be expressed both through quantitative and qualitative data: the latter, generally related to functional damages not easily quantifiable (e.g. congestion phenomena along roads) should not be undervalued. In many cases the description of such failures or troubles may help to avoid "crises", mostly in terms of emergency management, which generally depend on the occurrence of unexpected or beyond the expected events.

Notes

[1] Even though this paper is based on a common research work, the first, the third and the fourth paragraphs have been edited by Adriana Galderisi; the second paragraph has been edited by Andrea Ceudech.

[2] Total damage was estimated in 100 million dollars.

[3] In the pile-up a tanker was involved too: a fire caused a BLEVE from the petrol tank of the motor followed by a firewall, while a jet fire 10 meters long came out of the broken tank.

[4] The disaster was caused by a tanker which ran into a building. The collision induced the break of a valve from which GPL come out and vaporized inside the building causing an explosion.

[5] The scenario was carried out by a multidisciplinary research group constituted, apart from the authors, by the prof. Franco Ortolani, for the geological aspects, and by the prof. Davide Manca for the likely industrial accident scenarios due to the mudflow.

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Images References

Fig.1: source Birkmann, 2006; Fig. 2: source: Paton and Johnston, 2006; Figs 3-5: elaborations of the authors.

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Port Cities and Urban Waterfront:
Transformations and Opportunities

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A B S T R A C T

In the wide and complex panorama of urban transformation, waterfront revitalisation is one of the most interesting phenomena of urban renewal of the last decades, bringing 'cities on water' around the world to a new leadership.
After years of oblivion, the presence of the natural element –water– have shown to be of great appeal as an attractive pole for the quality of every day's life.
In particular, the visual contact with water together with pedestrian paths along the waterfronts and the implementation of waterborne transports, where possible, are giving an added value to these areas, becoming even more interesting in terms of Real Estate.
Now spread out and developed at a global dimensions, involving both, big cities but also medium and small-scale cities at all latitudes and in all continents, waterfront regeneration is in many cases the starting point for the regeneration of the city itself and of its relocation in the international context.
Under this point of view, marine, port and fluvial cities can be considered laboratories for the process of urban renewal in terms of residential, transports, public spaces and quality of the environment, in view of both, the broad range of cases and the quality of the results.
In light of its 20-year long activity in terms of monitoring and studying best practices in the field of waterfront revitalisation, the Centre Cities on Water carried-out an international overview, developing a comparative analysis of the key element for the success of these operation.
To this regards, a selection of case-studies has been identified at international level, according to the main 'ingredients' for a sustainable cohabitation between ports and cities and for a lasting success in waterfront regeneration processes.
Water quality, public and free access and to water, public spaces, gradual and flexible development and shared participation in the entire process as well as a mix of functions and uses and the collaboration between public and private entities are some of the key aspects that needs to be taken into account in new interventions.
These elements, summarised in the 10 Principles for a Sustainable Development of Urban Waterfront Areas, elaborated years ago by the Centre Cities on Water, together with the German company Wasserstadt (Berlin), can be the hinge for a wide and shared transformation process as well as the key for a positive impact at urban and territorial scale.

In recent years, cities internationally have undergone radical transformations – both physically and conceptually – in the way the territory is inhabited and experienced. The changes have involved ways and means to circulate through the urban fabric and the system of relationships; the concept of border has progressively lost meaning, the relationships between public and private spaces have changed, traditional meeting places have become undefined spaces, and the great containers have become spaces for new socialization.
The city of the XXIst century, complex and stratified, transforms shapes, structures and uses, taking on new configurations that tend to be open but often undefined, and offering new images as a response to the rise of social and cultural phenomena that are rapidly modifying the economic processes, the spatial configuration, the utilization of places.

It may be understood as a group of "fragments", of systems of relationships, of forms of exploitation and a diversification of elements, combined in recurrent or original ways, where the past and the contemporary coexist, and where ancient culture blends with new forms of fruition; where the evolution of the urban fabric takes place by integration, substitution and connection, often on abandoned lots and urban voids. That city planning needs to conceive of "new" places and spaces in the territory that can interpret historic values and multiple identities in contemporary terms appears evident.
The transformations have also concerned the relationship between the city and the port, generating one of the most widespread contemporary urban phenomena, *waterfront redevelopment,* which has led to many extremely interesting and successful cases. Here,

the themes of architecture and urban design experiment with innovative ways of interpreting space, but move in tandem with methods of economic and social development, protecting resources and the cultural heritage.
Magnets for resources and fluxes, capable of exploiting opportunities to generate new economies and dynamics of regional development, the waterfronts interact with the contemporary landscape in innovative ways.
They can in fact describe the evolution of cities and regions, help understand the most recent transformations and stimulate the creation of future scenarios. These are places in constant evolution, where resources and opportunities can stimulate new representations of the collective imagination to become design, generating new urban forms, relationships, new landscapes and symbols within renewed market dynamics and social needs that respect existing conditions and the local identity.
If on the one hand the city-port is the expression of a change – a change that in practical terms translates into methods and tools of city planning, architecture, innovation and modern technologies – on the other it is a place where memory is preserved and the historical legacy is protected.
This is the result of a long process of selective sedimentation that has produced original syntheses through the contamination with existing conditions.
Therefore in the changing contemporary city, the interface between land and water may be identified as an area of specialized transition, independent and in constant evolution. A new urban centrality characterized by the persistence of consolidated situations and new balances to define, by interaction and conflict: relationships between various actors, multiple levels of skill and disciplinary fields, constraints that make an integrated approach difficult, a plurality of interpretations and representations, specific and contrasting interests.

The richness and potential of the waterfront

If the waterfront appears as a complex and problematic reality, its wealth of resources and potential is equally clear.
A space relating to the historic city centre, a scenographic space with particular visibility, a space for interaction between two different systems – land and water – the urban waterfront has always been especially attractive, not only in real estate terms, but also from a socio-cultural and landscape point of view.
From a place of intense traffic and economic development, to a formerly blighted and inaccessible urban area that later became one of the most valuable in the city, often at the centre of new urbanization projects, over time the urban-port context has progressively focused attention on its historic and cultural identity, on the natural environment and the landscape, and now represents an important opportunity for many international-level cities to delineate, promote and implement their development at the local level, and further.
There are many experiences in which the waterfront was chosen to serve as a leading value in the perspective of urban and regional development. Most of the more recent regeneration projects have primarily meant that the collectivity has been able to “reclaim” the areas facing the water.
The urban history of the past decades, both in Europe and in the international context, has turned the attention of scholars, operators and administrators to the concerns of this “part” of the city, the waterfront, sandwiched between the urban fabric and the water (be it river, sea or lake), becoming a central theme of planning and a paradigmatic element in policies for the transformation and regeneration of urban fabrics.

The 10 Principles for the Sustainable Development of Urban Waterfronts

The twenty-year research and monitoring project on the theme of *waterfront redevelopment* conducted by the Center for Cities on Water in Venice, made it possible to construct a picture of the state of the art at the international level, and to delineate an initial balance sheet that, based on a variety of disciplinary contributions from different points of view, could highlight the strongest elements in this process of transformation.
This picture become a sort of general guideline that can be referred at in case of new interventions in this field: the *10 Principles for a Sustainable Development of Urban Waterfront Areas.* These principles, previously developed by Cities on Water in collaboration by Wasserstadt GmbH, Berlin, in the course of international seminars, were approved in the context of the initiatives for the Global Conference on the Urban Future (URBAN 21) held in Berlin in July 2000 and in the course of the EXPO 2000 World Exhibition. Recently revised, they have been adopted by several institutions at international level and they are still a valid reference for waterfront redevelopment.

1 - Secure the quality of water and the environment
The quality of water in the system of streams, rivers, canals, lakes, bays and the sea is a prerequisite for all waterfront developments. The municipalities are responsible for the sustainable recovery of derelict banks and contaminated water.

2 - Waterfronts are part of the existing urban fabric
New waterfronts should be conceived as an integral part of the existing city and contribute to its vitality.
Water is a part of the urban landscape and should be utilized for specific functions such as waterborne transport, entertainment and culture.

3 - The historic identity gives character
Collective heritage of water and city, of events, landmarks and nature should be utilised to give the waterfront redevelopment character and meaning. The preservation of the industrial past is an integral element of sustainable redevelopment.

4 - Mixed use is a priority
Waterfronts should celebrate water by offering a diversity of cultural, commercial and housing uses. Those that require access to water should have priority.
Housing neighborhoods should be mixed both functionally and socially.

5 - Public access is a prerequisite
Waterfronts should be both physically and visually accessible for locals and tourists of all ages and income.
Public spaces should constructed in high quality to allow intensive use.

6 - Planning in public private partnerships speeds the process
New waterfront developments should be planned in public private partnerships. Public authorities must guarantee the quality of the design, supply infrastructure and generate social equilibrium.
Private developers should be involved from the start to insure knowledge of the markets and to speed the development.

7 - Public participation is an element of sustainability
Cities should benefit from sustainable waterfront development not only in ecological and economical terms but also socially. The community should be informed and involved in discussions continuously from the start.

8 - Waterfronts are long term projects
Waterfronts need to be redeveloped step by step so the entire city can benefit from their potentials.
They are a challenge for more than one generation and need a variety of characters both in architecture, public space and art. Public administration must give impulses on a political level to ensure that the objectives are realized independently of economic cycles or short-term interests.

9 - Re-vitalization is an ongoing process
All master planning must be based on the detailed analysis of the principle functions and meanings the waterfront is concerned.
Plans should be flexible, adapt to change and incorporate all relevant disciplines. To encourage a system of sustainable growth, the management and operation of waterfronts during the day and at night must have equal priority to building them.

10 - Waterfronts profit from international networking
The re-development of waterfronts is a highly complex task that involves professionals of many disciplines. The exchange of knowledge in an international network between contacts involved in waterfronts on different levels offers both individual support and information about the most important projects completed or underway.

International experiences

To describe some of the most frequent innovative and conservative processes that take place in the interface between city and port, we identified a number of experiences that, based on the search for specific characteristics, elements of continuity and contemporary images, would allow us to present a synthetic interpretation of the phenomenon. The selection specifically identified cases in which the *waterfront redevelopment* projects have become particularly meaningful, even serving as authentic "models" to refer to in successive operations, obviously adapted to the conditions of the context.
In the process of enhancing waterfront areas, ideas and suggestions are often borrowed from the most famous and successful experiences; however not always is it possible to export these "models", except perhaps single components or aspects of them.

The quality of water and the landscape in residential contexts and public spaces

The city of **Berlin** traditionally displays a strong relationship with the element of "water", which becomes an integral part of the urban fabric which boasts an extended system of river banks and canals. The Wasserstadt GhbM, a public-private company instituted between the late Eighties and the early Nineties with the purpose of managing the development of the city overlooking the water, has sought to make urban areas attractive with a project for the creation of public spaces, pedestrian trails, urban parks, green spaces and residential complexes, particularly oriented towards the

water and the landscape, to preserve the local resources and identity. The regeneration of the waterfront began with the construction of two urban development projects involving the city centers overlooking the banks of the Haven and the Spree, on Lake Spandau and the Bay of Rummelsburg, two areas that include the former industrial, port and military areas, on a surface of 336 hectares.
The architecture on the water was built to fit into this extraordinary landscape, where it is possible to live in exclusive "floating houses" and in an extremely peaceful context. The quality of the dialogue between the territory and the project and the "water element" has made the riverfront spaces more attractive and guaranteed sustainable development, restoring the balance between nature and the built environment. The different ways of using water have become a priority and an integral part of the design proposals, a fundamental resource in the promotion of projects in this region.

The port in the city

Rotterdam is one of the best examples of how the renovation of port functions and structures can go hand in hand with the revitalization of the city centre, the regeneration of the waterfront areas can redefine the relationship between the urban fabric and the waterfront, the establishment of new functions and service can guarantee public use of the areas. The excellent exploitation of the opportunities offered by the location on the estuary of the Rhine River made the city one of the major ports of call in the world. In this experience it is hard to distinguish the port from the city and the search for an agreement between the needs inherent to economic growth and technological development, and those inherent to urban spaces and environmental issues has brought excellent results, thanks to an excellent capacity of "institutional adaptation" and "innovative" planning based on policy coordination, on extended participation in the decision-making processes, on the cooperation between different agencies and subjects.
The project drafted by the Municipal Port Authority for the Port 2010 established the priorities for development, setting guidelines and making concrete proposals based on a provisional framework. In the Kop van Zuid area the project financed by the Dutch government will connect the urban areas along the Maas River and the two embankments, reinforce the centrality of the river in relation to the urban fabric, stimulate economic development towards the river and build new districts. The revitalization of a 202-hectare area with offices, residential units, shopping and leisure areas, educational and training spaces has transformed a particularly blighted area into a district that in a few short years has attracted businesses, residents and tourists, thanks to integrated planning and the coordination between different work teams. In the project for the Waterstad – which will include the construction of a shopping and leisure center, a theatre, exhibition spaces, hospitality structures, offices and residential units – private capital and attention towards the preservation of the maritime landscape play a fundamental role. The Stadhavens, which occupy a particularly large area (1,500 hectares) on the banks of the Nieuwe Mass River, will be the venue in coming years of a project to establish new residential districts. The regeneration program for the port area has become an integrated urban-scale project, strategic for the city and its inhabitants, and developed with special attention to public interest and social objectives.

Reclaiming the port heritage and identity

Liverpool has been involved for many years in a process of urban revitalization led by public and private partners, which has reversed the downward trend and led to the renascence of the city. An exemplary demonstration of sustainable development and conservation of the historic legacy, in 2004 the city was listed as a UNESCO World Heritage site thanks to the 135 km of coastline along the Mersey River, which boast a natural and architectural legacy of international interest.
Significant public and private investments and joint ventures between the two sectors have been activated – thanks to the designation of Liverpool as the European Capital of Culture 2008 – to manage a complex yet flexible system, to reinforce the cruise ship industry, to build a sports complex and a shopping center, to create new natural reserves and improve public access with the objective creating a synergy between a multiplicity of functions and to reinforce local identity.
This is a very ambitious development program with large-scale investments that includes spatial and functional projects to be completed by 2020 for the regeneration and public utilization of the waterfront, to preserve the maritime-port legacy.
Specifically, the projects include the construction of a new cruise ship terminal, the transformation of the International Garden Festival (20 hectares) into a new center of attraction, a city-planning project with sufficient financial revenue for the port legacy of the Central Docks Site, adaptive reuse for the three historic warehouses in the Stanley Dock Complex, the River of Light program which includes a series of projects along the banks of the Mersey to connect the two shores.
The investments have produced excellent results, leading to a new image for the city.

The success of a functional blend

The project for the urban development of **Amsterdam** in the area of Oosterdo – between the historic city centre, the IJ river and the central train station – intends to create a valid alternative to the city centre where available spaces are increasingly rare, by revitalizing the blighted area and building a new district with public spaces and services, with a superior level of quality from an architectural, technological and environmental point of view. The project, selected through a competition process, was approved in 2000, and entrusted to the mixed company Mab formed by the Bouwfonds Property Finance, the City of Amsterdam and several private companies. Work began in 2004 on the acquired area, a surface of 5 hectares, and will lead to the construction, in successive phases, of 225 thousand square meters of space divided as follows: a hotel and convention center (25,000 square meters), diversified residential buildings (336 units), commercial buildings (15,500 square meters), offices with extreme flexibility (80,000 square meters), recreational and cultural spaces including a conservatory and a new public library (49,000 square meters), a dock for leisure yachting and parking areas. The project, which has attracted a large number of institutional and private investors, local and international, should garner positive results given the expectations deriving from the situation in the real estate market, which suffers from a lack of supply of new urban centralities and high-standard public services.

Public spaces and city squares on the water

Bilbao, a river port that extends uninterruptedly for 20 km from the city to the sea, grew over time with the port, without creating interferences in urban activities. When the port moved from the inside of the river towards the outside and several industrial areas shut down, it became possible to revitalize the riverfront and several other areas near the mouth of the Nervion, and restore an extraordinary scenario of great public and social value to residents and tourists. The transformation of the riverbanks into qualified urban spaces, on which to establish the most representative functions of the future metropolitan area, is the primary shared objective of the program to revitalize the economic and productive sector and to increase the accessibility and utilization of port spaces. With the coordination of the Ministry of Public Works, Transportation and the Environment, in 1992 came the foundation of Bilbao Ria 2000, a private corporation with the equal participation of the Spanish and Basque administrations, and constituted by other agencies interested in the program, whose responsibility is to administer and decide specific uses and zoning classifications for the lots of land, to address the sale, management and future maintenance of areas and structures. The schedule for the sale of the strategic areas, of Abandoibarra and the Canal de Deusto and Zorroza, put the focus on short and long term projects which, on the left bank, were aimed at the social revitalization of the urban fabric, and on the right bank were characterized by a spectacular city planning and architectural operation with considerable impact.
The short term projects consisted in the integration of the urbanized area of Abandoibarra with the urban fabric of the Ensanche and the rest of the city, in the construction of a pedestrian walkway along the estuary of the river and a number of structures (the Maritime Museum, the Convention and Music Center, Parco Ribera, Parco Ametzola, a residential and shopping complex, a financial center, etc.); while the long term operations included the opening of the Canal de Deusto, the integration of the Zorroza peninsula, a prevalently industrial port area with the trade fair grounds and the connection of the island of Zorrozaurre to the two river banks with the construction of 7 bridges and new residential and office districts.

Consultation and participation for the future of the city-port

In **Marseilles** consultation and dialogue, on both the political and technical level, were accompanied by moments of reflection and constructive debate; the urban regeneration of the port area took place with the involvement of the community in diversified actions and a process that questioned and carefully assessed possible scenarios of strategic development, to define and implement a common project to bridge the gap between the city and the sea. The port of Marseilles is characterized by the fragmentation of its spaces across a metropolitan reality in which the city and the port appear clearly divided because of a process of specialization of the productive and commercial spaces that excluded the city centre with its constant and disorderly growth. In the 1980's the idea emerged for a new urban centrality recomposed around the ancient port basins between the Joliette and the Estache, but the relationship between the city and the port, between urban architecture and port development, appeared rather complex. With the objective of justifying and supporting a strategy to reconvert the port waterfront and to build a technological hub complete with university, research laboratories and advanced tertiary activities, the city sustains the presence of abandoned port spaces and rundown warehouses to be renovated, in total contrast with the opinion of the Autonomous Port; in the debate between city and port the community of Marseilles remains attached to the idea of a port city where the port blends with the city center and the suburban area with indefinite limits. An anticipation of the Euromediterranée project was the

Schéma de Cohérence Marseille 2015, published in 1997, the Plan Directeur and the Marseille Port Global project, which the Autonomous Port began to work on the following year, at a time when the port and city seemed to have reached an agreement, established common strategies, shared issues and solutions. The Euroméditerranée project represents a great opportunity for regenerating and 'stitching together' a strategic bond between port space and public space along the waterfront, and for the ambition to create a "coexistence" between an active port and an inhabited city preserving its historic and cultural resources and its identity as a port. The planning process, divided into a series of public or private-based initiatives, concerned several different regional areas, each of which acquired a specific role within the overall vision: the new advanced tertiary hub at the Joliette, the office district and multi-modal hub at Saint-Charles Porte d'Aix, the cultural complex of Belle-de-Mai, the Cité de la Mediterranée with the museum and the training center, the hub dedicated to the sea, the new maritime station, the tourist and cultural structures, the businesses and offices, the green spaces and the public spaces.

Flexible and long-term projects for new scenarios on the waterfront

Genoa, a port city overlooking 33 km of coastline has long pursued the ambition of becoming a great international port, but has had to contend with several problems concerning the morphology of the land, the infrastructure system and a complex relationship with the inner urban fabric. This is the context surrounding the process of urban regeneration regarding the Dock and the Ancient Port in particular, whose purpose is to recreate the bond between the historic city centre of Genoa and the port. The concession of the port spaces in question (130 thousand square meters) has belonged since 1995 to the Società Porto Antico, whose shares are owned by the City in the measure of 51%, by the Chamber of Commerce in the measure of 39% and by the Port Authority in the measure of 10%: its objective is to return the areas to the city with the organization of cultural initiatives, the development of a convention industry, the construction of general-interest structures to create a center of tourist attraction.

In 1992 the Ancient Port was the venue for the celebrations in honor of Christopher Columbus and for an exhibition in the port area where many activities still take place: on that occasion the City Administration and the Port Authority collaborated to build several projects in the area between the Old Wharf and Ponte Spinala; a series of projects by architect Renzo Piano served to create the Piazza delle Feste, to restore the Cotton Warehouses which were transformed into a convention center, to build the largest aquarium in Europe and the Bigo that supports the panoramic elevator. Other projects followed in the years after the event: the construction of a multipurpose complex, of a new venue for the Faculty of Economics and Trade in the Scio district, underground parking and public spaces that complete the seaside promenade in 2000.

With the concept of physically and functionally relating the historic city center to the water, during the G8 in 2001, more projects are brought to term: the tourist port, a movie theatre complex, the Museum of the Antarctic, the City of Children and the Biosphere. In 2004 Genoa became the European Capital of Culture, an event that brought new opportunities for the revitalization of the historic city centre near the port area (Via San Lorenzo, Via Garibaldi, etc.) and the construction of the Museum of the Sea and Navigation designed by architect Guillermo Vasquez Consuegra in the spaces of the Galata port warehouse. The renovation of the Ancient Port in coming years will include the construction on the Ponte Parodi – a port wharf located between the Darsena and the Aquarium where a grain silo had stood through 2002 – of an international center with high-impact architecture, cultural and recreational activities at the service of the city and a new cruise ship terminal with a total surface of 37,800 square meters. The structure, which will become a new "city square on the water" was designed by the firm Van Berkel & Bos for an international competition launched in 2001.

A possible long-term scenario for the future of the port and the city was recently hypothesized by Renzo Piano's Affresco, divided into three different phases of transformation over a period of 18 years for the 200-hectare area which the Port Masterplan attributes to the city. Uninterrupted development along 8 km of coastline, the construction of two artificial islands connected to the mainland by underground tunnels to host the new airport and shipyards, the renovation of the promenade along the urban waterfront from the Darsena to Boccadasse, the creation of three new urban parks.

Great events and cultural exchanges

Within the context of the great transformations that have taken place in recent decades, special attention must be reserved for the great temporary events underlying some of the most interesting cases of *waterfront redevelopment*. Both in Europe and in the international context, these great events and their long-term effects have turned several cities on water into the unquestionable protagonists of the most recent urban affairs.

Access to considerable and exceptional funding and resources, clear-cut construction schedules and extraordinary opportunities made it possible to transform temporary events into long-lasting and usable acquisitions.

The river cities of Valencia and Zaragoza are among the latest cities that have gambled on water as a resource and on regional marketing for their revitalization. To mix tourism and culture for local development and to project a new urban image at an international level by organizing a great event, is a widespread formula which has now been consolidated by many successful experiences.

Valencia exploited this great opportunity during the XXXII America's Cup, which resulted in a real metamorphosis of its riverbanks, regenerating the urban fabric with a number of specific projects that respected existing conditions and reconnected the historic city centre to the port and to the sea.

A series of projects were initiated on the waterfront of the city, within the context of a unitary plan, which made it possible to renovate and extend the port area, to restore blighted neighborhoods and regenerate several abandoned urban areas, creating points of interest and elements of attraction.

The design of diversified functional spaces, the reorganization of traffic and mobility, the enhancement of the Darsena Interna have generated positive effects for local development.

There has been an increase in nautical, cultural, commercial activities and new public spaces, urban parks and green areas, waterfront promenades and pedestrian-bicycle trails have been created.

The interventions in the Balcon del Mar project have revitalized the real-estate market in the areas near the water, improved the transportation infrastructure with interventions on the airport, on the High-Speed Railway and on access roads to the port, on public transportation and on urban connection axes.

The most recent experience on the waterfront, in the category of great international exhibitions, was in **Zaragoza**, which in recent months organized Expo Zaragoza 2008, dedicated to the water and to sustainable development.

The expo became an opportunity to initiate a process of urban, landscape, social and cultural transformation, along 12 km of riverbanks; and to restore continuity with the urban fabric relying on natural materials and technological innovation.

Destined in the near future to become a scientific-cultural park and a hub of strategic centrality for sustainable development, the area will restore continuity between the two banks of the Ebro River and the city centre, with the addition of a new urban unit located near the intermodal station.

The event benefited from significant public investments (estimated in 2,500 million Euro), divided between the Spanish government (70%), the Aragon government (15%) and the City Administration of Zaragoza (15%) – managed by EXPOAGUA Zaragoza 2008 SA, a company responsible for the organization and promotion of the event.

The strategies for economic and urban development aimed at the diversification of industry and sustainable economic growth, an expansion in quality and quantity (approximately 200 works) and public structures, a new status for the city on the national and international level.

The entire process was characterized by the creation of consensus, with the active participation of citizens, and by the public-private partnership with actors from various sectors. In addition, the event was preceded by many actions concerning infrastructure and mobility: the extension of the Airport in Zaragoza (36 million Euro), the new Estación Intermodal de Delicias and the improvement of the road system (80 million Euro) along with the construction of a new city square (16 million Euro), the construction of tunnels between El Portillo and the AVE district (29,7 million Euro), the Estación Central de Autobuses (15 million Euro), the section of railroad between the Iriarte Reinoso road and the Estación Intermodal (20 million Euro), the recently built bridges, the investments in public transportation and in the Plan de Movilidad Sostenible, etc.

When the event ended, many buildings and facilities were reconverted, the city had doubled its green spaces; the pedestrian and bicycle trails in all the districts of the city and the process of refunctionalization should be completed by the year 2011. Important commercial projects, in terms of size or impact, are now "crystallizing" in the wake of the positive effects produced by the Expo. They include the *Terminal Maritima di Zaragoza (TMZ),* a node and "access gate" from the city to the sea, directly connected by rail to the port of Barcelona.

The city of **Shanghai,** which has always been tied to the water and the port, is preparing to host a great event, Expo 2010. Recent city plans seek to transform the city into a great financial, commercial and naval centre, an international-level economic node strictly related to the development of the Yangtze River delta and river banks.

There is a project currently under completion for the construction of a new port in the suburban area, that could hold 25 million containers and rely on a 13 square-kilometer logistical area; the shipyard industry, along with a number of warehouses and other industrial activities, will be moved to an island on the Yangtze River. A 5,4 square-km artificial lake will be built for the benefit of residents and tourists, with a new landscape on the water, adjacent to the north port with its 15 kilometers of waterfront and 30 new slips.

The opening of the Pudong area – along with eastern banks of the Huangpu river – constitutes a fundamental element for the future of

the city and an important development opportunity for the regeneration of the urban space overlooking the waterfront and for the preservation of many historic buildings, for the construction of an ecological system along the shores, improved fruition of the public space and the quality of life.

Conclusions

The transformations produced by the new waterfront projects refer to the territory as a system that must be built but not planned, to a strategy that responds to renewed market dynamics and to urban and social needs and leads to interventions at various scales with a certain sensibility and a practical approach, and a certain conceptual freedom based on site observation and an urban process.
The urban project to define the interface between land and water often intends to create relationships rather than defined forms, to use gradual flexible strategies, often articulated as a succession of additions and specific limited-range actions.
The "fragmentation" therefore becomes an opportunity to trigger virtuous circles and present a program of interventions that is sustainable at several different levels (formal, cultural, environmental, etc.), making it possible to present a plan for the landscape that works at different speeds, seeking through synthesis to achieve a new logic and an overall vision, interpreting the identity of a place and of its existing conditions.
The regeneration of waterfronts represents an extraordinary opportunity for *cohesion* and for *stitching* the territory together, where water – a collective legacy – can play a central role and become the engine for sustainable development, recreating the relationship between spaces, uses and visions, building a dialogue between spatial organization, port and city functions, and their economic, environmental and social aspects.

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Urban Transformation and Property Value Variation

The Role of HS Stations[1]

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ABSTRACT

The article aims reading and interpreting the positive externalities, especially in terms of urban redevelopment, connected to the building of node/station of the High Speed railway network. The measure of the variations of the real estate values, carried out through the analysis of numerous European and Italian experiences, is considered as a synthetic indicator of urban quality consequent to the strengthening or establishment of a new High Speed station. The identification of relationships between High Speed station, residential property values and typologies of cities (role and urban specialization) and urban context in which the station are located is one of the conclusions of this work. In accord with the aim, this paper is organized in three principal parts. The first part identifies the relation between urban transformations, urban quality and property values and provides a scientific frame of the studies on the relationships between accessibility increase and property values. Indeed, the results of many studies and reports reveal that the reduction in generalized cost of transport and the increase of accessibility related to the implementation of new infrastructure such as a railway station, in some cases have impacted significantly on increasing demand for space in the surrounding areas and, accordingly, on property values. The second part proposes the reading of some experiences of building of High Speed stations in some European and Italian cities, with a focus on the case of Roma-Napoli High Speed line. The choice of cases was made using criteria that seem to give a guarantee of representativeness to the variety and multiplicity of experiences. In particular, the criteria used are: geographic location of railway line (selecting cases with different geographical locations); city-node size (choosing different types of cities for size and population), functional role of the city-node, timing for the completion of railway line (fully in operation, partly in operation or not yet in operation). Besides, the description of each case is divided into: summary description of the characteristics of the HS railway line; description of the main features of cities that represent the nodes of the selected routes; identify the characteristics of the surrounding context of the railway station; measurement of the change in property values in the surrounding context of the railway station due to HS link. The third part provides a comparative outline of the effects of High Speed stations on property values and the urban typologies and characteristics that influence this relation. The first result of this article is a comparative framework between all study cases. In conclusion, the comparative reading shows that the effect from opening of the High Speed railway stations on property values is valuable in cases where it contributes significantly to raising the socio-economic and the quality conditions of spaces.

Urban transformation, urban quality and property values

To transform the city, the most common aspiration, both in research and practice, seems to be to manage the establishment of new functions and new services so that the positive externalities produced can contribute to achieving effective policies for urban regeneration (Stanghellini 2007).

The transformations of the city, contributing to raising or lowering the physical, functional and environmental quality, cause location advantages or disadvantages that result in changes of the rent.

In other words, the actions of urban transformation have significant impacts on the physical, functional and environmental quality of an urban area (AA.VV. 2006), and the property market, which is very sensitive to these effects, responds in a timely manner through changes of property values. The location advantages are created by different assets, such as accessibility to public goods, urban environmental quality, public services, the overall size of the city and its general attractiveness (Camagni 2007). From this perspective, the article aims to read and interpret, through many experiences in Europe and in Italy, externalities related to the implementation of High Speed stations through measurement of changes in property values that can be considered as a synthetic indicator of urban quality.

Through reading and measuring the change in property values, the article attempts to identify the effects on the housing market by

strengthening or establishment of HS stations, in relation to the kinds of cities and the main characteristics of the smaller urban context in which they are located.

Accessibility and property values: the scientific reference

Early studies on the socioeconomic and territorial impacts of public transport infrastructure (in particular the railway) were conducted in the United States in the mid-sixties. The results of many studies and reports reveal that the reduction in generalized cost of transport and the increase of accessibility, related to the implementation of new infrastructure such as a railway station, in some cases have impacted significantly on increasing demand for space in the surrounding areas. Consequently, in some cases there has been an increase in property values over the other urban areas.

In other cases, by contrast, generally when degradation and rising crime result from the realization of a railway station, there has been a sharp decline in residential, commercial, tertiary demand, and thus also in property values in the surrounding areas. With the spread in many European countries and beyond of High Speed lines, it has focused attention on the spatial and economic impacts of this new link system which offers transportation costs significantly lower (particularly in terms of savings time) and often represent a strong catalyst for economic and residential activities and services of general interest.

Some studies and experiences in Japan, for example, show that the start-up of High Speed railway (the first train goes back to 1964) produced both a significant increase in population in the cities with HS stations, that significant increased property values of commercial space that has reached even 67% (Nakamura and Ueda 1989).

Some studies on the French experience show that the start-up of TGV HS link (1981) resulted in redistribution of population, relocation of many companies and thus also increased residential and commercial property values in the areas around the stations, as in the cases of Paris and Lyon (AA.VV. 2005).

Examination of the data, reported in the following pages, shows that this last statement, especially if compared to the overall urban situation, it should be considerably reduced. Indeed, in anticipation you can read below, it appears, for example, that in the X arrondissement of Paris, upon the arrival of the TGV at Gare du Nord in 1994 for connection to London, that the arrival the TGV in 2007 at the Gare de l'Est for connection to Strasbourg, property values have been growing more contained than the performance average in Paris, showing in 1994 a percentual variation of -12.93% against -7.07% of city's average, and in 2007 a percentage change of 2.18% against 4.06% of city's average. Many authors, both Italian and foreign, agree that the market value depends on many factors, among which occupy a primary place the accessibility, the density of services in the vicinity, the habitat quality (Curto 1993, AA . VV. 2002) and argue that the analysis of property value can be useful to assess the social appreciation (Garrod et al. 1992). The land rent increases by some conditions that occur in an urban that Camagni (2007) identifies as: disposal of significant areas in terms of dimensional and functional, degradation cumulative, urbanization of peri-urban agricultural areas, processes of regeneration of historic centres, establishment of new public goods (metro, High Speed, universities, etc.). In most of the studies and research, therefore, shared the view that the link service on iron, especially High Speed link, provides a benefit in terms of social and economic development and improved quality of life, whose value may be capitalized into the price of real estate nearby (Bowes and Ihlanfeldt 2001). In this regard, it is worth, once again, anticipating one of the results described below. The survey, in fact, does not refute this position in general but the data reported reveal that the capitalized value is not always and not just linked exclusively to the High Speed station; significant changes in property values, in fact, make reference to a system of articulated action or a more comprehensive process of regeneration. This is shown in most cases reported later in this article, whether it be world-class city, international-class or national-class city. The only exception is the case of Ashford which has its main functional specialization in the High Speed rail link.

HS stations and property values: the criteria for reading

As mentioned above, to identify the effects on the housing market arising from the start-up of the High Speed Link t (with opening of new stations or just with the reorganization of existing ones) were considered some of the most important Italian and European experiences.

Through this reading, it has come to a description of the various effects recorded in the property market because of some important features related to the examples taken into consideration and, in particular, relating to the rank and role of the city-node of High Speed rail and to the physical (center-periphery) and functional characteristics of urban context of each HS station.

The choice of cases reported in this article has favored certain criteria that seem to give a guarantee of representativeness to the variety and multiplicity of experiences.

In particular, the criteria used were as follows:

– geographic location of railway line;
– city-node size;
– functional role of the city-node;

– timing for the completion of railway line.

In particular, in reference to the first criterion was selected cases with different geographical locations in so you can read the changes in property values for territorial characteristics, i.e., linked to cultural and socio-economic national factors.

With reference to the second and third criteria were selected cases with different types of city-node both size of population for functional specialization: world-class cities when they can capture all the functional urban specialization; cities with strong and specific functional specialization such as, for example, tourist, cultural or political specialization; cities with low functional specialization. In reference to the last criterion, were selected cases because of the progress of the completion of HS station: fully in operation, partly in operation or not yet in operation.

Furthermore, within the selected routes, has focused attention on cities that host terminal stations and intermediate stations that in most cases are medium size cities.

Finally, to influence this selection was the availability of data on changes in the housing market and socio-economic and functional features of urban areas considered, necessary to permit the reading and interpretation of the phenomenon. Through the reading of the cases, therefore, attempted to understand the effects that the HS generated in property values in different urban realities and to identify factors that contribute to the most relevant spatial variation of them.

The European cases considered are:

– the nodes of Paris, Reims and Strasbourg on the Paris-Strasbourg HS railway (TGV Est-européenne), in operation only since 2007 from Paris to Lorraine;
– the nodes of London, Ashford and Paris, on the London-Paris, in operation since 2007;
– the nodes of Madrid, Ciudad Real and Puertollano, on the Madrid-Puertollano, in operation since 1992.

The Italian cases considered are:

– the nodes of Turin and Milan on the Turin-Milan HS railway, in operation only since 2006 from Turin to Novara;
– the nodes of Bologna and Florence, on the Bologna-Florence, under construction;
– the nodes of Rome and Naples on the Rome-Naples, in operation since 2005 except the last kilometers.

In particular, the European stations are already in operation for the High Speed Service (except Strasbourg, where the LGV-Ligne à Grande Vitesse has not been completed). Among those considered to Paris, Strasbourg, London and Madrid are the last stop, while Reims, Ashford, Ciudad Real and Puertollano are intermediate nodes. As regards the Italian stations, should be highlighted that:

– Porta Susa station (Turin) is under construction and is a terminal station;
– Tiburtina station (Rome) under construction as a terminal station;
– Milan Central station haed node, is awaiting the completion of high-speed lines;
– Belfiore station (Florence) and Bologna Central station are terminal stations and they are in design phase;
– Naples Central station, terminal node for high-speed, is under construction.

To enable a simple and immediate reading of selected cases and thus facilitate the comparison between them, the description of each case is divided into:

– summary description of the characteristics of the HS railway line;
– description of the main features of cities that represent the nodes of the selected routes, with particular reference to the urban hierarchy, the prevalent vocation, the main characteristics dimensional (area, number of inhabitants) and functional;
– identify the characteristics of the surrounding context of the railway station, with particular regard the location and role within the urban system;
– measurement of the change in property values in the surrounding context of the railway station due to HS link.

The European cases

The case of Paris-Strasbourg

In June 2007 he was inaugurated the first stretch of the High Speed Line Est-Européenne (LGV-Ligne à Grande Vitesse), which is part of a broader project of the high-speed Master européenne, linking Paris and Budapest, through Germany, Austria and Slovakia.

Est-européenne line, connecting Paris to Strasbourg, serves the major urban centers in northeast France. The first section put into operation spread for 300 km and linking Paris, Reims, Meuse and Lorainne; the second stretch, from Lorainne in Strasbourg, is expected to be completed by the end of 2014. In addition, the strengthening of existing stations of Paris (Gare de l'Est), Reims, Nancy, Metz and Strasbourg and the construction of new stations in Champagne-Ardenne (5 km from Reims), Meuse and Lorraine are part of the project. The opening of the East-européenne has made it possible to connect very quickly between Paris and cities northeast of the French: 45 minutes to get to Reims and currently 2:20 to get to Strasbourg (with completion of the second section, the timing of the Paris-Strasbourg will drop to 1:50).

Paris, as you know, is the cultural, political and economic centre of international level and represents an important traffic hub in Europe.

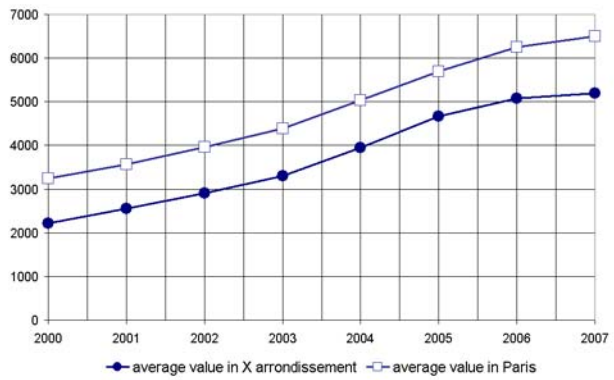
From Paris originate other lines of the High Speed Railway built between 1981 and 1992: the Paris-Lyon-southeast of France line, the line Atlantique Paris-Le Mans-Tours and the northern line Paris-Lille-Arras, which branches in two directions to Belgium and Britain.

In Paris, the station of Est-européenne line is the Gare de l'Est, built in 1849 in the X arrondissement, opposite the Boulevard de Strasbourg. It's one of the largest stations in Paris and is terminus of a branch of SNCF network (French National Railway Company) and, in 2006, was subject of a renewed and strengthened to accommodate the trains of the High Speed TGV.

They are still work in progress for redevelopment of public spaces around the station to improve accessibility and exchange intermodal.

The X arrondissement, located on the right bank to the north east of Paris, is characterized by multi-ethnic population and for the presence of many tertiary activities (especially related to advertising and fashion), cultural and health of prestige (Saint Louis, Fernand-Widal). The X arrondissement, in addition to being well served by transport public local (bus and metro), receives another important railway station, terminal of the High Speed line Paris-London: the Gare du Nord.

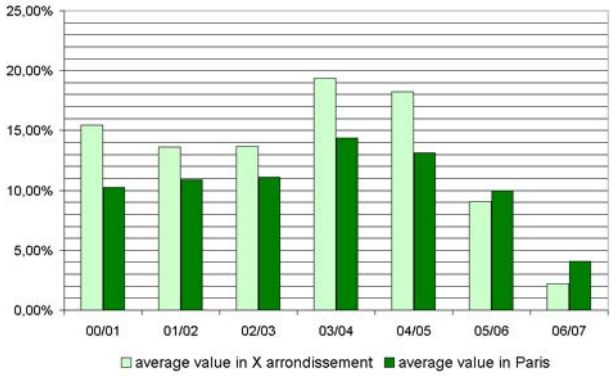
To evaluate the effect of start-up of the HS link at Gare de l'Est, we compared the trend of property values in the X arrondissement with the urban average change between 2000 and 2007, using data from the Chambre des Notaires de Paris-Ile de France, and the annual percentage change in the X arrondissement with annual average percentage change in the city at the same time frame.



The trend in property value in the X arrondissement follows the general average value between 2000-2007.

From the first comparison revealed that in the X arrondissement the deviation between property values in X arrondissement and the average in the city keeps almost constant over time, except that in the last two years.

The annual percentage change in the neighborhood, after a long period of growth greater than the urban average, recorded in the last two years a lower growth than average annual in the city. In particular, between 2006 and 2007 (year of opening of the East-européenne), in the X arrondissement there is a percentage change in property values of +2.18%, lower of the percentage changes that occurred in previous five years with a peak of +19.35% in 2003-04.

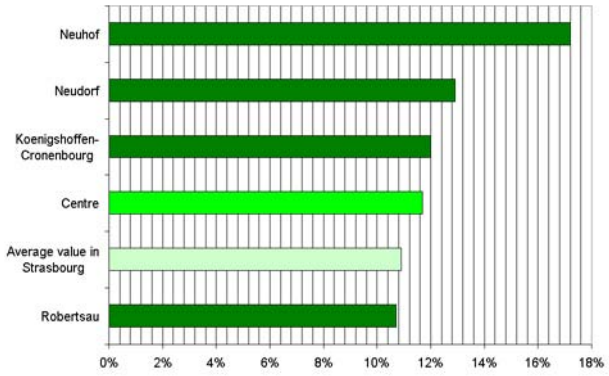


In the X arrondissement, the annual percentage change of property values is lower than the average value in Paris in 2007, when the TGV arrived.

Strasbourg, city of the Alsace region, is located on the right bank of the Rhine. Seventh city of France for the population (first in the north east), is a major economic centre of the region, standing out in the industrial and tertiary sectors mainly aimed at business financial, research and business services. Furthermore, Strasbourg is the seat of important international institutions: the Council of Europe, born in 1949, and the European Parliament, established in 1981. The Central Station is the node of the LGV Est Européenne, located in the Center neighborhood. To accommodate the LGV, the Central Station have had a radical transformation, by adapting its structure to the new flow of passengers and so fulfill the role of multi-modal hub.

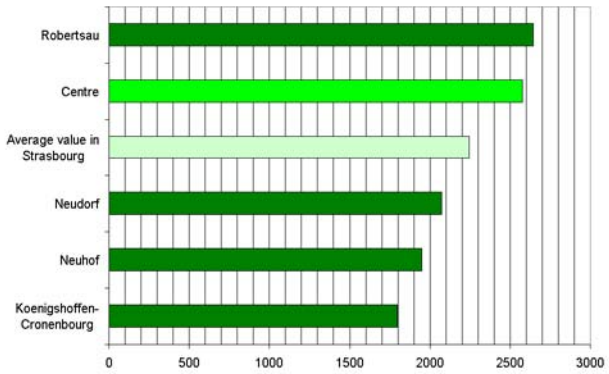
This operation, which began in 2005 and completed in June 2007, was also the occasion to reorganize the square outside the station, rethought as a space of encounter and exchange. The graphs on the percentage change in residential property values in the area surrounding the station, taken from Special Dossier Immobilier 2007 of French newspaper L'Express, shown an increase in values of 11.7% between 2006 and 2007, slightly higher than the average in the city. Moreover, Center is historically among the most expensive neighborhoods in the city (with Robertsau) and retains this feature in 2007. Other neighborhoods, such as Neuhof in the suburbs

northeast of the city, while showing property values among the lowest in the city, have recorded highest rates of change in 2006-2007 (17.20%).
This phenomenon, probability, can be attributed to the interventions of urban regeneration and reorganization, will be completed in 2009, and to improve accessibility in those areas (thanks to the creation of a new tram link).



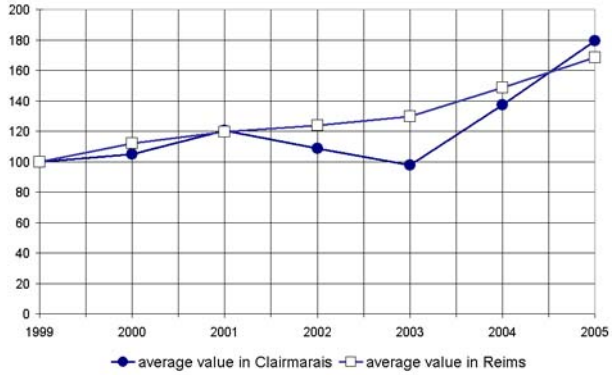
The percentage change in residential property values in the Center district, where is the Strasbourg railway station, is slightly above general average value between 2006-2007.

According to Marie Pellefigue (Nouvelle Observateur, 30 August 2007), "the arrival of the TGV and the end of some major urban interventions should create new opportunities in the real estate market in Strasbourg, without causing a surge in prices. Between 2000 and 2005, in fact, the real estate market in Strasbourg has already reached high values, with a price increase by 60%. The year 2006 marked a pause, because the rise has slowed. Still, in the first half of 2007, the average increase in prices recorded in Strasbourg is an average of 3.5%, according to the group Orpi Strasbourg, compared to 7% last year.



Center is historically among the most expensive neighborhoods in the city and retains this feature in 2007, year of arrival of the TGV.

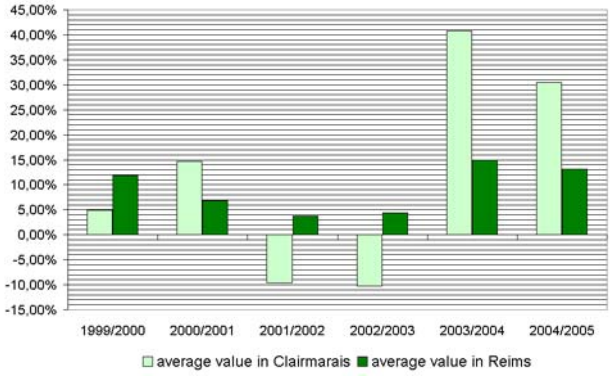
Reims is a major economic centre of the Champagne Ardennes region (department of the Marne), in north east of France, mainly because of its excellent wine production. With 187.206 inhabitants, is the thirteenth French city by population and is the most populated municipality in the north east of France, after Strasbourg. The Reims Station enjoys a privileged location in the city centre. The south entrance opens on the Place d'Erlon, the most animated of the city, and the entrance in the north district of Clairmarais. This neighborhoods, historically characterized the presence of industrial and railway activities, present important opportunities for development for the availability of brownfield.
At the beginning of 2007, the Central Station has undergone enhancement work in anticipation of the arrival of the HS Railway link, with the adjustment of existing facilities and the construction of new parking and a bus station.
In this district, the City administration had already started, in 2004, the project for the construction a pole of tertiary, commercial and residential activities with related services and a new pedestrian link between the district and the city centre, be completed in 2010.
The data on property values, of Perval Notaires de-France (French professional organization) show in the neighborhood of Clairmarais a discontinuous trend until 2003; then property values tend to increase steadily, to over the average value in Reims between 2004 and 2005.



The property value (assuming the index 1999=100) in neighborhood Clairmarais exceed the general average value between 2004 and 2005, when the conversion of vacant areas begins.

This trend could be reported at the start of realization of the tertiary pole and commercial and residential structures, behind the station. The percentage change in property values of Clairmarais, moreover, since 2002, appears to be higher than the average town, with an increase of 40.82% over 2003-2004 and 30.52% in 2004-2005. In summary "Property prices in Clairmarais, neighborhood behind station in Reims, have suffered the sharpest rise in between 2004

and 2005. This finding may be the sign of a certain interest in the district that receives station, providing the HS rail link with Paris. Moreover, this area will benefit from a series of urban interventions related to commissioning TGV. These trends are thus capitalized in estate prices, which may partly explain the progression property prices in this neighborhood "(Bazin et al.2007).



The annual percentage change of property value in Clairmarais, between 2003 and 2005, is higher then both the average general value in Reims than all those registered in the district between 1999-2005.

The case of London-Paris

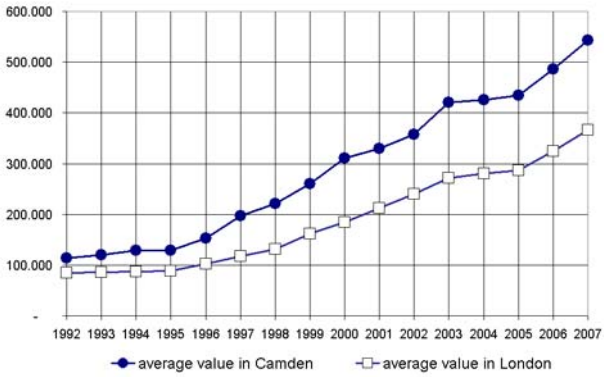
The stretch of London-Paris HS line, which runs Great Britain, called High Speed 1, links London to the Channel Tunnel through Kent. The last section of this link, which arrives at London station St Pancras International, opened in November 2007, provides the link between London and Paris in 2 hours and 15 minutes. Between the Channel Tunnel and Paris, the line, which is called LGV Nord, has been operating since 1994. The entire line from London to Paris, as well as connecting two of the major world capitals, it is also four medium-sized cities (Ebbsfleet, Ashford, Calais and Lille).

London, as is known, exerts enormous influence worldwide in terms of economic, financial, political, tourist, cultural and communication and produced goods and services each year by 365 billion dollars, or 17% of GDP throughout the United Kingdom (Oxford Economic Forecasting 2005). London is also the most populated city in Europe, with 7.5 million inhabitants residing in the territory of the Great London, consisting of the City of London and thirty-two districts where it divides the city. The city is the largest global air traffic hub, with five international airports, and is one of the most important railway junctions in the United Kingdom. Moreover, urban public transport, including the London Underground (subway, with twelve lines and 274 stations), the London Overground, DLR, Tramlink and bus services and the urban river, is known for its efficiency.

The St. Pancras International Station houses the HS line, opened in 2007. The station is located in the heart of London, in King's Cross area in the neighborhood of Camden. By modifying the original design (which wanted a new station in south east London) and in line with the supervening need retraining sector east of the city, the project has focused on the reuse of the St. Pancras station in London as a HS terminal, ensuring even the interchange with the North London Line. The project of renovation and expansion of the station to accommodate HS rail has accelerated the action already taken by the City Government for redevelopment and revitalization of the area of Kings Cross, characterized by high levels of degradation and crime for several years.

The redevelopment project of this area dates from the early Nineties, but only in the following decade, with the choice of St Pancras as a high speed terminal, are implemented early interventions in the area. Following the construction of offices and hotels, the opening of the London Canal Museum, the British Library (1997) near St Pancras Station, the area became a place for cultural meetings. Furthermore, to reassess King's Cross will be the realization of the new St. Pancras station and the redevelopment of the surrounding area.

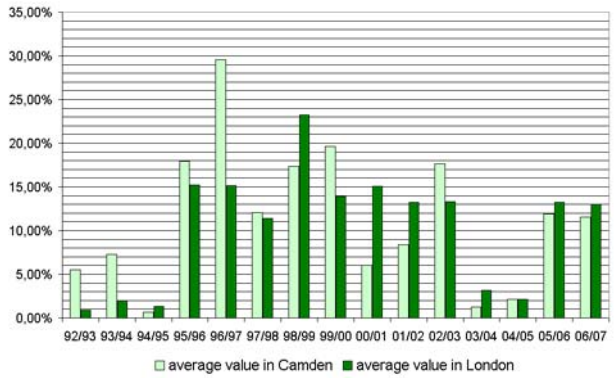
As is apparent from the Wealth Report 2007 of estate agency Knight Frank and City Private Bank, London stands at first place for property cost, followed by the principality of Monaco, New York and Hong Kong. Despite the prices, the housing market is still holding, even if the cost of money, weaker demand and supply more abundant are indicated as possible causes of any slowdown. The housing market is no longer growing, but turns to consolidation, although there are still several opportunities for growth.



The trend in residential property values in the neighborhood of Camden tends to increase and is always ahead of the average value in London.

With reference to Camden, the trends in residential property values, reported in the English finance company HBOS, after a period of

stagnation between 2003 and 2005, tends to increase but it is always over the average value in London in the time period from 1992 to 2007. The highest values are found in the period 2005-2007 in which there is a percentage change of nearly 12%. In any case, in 2007 Camden ranks as the city's most expensive borough, after Kensington and Westminster.



The annual percentage change in the neighborhood of Camden shows an increase in value between 2005 and 2007, in coincide with the opening of the St. Pancras International station.

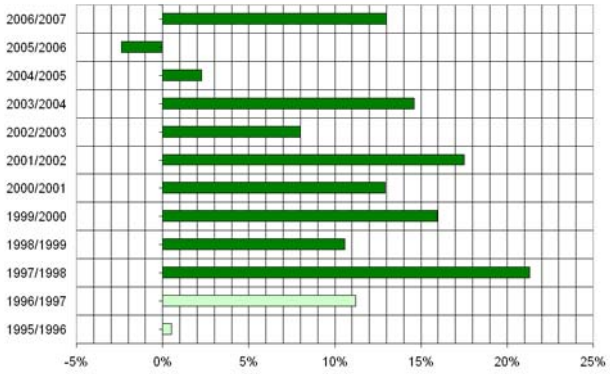
Ashford, with a population of approximately 102,661 inhabitants (including the surrounding districts), is an average city in England, located in eastern region of Kent, 80 km from London.

The city is a railway junction and a centre steel. Thanks to its strategic position, the city is characterized by a thriving business, as witnessed by the presence of numerous companies and business parks. Since 1996, Ashford is served by high speed trains Eurostar, with eight daily services connecting to/from Paris and to/from Brussels. In 1996 the Ashford International station was inaugurated, in the first section of the High Speed 1 (then called Tunnell Channel Rail Link), adjacent to the old station still up to national and local links. As for the national housing market, the percentage change in average residential property values in town, taken from PROVISER (online service of English society TSI Consulting Ltd), has increased significantly in 1996, opening station.

The percentage change in fact varies from 1% in 1995 to over 11% in 1996. Even compared to other cities in the region, property values in Ashford show a trend that places the city in 1996 in a dominant position (Preston et al. 2006). From the analysis, although macroscopic and conducted using only the average value in Ashford, it seems undeniable the effect on rising property values from the opening of the high speed station in the city.

As already mentioned, in 1994, the line of the High Speed LGV Nord reaches Paris, arriving at the Channel Tunnel via Lille, then branching out in two directions to Belgium and to England.

Until 2007, the Eurostar train to England walked the remaining stretch to London on the traditional line, sharing platforms with local traffic. The Paris station of LGV Nord is Gare du Nord, one of the main city train station and the terminus of a branch of the national network SNCF, with 180 million passengers annualy.

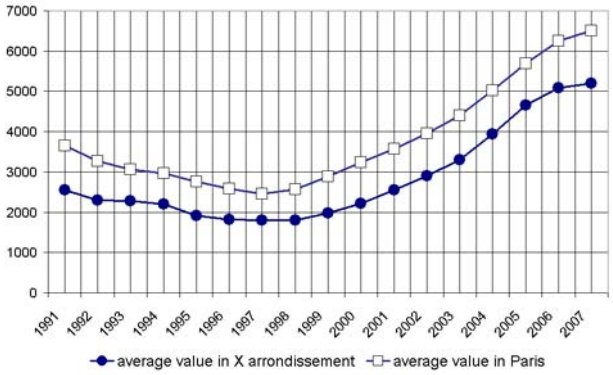


In Ashford the percentage change in property values has increased significantly from 1% to 11% in 1996, when the station opened.

The Gare du Nord is also among the first railway stations of Europe and, probably, the third in the world for passenger traffic.

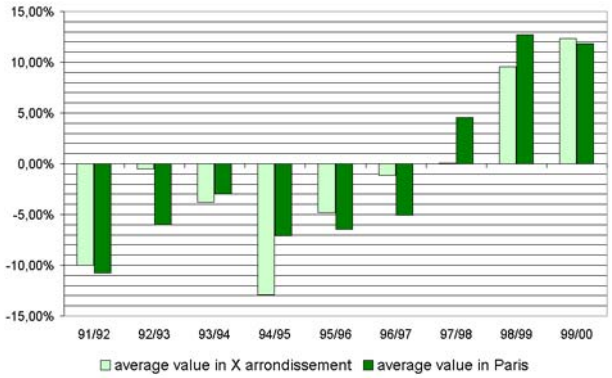
The station, built in 1865 on the Rue de Dunkerque in the X arrondissement, is close to the Gare de l'Est, which is just over 500m. The X arrondissement, as mentioned earlier, is located in the north east of Paris, an area well served by transport local and characterized today by several companies, especially advertising and related fashion and service activities.

The trend in property values, derived the Chambre des Notaires de Paris-Ile de France, in this area between 1991 and 1999 (period at the entry into operation of LGV Nord), shows a trend decreasing.



The trend in property values in the X arrondissement follows the average value in the city and does not seem influenced by the arrival of the TGV (1994) to the Gare du Nord.

The variation percentage is -3.77% between 1993/1994 and 12.93% between 1994/1995, already reaching -4.81% in the year after. This phenomenon should be analyzed in a more general trend of property values in the city, which shows a decrease in property values in all district between 1994 and 1995.



The annual percentage change in the X arrondissement is less than the average variation in the city, in the period 1993-1995.

The case of Madrid-Sevilla

The first high speed rail link in Spain was between Madrid and Seville, opened in 1992, with three intermediate stops: Cordoba, Ciudad Real and Puertollano. In the same year and on the same link was opened further regional high-speed service, called Lanzadera, which from Madrid, touching Ciudad Real, arrives at Puertollano, to meet the high demand for travel between these cities.

Madrid is the third largest city of the European Union by population (3,092,759 inhabitants over an area of 667 sq km) after London and Berlin. Its economic growth has a strong push from the middle of last century, when became the administrative center of the country, has experienced a strong industrial development, especially in chemical and metallurgical sectors. In recent years the city economy has brightened, as well as from traditional activities administrative and financial, also from activities related to tourism, culture and fun. In 1992, The Atocha station, the largest and oldest railroad junction town, thanks to an intervention of strengthening and reorganization of space, has been transformed into a modern rail terminal and adapted to receive the AVE trains (Alta Velocidad Española) coming from Southern Spain (Seville and Lleida).

The station is located in the district Arganzuela, which borders the historic town center and represents a natural extension. In the quarter, historically characterized from the settlement of industrial and general markets in the last decades of the last century was a process of replacement of many industrial activities in parks and cultural centers.

Ciudad Real, capital of the province and major city of the autonomous community of Castilla-La Mancha, is medium-sized urban center with almost 70,000 inhabitants. Since the eighties, the city is home to the University of Castilla-La Mancha, and now it hosts a large campus in south-eastern area with more than 10,000 students and who, it is believed, owes its development to the pursuit of nearby AVE station, inaugurated 1992.

This intervention has also encouraged economic growth of the city, relying on the development of tertiary activities that were saying at that time. The AVE train station of Ciudad Real is located on the south-east, characterized by an low density urban texture. A few years after the construction of the new station, thanks to the reuse of vacant areas by the old railroad tracks, was created a new neighborhood, a new urban park (Parque del Pilar) and expansion of university facilities, already in the area.

On the effects of the opening of the station on the property market, you can refer to a study conducted by the Universidad Politécnica de Madrid (2000) on the economic and territorial impacts of High Speed in Spain, prepared on the basis of data from periodic field and interviews with estate agents. The study showed that in Ciudad Real, in coincidence of the arrival of the AVE link, the highest increase of property values are registered in the old town and the area near the station (135,000 pts/sqm in the old town and 132,000 pts/sqm area of the station AVE), with a transition zone between them. It is noted, in other words, a break in the pattern of property values, usually characterized by a negative gradient from the center to the periphery, in fact, the study shows that the normal pattern is interrupted in the area of the AVE train station, about to undergo a jump that bring the property values of this area than in the old town. We must, however, note that in this area, the values may have increased thanks to the University and the opening of the ring road south-east.

The town of Puertollano is a center of 50,470 inhabitants, situated in the province of Ciudad Real (Autonomous Community of Castilla-La Mancha). The city's economy, traditionally linked to the industrial sector used resources Basin coal, is still tied to the strong industrial vocation.

In 1992, the Madrid-Seville AVE line and the service's regional Lanzadera, already mentioned above, have made it much more efficiently and quickly connected with Madrid and Ciudad Real (1:10 to reach Madrid, 20 minutes for Ciudad Real). The morphology of the mountainous territory has influenced the urban development of the city and forced the passage of the railway line the city center, in a small step in the Sierra Calatrava.

The high-speed connection using the traditional railway tracks, leading to a new station constructed ad hoc, opened in 1992 in the historic city centre, about 200 m from the traditional railway station.

In the study conducted by the Universidad Politécnica de Madrid, in the case of Puertollano appreciates a negative gradient in the pattern of property values as they pass from the center to the periphery with a sharp variation at the area where the station is located, which is better connected to the city center area that west of the city, partly because of the physical barrier created by the railway track. The difference price/sqm in area central and west of the railroad, in fact, is 2.5 points. To understand the magnitude of this gap, we must remember that in Ciudad Real, the difference between the most expensive and the cheapest is 1.3 points.

Italian cases

Designed in the EC plans for the development of European High-Speed network to promote rail transport of passengers and goods, the Italian lines have adopted a different formula than the other countries named High Speed/High Capacity and is distinguished essentially for technical-engineering features in the transportation of passengers and goods and for their close integration with the existing railway lines.

Within the European High Speed network, the Italian lines play a crucial role and constitute an essential part of some large trans-European corridors: Corridor I Palermo-Berlin; Corridor V Lisbon-Kiev; Corridor VIII Bari-Varna and the Corridor of the two seas, Genoa-Rotterdam.

The case of Turin-Milan

Strategic part of the axis of the rail network called the European Corridor V, Lisbon-Kiev, the Turin-Milan has a length of about 125 km. On this route was made an intermediate station at Novara, which allows the link between western Piedmont and Malpensa airport. Now the link is available between Turin and Novara, commissioned in 2006 at the Winter Olympics in Turin; in the stretch Novara-Milan the work commenced in February 2005 and completion is scheduled for 2009. Once in operation the whole link, moving between Turin and Milan, the two most important urban centres of Northwest Italy, will take place in 50 minutes, compared with a current average time of 1 hour and 50 minutes. Turin is the fourth Italian city in population (after Rome, Milan and Naples) and, according to an economic study of Censis of 2006, is the third economic centre. Furthermore, according to the study carried out for the Strategic Plan city, Turin is a "European city of the third rank, namely, a regional capital characterized by strong specialization in a field, as cities like Bilbao, Lyon, Toulouse, Marseilles, Dresden, Glasgow, Manchester. Almost all live in or have recently passed a very difficult situation, arising from the need to convert spaces and functions, first dedicated to sectors that are undergoing decline or massive restructuring (Turin International 1998).

Since the Eighties, in fact, the production system has been affected by a transition process, aimed at addressing the city's economy toward the service sector and research. The urban section of the High Speed, which affects the city of Turin, is substantially constituted by passing rail. The project, already partly realized (in 1999 the link was activated from Porta Susa to Porta Nuova) will be finished by 2011, with the new Porta Susa railway station for High Speed trains.

Porta Susa station is located in the Cit Turin, within the so-called Central Backbone (more precisely in the area called Spina 2), an avenue of 12 km running north-south, create by undergrounding of the long rail line that divided the city into two parts. The design of the new station is part of the broader urban development plan of the city. The realization of the great urban boulevard, with the redevelopment of many vacant areas sites along the rail line, will promote the localization of production plants, facilities, cultural activities and leisure.

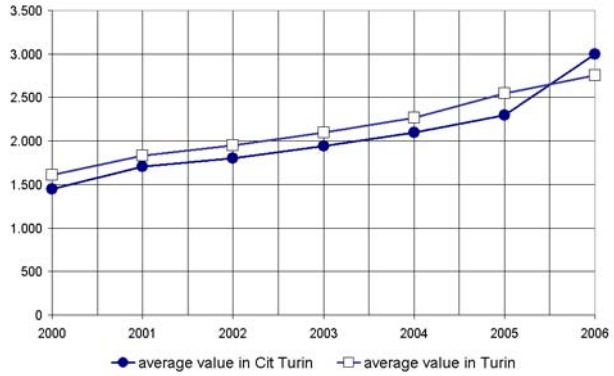
Cit Turin, bordering the old town, is a residential neighborhood always considered prestigious for the presence of an important market town and its shopping streets.. The new station, more than 15,000 square meters, will consist of passenger building, a tall building (more than 100 m) that will house directional centers, hotels and places for trade and will be integrated with the metro line 1 and the other rail links (including the airport link).

In the area around the station the Master Plan includes a series of interventions such as enlargement of the Gallery of Modern Art and the Polytechnic, the public library, a new theatre obtained from the partial recovery of a factory building industrial use.

Turin is, after Milan and Rome, the third Italian real estate market as evidenced by the number of annual trading, which is around 5% of national trading, and by the increase average annual purchase of housing, which is around 6%. The reason for this dynamism is also attributable to the fact that "in recent years, construction activity has taken effect: the pressure of demand continues to support the development of new housing, because, in 2002-2004 there was a peak with about 2,401 new dwellings to remain, however, still high in the period 2005-2006, which recorded an increase of approximately 2,000 new buildings "(Scenarios Estate 2007).

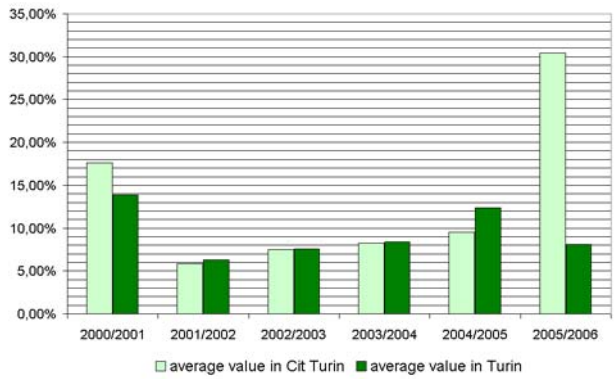
To see the effect of opening yards of the station of Porta Susa (in April 2006) on the trend of property values in the neighborhood of Cit Turin, were compared to property values in the neighborhood with the average value in the city, in the time period 2000-2006, using data from Scenarios Estate (2007). We note that the values in the neighborhood of Cit Turin are identical to the trend of growth

seen in the city until 2005. In this year, there is indeed an abrupt change: in mid 2005 the values increased to more than the average value in the city, from an annual percentage increase of 9.52% in 2005 to an increase of 30.43% in 2006.



The property values of Cit Turin follow general trend until 2005, when it is noted a sharp increase in values that exceed those average in the city.

On the other hand, comparing the percentage change in values properties of Cit Turin with other urban areas, in the interval of time 2004-2006, the district shows the highest increase, equal to 42.86%. Reading these data should be considered that the Central Backbone is the urban area with the highest degree of physical transformation and functional, in which are carrying out many other interventions such as the conversion of over 340 thousand square meters of vacant areas in higher learning, cultural, technical-administrative and residential activities and the construction of new subway which crosses Cit Turin with the city centre.



The annual percentage change in the area of Cit Turin rises sharply during the start of construction Station (2006), resulting the highest in 2000-2006.

Milan, with 1,303,670 inhabitants, is the second Italian city in population (after Rome), with a density slightly less than that of Naples. The urban fabric extends beyond the municipal boundaries, incorporating the territory north and east, forming an urban area, even called Greater Milan, which has about 3,900,000 inhabitants. Economic and financial capital of the country, Milan has developed an economy primarily geared to advanced service industries in various sectors: finance, national and international commerce, publishing, industrial design, advertising, information technology, marketing and multimedia, also becoming the world's fashion capital with Paris.

Currently, the city has undergone several projects for the architectural and urban renewal.

They are, in fact, in several projects relating to both the shipyard redevelopment of whole areas that the revitalization of his image as an European and world cities (among them the new Milan Trade Fair, the fair city and the CityLife project, the district of S. Giulia).

Milan is also a national and international node of communication, with a system Airport (consisting of the three airports of Malpensa, Linate and Orio al Serio), which concentrates most of the Italian air traffic (ISTAT 2007) and the largest railway system of northern Italy, with 22 stations of the city.

In Milan cross three lines of the High Speed: Milan-Rome-Naples, Turin-Milan-Venice and Milan-Genoa, merging in Milan Central Station, the only point of intersection between the three national lines. The other stations are Milan AV Rogoredo, on the south line Milan-Rome-Naples, Milano/Rho Fiera, on the west line Turin-Milan and Pioltello, on the east line Milan-Venice. In particular, the final draft provides that the urban stretch of the High Speed from Turin will have a station in Rho, at the Fair (14 km from Milan), and will arrive in Milan central station.

Milan Central Station, with a daily flow of 320,000 passengers, has since the beginning of the century one of the main European stations for the railway traffic, national, regional and inter-urban and metropolitan. The station is located in Zone 2 (one of nine administrative divisions of Milan), and borders the north east of the city centre. Since 2005, the station is affected by major repairs and upgrading, within the wider regeneration project “Grandi Stazioni”-State Railways Group, and that should be completed in 2008.

Milan and its province are the most important real estate market in Italy in volume and dynamics. "The complexities of its urban system, the plurality of demand expressed in parallel with real estate projects developed, are the benchmark for the entire domestic market that historically it follows the model" (Scenarios estate 2006).

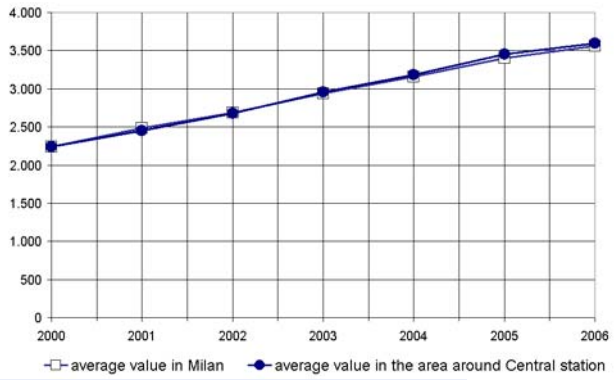
The national housing market is solid and stable growth. At the end of 2005, in fact, there has been a number of trading amounted to 13.8 billion euros, an increase of 6.5% compared to 2004.

The first part of 2006 saw an initial slowdown in growth rate, which is beginning to stabilize on smaller variations, after seven years of steady growth, registering a slight decrease of trade in Milan city and a parallel increase in the province.

As property values in town, "at the end of 2005 there was a variation of +6% over 2004 (it was increased by 11% last year) only in the most prestigious borough inside the ring of canals and in the most recent achievements also arisen outside the ring (the area formerly OM, Maserati Park, Milano Certosa, Lorenteggio).

However, we must also consider the areas affected by large levels of transformation that have registered growth trends consistent in the last 18 months. Among these, the area of the project Rogoredo Santa Giulia (+14%), the area of the square Martini (+19%) with the PII and the area of Porta Vittoria Garibaldi (+18%) with the project Garibaldi-Repubblica (Scenarios estate 2006).

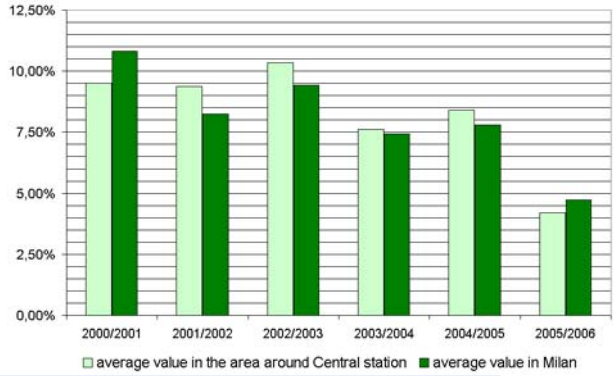
In particular, referring to the district of Milan Central station (which coincides with the areas of Corso Venezia, Corso Buenos Aires, City Studies, Management Centre), the trend residential real estate values from 2000 to 2006, drawn from the Value property of Scenarios (2006), basically follows the trend of the average value in the city.



The trend of property values in the area of Central Station is superimposed upon general average values.

Even the annual percentage change shows that in this district the prices, although remained at medium-high, followed by a slowdown phenomenon that occurs in all prestigious neighborhoods, from +8.41% between 2004-2005 to + 4.72% from 2005-2006.

In other words, at least for the moment does not seem to resent the effect of the arrival of the High Speed Train Station, which will be fully operational from 2009.



The arrival of HS trains in Milan Central Station not seems to have had an impact on the general slowdown of the percentage change in property values in recent years.

The case of Bologna-Florence

High Speed Railway line Milan-Rome-Naples, which is the Italian section of the Trans-European Corridor Palermo-Berlin and across Italy from north to south, touching the major cities (Turin, Milan, Bologna, Florence, Rome, Naples), is currently under construction trafficking between Florence and Bologna.

The work for the construction of the track (78.5 kilometers long) began in 1996 and its inauguration is scheduled for 2009. On the track, there are no intermediate stops and it will connect the two urban areas in 30 minutes, half the time taken today by the traditional line. A little over 100 km away, the two cities are both a part of major importance in the Italian economy for the functions you are located (Bologna is an important hub of transportation, logistics and exhibition, Florence is also the centre of business, but especially tourism and cultural).

Despite the small population size (lie seventh and eighth place among the Italian cities) and urban size of both, their spatial and social dynamics have affects on wider audience. Already a study by the DATAR (Délégation à l'aménagement du territoire et à l'action régionale), in 1989, in which he had proposed a classification of European cities for the degree of importance, puts the two cities at the same level of the largest and most populous metropolis for the major cultural and economic.

Bologna, located at the southern of the Po valley, stands in seventh place among the Italian cities by population with 373,026 inhabitants.

Bologna is an important university, economic and logistic centre in Central North. It is the second Italian fair city, receives an important logistic hub (one of the largest Italian hub, a major food centre and a leading wholesale trade centers in Europe, the Centergross) and is home to one of the most oldest universities in Europe, which attracts students from many parts of Italy and is the second Italian

after La Sapienza University of Rome, both in number of students who graduate.

According to the study of DATAR (1989), by the end of the eighties, the city and its metropolitan area had much higher importance than expressed by the simple demographic parameters at both national and European level. The study, which suggest a classification by degree of importance of cities with more than 200,000 inhabitants in fourteen European countries, classified Bologna, Florence and Venice at the same level of much more populous metropolis (eg. Glasgow, Edinburgh, Oslo, Vienna, Lisbon, Marseille, Seville, Valencia) for his cultural and economic significance. His position with respect to the rail routes and highways of central North has made it an important hub of communication.

Furthermore, with the completion of Highs Speed rail project and the completion of two rail routes that connect with Milan and Florence, Bologna will be respectively 55 and 30 minutes from the two cities.

Bologna Central station will be High Speed rail station, which will be affected by important transformations, both from the point of architectural and technology, to make it an integrated junction in which converge HS link, domestic and international traffic, regional and metropolitan and urban public transport.

It is currently carrying out the international design competition for the new integrated complex, which began in 2007. The design for the new station includes a multi-storey structure which will include the underground station for High Speed, the less profound for the Metropolitan Railway Service, and a third surface for local trains and long distance services. An area of 350 thousand square meters will be built with 42.000 sqm for service station and 120 thousand square meters for urban commercial functions, directional and accommodation.

The project also will extend for a further 36 ha to the surrounding urban area (called Ravone) which will be the subject of extensive redevelopment and whose use is intended to partly fund the construction of new station (Nomisma 2007).

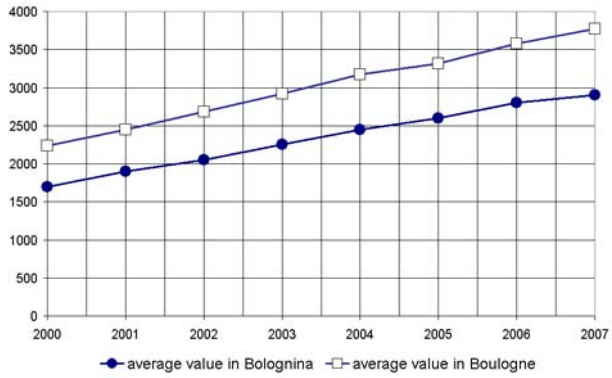
The station is located in the district of Navile, in the area of Bolognina, bordering the historic city center; the two areas, currently separated from the bundle of tracks, will be reconnected thanks to the project of the new station that provides the burying of the tracks.

In relation to the property market in Bologna, in recent years the trend of trading was broadly stable. The opposite was the trend in prices, which registered a steady growth, although inconsistent. Between 2000 and 2007, the central areas of the city are those that have recorded a total price increases larger than those of historical neighborhoods (Bolognina) and more recent ones.

Over the next few years to influence positively the framework of the Bologna market values, there will be the effects of retraining and modification of functional structures related to major urban projects planned (Scenarios Estate 2007).

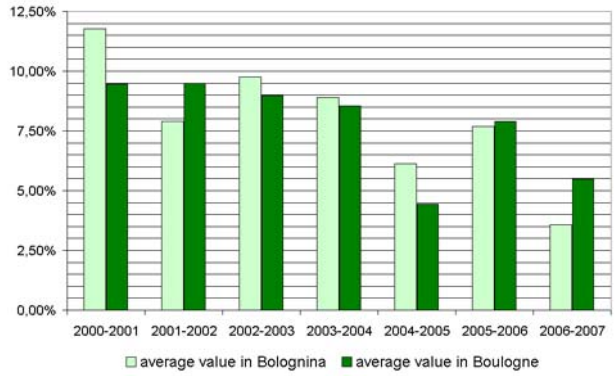
To identify the effect of the arrival of high speed line in the city (2009) of property values, was compared to the trend of property value with the average value of the district Bolognina in the period 2000-2007, using data from Scenarios Estate (2007).

The comparison shows that the evolution of values in the neighborhood mainly follows the trend of the average value in the city, although it always is lower.



The trend of property values in the district of Bolognina follows the general average trend, keeping always lower.

Furthermore, in Bolognina, the annual percentage change tends to decrease, especially in recent years (since 2005), and the variation 2006-2007 (3.5%) is the lowest reached since 2000. Moreover, even compared to other city districts, Bolognina shows the lowest percentage change in 2006-2007.



The start of the design phase of the HS station (2007) does not appear to affect the annual percentage change in Bolognina which tends to decrease.

In summary, the arrival of the High Speed (2009), which carries the station's building projects and urban redevelopment, not least for the moment seems to produce effects on the local property market.

Florence, with 366,488 inhabitants, is the largest and most populous city in Tuscany, and its main hub historical, artistic and economic-administrative. Despite the paucity of resident population, the social dynamics and spatial city covering a much wider catchment (Scenarios Estate 2007). The city, in fact, has a diversified economy operates mainly in the tertiary sector, but is also home to industrial mechanical, chemical, pharmaceutical, processing of leather and clothing. Another important resource is its tourist activity, with a number of appearances that comes to touch the 10 million per year (Regione Toscana 2006).

The station Belfiore will be the urban node of HS link, to be built in the north east of the town, between Viale Belfiore and Viale Redi (a short distance from the Santa Maria Novella, the main railway junction current), in Rifredi district.

This district, which is the largest city, includes the areas of Novoli, Careggi Hospital, Castle and the area Rifredi, which because of its importance has come to give its name to the neighborhood. Seat of the hospital and several universities of Florence, Rifredi has passed predominantly industrial vocation.

Presence the railroad and its train were in fact determined the location of various industrial activities (the Institute Military Chemical and Pharmaceutical, Fiat), which in recent years have been a phenomenon of divestiture and conversion. Infact, Rifredi today is involved in several projects of urban transformation, including projects Novoli and Piana Castello. These projects fall within the wider process of change of government in Florence, which has the main objective to reorganize the city using the large brownfield sites to move some important executive activities and service from the centre, and to restructure the system of mobility (high speed train, tram system, highway).

The Novoli project (area ex Fiat) is the principal involvement of real estate development under construction in Florence and covers an area of about 32 ha.

The project includes a large urban park, the new courthouse in Florence, the University Centre of Social Sciences, residences, offices, shops and facilities, with new streets, squares, walkways and two large underground parking. The first part of this plan was completed in January 2004, after the completion of the housing and inaugurated the new University of Florence and are currently under construction the new courthouse and related structures, offices, businesses, car parks and the park (12ha) located in the centre of the area.

The new Belfiore station will rise in the Southern End district of Rifredi, just steps from the Santa Maria Novella. In 2003, the international design competition for this station was won by Norman Foster. The project covers an area of over 45 thousand square meters, with a structure that develops in depth to accommodate HS trains, and the plan of campaign to host the services of the station, parking lots, bus stops and tram, to conjunction with the Santa Maria Novella station and the historic centre.

The opening of the new underground station is planned for 2009, time needed to complete the construction of the line, complicated by the particular topography of the area.

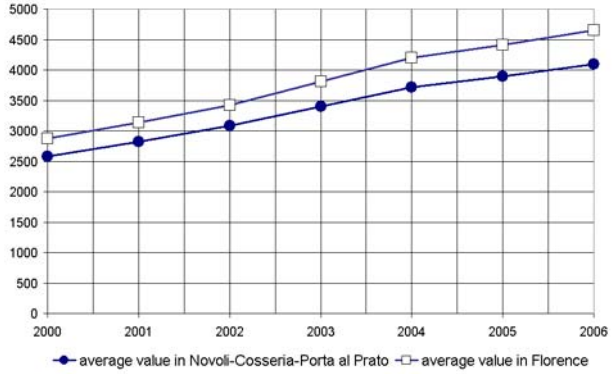
As for the national housing market in Florence are concentrated around 45% of all homes in the province, its characteristics of being a city of art open to international tourism has led to the demand towards more varied housing market, compared to average of Italian cities.

In late 2006, the main indicators of the residential property market in Florence showed negative sign, indicative of a cyclical downturn recorded in late 2005. Indeed, the high level of prices (which in 2006 marked mean increases above 6%) is believed to be behind the decline of trading in the capital (-5.8%).

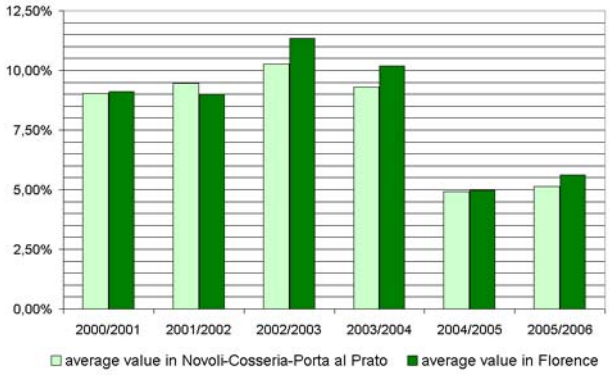
Indicative of this situation is the crisis that hit the apartments of the old town, until a few years ago in high demand and sold at prices much higher, but currently considered economically inaccessible and unsuited to the needs of most potential buyers (Scenarios Estate 2007).

As regards, in particular, the area where the Belfiore station will rise, residential real estate clearly was affected by this phenomenon.

The area of interest, as identified in the graphs Novoli-Cosseria-Porta al Prato, seems to show essentially the same trend as the city average, from 2000 to 2006 (data provided by Scenarios Estate 2007), although the percentage annual change shows a sharp decline in recent years (from 9.31% in 2003-2004 to 4.93% in 2004-2005), before recovering slightly between 2005-2006 (approximately 5.13%).



In the area of the future station Belfiore, the property values show the same trend city growth from 2000 to 2006.



The annual percentage change in property value around the station of Belfiore shows sharp decline in recent years.

In conclusion, in 2006 the real estate market in the area of the Belfiore station shows a slight sign of regrowth that should still be observed in the next few years, it can be attributed to the arrival of the High Speed (2009) and the redevelopment project of the area.

The case of Roma-Napoli

The Rome-Naples is part of the HS Railway Line that connects Turin, Milan and Naples, and replacing the Italian section of the Trans-European Corridor "Palermo-Berlin". On this line, in addition to the link between Rome and Naples in operation since 2005, which allows you to travel 204 km in 1:20, is also functioning the link between Turin and Novara (opened in 2006, during the Winter Olympics). Remain to complete the last 18 miles to Naples (the section from Gricignano d'Aversa and Afragola to Naples), the new stations in Naples-Afragola and Rome Tiburtina, the strengthening of Naples Central Station.

With a population of over 2,700,000 inhabitants, Rome is the first Italian town by population, as well as extension, and represents, along with Milan, the Italian largest economic centre whose activities (services, functions administrative, construction, tourism) in 2006 have produced about 8% of national GDP, more than any other city in the country (Censis 2006).

The city is the centre of a radial primary roads that trace the lines of ancient streets and is the most important railway junction in central Italy, both strategic location for provision of infrastructure on iron (Tirrenic line Roma-Genoa, the line north Rome-Florence-Bologna, the lines towards the Adriatic and the lines toward the south from Rome to Naples, the line Rome-Caserta and the new line of the HS Rome-Naples, along the way Casilina).

Termini station, who has the highest number of daily transits in Italy (about 400,000), is currently the only the High Speed terminal in Rome until it is completed of the new station Tiburtina, in 2009.

The new station Tiburtina is located in the north east of Rome and intended to be the largest High-Speed rail station.

The design of the new station (by Paolo Desideri) try to "mend the two historic districts divided by the driving of the track, both through the system of services contained within it, both through the element of the great urban boulevard, covered, elevated that crosses the tracks "(Rfi 2007). The station building represents a bridge-tunnel that serves both the function of international railway station and great urban boulevard. These two functions are compatible thanks to a great height and interior space to the complete availability of decking to share more diverse fitting needs. A gallery totally free of structural elements will provide real flexibility in the use of space through displays that integrate effectively free, as in large areas of airport, the areas for trade and those for business lounges (www.archiportale.com).

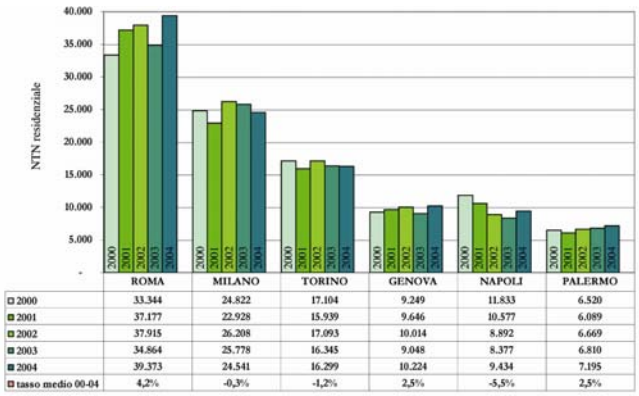
The realization of the new station is part of the wider urban project Pietralata-Tiburtina, which covers an area of approximately 200 ha. This project, approved in 1996, aims to create a new system for directional in the east area of the city.

In the Pietralata neighborhood, in fact, will be localized sites of public administration and a tertiary centre around the station Tiburtina. These interventions, accompanied by a deep urban regeneration, proposed by the Master Plan for the area of Pietralata (2001), which is based on “the completion of roads, parking lots and the provision of services, a system of urban parks, the construction of 900 new housing and a pole craft (40 shops), a university campus, new school complexes, a market, a social centre and sports facilities"(City of Rome, 2004).

In other words, the strategy planning of the City Administration, pointing to decongest the city centre and the redevelopment of the suburbs, find among the new central urban district Pietralata, thanks to its good accessibility afforded by metro line B and the Tiburtina train station.

The residential property market in Rome, in recent years, was certainly among the most lively in Italy (OMI 2005). The importance of the Rome’s housing market is clearly looking at data concerning the change in the number of transactions compared to that of other Italian cities.

According to data from OMI (Center Real Estate Market-Agency of the territory) in 2005, Rome record the highest average rate of change in the number of transactions compared to large cities in the five years 2000-200 (4.2%), followed by Genoa and Palermo (2,5%), Milan, Turin and Naples recorded negative rates ranging from -0.3% (Milan) to -5.5% (Naples). Among the factors that contributed to the dynamism of the national residential real estate market, increasing the housing stock, built between 2000 and 2005, certainly played a decisive role (IMO 2005).



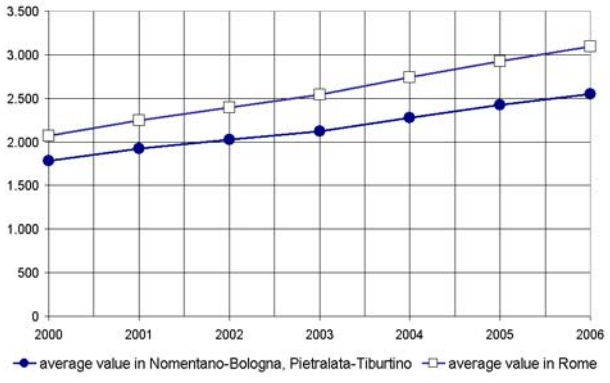
	ROMA	MILANO	TORINO	GENOVA	NAPOLI	PALERMO
2000	33.344	24.822	17.104	9.249	11.833	6.520
2001	37.177	22.928	15.939	9.646	10.577	6.089
2002	37.915	26.208	17.093	10.014	8.892	6.669
2003	34.864	25.778	16.345	9.048	8.377	6.810
2004	39.373	24.541	16.299	10.224	9.434	7.195
tasso medio 00-04	4,2%	-0,3%	-1,2%	2,5%	-5,5%	2,5%

The residential property market in Rome, in recent years, was among the most active, recording the highest number of transactions between the Italian cities.

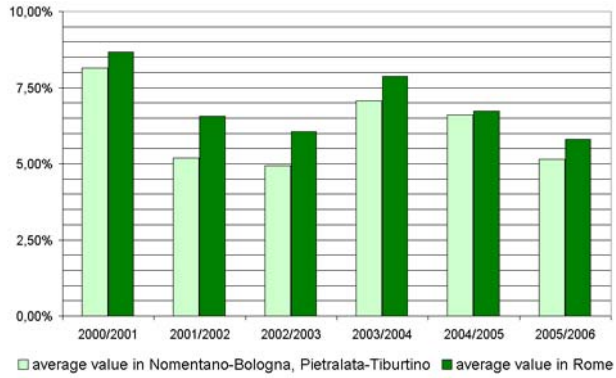
With reference to trends in property values (constructed on the basis of data from Scenarios Estate 2006) in the neighborhoods around the station, Pietralata and Nomentano, in 2000-2006 (the reference to read the effects resulting from the announcement, in August 2004, the next opening of the yards of the high speed station), these values are in continuous increase.

However, these still remain below the average value in Rome. Compared to the annual percentage change is also noted that these districts have an annual percentage change substantially following the trend of changes in the average value.

In recent years, in particular, peak percentage change in the district are 8.67% (2000/2001) and 7.86% (2003-2004), showing decreasing values in 2004-2005 and 2005-2006 (in fact it has gone from 6.59% to 5.15%).



The property values in neighborhoods around the new Tiburtina station show a trend continues growth, although lower than the general average value.



The annual percentage change of neighborhoods around the station Tiburtina shows decreasing values in recent years, exposing a substantial indifference to the advertiser opening the yard in 2004.

The news of the imminent opening of the yards of the High Speed Train does not therefore, a significant change in property values, while registering a reduction of the distance from the average value in the city from 2004-05. There appear to produce a climate of trust (and therefore have implications on property value) and the award of work on building the ring road linking between A24 and the Battery Nomentana in October 2004 (an action under Detailed Plan for the area of Pietralata 2001), that the inauguration of high-speed rail link between Rome (Termini) and Naples, in 2005.

The third city of Italy for population (almost one million), after Rome and Milan, Naples ranks among the last places for economic growth. Despite the presence of productive activities and business major, the city to be sluggish.

The situation in Naples, however, reflected in a more widespread regional malaise: estimates Istat (2005), provinces of Campania grow less than the other Italian provinces (+1.5% right, 0.7 points less than the national average and 1 point lower than the average for Southern Italy, unexpectedly more active than the North East and North West) and, in particular, the province of Naples has stagnated at 0.8%.

In Naples last decade has initiated a broad program of transformation of the city, bound on one side to total redesign of the city and the other to the development of mobility system. Following approval of the Guideline document for urban planning in 1994, began a planning process that, together, led to the drafting of the municipal planning instruments and tools of mobility: the Municipal plan of Transportation (1997), the Plan's primary road network (2000) and the Plan of 100 stations (2003) were prepared in parallel with drafting the new General Master Plan, which began in 1994 and ended in 2004.

In this rich and complex system of interventions that is grafted on a new vision for the city, there is also the project of the High Speed

Railways, which envisages the construction of a new station to Afragola, and the Grandi Stazioni project, which provides for the renewal and strengthening of the Central Station, the High Speed terminal station.

In the Naples Central Station, then, come HS trains into the city, while in the station Afragola, whose work will be completed in 2009, will arrive fast trains bound for Battipaglia-Reggio Calabria and for Naples and will be can exchange with the regional rail services and Circumvesuviana. Naples Central Station is the main railway junction in southern Italy since the beginning of the twentieth century and the sixth in the national rail system for the number of passengers, with about 137 thousand visitors daily and 50 million a year. This station is divided into a surface station for domestic shipping and an underground station (Napoli Piazza Garibaldi), intended to serve the metropolitan (metro line 2, Circumvesuviana) and partially to the national network.

The station is located southeast of the city, bordering the industrial area, between the historic districts of Vicaria, San Lorenzo,Pendino and Mercato.

Since 2005, is ongoing work of enhancement and adjustment of the structure, now dilapidated, which occurred with the requirements of the flows of travelers who cross here.

The project is funded and managed by Grandi Stazioni-Gruppo Ferrovie dello Stato, a company that was founded in 1998 with the aim of regenerating areas inside and outside of the twelve major Italian stations. Work on the renovation of this station is the framework in the proposed reorganization of urban and regional mobility proposed by Regional Transport Plan of the Campania Region.

In particular, the reorganization of mobility at the city level is entrusted to the Dominique Perrault's Rearrangement project of Piazza Garibaldi, commissioned by the Naples Metropolitana, which aims to redevelop the area of Piazza Garibaldi, the overall structure by reorganizing, rearranging spaces for vehicular and pedestrian circulation and strengthening staging areas for public and private. The project plans to fill the urban void of the existing Piazza Garibaldi area by inserting new functions but not new volumes and articulating the whole space into three large squares, rich gardens and green spaces that connect five stations.

A strategic railway station, therefore, insist that Central Station of the national traffic, the HS station, the Circumvesuviana and the two metro stations for line 1 and line 2. It is estimated at a daily transit system 260mila people, or 75 million a year, compared to 8 million of the Port and 5 million of the Airport of Capodichino, besides the increase of flow due to High Speed.

As for the national housing market, as the Property Report 2005 Observatory on Real Estate Market-Agency of the Territory, Naples and its province also have a little flexibility, which not meet the needs of a modern government of urban systems.

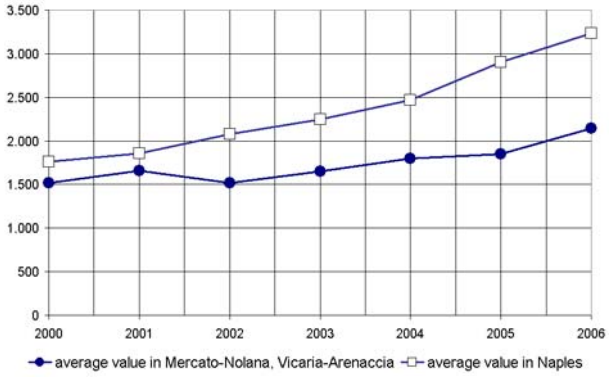
Although Naples has a housing stock that ranks among the five largest in the country and has a resident population that ranks third among the Italian cities, has seen a phenomenon of reducing the number of transactions, amounting to around 20% between 2000 and 2004.

This decrease corresponds to an increase in transactions in the province.

"This means that the city, unable to give an answer to the question of population, suffers a residential forced toward decentralization neighboring municipalities" (OMI 2005). Another important issue that the Report highlights concerns property prices: "They are, in Naples, segmented and highly variable from area to area and within the same area.

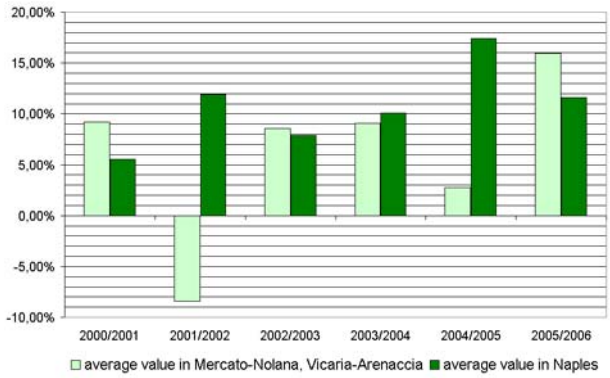
Is this the result of a random densification process buildings constructed outside of any coherent policy "(OMI 2005).

In particular, focusing on neighborhoods surrounding the central station, you can watch the trends in property values (built on the basis of data from Scenarios Estate in 2006) than the average value of Naples in the period 2000-2006, which includes the year that started operations in the HS and they have started work adjustment and upgrading of the station.



The property values in the area around the station have a discontinuous trend, while always keeping it below the city average.

In these districts the values always remain below the city average, with no increasing trend. From reading the annual percentage change in this area also shows that this increased rapidly, rising from 2.78% in 2004-2005 to 15.95% in 2005-2006, overcoming, so even the average value. This value is significant even in comparison to individual percentage changes of the other districts of Naples. Fact, this is placed in the middle position within the range of variation ranging from 31.15% (Arenella-Rione Alto) to -7.50% (Industrial Area).



The annual percentage change in the area around Central station is in increase between 2004 and 2006, coincide with the arrival of HS link, above city average value.

HS, types and characteristics of urban and real estate changes

The reading of selected cases, as described in the preceding paragraphs, reveal that significant changes in property values related to the arrival of the High Speed in the urban setting of reference are recorded mainly in the following circumstances:

a. when the opening of the new station or the adaptation of an existing one to accommodate High Speed rail is one of the actions of a wider process of regeneration of urban in a districts with high levels of physical and social deterioration in the city of rank very high;
b. when the arrival of High Speed trains is in a central area of the city in a radical physical transformation and functional result of a widespread phenomenon of massive industrial decline;
c. when opening a new station of the High Speed invests a small to medium sized cities and with little functional characterization.

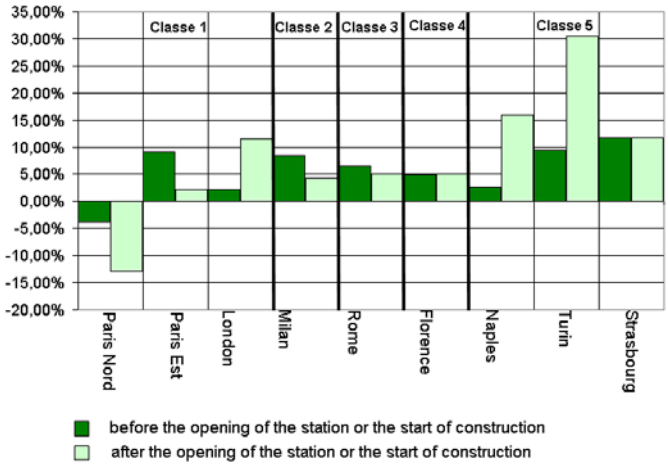
The occurrence of these conditions can be read explicitly in the charts and table that follow although it must still take into account the socio-economic background of the particular urban context. In the first two graphs of this section, also constructed on the basis of the criteria used in the selection of sample cases contained in these pages, are compared to the percentage change in property values during the opening of the station or to initiate the construction of clusters of cities established on the basis of the classes identified in the benchmark for European cities of Datar (2003) and between clusters of cities with different geographical location and, therefore, social and economic life.

In the third graph, the comparison is divided because of the type of transformation started in the station and its surrounding urban; from reading of cases is apparent that the effects of implementing High Speed rail hub on property values may also vary because of the types of intervention implemented in the urban areas of the station. In the first chart, then, is represented the percentage change in property values during the opening of the station or building work begun by city, grouped according to class of Datar identified in 2003.

The study of Datar, in fact, is the reference for all subsequent studies that propose a classification of European cities for functions and population size. In particular, the classes referenced in the chart and the table are defined in view of the role of global and European cities involved in the international context. Class 1 is the only world-class and classes from 2 to 5 are the European level. In brief, we outlines the definition derived from the study of the Datar single classes of cities:

– Class 1: cities with world-class functional mix (Paris and London);
– Class 2: cities with economic and financial functions of high level (Madrid and Milan);
– Class 3: cities with high-level functional mix (Roma);
– Class 4: cities with strong functional specializations (Florence);
– Class 5: cities with at least one function of European level (Turin, Bologna, Naples and Strasbourg);
– Classes 6 and 7: cities with almost no connotation of European level (Reims).

The medium-small sized cities selected in this article are not placed in classes defined by Datar, but for Ashford is highlighted its role as a major national commercial node and hub rail; for Ciudad Real and Puertollano the role of university and industrial mining the role of national level.



The comparison between the cities, grouped by Datar classes, read in light of the percentage change in property values, shows in the areas of the station a disregard of the property market to the size and the functional specialization.

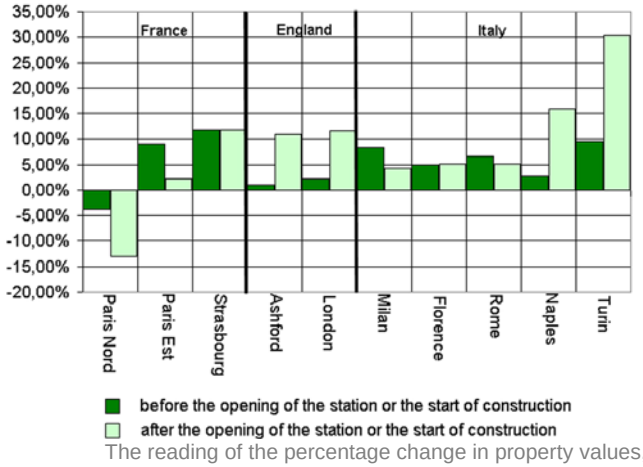
A reading of the graph is found that among the cities belonging to the first three classes, Paris, Milan and Rome did not seem to feel the effects of the connection of the High Speed Railway, showing even a decrease in property values in areas around stations. We must remember that in the cases of Paris and Milan, the stations are located in the heart of the city, in areas with levels of quality, accessibility and property value at the highest.

It should, however, taking into account all three cases that the negative change of values in the neighborhood of High Speed station reflects the more general trend in the cities which is aligned perfectly. Even in the case of Rome, which has characteristics very different from the cases of Paris and Milan, there is a substantial "estate indifference" to the arrival of High Speed.

Indeed, the district where is located the station Tiburtina, which is not yet in operation for HS rail line is part of the periphery is involved in a consolidated and comprehensive process of renewal and regeneration that involves the construction of the new directional system in the east Rome. Among these cities only exception was London where property values have increased significantly compared to previous years the opening of the HS train. The station that welcomes the High Speed Train is located in the borough of Camden, a neighborhood that for many years was characterized by high levels of degradation and crime and is now interested also intervention of a large urban redevelopment.

The significant change in property values in the neighborhood can therefore be viewed primarily as a tangible sign of renewed interest to the district, however, occupies a central position within the city. Among the cities below the third class, Naples, Turin and Reims show in the areas around the high-speed rail stations a substantial increase in property values compared to the previous period to the start-up of high speed. In these cases the stations are located in central urban areas involved in rehabilitation processes involving the surrounding spaces (the case of Naples) or re-articulation and rearrangement for the presence of vacant areas (the case of Turin and the occurrence of Reims), as can be read even in the third graph. In the neighborhood of the station of Strasbourg is not found appreciable variation of property values, probably due to the fact that the station is located in the central area where the buildings have the highest value of the city. In Florence, in conjunction with the start of the work of the new station by Norman Foster, whose entry into service is scheduled for 2012, there was a slight rise in property values in respect to the trend in previous years, probably supported the implementation of the new residential and tertiary Novoli on vacant land Fiat industries, which will be completed during 2008. Finally, in Ashford, Kent cities with the highest growth rate of the entire England, growing population, residential and infrastructure has been a significant increase in property values which is passed from 1% between 1995-96 to 11% in the following year, coinciding with the opening of the station, located in the city center. It is enhanced, thus further its role as a commercial centre and communication mainly due to geographical location (the city lies at the confluence of two rivers, the Upper Great Stour Stour el'East) and, since the nineteenth century, the role of major railway hub that had a further boost during the implementation of the international station of the railway line linking London to the Channel Tunnel.

The geographic criterion for reading, unlike the previous one, does not seem to offer explanations to interpret the effects of the HS stations on property values. However, from reading the second graph is found that the presence in the French cities of High Speed stations does not produce effects on property values, unlike the English cities, for the sharp increase in values in station areas, seems to have decided once the effect of the opening of these stations.

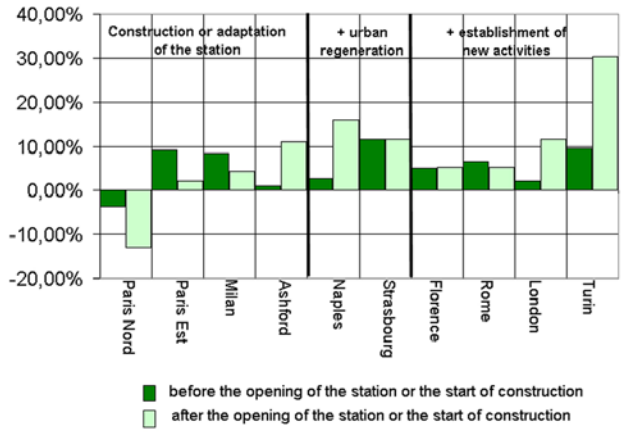


The reading of the percentage change in property values, depending the geographical location of cities, do not appear to explain the effects of the HS stations opening on property values.

In the third graph, the changes in properties are read in relation to the kinds of transformations implemented in the urban areas of the station. As in other cases, also because of the types of transformation is not possible to identify a homogeneity of effects of property values. Indeed, in cases where the intervention of transformation was limited to strengthening and/or adaptation of the railway station in Paris and Milan, there are no significant changes in values, while in Ashford, despite the intervention is limited to the building at station, the increase in property values is remarkable.

In the event that the transformation also involves the space surrounding the station, based regeneration and reorganization of mobility, there are significant increases in property values in Naples,

but not in Strasbourg, probably due to different physical and functional conditions of the respective station areas.



The size and type of the urban transformation process in the area of station does not always have the expected impact on changes in real estate, which may also depend on other factors such as size and functional specialization, especially in medium-sized cities.

Indeed, in Naples, in the presence of an area characterized by low levels of habitat quality and accessibility, the arrival of the High Speed with the initiation of work to the reorganization of vehicular and pedestrian traffic in the square outside the station Centrale (Piazza Garibaldi) and the presentation of the project to more comprehensive physical and functional rehabilitation of the area, produced an increase in property values in terms of annual percentage change by more than 15%. Even if the intervention of the Strasbourg building the resort has an opportunity to reorganize the square, but the level of physical quality and functional area and the already high real estate prices have not produced an increase in property values. Finally, in cases where intervention at the station is part of a larger project of urban transformation, with the establishment of new functions, residential, cultural, tertiary, the positive effect of property values is evident in the cases of London and Turin but not in cases of Florence and Rome. Indeed, London and Turin, the percentage change in property values reach the quota, respectively, 12% and 30%. In Florence and Rome the property values does not undergo any significant change as a result of the extensive processing operations implemented or being implemented.

In conclusion, the comparative reading of the cases shows that the effect from opening of the High Speed railway stations on property values is valuable in cases where it contributes significantly to raising the socio-economic and the quality conditions of spaces. In other words, in the towns of high class leading cases seem, therefore, be ascribed to those in which the station, rising in slums and criminals, is an opportunity to revive socio-economic and physical rehabilitation and those in which, rising near or within vacant areas, is an important element in defining the new role to be given urban area. In the cities of lowest rank, characterized by the limited presence of strong urban functions from a small town but still dynamic, the effect on property values is significant, despite the absence of broader interventions on the urban system.

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Notes

[1]Although part of a joint discussion, Carmela Gargiulo edited "Urban transformation, urban quality and property values"; "Accessibility and property values: the scientific reference"; "HS stations and property values: the criteria for reading", "The case of Roma-Napoli"; "HS, types and characteristics of urban and real estate changes"; Fiorella de Ciutiis edited "The European cases"; "The case of Turin-Milan"; "The case of Bologna-Florence".

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Soft Mobility and Urban Transformation

some European Case Studies

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A B S T R A C T

This paper examines some European cases referred to promotion of soft mobility as a new lifestyle aimed to improve benefits on environment and urban livability.
Soft mobility includes any non-motorized transport (human powered mobility). According to this, soft mobility refers to pedestrian, bicycle, roller skate and skateboard transfers. It could be indented as "zero-impact" mobility too. As a matter of fact, the words to define this way of moving have not been codified yet, therefore *mobilitè douce*, *soft mobility*, *slow traffic* are synonymous in referring mainly to pedestrians and cyclists to indicate alternative to car use. Soft mobility, indeed, can be defined as a special form of sustainable mobility able to optimize urban livability, by keeping the individual right to move.
At present, cities are engaged in defining policies, procedures and interventions to further "slow traffic", both to relieve the traffic congestion, and to work for regeneration and environmental improvements.
This asks for an in-depth cooperation between different political and administrative levels to achieve common objectives of development more attentive to environmental concerns.
Despite this increasing attention, the idea of a "network" for soft mobility has not been yet achieved and the supply of integrated facilities and services as an alternative to the car use seems to be still difficult of accomplishment.
High disparity characterizes European countries in promoting soft mobility: despite a prolific production of laws and roles referred to emergency of adopting alternative ways of moving to minimize negatives impacts (especially air and noise pollution as very threat to health) due to car dependence for urban short distance too. And yet, soft mobility could represent a real occasion of urban and territorial regeneration aimed to rehabilitate some disused paths and routes (greenways). Some successful European cases show how it is possible to capitalize territorial resources by promoting alternative way to visit them.
Tourist and leisure activities, in fact, are probably the most suitable to improve a car-free lifestyle.
Some pilot projects carried out in alpine regions, for instance, propose to integrate public transport supply with tourist demand of visiting different destinations.
"Soft mobility" should be a different way of thinking about mobility and its impact on environment.
This is what this article try to underline giving an overview of some European cases of public policies aimed at supporting soft mobility.

Mobilitè douce, soft mobility, slow traffic...different ways of saying similar thing

"Soft mobility" includes all forms of non motorized transport (NMT) that use only the "human energy" (Human Powered Mobility).
The Swiss Department of the Environment, Transport, Energy and Communications (DETEC) gives such a definition also to indicate its policy for sustainable mobility.
The Guidelines for Slow Traffic drawn by the Federal Roads Office (FEDRO) in 2002, in fact, intend to serve as a framework for defining general conditions to improve the mobility system both at urban and regional level.
Among the European cases the Swiss one is perhaps the most significant example of public policy involved in integrating "slow traffic" into the global mobility system (private motorized traffic and public transport).
In fact, the Swiss Department of the Environment, Transport, Energy and Communications (DETEC) and the Federal Roads Office in particular, has the specific task of creating the more favourable conditions to develop this particular way of moving.
Even though there is not yet a unique definition, we can argue that soft mobility (pedestrian, cycle and other not motorized displacements) is a "zero impact" mobility trying to be alternative to the cars use. According to this, *"mobilité douce", "soft mobility" or "slow traffic"* are different ways to express the same concept.
This refers to the global concept of sustainable mobility aimed at increasing urban livability, keeping the individual right to move.
As a matter of fact, soft mobility could improve urban environment especially referring to:

– levels of noise and air pollution;
– traffic congestion;
– road safety.

Generally, soft mobility and its promotion in urban policies has been linking to the problem of emissions generated by vehicular traffic. Such a promotion is also based on the belief that the increase of soft mobility would reduce private car traffic, particularly as regards short trips.
The emerging attention to environmental concerns has been leading many cities towards the development of specific infrastructures and services dedicated to soft mobility.
This should ensure highest levels of urban safety increasing occasions of public spaces regeneration.
Despite this increasing attention, the idea of a "network" for soft mobility has not yet been carried out. The supply of integrated facilities and services, being alternative to the car use, seems to have still difficult of accomplishment.

Soft mobility supports territorial fruition

"Soft mobility" should be a different way of thinking about mobility and its impact on environment. This needs for an in-depth cooperation between different political and administrative levels to achieve common objectives of liveability.
Tourist sector is probably the most appropriate for supporting the implementation of soft mobility and the cooperation above mentioned.
The "Alps Mobility" project is a valid example of political and administrative cooperation aimed at implementation of sustainable mobility in tourist development. The pilot project has been carried out in the framework of the European initiative "Alpine Space" and it has concerned eight different regions sharing the same objectives of well-balanced development as the EU Interreg III program suggested. The "Alps Mobility" project (the title was *"Pilot Project for Environmentally Sound Travel Logistics Linked with Electronic Booking and Information Systems in Alpine Tourist Regions"*) Started in 1998 and has been developed till 2001.
The main purpose of this project was to reduce mobility impacts by implementing public transport to ensure tourist displacements inside destinations (car free tourism). The pilot project focused on the development and the establishment of environmentally sound travel logistics with regional mobility management centres (optimization and combination of rail, bus, taxi, bicycle, shipping and lift offers and services) linked with the development of an integrated travel information system by connecting public transport timetable and touristic information.
At beginning, the partners involved were Italy, Austria and Germany, but the positive feedback have been leading toward a new transnational project with the inclusion of new partners (France and Switzerland). Furthermore, based on the successful result of the "Alps Mobility" the cooperating partners decided to expand their collaboration to develop further transnational strategies aimed at promoting soft mobility in the Alps regions. The new project "Alps Mobility II" has been carried out from 2003 till 2006.
Based on the idea of promoting high quality level in tourist supply, this new project has lead to the creation of a tourist destinations network called "Alpine Pearls". This tourist region is a network of twenty communities sharing the same objective of promoting their territorial resources in environmentally conscious way.
Soft mobility is strongly supported to visit and to enjoy tourist destinations. In fact climate protection and nature conservation via soft mobility is one of the main focus of the Alpine Pearls association.
Both projects have been based on a wider concept of soft mobility

Project partner	Project region
Federal Ministry for Agriculture and Forestry, Environment and Water Management Federal Ministry for Transport, Innovation and Technology, Province of Salzburg	Pongau (Salzburg)
Bavarian State Ministry for Provincial Development and Environmental Affairs	Oberallgäu and Berchtesgadener Land (Bavaria)
Region of Lombardia	Alta Valtellina
Region of Veneto	Dolomites
Region of Friuli-Venezia-Giulia	Carnia
Autonomous Province of Trento	Sella Range (Dolomites)
Autonomous Province of Bolzano	Sella Range (Dolomites) and Alta Pusteria /Hochpuster Valley

Nine project partners have worked together under the title "Alps Mobility", developing environmentally friendly transit and tourism solutions.

that also includes the supply of environmentally sound transport (electric buses and cars, dedicated rail lines, etc.) besides cycles and pedestrians. The progressive feature of these projects is still trying to affirm a new tourist model of visiting also supported by innovative instruments (GPS, GIS, webGIS, etc) to improve quality levels of supply services. Some other European projects have interested Alpine regions remarking that alternative ways of travelling are possible via soft mobility.

The "Alpine Awareness" project (2006-2008), for instance, has chosen the claim *"in the mountain without my car"* to promote soft mobility as lifestyle especially for young generation.

Italy, France, Austria and Germany were the partners involved in this project. Provincial administration of Belluno (Italy), in particular, led the project with DolomitiBus, the local transport service provider.

This project has invested a lot on education of young generation to make themselves promoter of sustainable mobility. French alpine regions were particularly engaged in working out specific plan for school mobility on the English model of the "safe routes to school" (Sustrans, 2007). The main idea was to convert some driveways along the home-to-school way, in order to create a distinct protected routes system.

Soft mobility and urban policies

British experience in supporting soft mobility is remarkable, mainly as regards promoters of this modality of travel.

By the end of the Seventies, the charity *Sustrans* (contraction of *sustainable transport*) has worked to affirm a vision in which people can choose to travel according modalities that benefit health and environment. *Sustrains* pointed to alert both common people and administrators about the need of reducing the environmental and resource impacts of transport.

To get this target, *Sustrans* has been engaged in demonstrating that it is possible to change people behaviors and the benefit of this change could be measured in terms of health, environment, quality of life and value for money. One of the main actions has been referred at retrieval of some disused railways, driveways or paths which have been turned into *greenways* (voies douces) on the American model. The *National Cycle Network*, for instance, could still represent one of the most significant project carried out by the Seventies. Disused Bristol & Bath Railway was turned into a traffic-free trail becoming one of the first "green route". Nowadays the network takes about 12.000 miles and it attends about 55% of population travels. Local and regional government have collaborate a lot to accomplish this project and also to support other projects aimed at soft mobility spreading. "Links to schools" for instance is another project funded by Department for Transport to connect schools and its communities to the National Cycle Network.

To create safe route for young people is the main objective but benefits on health and environment are not negligible.

Since 2004, when the project started, about 260 links (500 linked schools) have been created, enabling to reach school in a safer way.

On the Dutch "*woonerf*" model are based other projects that try to integrate urban requalification and vehicular mobility.

The concept of home zone briefly refers to reverse the logic of giving priority to the car encouraging cycles and pedestrians. Home zones are designed so that drivers naturally chose to proceed slowly and carefully. Residents are involved in redesigned their streetscape and contribute to the success of the project.

As concerns English experience, since 2000, home zones projects have been funded by "Home Zones Challenge Fund" of Department for Transport that has allowed many projects of urban regeneration and environmental improvements.

But the *greenways* concept has really modified the way of thinking about soft mobility as a real chance for territorial retrain. This is particularly referred to a system of routes dedicate to a non-motorized traffic, and connected each others in a network enabling people to move in a different way.

In 1987, President's Commission on American Outdoors in the USA outlined a widely accepted vision referred to the need of creating *"a living network of greenways... to provide people with access to open spaces close to where they live, and to link together the rural and urban spaces in the American landscape... threading through cities and countrysides like a giant circulation system*" (President's Commission, p. 102; Walmsley, 1995 in Fabos 1997).

The publication of the President's Commission report on greenways appears to have launched the *greenway movement* that has spread all over the world and it has captured the interest of professionals from diverse field (from lawyer to scientists, to landscape architects, to politicians).

This movement is still engaged in creating a network of "nature corridors" that will be evident like highways or railways networks are. The project idea refers to a mobility system of routes and paths completing the traditional one (highways, roads, railways).

This vision requires strong and in-depth cooperation between land use decision makers and also means turning into a new idea of moving, especially for leisure and tourist activities.

Nevertheless, to support this vision greenways movement has improved to make government and local administrators more aware of the need to change. The retrieve of abandoned railroads, rural roads, mountain and lowland paths has become the main proposal to get a soft mobility network. By the latest Nineties, Italy has her

own Greenways Association engaged in creation of a soft mobility network. Its work is particularly dedicated to the use of greenways as opportunities of enhancing territorial resources also for sustainable tourist development.

It is interesting to note how greenways always refer to a "system of routes" well-connected so that they can be also dedicated to weak users (children, pregnant women, elderly and disabled person). Project of greenways, in fact, must consider different solutions to make available and safe routes. The system of routes, indeed, should meet specific project requirements (width, gradient, type of flooring, and so on) in order to allow the access to all users and assure an easy route and comfort.

The Italian Greenways Association (IGA) defines the characteristics the routes should have in order to be included in a greenways network:

– high safety levels by split-up from road network;
– availability by adopting specific technical solutions (slope, width, flooring etc.).

Perhaps greenways are the most expressive examples of integrating mobility system with the objectives of territorial regeneration.

Belgium has greatly spent specific political objectives in supporting soft mobility. The RAVeL project (Autonomous Network for Slow Road) has been developed in the Nineties and it refers to the creation of a soft mobility network all over the Walloon region with a total length of 2000 kilometres. The network RAVeL has been built along towpaths, abandoned railways or country lanes, its users are pedestrians, horse riders, cyclists all type of non-motorized users.

It has been regulated by Highway Code that establishes the rules for all kind of users. Particular vehicles are admitted for disabled users but they have to respect the imposed speed limits.

At urban scale, Belgium is engaged in the fulfilment of "PICVerts" project (Plan d'Itinéraires Communaux verts). Funded by Walloon Government (Home Office) it has been started in 2005 and it is still in progress. The project PICVerts supports and funds Walloon cities in developing and building green route networks.

In its first phase (2005) thirteen cities were involved, nine projects have been selected and 1.5 million euro were funded. In the second phase (2007), 106 cities were involved, 41 projects were selected and 3.6 million euro were funded.

The main goal of the project is to create a network of cycle and pedestrian paths to allow safety routes for short urban displacements. These routes have their own circuit being apart from road and vehicular traffic.

This is to assure higher level of safety for slow traffic. Main urban function (education, administration, trade, leisure) are connected by the slow traffic network that allows to reach them in a few time. Final goal of the project is to replace cars use for commuters too.

A further tool targeted to promote soft mobility within the cities especially referring to weak users (elder and disable peoples) is the so called "Plan Escargot" (Snail Plan). This plan has the main goal of supporting the local administration in creating favourable conditions to soft mobility development. It also represents a tool for realizing urban regeneration project.

Particularly aimed at improving safety road level, this plan refers to the intersection areas between vehicular traffic and crosswalk.

Projects are funded for 75% of the total cost.

Cities must have worked out Urban Mobility Plan to profit by funding. In 2008, Grand Duchy of Luxembourg has worked out a "National Action Plan for Soft Mobility". This plan aims to increase slow traffic from 18% to 25% of total amount by 2020.

This plan defines a program of actions to develop soft mobility within different sectors (information, communication, land and regional planning, legislation, transport infrastructure).

Its goal is to affirm soft mobility as life style to improve conditions of natural and urban environment.

The Swiss Federal Department for Environment, Transport, Energy and Communications has drawn the *Guidelines for Slow Traffic* (2002) that establish rules and conditions for promoting soft mobility. Guidelines consider different sectors that could be engaged in development of soft mobility (urban and regional planning, infrastructure; cities and agglomerations, guide and information systems, safety, combined mobility, training and information for people, research and development, pilot plants and demonstration, statistics and assessment, mobility information system).

Global vision intend to integrate soft mobility with motorized private traffic (MPT) and public transports (PT). Soft mobility must be integrated also in urban and regional planning proceedings to assure implementation of dedicated infrastructures and facilities.

Confederation supports cantons by:

– specific funds for setting up soft mobility infrastructures;
– publication of directives, aids to implement and documentation;
– basic research and support of pilot projects;
– updating laws for transports;
– rating and monitoring.

Guidelines give framework conditions to develop local policies of increasing soft mobility in each Swiss canton.

This is also to involve private actors in financial support to spread slow traffic as the main modality of transport.

Soft mobility in Italy

Italy stands out for the delay in replaying the increasing attention to the promotion of soft mobility as life style.

The research report "Sustainable mobility in Italy survey of fifty cities" (Euromobility 2008), worked out by the Kyoto Club together with Euromobility, underlines internal disparity, among the Italian regions referring to sustainable mobility. Car dependence is so much strong that the rate of motorization is one of the highest in Europe (62 vehicles per 100 inhabitants). Italy has not yet defined a global policy of promoting soft mobility; initiatives have been performed at regional or local administrative level.

Generally they refer to restrictive actions to limit car access to specific urban areas (that is normally the inner city).

"Ecologic Sundays" or "Day without car" instead try to make people awake about the chances that soft mobility could offer.

There are not yet remarkable examples referring to soft mobility improvement. Probably the most significant action aimed at improving alternative way of moving within the city is "bike sharing". On the model of many other European cities also Italian cities have adopted this solution in order to promote alternative to the cars. Nevertheless its diffusion is still limited to a few number of cities that have decided to invest in sustainable mobility.

At regional level it is possible to notice better conditions of actions planning. Puglia Region has moved forward in promoting sustainable model of development also referred to mobility system.

The CYRONMED project (CYclo Route Network for the MEDiterranean) has been funded by the European Interreg IIIB Archimed (Mediterranean Archipelago) and it has been coordinated by the Local Authority Transport Department of Puglia Region.

Project proposes to create a Mediterranean network of cycle route integrated with other transport link (railway, bus, sea port and airport). The network should join Mediterranean countries of South Europe on medium-long routes. It is linked to the routes of the EuroVelo and Bicitalia project. Campania is involved in this network too, but at present, it has not elaborated any feasible proposal.

Italian confederation of associations Co.Mo.Do. has proposed to create national network for soft mobility and has also established its requirements:

– recovery of abandoned territorial infrastructure;
– integration among different users;
– separation from road network;
– integration with local public transport system;
– connection with accommodation network.

Soft mobility network projects always base on retrieve of abandoned railways to turn into cycle or pedestrian paths. Nevertheless, at present in Italy, few projects have been carried out. Modena-Vigliola, Cortina-Dobbiaco; Rocchette-Asiago and Caltagirone_San Michele di Ganzaria in Sicily have been turned into cycle paths, allowing a new use of regional resources both for inhabitants and for tourists.

At urban level, the proposal worked out by Municipality of Palermo, in 2007, within the strategic Plan for Sustainable Mobility, seems to be particularly interesting. It contains the indications to promote soft mobility referring both to intervention aimed at transforming some urban areas into pedestrian zones.

Soft mobility in Paris (France)

Among the European cities Paris is probably the most engaged in a continuous activity of requalification of public spaces in order to make them more available to all users (residents and tourists).

The projects of requalification are mostly aimed at improving the quality of urban environment by encouraging soft mobility (cycles and pedestrians).

Actions mostly refer to the creation of:

– "green districts";
– espaces civilisés;
– planning of cycling.

The creation of *green districts* is a specific urban policy target to improve the use of public spaces and to increase the road safety Action for this mostly refer to:

– creation of reduce speed limit zones (30 km/h);
– road direction planning ;
– dedicated routes for soft mobility.

Espaces civilisès refer to action to differentiate zones within the same road. The interventions refers to:

– creation of cycle tracks along the road;
– widening of sidewalks;
– crosswalk;
– protected corridors for buses;
– loading zones.

The Cycle mobility planning deals with the widening of about 327 kilometres of cycle tracks that Paris already has available at present.

One of the most significant project of requalification aimed at promoting soft mobility refers to the so called *Promenade Plantée* or the *Coulée Verte*. This crosses the 12th arrondissement extending for more than five Kilometres.

The idea of recovering the ancient abandoned railway Paris Bastille-Vincennes dates back to the end of the Seventy's, but only at the beginning of the Ninety's the project of transforming the viaduct into a green axis connecting Bastille Square to Varenne Wood was accomplished.

The upper part of the original viaduct has been turned into a greenway while the lower side has been turned into artists' studios or art gallery. The ancient viaduct Daumesnil has been turned into the "Art Viaduct" (*Viaduct des Artes)* by Samaest (Societé

d'economie mixte d'amènagement de l'Est de Paris) which has been responsible for the project.
It is possible to rich the "Promenade Plantée" by different points corresponding to specific filter areas equipped with pedestrian and children facilities.

Conclusions

The promotion of soft mobility affects different countries and different administrative levels.
Although actions targeted to create dedicated facilities for cycle and pedestrian are still different according to territorial scale, they have been oriented at encouraging alternative way of moving that should be more compatible an sustainable. This is to reduce the noxious emission caused by vehicular traffic as well as to improve healthier life styles, at least for leisure and tourist activities.
Despite a prolific production of laws and roles referred to emergency of adopting alternative ways of moving to minimize negatives impacts (especially air and noise pollution as very threat to health) due to car dependence, the promotion of soft mobility still depends on private initiative of associations or institutions, although they act together with public institutions.
This is widely common, except small European country (Luxembourg, Switzerland, Belgium, the Netherlands, Denmark), where the promotion of soft mobility takes a specific segment of public policies. This often involves different governmental department (environmental, infrastructural transport, and urban and regional planning) that have been engaged in a cooperative work to allow the implementation of soft mobility use.
As concerns large scale it is possible to individuate a common trend toward the creation of a "system of routes" dedicated to soft mobility aimed at promoting territorial resources too.
As concerns urban level it is more difficult to refer to a "systemic idea" of promoting soft mobility even though there are some good practices that have been carried out in big cities too.
The cases examined in this paper have shown that soft mobility should be a new way of thinking the ways to move in urban and territorial region.
At present, this is still difficult to achieve but some cases have underlined that it is possible to change human behaviour when benefits could be measured in terms of health, environment, quality of life and value for money. There is still a lot to work to.

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Urban Sustainability and Parking Areas in Naples

a Tool for Decision-Makers

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ABSTRACT

The methodological target of this paper consists in setting up a supporting tool for the public decision-maker in individuating the areas for parking within urban territory. The construction of this tool is guided by criteria referring more to urban and regional planning choices than to transport ones and concerning mostly the integration among environmental safeguard, activities distribution and need for mobility. As matter of fact, the methodological route tends to join the morphological-settlement and environmental characteristics of the site with the demand for parking, which depends on the activities settled in the urban ambit of reference, considering them as keyelements in building compatible choices of city transformation either in the phase of localization, distribution and sizing of interventions or in the following phase of planning the building typology of parking equipments.
This paper shares the position expressed in the report on sustainable European Cities, destined to the local authorities of any city in the states of the European Union, which belongs to those documents targeted to affect the development and implementation of innovating policies and actions for promoting a more sustainable urban Europe. Therefore, the paper is divided into three parts.
The first part defines the algorithm showing the iter through which it is possible to define feasible and compatible solutions for envisaging localization, distribution and typology of the areas and spaces to be realized. The second part, through the real implementation in a particular case, the city of Naples, deals with the definition of further criteria that are time by time implemented according to the urban context of reference. The tird part deals with the application to Naples and individuates a specific typology of parking areas, as implementation of the worked out algorythm and of the above-said criteria. The central part of the paper deals, then, with defining a route through which, among the possible transformations, the feasible alternatives are univocally individuated according to the environmental, historical and geo-morphological compatibilities and on the base of the expressed demand. All the building process is targeted, from its beginning, to reach desired and chosen aims with the awareness, confirmed by the previous analysis phase, that there are limits, bonds and conditions circumscribing the field of physical transformation planning - concerning the parking realization in this case - within well defined boundaries. Although this paper shares the choice of mobility policies targeted to stop and discourage the vehicles transit in the city downtown and against the realization of parking in those areas, nevertheless the suggested algorithm leads to realize exclusively areas for residential parking in historical central areas.

The methodological target of this paper consists in setting up a supporting tool for the public decision-maker in individuating the space for parking areas within urban territory. The creation of this tool is regulated by criteria directed more to urban and regional planning choices than to transportation ones and concerning mostly the combination of environmental safeguard, activities distribution and need for mobility (Beguinot and Papa 1995). As a matter of fact, the methodological course tends to integrate the morphological-settlement and environmental characteristics of the site with the demand for parking, which depends on the activities in the urban area of reference, considering them as key-elements in building compatible choices in city transformation, both in the localization, distribution and sizing of interventions phase and in the next planning of the building approach for parking equipments phase. This paper, referring to a wider study (Papa and Gargiulo 2000), is divided into three parts. The first part defines the algorithm showing the process through which feasible and compatible solutions of localization, distribution and typology of parking areas and spaces planning are developed.

The second part deals with the definition of additional criteria that are progressively implemented according to the urban context of reference. The third part deals with the identification of relationship parking areas in Naples as example of the developed algorithm and of the above-said criteria.

The leading idea of the whole work aims at discouraging the vehicles transit in the consolidated urban areas and, therefore, at avoiding the localization of parking lots downtown, considered as additional elements in attracting traffic flows.

A tool for compatible transformation areas

The location of single areas in wich realizing parking lots has been individuated, as shown in the following pages, also according to the analysis of parking areas, exchange, relationship and residence demand, and represents the base of the supporting tool for decision-making shown afterwards.

The target consists in conceiving a route though which, through all the probable transformations, it is possible to univocally individuate the achievable alternatives in accordance with the environmental, historical and geo-morphological compatibilities and on the basis of the expressed demand for parking.

All the construction process is addressed, since the beginning, to reach desired and chosen purposes with the awareness, confirmed by the previous analysis phase, that there are limits, bonds and conditions reducing the field of physical transformations planning, regarding in this case the realization of parking areas within well defined boundaries.

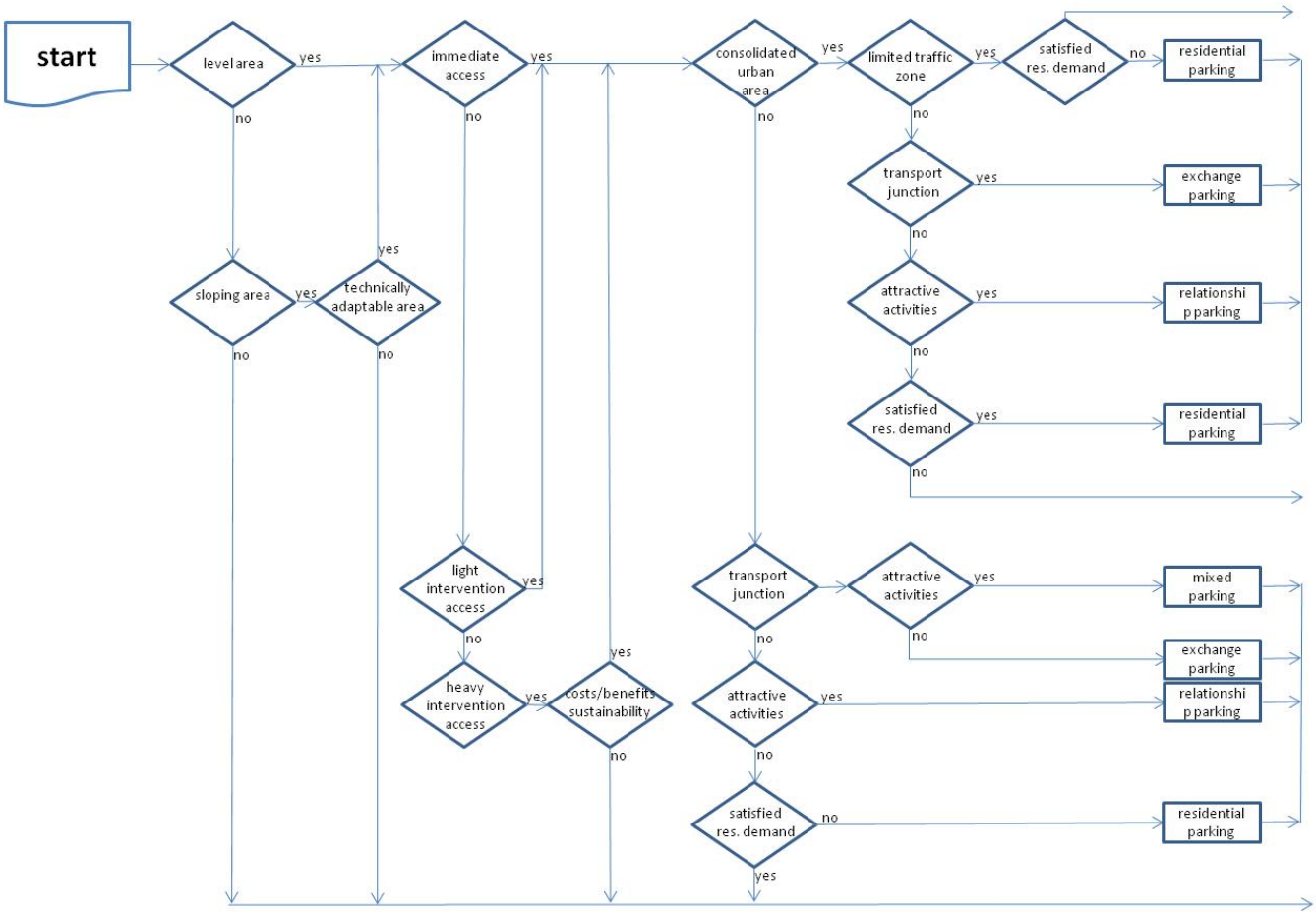
Each single query, included into the diagram or algorithm, has been individuated as crucial element for the final project choice. The diagram has been built comparing alternatives.

That comparison among choices has been made by using both quality judgments and criteria of quantity calculation.

The main object of comparison are the benefits arising from each action alternative.

The above-said comparisons are essentially useful for the following goals:

– individuating the choice allowing to reach the maximum benefit among all the achievable ones under the same conditions;
– assuring project interventions compatible, from the environmental, morphological, geological and perceptive point of view, with the urban tissue where it is placed the area chosen for parking;
– assuring project interventions appropriate to the parking demand expressed by the urban context of the area where the parking spot will be built.



In other words, a flux diagram has been worked out according to a regular sequence of queries, hierarchically and logically linked to each other, whose route leads to determine a rational and compatible project choice. Each query, representing a discriminating element in order to determine the project alternatives for parking, is built on a number of themes and problems referring to a single common matrix: for example, the query in a *limited traffic zone* "synthetically" includes some information about the historic value and the artistic-architectural-archaeological quality of the area.

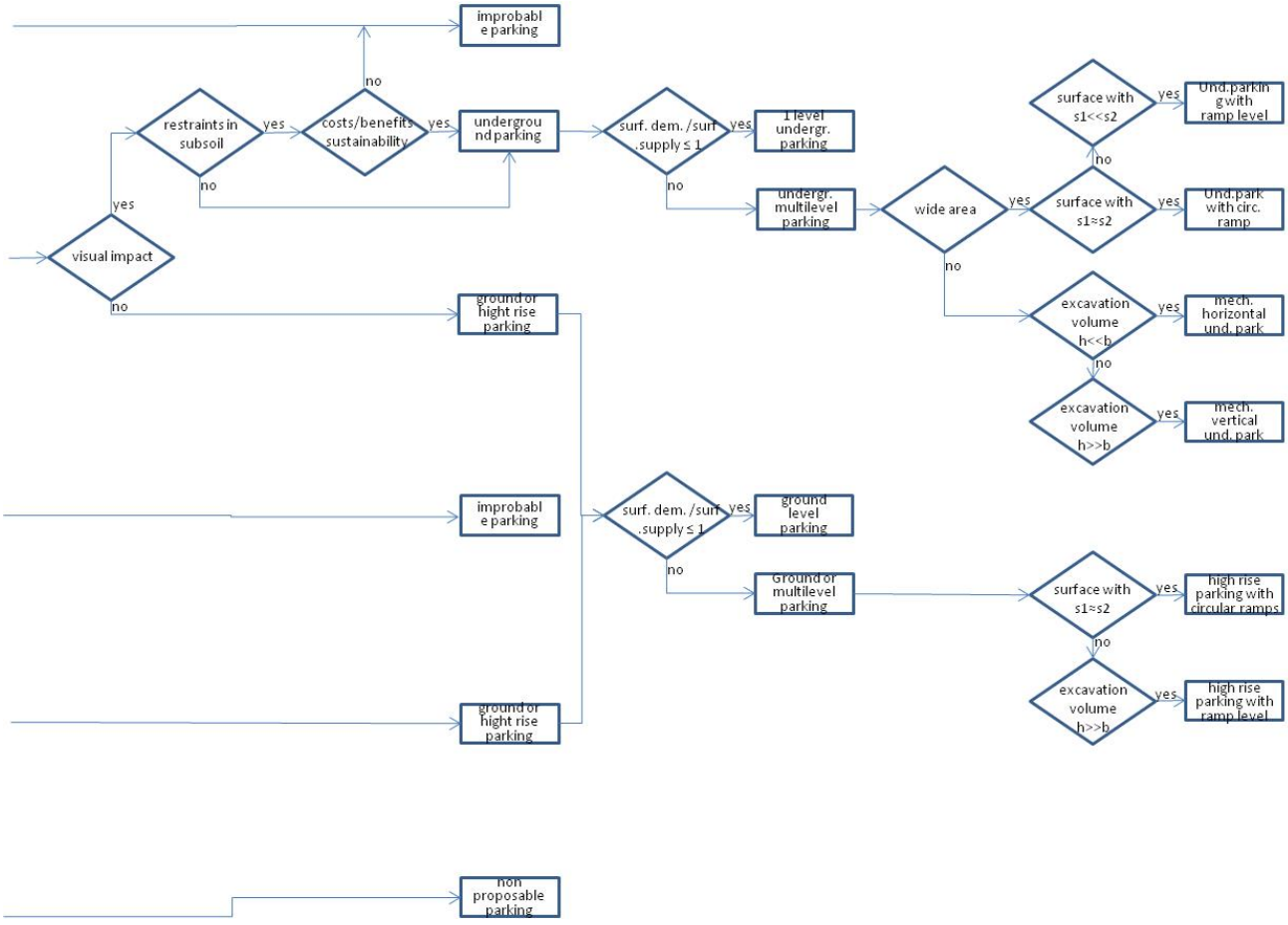
The query sequence, the whole course consists of, refers to three main phases for realizing the parking area: the project feasibility; the typology of the parking area to be realized; the projectual solution to adopt in order to build the parking area.

Consequently, the starting point is given by the information on the area morphology as first important discriminating element for the algorithm's objective.

In sequence, the second discriminator refers to the modality of access to the area on which the parking lot will be built.

The queries shaping this step are three: immediate access; access with interventions of modest entity; access with important works.

Each of them leads, through different routes, to the next discriminator query, *consolidated area*, which contains indications regarding: the centrality of the area in relation to urban context, to resident population density in the area; to the intensity of area use; to the compactness of the area. The following query, the previous ones lead to, is the "synthetic" question about *limited traffic zone* that, as said above, contains also information about: the historical value of the urban tissue where the area destined to parking is located; the architectural, urban planning, artistic and archaeological quality of the urban tissue where the area destined to parking is located. If the choosing alternative, as to the last two described enquiries, it's the negative one, the course leads to verify whether in the urban area, which has no characteristic of consolidated area nor of a limited traffic zone, there are, in alternation between them, exchange nodes, polarizing functions or if the demand for permanent parking is satisfied.



Through this last step, the course leads to individuating achievable typologies of parking. To obtain that, the progress arising from the passage to *consolidated urban area,* it develops considering the compatibility between *visual impact* and *restraints in subsoil*.

In particular, the query about *restraints in subsoil* refers to geological and archaeological restraints and/or restraints depending on the presence of infrastructural networks placed underground. Besides, the course individuates another choice, this time a financial one, regarding the *sustainability* of costs in comparison to *benefits* obtained by realizing the parking lot.

That last query is useful in understanding whether the construction of the parking lot, even when it is required by an "unsatisfied demand", can be proposed or not. If, after compatibility test on which the course is built, the realization of the parking lot can be proposed, the project possibilities of the structure destined to parking are three: underground lot, ground lot, high rise parking lot.

In order to better specify the project characteristics of the parking lot to build, the course leads to the query on the ratio between the area required to meet the demand for parking and the individuated area representing the usable supply.

When that ratio's result is equal to 1, the demand can be met by building one-level parking lot. In details, if the course issues from the possibility of realizing an underground parking, this one level parking lot should be realized under the ground floor otherwise it can be built on the same floor.

When the ratio between the area needed to meet the demand for parking and the individuated area is smaller than 1, it might be necessary to realize more levels of surface destined to parking.

In that case the course leads to identify two solutions: underground multi-level parking lot and ground multi-level parking lot.

The algorithm goes on, on the course deriving from the *underground multilevel parking lot,* with a demand about the size of the available area.

The projectual alternatives of that query are the following two: underground parking lot with ramps; mechanical underground parking lot.

The first type of parking lot can be realized in a big-sized area, while the second one on a small-sized area. A mechanical parking lot, in fact, allows to use almost all the surface for cars stall since a very small space is necessary for achieving the stall.

The last step of query refers to size parameters affecting the shape of the structure destined to parking. A first group deals with the size of the area and a second group deals with the volume of the excavation for the underground parking lots.

The first group of queries, in the case of underground multi-level parking lots with ramps and of ground multi-level parking lots leads to the following structures:

– underground parking lot with ramp level;
– underground parking lot with circular or rectilinear ramps
– ground parking lot with ramp level;
– ground parking lot with circular or rectilinear ramps
– depending on whether the sides of the surface are identical or one side is longer than the other one.

The second group, referring to the volume of the excavation, helps individuating two different possibilities of realization – mechanical underground parking lot with horizontal mechanism and mechanical underground parking lot with vertical mechanism – depending on whether the height of the excavation is smaller than the base of the excavation or greater than the base of the excavation.

Context Criteria to establish parking areas in Naples

Before tackling the detailed examination of the areas destined to parking within the municipal territory of Naples, it is necessary to define the specific criteria to adopt considering the particular urban situation. In other words, according to the particular characteristics of the settlement and geo-morphological structure and the urban policies adopted in the Neapolitan situation, it is necessary to specify the context criteria in order to individuate the parking areas (Papa and Gargiulo 1996).

Because of the particular density of the central areas of the Neapolitan context, aside the exchange, relationship and residence parking lots, it was necessary to define two additional typologies of parking areas: the mixed parking lots that are areas or volumes destined to both relationship and residence parking, and the integrated parking lots that are meant for structures in which part of the levels is destined to parking (of exchange, relationship or residence) and the rest is destined to public and/or public use facilities.

The aim moving the choice of the criteria for detecting the areas destined to –relationship, residence, mixed (relationship/residence) – parking, can be found in the intention of reducing the impact that building, but also the use, of parking lots will produce on the mobility system and, more in general, on the harmony of the whole urban system. In other words, inside each urban area (Area of Balance – AE), the inspiring criterion used in determining the single areas is the rule of the minimum impact on the following elements:

– the consolidated resources of the infrastructural-building stock, meant as all the capitalization stocked by man in the course of time (first of all the artistic, architectural, environmental ones, but also the infrastructural one);
– the transfer flows on the network of inter-district and district transfer;

– the vacant sites that can be better destined to other public and/or of public use facilities.

Starting from those "guiding targets", the criteria of the Neapolitan urban context, used in defining the parking areas, can be classified according to the minimum impact on the above said three elements. Consider that the areas meeting the majority of criteria have been chosen.

The following criteria have been chosen in regards to the" minimum impact on the consolidated resources":

– the safeguard of the areas with recognized environmental (artistic, architectural, historic and landscape) value;
– areas with public or private parks and gardens;
– areas destined to agricultural use.

According to the above-said criterion the areas inside the historic centre have been excluded, taking into account that a ground parking lot produces a strong environmental-landscape impact, and that building an underground parking lot, almost surely, compromises the archaeological resources characterizing the historic centre of Naples.

Referring to the" minimum impact on the relevant transfer flows", the following criteria for the parking-destined areas have been chosen:

1. The reduction of the "conflicts" with the ordinary traffic circulation.

For this purpose preferred areas are those for which the realization of the parking lot produces, both in the building and implementing phase, the minimum impact on the existing mobility.

2. The use of blind alleys and local roads, mainly for residents parking lots. This criterion has allowed to individuate many underground parking lots for residents mostly in those areas where the demand for parking is high and the areas available are scarce.
3. The satisfaction of the increasing demand for tourist parking. Those areas have been planned mostly around the borders of the consolidated urban tissue near the rail/road exchange nodes, in order to avoid the overlapping of tourist flows with ordinary mobility.

In regards to the "minimum impact on the availability of areas that can be destined to other public and/or of public use facilities", the following criterion for the parking-destined areas has been delineated:

4. The safeguard of the areas that, in regards to their distribution and position, can be better used for settling urban (standard) facilities.

Finally, in regards to the clearing of cars parked in plazas with historic-artistic-environmental value, in order to restore their social and community life, it has been planned, where possible, the construction of underground parking lots near the plazas invaded by parked cars, whose clearance allows the social and perceptive recovery in that particular urban environment.

The individuation of relationship parking areas

In accordance with the above-defined context criteria and on the basis of the algorithm supporting the localization consistent with the geo-morphological and settlement characteristics of the urban territory, in the last phase of the work, the areas destined to parking within Naples city boundaries have been defined, and they have been articulated according to the parking typology. Moreover, this articulation is based on the analysis of the demand and supply of parking zones carried out in the wider research work.

This report tackles only the individuation of parking zones for the relationship parking (as it is defined in the Law 122 of 1989) and the definition of the reasons affecting the choice of those zones, by synthetically referring to the guiding criteria, to the algorithm supporting the decision-makers and, of course, to the analysis outcome on the parking zones demand and supply.

The relationship parking lots involve both the interventions targeted to foster vehicle traffic fluency on the city main road system, and those interventions targeted to help use urban pedestrian areas or limited traffic zones by allowing private car parking only for limited periods of time (D.M. n°41 dated February 14th 1990).

One of the main goals of those interventions consists in removing vehicle parking along the city main traffic flow areas with particular attention to the central areas. Note that the central areas are characterized by a high compactness of urban tissue and, therefore, by a limited availability of vacant sites to be destined to parking, as well as a significant concentration of activities attracting a great deal of traffic flows.

In some cases, the demand is so high that makes it impossible to offer new elements capable of abating at least the highest "peaks". However, in the relationship parking too, the phenomenon of demand, and in particular its territorial distribution, should be reviewed and analysed together with several elements and variables.

The relationship parking shows aspects and peculiarities that are to be necessarily investigated with care, because it affects almost the whole system of mobility and establishes strong relations with the city functional system.

From that point of view it's necessary to define a system of relationship parking based on a network typology able to localize its nodes of supply within those territorial areas, and/or along those circuits, for which the demand values are higher.

That demand should be calculated, then, according to the surface data of the area it refers to.

This allows to uniform the demand values according to a territorial reference in a more useful and meaningful way for the intervention.

Focusing at detecting the relationship parking areas not clashing with the indications contained into the other two plans of urban mobility governance (PGTU and PCT), it should be mentioned that, in regards to parking lots typology, the PGTU excludes the possibility of localizing them within the central and more consolidated urban tissue, because it considers those parking lots as additional elements attracting mobility.

Therefore it suggests locations outside that ambit and strategically placed in a way that doesn't produce synergic effects of attraction.

In the PCT, as to central areas, it is suggested a special tariff policy to discourage long-lasting parking and to foster the fast turn-over of parking.

Consequently, it is expected the possibility of entailing relationship parking zones within the central areas too, which should be managed by a proper park-pricing as it has been already implemented by Naples Municipal Administration.

The expected network system entails also the integration among transfer modalities which could allow to move the supply nodes outside the boundaries of the city area with the highest functional density. All that should be supported by territorial references considering, in any case, the distribution of the demand. In details, this part of the study, aimed at localizing the areas for relationship parking, is divided into the following three steps: the study of the demand for relationship parking, the individuation of the demand distribution and, finally, the location choice.

Fig. 1 - Unsatisfied relationship parking demand compared to the territory (parking spot per ht) and the six "functional" arteries. Darker grey areas show higher unsatisfied relationship parking demand

From the first step, it is evident that the territorial distribution of the (mere) data concerning the unsatisfied demand for relationship parking does not give univocal indications, describing a spotty trend of values or a trend with little continuity.

By making a territorial reference of the data, computing the ratio between the demand for relationship parking and the size of each balance area, a more homogeneous and important territorial planning can be achieved. In particular, the urban territory can be arranged according to the three levels of demand.

A first level of high and/or very high demand, which defines a concentration characterizing mainly the central areas of the consolidated urban tissue; a second level of medium demand, which defines four agglomerations consisting of balance areas placed in a radial arrangement according to six arteries, with other two important concentrations represented by the BA of Mostra, Tecchio, Leopardi, Augusto, p.co S. Paolo and M.te S. Angelo and by B A of Policlinico; a third level of low or null demand is distributed on the remaining balance areas representing more than 60% of the total.

Therefore, considering the above-said values, it is possible to distinguish three different territorial areas where to articulate the network of relationship parking. A first area is represented by the territory with the highest density of urban activities that later will be called "functional city". So it is possible to distinguish a first circle, spiralled around the functional city, made up of BAs placed along the pointed out arteries.

In order to obtain indications useful in sizing new settings, it has been worked out an assessment of the supply deficit for the first two areas described. Since the deficit values are very high, it has been necessary calculating the area to find within each area, to at least meet the town planning standards provided for by the DM 1444/68 for the areas destined to parking.

Taking into account the objective impossibility to find areas capable to meet these needs, the demand could be reduced by entailing sites placed, as said before, according to a network capable of strongly reducing the access to central area. Inside the functional city it is difficult to foreshadow important interventions for several reasons resulting from restrictions systems such as:

- the proposals of town planning for the historical and central urban areas;
- the underground archaeological peculiarities;
- the proposals of the laws n. 1089 and n.1497;
- the proposals of the landscape plan;
- the proposals of the other tools governing the mobility system (PGTU, PCT);
- the policy of the Administration, widely shared, targeted to discourage the use of private car to reach central functional sites.

A.E.	Nome	Utenti attratti	Domanda di sosta	Auto uscenti dall'A.E.	Offerta esistente	Deficit offerta
59	Torretta	12.561	4.087	518	233	3.854
62	Villa comunale	6.614	2.152	419	188	1.964
63	Chiaia	5.936	1.931	473	86	1.845
66	Chiatamone	518	169	270	118	50
67	Monte di Dio	5.269	1.714	405	82	1.632
68	S. Lucia	12.855	4.182	370	226	3.956
69	Municipio	12.412	4.038	574	62	3.976
70	Matteotti	20.133	6.550	458	151	6.399
71	Piazza Borsa	17.872	5.814	437	235	5.579
72	Montesanto	6.856	2.230	222	77	2.153
74	Quartieri Spagnoli	4.969	1.617	522	172	1.444
75	Dante-Tarsia	8.299	2.700	509	145	2.555
76	Neapolis	15.029	4.889	404	118	4.771
86	Università	11.488	3.737	382	113	3.625
	TOTALE		**45.811**		**2.008**	**43.803**

Table 1 - Relationship parking offer and demand during critical hours

After what said above, then, it is possible to foreshadow, in different ambits, a differentiated articulation of the network consisting of a central grid, for the functional city, where there is a diffused relationship parking supply represented by the existing parking areas and by new car spaces (blue lines) provided for by the Administration.

In this area it is impossible to place important nodes of supply. The relationship parking network, crossing the borders of the functional city is settled near the six functional arteries identifying specific nodes of supply.

Then, in the second step it is achieved the radial distribution along the individuated six functional arteries, which shows that the functional sites have been placed along the preferential directions corresponding to the penetration axes into the functional city. Therefore, it is possible to identify, for each pointed out artery, a corresponding road axis representing the main corridor of access, for each of them it is identified a final point, which represents the contact and/or entrance site to the functional city. Along those channels, inside the first belt of the ring, the new sites of the relationship parking supply are to be planned.

Those parking lots, placed strictly near the functional city, help reduce the vehicles flows directed to the central area, offering a valid alternative to the choice of parking inside the area.

However, it is important to point out that a part of the relationship parking supply found in this belt is fulfilled by the exchange parking lots planned in the areas near the BAs and belonging to the first ring.

Finally, it is worth mentioning that, in regards to the areas included into the second ring, the calculation of the supply deficit does not show the need for intervention by widening the above-said network. In that ambit there are, anyway, some “nodes”, produced by few isolated functions, for which punctual solutions are to be expected.

From the above-shown analyses and charts, the third step aims to identify the areas destined to relationship parking. In regards to the central area, the suggested supply is represented, other than the regulated road parking (blue lines), by two new built parking lots. The first has a barycentral position within the area, since it is placed in Piazza Matteotti where the demand for relationship parking is particularly important because of the high concentration of public structures of urban and metropolitan governance and management.

The settlement characterized by buildings of the Thirties, represents the Neapolitan City. Besides, that parking lot has a strategic position because it is located into an area adjacent to Via Toledo (which the PGTU outlines as limited traffic zone) and Piazza S. Maria La Nova (pedestrian area) and it is in close proximity to the historic centre pedestrian areas. For this area it is suggested a three-level underground parking lot containing 350 cars for the exclusive use of the institutions located in the area.

The second parking lot of the central area has, on the contrary, a fringe position, since it is placed in via G. Bruno; also in this case the structure proposed is a two-level underground parking lot containing 250 cars.

Before the detailed description of the first ring areas destined to relationship parking, it is necessary to make some considerations.

First of all, areas have been considered that are closer to the points identified as terminals of the penetration axes.

A.E.	Nome	Utenti attratti	Domanda di sosta	Auto uscenti dall'A.E.	Offerta esistente	Deficit offerta
7	Carelli	2.680	872	204	38	834
14	Parco S. Paolo	3.159	1.028	382	239	788
15	Tecchio	4.173	1.358	393	266	1.091
16	Leopardi	8.065	2.624	1.039	433	2.190
18	Augusto	4.636	1.508	640	335	1.173
21	Mostra	9.399	3.058	299	216	2.842
29	Monte S. Angelo	5.195	1.690	246	91	1.599
34	Giustiniani	4.944	1.608	427	89	1.520
42	Policlinico	5.095	1.658	236	131	1.526
48	Medaglie d'oro	14.197	4.619	768	371	4.248
53	Vomero	5.756	1.873	396	144	1.729
54	S. Martino	4.969	1.617	519	225	1.392
55	Floridiana	5.839	1.900	420	66	1.833
56	Aniello Falcone	5.532	1.800	370	32	1.768
77	Castelcapuano	7.096	2.309	418	141	2.167
78	Sanità	8.297	2.699	542	164	2.535
80	Miracoli	8.191	2.665	516	203	2.462
81	Borgo S. Antonio	10.254	3.336	655	296	3.040
82	Ponte di Casanova	11.654	3.791	285	173	3.618
83	Vasto	4.136	1.346	325	139	1.207
85	Carlo III	7.856	2.556	356	124	2.432
87	Piazza Mercato	12.765	4.153	438	81	4.072
88	Borgo Loreto	7.538	2.452	416	132	2.321
115	Doganella	4.885	1.589	385	206	1.383
120	Centro Direzionale	9.627	3.132	469	198	2.934
123	Gianturco	9.091	2.958	499	369	2.589
	TOTALE		**60.196**		**4.902**	**55.294**

Table 2 - Relationship parking offer and demand in the first circle area during critical hours

This choice is related to the width of the central basin; in fact the chosen areas, indeed, can properly play their role of relationship parking only if they are placed in the closest proximity to the most important agglomeration of urban functions and near the most significant road axes.

Moreover, in the areas specific definition, the chosen areas have been the ones that, although showing the necessary centrality, would be placed either in a position which would not slow up the vehicle circulation, because of drivers looking for parking, or in such a way as to hit the target of centre decongestion, by transferring as much mobility demand created by urban functions to the public transport system – which should be improved and modernized. Then it becomes possible to describe the single interventions proposed for each penetration axis.

In regards to the first of them, related to the east area and placed on the arteries of via A. Vespucci – via A. Volta – via Reggia di Portici – via Ponte dei Granili – via Ponte dei Francesi – Corso S. Giovanni a Teduccio, it has been suggested to devote part of the existing parking lot on via Brin to the relationship parking.

That choice originates also from the morphology and settlement characteristics of this axis terminal part: the area of Piazza Mercato, characterized by high population density, by the presence of several commercial activities, by a rich and dense tissue of architectural and historical buildings. For the above-said reasons important transformations inside this tissue have been avoided and, given the lack of vacant sites, an existing structure, has been destined to this typology of parking. This structure, indeed, with its 1,340 car spaces and an area of 31,850 sq.m., can satisfy, apart from the exchange parking, also the relationship parking because of its proximity to piazza Mercato and of its present underutilization as well.

Similar considerations have been made on the second penetration axis identified in the segment via Casanova – via Nuova Poggioreale – via Stadera for which the located terminal point is piazza S. Francesco and piazza E. De Nicola.

In this case too, existing parking areas can be used and in particular the two structures under construction placed on the pointed out artery: the parking area in piazza S. Francesco and the adjacent piazza Nazionale. In both cases the dealt-with structures are multi-storey three-level underground ones with 415 and 1.155 available car spaces respectively.

A third defined penetration axis is the one placed in via Foria and the terminal point of piazza Cavour. In this case too there was no possibility of finding parking areas in the closest proximity to the terminal point, which represents a crucial point in the historic centre for many reasons, such as the confluence of via Foria into via Pessina and via S. Teresa degli Scalzi, Museo Nazionale, Galleria Principe di Napoli. Here the selected area, although being far from the terminal point, is easily reachable from piazza Carlo III, another traffic crucial node of the east central area. The pertinent area is placed in via Cavallotti, where it would be possible to build a two-storey multi-level underground parking lot for 180 car spaces in total.

The fourth penetration axis converges with corso A. Di Savoia and via Miano, whose terminal point is represented by the hemicycle of Capodimonte. In this case there was no possibility of finding either a vacant site or an existing structure close to the terminal point concerning the densely populated areas of S. Teresa, Stella and Materdei.

The fifth axis starts in correspondence of the ring road junction of Vomero and winds down via Cilea as far as the crossroad with via L. Giordano. In this area it has been suggested to build a multi-storey three-level ground level parking lot containing 400 car spaces to be realized near the ring road junction and so 700m far from the terminal point.

Finally, in regards to the sixth penetration axis, coinciding with the artery viale Kennedy – viale Giulio Cesare, the terminal point suggested is the entrance of the Posillipo tunnel.

The area destined to parking has been identified near the metropolitan station of piazza Leopardi, along via Giulio Cesare, where it would be possible to build a ground level five-storey structure for 880 car spaces in total. Together with the individuation of relationship parking areas placed near the above-said penetration axes it is possible to define, in proximity to some functional poles, areas capable of meeting, at least partially, the demand for relationship parking.

In particular, in regards to Furorigrotta functional pole, it is considered that the demand for relationship parking can be met by the existing road regulated parking spaces (blue lines) and by an existing parking lot placed in via Terracina.

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Mobility and Safety

a Challenge to Win for All

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ABSTRACT

The article describes the situation of urban mobility in Europe in the last 15 years. In consideration of the increasing transport's flow from 20th Century until today, traffic and transport obtain a high level of congestion that is not more possible to effort. This congestion first of all concerns the so called "tyre mobility", generating two negative effects: car accidents are in continuous growth, with high costs in terms of human-lives and permanent damages; our streets became in the last 15 years very dangerous. To reach one point from another in a town is not only dangerous, but also takes an increasing amount of time. People called "weak customers" (children, old people, pregnant women with babies, temporarily disabled persons) are the principal victims of this situation. In this article we will also explain the newest data about transport accidents and mortality in the last ten years. This researches show how mortality rate in the last ten year is constantly decreasing, while in the last 50 years, from 1950 to 2000, it has always grown. And this is a positive item that lead us to place the bases for the future. In this direction goes the so called "White Paper" submitted by the UE on 12 September 2001: "European transport policy for 2010: time to decide". The Commission has proposed 60 or so measures to develop a transport system capable of shifting the balance between modes of transport, revitalizing the railways, promoting transport by sea and inland waterway and controlling the growth in air transport. In this way, the White Paper fits in with the sustainable development strategy adopted by the European Council in Gothenburg on June 2001, introducing the concept of the trans-European network (TEN). Concerning this situation, we also highlight that FIABA has been founded in order to pull down the cultural and physical barriers created by isolation, marginalization, and social unfairness. Let's think about the birth of a human being: mothers and their children are part of the environment and it should be able to hold them. An environment that is suitable to growing up children is respectful of people's elementar needs. We have to cultivate our sensitivity in order to prevent the appearing of new barriers, being it architectural features or not. This argument is strictly connected with the reorganization of our urban spaces trough the so called PUT (Urban Traffic Plans) and the National Plan. We also never forget that a convenient, universal-accessible environment help us increasing the value of our time and our lives. If we can have back the value of our environment we can increase the inner value of ourselves. In conclusion, architectural features that are commonly found in apartment blocks and cemeteries make clear that the planning wasn't for everyone. FIABA deeply wants to develop a different awareness of mobility problems, in the hope it can trigger off a new way of planning. We want, in the next future, that every building and every road will be thought without architectural features, in order to simplify everyday life and to assure us and our relatives the accesses.

Development without control

The whooping expansion has affected our towns on horseback in the last two centuries has brought great and positive innovations in daily living and mobility, along with consequences not always reason or vector of a decisive improvement.

A so strong expanding of technology, and of the size of many cities which have turned into sprawling industrial metropolis, and in their local administrations, could only lead to many changes that will certainly have positive effects on paper, but have also complained, in many cases, a lack of planning and long-term vision of the possible consequences. Where once the mobility of the city was a matter of secondary interest, nowadays, it has become a matter of prime importance, even for the implications that fall at different levels on each class citizen, on every inhabitant of urban space.

Traffic is now reached a level often unsustainable with the proliferation of means of travel, improved quality of life and the increase of population and size of city, not only for those who use public transport road, and they are the majority, but also for those who use the public transport service, or simply move in cycling and walking. According to FIABA, the last two examples are fully included in the general category of "vulnerable road users" to which we address our activities, not only in the sense of disability "all-comprehensive", but also for those who have some difficulties in

the daily movements as women pregnant or with babies, the elderly, and people injured.Breaking down cultural and architectural barriers, thus improving mobility in towns is therefore a primary objective that must be upheld primarily by government and municipalities, and that FIABA has been promoting and carrying from long time.

On closer inspection the problem goes even further, and it affects the safety of the same people: the chaotic growth of mobility in towns and villages has been brought to a level of accident hardly acceptable. Cultural plan is to change is the misconception that the incidents are natural consequences of the freedom of mobility.

Instead, we must consider the human being as fallible by nature, and therefore we need to have all the technical and cultural for minimize a situation that has become 40 times more dangerous than any other work, and that helps to lower the life average person about a year. It seems clear, therefore, that the poor and violent city planning has search resulted in the first instance to a number of problems encountered in heavy traffic, poor service mobility in public and then in the difficult crossing of living spaces and citizens, a situation that makes a result our roads less safe and more prone to accidents.

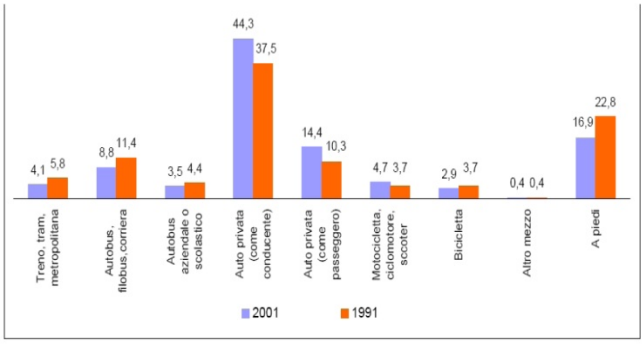
ISTAT data on mobility and accidents

Take for example the latest data on mobility and on accidents at our disposal to give a true picture as possible of mobility today and the pitfalls inherent in the model of contemporary traffic. We speak in both cases of research carried out by the National Institute of Statistics, in 2001 and in 2007, which helps us to quantify and understand the developments that led to goals by the White Paper of 13 September 2001: reduce mortality by 50 % by 2010 and make the European traffic flowing and intermodal (i.e. a system in which the various means of transport are interchangeable).

We are referring to the following researches:

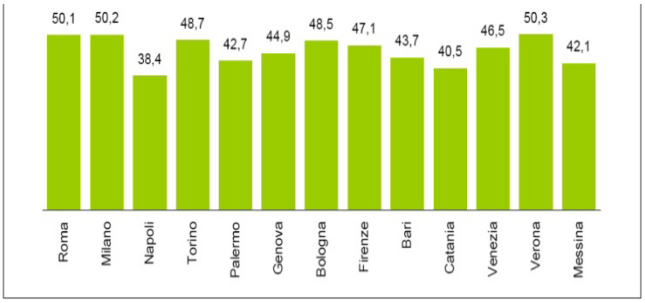
– 14th General Census of Population and Housing "(2001)
– Report ACI - Istat Road Accident "(2007)

What we see from the figures released by ISTAT on the movements of newspapers and magazines of the Italian population data for 2001 released and made final in 2005, the majority of residents (83.1%) reach the place of study or work using public transport and the remaining 16.9% on foot. Drivers are 58.7%, while people that use public means as train, tram, subway, and bus are 12.9%. Motorcycles, mopeds and scooters are used by 4.7% of the people, while only 2.9% of them use bicycles. What we believe to be worrying are the changed since 1991 to nowadays: the increase of people using car (from 47.8% to 58.7%) the decrease of those who use public transports (from 17, 2% to 12.9%) and the percentage of those who choose to travel by foot (from 22.8% to 16.9%). Worrying factors are the increasing use of the car (compared to 1991, from 47.8% to 58.7%), the decreasing use of public means (from 17.2% to 12, 9%,) and the percentage of those who choose to move on foot (from 22.8% to 16.9%). It is clear from these data that the car is the most used mean in all Italian regions. The highest percentage of those who use train, tram or subway is logged in the north-west, with regional peaks in Lombardy (7.6%), Lazio (7.4%), and Liguria (6.6%). The record for the use of the motorcycle, moped and the scooter is for the Liguria (13.8%), followed by Tuscany (9.1%).



Population resident who moves by vehicle: Percent and Census 1991 and 2001

The bicycle, finally, is the means chosen especially by those living in the Northeast, especially from residents in Emilia-Romagna (7.9%) and Trentino-Alto Adige (7.4%), where structures are sufficiently developed and there is a favorable geographical morphology. Southern residents reach study or work places on foot, especially those that live in Puglia (28.7%) and in Campania (27.7%). The municipal data that we have available show us that in the 13 towns of larger size (over 250 thousand residents) 46.7% (4,252,009 units) of the resident population makes daily trips to their place of study and of work (47.0%, is national value).



Residents moving day to municipalities most populated. Percentage of total resident population. Census 2001.

The percentage of the population resident who moves to reach the workplace (30.0%) was more than that of who moves to reach the study place (16.7%) in the municipalities with larger population size. Of course, even in this case the different age and the different work situations have their influence.

As for travel times, the data we see 41.6% of large municipalities of commuters reach their place of study or of work within a quarter of an hour (58.7% is national value), 34, 2% employ between 16 and 30 minutes (24.8% is national value) and requires from 31 to 60 minutes for 20.7% of commuters (13.0%, is national value).

A factor shows a certain difficulty in moving of the urban population, even if, usually, travel times to arrive to workplaces are longer than those to the study places.

A fact very comforting is that residents reach their place of study and of work, using mainly the means of transport (80.1%), the remaining 19.9% on foot, even if we don't forget to consider the size of settlements, the diffusion of public transportation, and the hard conditions of traffic in these municipalities.

In large towns, public transport (train, tram, underground, and bus) are therefore used more (22.0% of cases) than the national value (12.9%), as well as motorcycles, mopeds or scooters (9.9% of cases in large municipalities, while 4.7%, is national value).

The car, however, is the preferred means of transport; its value has lesser importance than the national value (33.8% versus 44.3% of National). What we gather from these figures is that the Italian mobility is almost totally concentrated on the road transport because the Italians, perforce or for pleasure, prefer the car, and this fact is incontrovertible.

The elements comforting about large town that we have examined previously, are viewed through the lens of the great centers of population which obviously have a network of public transport more capillary that in small towns, inducing more people to use them. But this still is not enough, the traffic in the biggest cities is constantly congested, as it is shown by the long travel times (ISTAT data) and by the largest use of the means on two wheels as the motorcycle, mopeds and scooters.

The solutions have been proposed by the White Paper seem therefore necessary to make future mobility more fluid, thus constituting a first step towards the improvement of life in our towns.

Another important factor, of which we have data sufficiently recent, is the high number of road accidents, and then the resulting problem for all persons traveling by any means and on foot.

As mentioned in the introductory phase, the issue of road safety has become central, especially for the impact involving all levels of mobility.

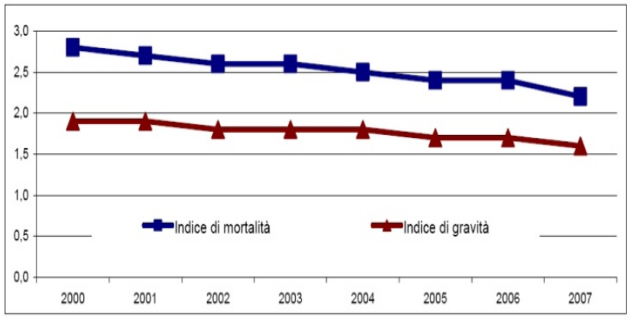
ANNI	Incidenti	Morti	Feriti	Indice di mortalità (b)	Indice di gravità (c)
2000	256.546	7.061	360.013	2,8	1,9
2001	263.100	7.096	373.286	2,7	1,9
2002	265.402	6.980	378.492	2,6	1,8
2003	252.271	6.563	356.475	2,6	1,8
2004	243.490	6.122	343.179	2,5	1,8
2005	240.011	5.818	334.858	2,4	1,7
2006	238.124	5.669	332.955	2,4	1,7
2007	230.871	5.131	325.850	2,2	1,6

(b) L'indice di mortalità si calcola come rapporto tra il numero dei morti ed il numero degli incidenti, moltiplicato 100.
(c) L'indice di gravità si calcola come rapporto tra il numero dei morti ed il numero totale dei morti e dei feriti, moltiplicato 100.

Road accidents, deaths and injuries - Years from 2000 to 2007 (absolute values).

The data we are referring to (published in 2008) are ISTAT data and they cover the whole year 2007. Every day there are in Italy 633 road accidents, which killed 14 people and injuring 893 ones. Overall, in 2007 there were 230,871 road accidents which have caused the death of 5131 people, while 325,850 others have had injuries of different seriousness. Compared to 2006, there is a decrease in the number of accidents (-3.0%) and injuries (-2.1%) and a larger decrease in the number of deaths (-9.5%). Overall, however, if we see the evolution of such incidents since 2000 we welcome the trend of this figure, enjoying a marked decline in the last 8 years, from the index of mortality (number of deaths per 100 accidents), which was 2.2% in 2007 against 2.8% in 2000.

Now we take this data and we can observe that there was an 10% decrease in the number of accidents, 9.5% for the wounded and 27.3% on the number of fatalities in accidents. These data are very important, especially given that, in the same period, the total fleet is grown of 15.7%.



Index of mortality and severity - Years from 2000 to 2007.

In 2007 a similar situation happened also in Europe where there was an estimated of 42,450 deaths in road accidents, 1, 2% less than last year. These data are encouraging when they are compared to the aims of the above-mentioned White Paper, which foresees for 2010 a decrease of 50% in the mortality. Italy has reached 27.3%, an excellent result, although not the full, on average with the rest of the European Union, bearing in mind that it

is the first time that it results in a reduction of such robust in terms of Mortality (-9.5%).
The countries in this matter are showing the best performance are the Czech Republic, France, Luxembourg and Portugal, while among the worst are the Eastern European countries. Another interesting fact regards where incidents happen.

TIPO DI STRADA	Incidenti	Morti	Indice di mortalità (a)
Una carreggiata a senso unico	2.507	59	2,4
Una carreggiata a doppio senso	33.803	2.118	6,3
Doppia carreggiata, più di due carreggiate	4.029	159	3,9
Totale	40.339	2.336	5,8

(a) Rapporto tra il numero dei morti ed il numero degli incidenti, moltiplicato 100

Accident on the extra urban network, excluding highways, in the several kind of road - Year 2007.

In 2007 occurred on urban roads 176,897 accidents (76.6% of total) that caused 238,712 injuries (accounting for 73.3% of total) and 2269 deaths (44.2%), while on motorways 13,635 accidents occurred (equivalent to 5.9% of total) with 23,135 injured (7.1%) and 526 deaths (10.3%). While the city has decreased the number of accidents and the mortality rate, even in motorway journeys despite an increase of accidents, the result is worst in rural roads (not highways), with mortality rate of 5.8 deaths every 100 accidents.That table is very important because it shows clearly how the construction and the type of roads influence the danger of route and mobility; it proves that buildings designed on the basis of safety criteria can decrease the mortality rate significantly in the streets. Very interesting for our analysis, are the data on who is actually involved in accidents, that is to say a road user.

UTENTI DELLA STRADA	Morti		Feriti		Indice di gravità (a)
	Numero	Percentuale	Numero	Percentuale	
Conducenti	3.645	71,0	227.326	69,8	1,6
Trasportati	859	16,7	77.999	23,9	1,1
Pedoni	627	12,2	20.525	6,3	3,0
Totale	**5.131**	**100,0**	**325.850**	**100,0**	**1,6**

(a) L'indice di gravità si calcola come rapporto tra il numero dei morti ed il numero totale dei morti e dei feriti, moltiplicato 100.

Deaths and injuries by type of road user - Year 2007.

We found the higher percentage in the drivers involved in car accident: 71.0% of deaths and 69.8% of injuries. The passengers are 16.7% of deaths and 23.9%. As for walkers, who are a few on the road and for this reason they are even more interesting for us, we note that they are 6.3% of injuries and 12.2% of deaths!
The data is certainly startling, as denoting a significant weakness of this class, relegated to a dangerous urban mobility that does not protect them and leads them to have a very high mortality. The differences between the levels of risk for different categories of users are clear from the relationship between the number of killed and wounded. In 2007, the average severity index that is equal to 1.6, is reduced to 1.1 for transported and to 1.6 for drivers, but increases to 3 for pedestrians. The pedestrian is therefore true that, as mentioned, the weakest among the people involved. The risk of injury caused by road investments is particularly high for the elderly population. The age group between 80 and 84 years shows the maximum value in absolute terms as regards the number of deaths (93) and those aged between 75 and 79 years old for the injured (1,573). Children from 10 to 13 years old who were victims of car accident were 730, but the risk is greater for boys aged 14-15 years old: they were 542 in 2007. One final element deducted from the data in our possession and that we want to bring to attention of everybody is the high cost, in addition to those quantified in terms of lives, that such a high number of accidents and such a mortality rate may be falling directly on government European Union: the date given on the economic impact from traffic accidents in 2007 amounted to 30.386 billion Euros, which represents about 2% of GDP that year.In this percentage are included several items that make up the massive annual government spending to tackle the problem of accidents: loss of productive capacity of the workforce, high level of medical costs, damage to property and infrastructure
In this figure included several items that make up the massive annual government spending to tackle the problem of accidents: loss of productive capacity of the workforce, high level of medical costs, damage to property and infrastructure.
From this analysis it is so obvious how and why European Commission has formulated the White Paper, that is to say to respond to an urgent need not only economic, but also and especially in terms of human lives.

White Paper

This urgency is thus confirmed in Italy and in Europe, too. The White Paper, sponsored by the European Commission, aims some important objectives by 2010.
The first White Paper on the development of common transport policy, published in 1992, had already put the accent on the transport market.
To this day, road traffic has become a reality, air traffic has the highest level of security in the world and the mobility of people has increased from 17 km per day in 1970 to 35 km in 1998.
In this context, research programs have developed modern techniques to achieve the challenges especially important if we consider the problems of which we spoke earlier clearly specified by the European Commission:

– Unequal growth of the different methods of transport: road is 44% of freight transport compared to 8% for rail and 4% for inland waterways. Road transport accounts for 79% of passengers, air for 5% and rail for 6%;
– Congestion of major roads and railways, especially in cities;
– Environmental and health issues of citizens and danger on the roads.

In reference to these issues, the White Paper proposes several courses of action depending on different areas of mobility identified in seven key points:

1. road transport;
2. rail transport;
3. air transport;
4. maritime and river transport;
5. intermodality - use of multiple modes of transport;
6. bottlenecks and trans-European net;
7. users.

MEASURES PROPOSED FOR ROAD TRANSPORT

- **Fix the maximum driving hours to 48 a week on average, except for freelancers;**
- **Bring together and harmonize international standards through legislation, relating to sanctions and freedom of movement on weekends;**
- **Harmonize taxes and trade relations for minimizing distortions and liberalize the transport;**
- **Develop the vocational training of drivers, including introduction of a certificate that verifies and regulates the employment situation.**

As for the road freight and passenger traffic, which accounts for 44% of freight and 79% of the transport of passengers and which has seen - between 1970 and 2000 - triple its fleet Communitarian (from 62.5 million nearly 175 million), one must consider that the forecasts indicate growth of 50% over the next 5 years, and that this accounts for 84% of CO2 emissions. As seen from it, there is a dual problem about congestion and mobility in the environment. Because of this the objective by the recent White Paper is definitely improving the quality of road transportation going to intervene even on national laws on sanctions and the inspections.

Leaving aside the plans covering rail, naval and air mobility, which are not directly related to our focus, we go to another fundamental concept focused on the White Paper: intermodality which involves using more transport resources. The main objective in this sphere is to balance modalities of transport through a policy that encourages intermodality and promotes rail, sea and river transports (to reduce road transport), and speaking of mobility in cities, to make possible more flowing traffic and fewer accidents, the choice of means of travel other than the car in order to decongest traffic itself. This plan is undertaken with the launch of the Community support Marco Polo, in place of the old PACT (Pilot Actions for Combined Transport), a new model that captures essentially the legacy of the former, trying to have more funds and to implement measures still more concrete European experience through improved networking.

But the point on which we focus in the European Commission's analysis is that on road users. They are in this sense the focal point for improvement of transport policy, because they are purchasers and recipients (and sometimes victims) of European transit flows. The first aims to be achieved are therefore reducing the number of incidents, harmonizing sanctions and helping the development of safer and less polluting technologies.

Whereas in Europe in 2000, road accidents killed over 40,000 people and that one in three people will be injured in the course of his life in a car accident (with an annual cost in terms of GNP by 2%), we understand well the reason that the main concern is that of increasing road safety. We also remember the impact that this has on mobility city: the traffic of our towns, chaotic and dangerous, inhibits the aforementioned use of intermodal transportation, forcing everyone to prefer private cars to other means of movement (public means and bicycles.).

For road users, therefore, the White Paper separates areas of intervention as follows:

Road safety:

– Implementing a new program with fixed term (2002 - 2010) aimed at halving the number of road fatalities;
– balancing sanctions, better road signs, and driving restrictions for alcohol abuse;
– setting up an e-Europe, that is to say, a rational and pointed use of new technologies (electronic driving licenses, speed limiters for cars, intelligent transport systems) that aim to an appropriate road safety improvement to protect pedestrians, cyclists, and occupants of vehicles while improving speed and flow of transport and mobility.

Pricing infrastructure. Providing a framework directive to regulate the use of infrastructure according to European standards:

– on the road, we evaluate the function of the environmental performance of vehicles (emissions of gases and noise), the type of infrastructure (highways, roads and urban roads), distance traveled, weight and level of congestion (road transport);
– in the railway sector, the burden is modulated depending on the capacity and influence of the service and environmental impact;
– in the maritime sector, particular attention to safety.

Taxation of fuels:

– varying the fuel taxation between private and professional use;
– balancing a European-wide tax on fuel for professional use.

In essence, the framework that attempts to delineate the White Paper says: a rationalization and channeling of transport in Europe because of the new principles of security (for users and workers), flowing in moving, and environmental sustainability. Such Operations can be realized, as written above, only with a work concerted interstate network that involves the whole of Europe in large-scale action.

Mobility for all: aims and solutions

If we talk about mobility, reduction of accidents and of urban and suburban trips, we cannot consider people with reduced mobility, that it to say how many people for permanent or temporary reasons, are unable to move freely both in public spaces and private ones. The mission of FIABA concerns to them it wish to solve all those problems that affect those who must cross the city, moving from one place to another or simply get on the sidewalk, cross the street or enter our building. FIABA promotes the concept of universal accessibility, to ensure that if nothing else, the new solutions in architecture or mobility are now built without barriers. But it's interesting how our messages are part of the abovementioned vulnerable road categories as pedestrians and cyclists, not just on people with reduced mobility, which of them are around 80 million in Europe, according to data of a few years ago. The problem is thus overcome the many architectural barriers scattered throughout the city, which consequently make them inhospitable for all, and not easily accessible for many, not just disabled. The desired end point is to high usability: designing territories and urban areas taking account of differences and peculiarities of all, so that movements can be intermodal and satisfactory performance. And therefore not only to overcome the barriers, but also eliminate the sources of danger, discomfort and fatigue. Reducing the space to walk, for example through the establishment of a network structured and timely public transportation, it may be a way to improve the ability to move for all, reducing both accidents and dangers of urban spaces. A network, as was said, inter-modal means of displacement, it is therefore necessary perspective in which there is no single means of efficient transport for all and for all needs. We all should imagine a "mobility system" that allows passing without too much effort from one medium to another, making it easier and fast as possible hubs. Since this integrated network of services and urban spaces, capable of making every place and every type of move faster and more accessible, we can finally think of a city free from all constraints, which not only fail to solve the traffic problem and atavistic of road deaths but that, at last we add, we can overcome those limitations inherent in the heavy architectural barriers scattered in every corner of our streets. A dream, perhaps, or just a project. Project and as such it needs a quote and reasoned contribution by all, without exclusion for any professional bodies and ranks of politics.

In general, we suggest some key points to keep in mind when discussing these topics:

– *The Right to mobility*: the possibility for everyone to move as needed at any time regardless of the needs and individual needs. In this category, of course, include all human beings, especially vulnerable road groups such as the young, the elderly, people with reduced mobility both permanent and temporary, hearing and visually impaired.
– *The Right to health*: the high accident obviously going to fall on the general concept of right to health of persons provided by our constitution. In this large container fall also aspects that are directly related to traffic but do not cover accidents such as the rate of high stress which we are daily subjected to the high level of pollution mainly due to road transport.
– *Sustainability of systems*: the concept of sustainability, introduced in the environment, can be easily extended to all categories of human action. At this point all the actions are connected today's man, which should be aimed at the continuation of the species and more particularly to guarantee to future generations a healthy world equal if not better than we received.

To promote these principles, because the goals of mobility for all and to reduce accidents, but you must equip themselves with practical tools and detailed planning and to help in overcoming such situations, transforming the city into a model similar to that hitherto described.

We recognize these instruments such as in the Urban Traffic Plan (PUT), or management programs of assistance in the city, in whose preparation are required all municipalities with populations over 30,000 inhabitants.

The PUT is typically an instrument of short-term, divided into a General Plan (PGTU) and in two successive levels of implementation.

A first level of PUT generally has a maturity of two years, according to which the administration should have acquired the know-how necessary to proceed with a subsequent, more detailed and possibly more effective Traffic Plan.

The main objectives of this Plan is thinning traffic, improving safety, reducing noise and air pollution and saving of energy and respect for environmental values. Some useful tricks to achieve these goals we can find them in the classification of the main road, to identify environmental and pedestrian islands in the reorganization of the staging systems and measures for the protection of public transport.

Unfortunately, we have noted that identification of these plans is often not provided of a bicycle paths planning, that is inexcusable and certainly we believe to be inserted.

The National Plan for road safety, established by Law 144/1999, is a result of European Commission No 131, 1997: "Promoving road safety in the European Union: Plan for 1997-2001".

It is another tool for improving mobility and reducing accidents.

In 2007 This plan saw the introduction of its third edition, for which the Finance Act 2008 provides for the appropriation of 200 million Euros up to 2013 (the funds subsequently resized).

Unfortunately we have to say that today this plan has not enough support from central government: a few funds and lack of organization so that it is neither incisive nor efficient.

Finally, there are a number of technical solutions propose from technology and from engineering and architectural awareness achieved.

A series of technological tools such as cameras, and above all the average speed detection system (Tutor), seem to be perfect for their intended use (we have seen the reduction in highway accident that occurred two years now).

Not only that, the introduction of roundabouts instead of traffic lights for example, helps the flow of traffic and avoid the dangerous red/green; the construction of wider sidewalks that can accommodate pedestrians and the disabled would help the livability of many of our roads.

Last but not least, we remember a rational design of spaces dedicated to parking, so it does not impede the normal traffic and that there are enough for the present demand.

At the same time the amount of cars should ultimately declined drastically as a result of a design fair and networked means shift public, able to reach all areas in the city guaranteeing a certain minimum quality performance.

Fiaba Safe Road

Because of these considerations, we would like to briefly reiterate the importance and the support that FIABA gives to projects and initiatives aimed at road safety, the removal of architectural barriers, and accessible mobility for all. For example, the campaign "We all are pedestrians" sets last spring, aimed at improving the safety of vulnerable road users, that here we are indicating as pedestrians, cyclists, children, elderly, disabled and mums and dads with strollers. We believe that even crossing the street in this urban chaos today is a danger. The Antarctic Research Center, sponsor of the project, has noted how the deaths on our roads are rarely due to chance, and focusing particularly in the areas the school has tried to spread civic culture according to which, indeed, we all are pedestrians, all with same right to mobility.

The White Paper of Parma on "accessibility and urban mobility" is another interesting attempt to realize a rational traffic and urban mobility planning. It has been announced recently by Minister Maurizio Sacconi, who is Minister of Labor, Health and Social Policy. One way to encourage and to sensitize all ranks of civil society for a consultation of mobility in towns including decisions made by all, designed around a table and finally concrete.

Another interesting experiment, promoted directly FIABA, is "FIABA Tourism for All", namely the establishment of a specific area of our association aimed exclusively at promoting tourism finally available to all vulnerable groups, to enable everyone to enjoy the pleasures of travel, culture and history without giving up their right to mobility and personal safety.

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Estimating External Costs of Transportation in Regional Areas

Using Available Statistical Data the Case of the Region of Campania

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ABSTRACT

In this paper simplified methods for estimating the external costs due to transportation in regional areas are proposed. The methods are based on data available by national and regional statistical sources and do not need specific surveys; they allow obtaining approximate estimates useful for a preliminary evaluation of transportation plans, policies and projects. In more detail, a negative externality is defined as a cost that is produced by subject A and is borne by subject B; moreover, subject A does not consider the effects of his/her behaviour on subject B and does not compensate subject B for the costs that this last one is forced to bear. In this paper after a literature review on methodologies proposed for estimating external costs, in national and international ambits, the main external costs produced by transportation systems in the Region of Campania are estimated. The main external costs considered are: greenhouse gas emissions, air pollution, noise, accidents and congestion. In the paper the secondary external costs are neglected; the main ones are: water and soil pollution; landscape and nature damages; upstream and downstream effects; visual intrusion; separation effects; soil occupancy. In this paper the external costs estimated are the ones produced not only by road traffic, that anyway is the main "culprit", but also by rail and air transportation systems. The evaluation of external costs has required the collection of several data on the regional mobility and the estimation of veh-kms per year produced in Campania by cars and freight vehicles. The estimation of veh-kms per year is based on circulating vehicles, subdivided by the COPERT classification, and on average yearly distances covered by each vehicle class. Other regional statistical data are collected about regional rail transport and air services at the main airports of the region. Moreover, since the evaluation of some external costs is based on damages on human health, it required to give a value to human life and to health damages. The results show as the largest costs are due to air pollution (38.0 %) and accidents (28.2 %); noise amounts to 18.4 %, while less importance is assumed by congestion (10.6 %) and greenhouse gas emissions (4.8 %). Moreover, the results show also as the amount of external costs overcomes 4 € billions per year and is equal about to 4.7 % of regional GDP; in particular, it is highlighted as the environmental costs (greenhouse gas emissions, air pollution and noise) overcome 60 % of total costs. The obtained results have shown as the external costs are significant respect to other costs of transportation systems and as they should be always evaluated when public funds are invested for improving transportation systems.

Introduction

Transportation system costs are generally classified in three main groups: the service production costs, the user costs and the external costs. The service production costs are borne by public bodies, (state-owned or private) enterprises or local authorities as regards the maintenance and construction of infrastructures (roads, highways, railways, stations, airports, etc.), and by (state-owned or private) transit companies as regards the purchase and maintenance of transit vehicles (buses, trains, airplanes, etc.) and as regards the management of transit systems (employees, fuel, overheads, taxes, insurance costs, other running costs, etc.). The costs borne by users of transit systems are mainly private car purchasing, maintenance costs, fuel, highway fares, transit fares, parking fares, etc. The external costs, instead, even if are produced by running and use of transportation systems, are borne by the whole community; indeed, also who does not use the transportation system bears these costs.

It is important to note that also a (great) part of the service production costs (e.g. infrastructure maintenance and construction costs of public roads and public subsidies to transit systems) are borne by the whole community; these costs are already (totally or in part) internalised in the transportation system since it can be assumed that they are covered by the taxes on fuel (excises) and on vehicles (road taxes) that are paid by the users.

If these taxes cover more than the amount of these costs, the difference can be seen as a partial internalisation of external costs; vice versa, if these taxes cover less than the amount of these costs the difference should be summed to external costs.

The external costs usually considered are sometime called social costs, since they impact on the society and represent the externalities of the transportation system.

The externality concept assumes an important role inside the classic microeconomic theory and it has been widely discussed in the literature since 1920 (Marshall, 1920; Pigou, 1920; Scitovsky, 1954;

Coase, 1960; Buchanan and Stubblebine, 1962; Meade, 1973; Varian, 1978; Baumol and Oates, 1988). Some specific studies about transportation externalities are the ones by Rothengatter (1994), Verhoef (1996) and Green et al. (1997).

The externalities produced by transportation systems can be negative (e.g. air and noise pollution) or positive (e.g. a new metro line that improves the value of buildings in its influence areas); in the following the paper will focus on the main negative externalities of transportation systems.

Examining the different definitions, it can be summarised that a negative externality is a cost that is produced by subject A and is borne by subject B; moreover, subject A does not consider the effects of his/her behaviour on subject B and does not compensate subject B for the costs that this last one is forced to bear.

In the field of transportation systems, in general, subject A represents the users and subject B represents the whole collectivity.

Beginning from '90 the interest for the external cost evaluation produced by transportation systems is really increased, mainly for the numerous studies on the effects produced by greenhouse gas emissions on climate changes. The importance of evaluation of external costs has been highlighted in several documents of international and communitarian policy (European Commission, 1995, 2001; United Nations, 2005). In particular, the European Union has promoted and financed several research projects in this field (CORINAIR, 1988; EXTERNE, 2005; COPERT, 2005; UNITE, 2005). The Kyoto Protocol, to which the European Community countries agreed, indicates the greenhouse gases reduction objectives; in this context, transportation systems are one of economic sectors with the higher impact on emissions.

Therefore, estimating external costs assumes an important role inside the evaluation of transportation projects, plans and policies. The aim of this paper is to propose some simplified procedures for estimating the main transportation external costs in regional areas, using available national and/or regional statistical data, without the need of specific surveys, and the results of other specific studies on external costs developed in Italy and in Europe.

The proposed procedures are applied to the region of Campania (Italy), but they can be applied without difficulties to other regions in Italy and, if the data are available, also to regions of other European Countries. Since the proposed procedures are based on some simplifying assumptions, that are not removable without specific (expensive) surveys, the obtained results should be seen as an approximate estimation of external costs useful in preliminary studies.

This paper will focus only on the methods for estimating the main external costs without examining how part of them are eventually already internalised (if there is a positive difference between taxes paid by users and service production costs); this problem will be object of further researches.

Definitions and literature review

The external costs produced by transportation systems can be classified in two groups: main costs and secondary costs. The main costs are the ones that are quantitatively prominent and that have been studied in the literature more or less widely. The secondary ones are the costs that produce less important and/or not easily quantifiable effects; in general, they have not been studied systematically.

The main external costs are due to:

- *greenhouse gas emissions*; the greenhouse gases (CO2, CH4, H2O, N2O, O3, etc.) are naturally present in the atmosphere and, therefore, are not assumed as pollutants from a technical point of view. The high concentration of these gases (mainly the CO2) increases the greenhouse effect, producing an increase in the average temperature of the planet, with serious climatic consequences.
- *air pollution*; transportation engines emit in the atmosphere some pollutants (SO2, NOx, PM10, CO, etc.). An high concentration of these gases cause damages to human health, buildings and cultivations.
- *noise*; transportation systems are noise sources. Besides disturbance, the noise produces health damages to residents in the more exposed zones.
- *accidents*; transportation accidents, mainly caused by road systems, are an important social problem. The costs produced by accidents are almost totally assumed as external, because the users do not perceive the accident risk and because the accident costs fall prevalently on collectivity (e.g. pain and suffering imposed to others).
- *congestion*; the increment of transportation costs due to congestion is not captured by the price system so the congestion costs are assumed as external, even if they are borne by users; they can be estimated by quantifying the users' lost time.

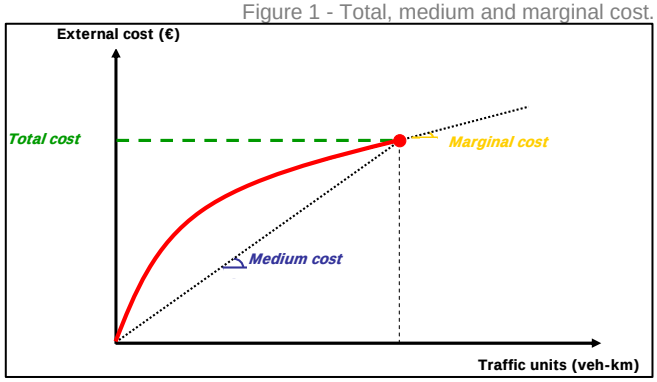
The secondary external costs are numerous; the most important are: water and soil pollution; landscape and nature damages; upstream and downstream effects; visual intrusion; separation effects; soil occupancy. In this paper only the main external costs will be examined.

Depending on the aim of the study, the externalities can be calculated as total, medium or marginal costs.

The total cost is the total amount of externalities produced by the transportation system, the medium cost represents the external cost

per traffic unit (veh-km, pass-km, t-km) and the marginal cost is the external cost due to a unitary increment of traffic unit in the system; the second one is the ratio between total cost and total traffic units, while the third one is the derivative of total cost function with respect to traffic unit. Figure 1 depicts the differences among the three kinds of cost. This paper will focus on the calculation of total costs.

Figure 1 - Total, medium and marginal cost.



In the literature several studies deal with the estimation of external costs. The Green Paper of European Commission (1995) reports in the Annex 2 a brief exam of approaches that has been proposed for valuating the external costs in monetary terms.

Some studies do not propose analytical methods but only some suggestions for estimate the external costs (EMT, 1998; Nash, 1999). Other studies refer to national (Samson et al., 1998; Proost and Van Dender, 1999) or European corridor (Nash, 2000; QUITS, 2005) case studies.

Marginal cost estimation is studied in the European research projects RECORDIT (2005), as regards the freight transportation, and UNITE (2005) in more general terms; the marginal external costs in urban areas are studied in the paper by Mayeres et al. (1996). Estimation of external medium costs is studied by Dings (1991), for the air transport, and by Maibach and Schneider (2002) for the main transport modes.

A recent study (INFRAS/IWW, 2004), that updates previous reports (INFRAS/IWW, 1995, 2000), estimates the total external costs of transportation systems in 17 European countries (15 European Union countries plus Norway and Switzerland).

This study considers, besides the main 5 costs before mentioned, also the nature and landscape costs, the upstream and downstream costs and the urban effects due to the barrier effect for pedestrians and cyclists.

The estimated total amount of these costs overcomes 650 billion € per year, equal to the 7.3 % of European GDP. The road system is the main guilty (83.7 %), followed by air system (14.0 %), rail system (1.9 %) and maritime system (0.4 %). This study gives also some results about medium and marginal costs.

Quinet (2004) compared different studies proposed in the literature, using the meta-analysis, and highlighted the wide dispersion of results, due to specific differences among the different contexts (economics, social, etc.), to the different kinds of costs considered, to the different assumptions introduced in the estimation mathematical models and to the unitary values given to some important parameters (value of life, value of time, etc.).

External cost estimation

In this section the main total external costs due to transportation systems are estimated for the region of Campania, using simplified methods based on available statistical data and on the results of national and European studies; all costs are estimated at year 2003. The proposed methods can be easily used for estimating the external costs also for other Italian regions and, if all data are available, for regions of other European countries.

In general, the external costs produced by road, rail and air transportation are estimated. For accidents and congestion only the external costs due to road transportation are examined; indeed, this mode causes the greater part of these costs. In the estimation of air pollution costs only the effects on human health are considered, neglecting the effects on buildings and cultivations.

The region of Campania

The region of Campania is sited in the south of Italy and is the second Italian region (after Lombardia) as regards the population (5,701,931 inhabitants); it is the Italian region with the high population density (419 inhabitants/km2) since it has a surface of 13,595 km2. The chief town is Naples that has 1,004,500 inhabitants (the third in Italy as regards the population after Rome and Milan) with a very high population density equal to 8,566 inhabitants/km2.

The road network of the Campania region (Ministero delle Infrastrutture e dei Trasporti, 2005) is constituted by 445 km of motorways, 2,660 km of national roads, 6,927 km of provincial roads and 41,739 km of municipal roads (of whom 19,119 km are extra-urban). The regional rail network is constituted by 1,210 km of railway lines (of whom 528 km of double tracks); other 153 km of railway lines are under construction. The railway extra-urban services are about 18 million train-km per year; the MetroCampania project will provide at 2010 an increment of services until 31 million train-km per year (Regione Campania, 2002). The public bus services produce 343 million bus-km per year. Napoli Capodichino

international airport manages about 2.3 million passengers per year (ENAC, 2005). The GDP (Gross Domestic Product) of Campania region is 87,817.1 millions € at year 2003.

Value of Life, Value of Time and road veh-km estimation

The methods for estimating the external costs require, among other things, the following important input data: the Value of Life, the Value of Time and road veh-km/year (total road traffic).

The entity of the Value of Life (VOL) influences highly the external cost estimates due to air pollution, noise and accidents. In the literature several authors studied the problem of estimating the VOL; a recent literature review (de Blaeij et al., 2003) shows as the values adopted in different studies are very disperse: from 113,000 € to 24,000,000 €.

In this paper, it is adopted as reference value the one proposed by two recent studies developed in Europe (INFRAS/IWW, 2004; UNITE, 2005); they proposed to adopt, for the year 2000, the value of 1,500,000 €, to adapt to the specific socio-economic condition using the pro-capita GDP.

The value adopted in this paper, therefore, it is calculated taking account that the average pro-capita GDP in Campania is the 71.9 % of the average one in Europe and that it has been incremented between 2000 and 2003 (at current prices) by 15.2 % (ISTAT, 2005c). So, the adopted VOL is 1,242,545 €. The formula used for estimating the regional VOL is the following:

$$VOL_R = 1{,}500{,}000€ \times (GDPPC_R^{2000}/GDPPC_E^{2000}) \times (GDPPC_R^{2003}/GDPPC_R^{2000})$$

where

VOL_R is the regional Value of Life (€);

$GDPPC_R^{2000}$ is the regional Gross Domestic Product Pro Capita (€/inhabitant) at year 2000;

$GDPPC_E^{2000}$ is the european Gross Domestic Product Pro Capita (€/inhabitant) at year 2000;

$GDPPC_R^{2003}$ is the regional Gross Domestic Product Pro Capita (€/inhabitant) at year 2003.

The VOL can be seen as a shade-variable that represents policy choices; so, in the evaluation of transportation plans or policies can be chosen higher (or lower) values in function of the importance that policy makers would give to transportation safety and environment.

The Value of Time (VOT) generally it is assumed different for each trip reason; in this paper we adopt the values proposed in a research developed in Italy (ENEA, 2003) that fixes 7.74 €/h for job/study trips and 1.93 €/h for other trips. Obviously, for each country or region it should be adopted the value that represents in the best way the specific socio-economic conditions.

The estimation of external costs due to greenhouse gas emissions, air pollution and congestion requires the road veh-kms/year as input data; the veh-kms/year have to be subdivided for different vehicle category and for different kinds of roads.

These data are not directly available from national statistical sources at regional level for Italy, except for (urban and extra-urban) buses, which data are available by contracts between public transit firms and local authorities.

Therefore, it is necessary to provide a method for estimating these values, using other available statistical data.

For estimating the veh-kms/year in Campania, the ACI (2005a) database was used; this database reports for each Italian region the circulating vehicles subdivided by the COPERT (2005) classification. Therefore, it is possible to know the number of vehicles by kind of vehicle (motorcycles, cars, trucks, etc.), by kind of fuel (petrol, diesel, gas, etc.), by kind of piston displacement (under 1.4 litres, between 1.4 and 2.0 litres, over 2.0 litres) and by kind of European antipollution regulations (ECE, EURO I, EURO II, etc.).

This database does not contain data on scooters and motor bicycles (under 0.05 litres), since they are not registered in Italy; the number of these vehicles is estimated using the data estimated by ACI and ISTAT (2004) for Italy: 5,076,413 motor bicycles at year 2003. Assuming that the percentage of motor bicycles in Campania in comparison with the total in Italy is equal to the corresponding percentage of motorcycles (obtaining by ACI data), it is possible to estimate 453,739 motor bicycles.

Table 1 summarises data on circulating vehicles aggregated by kind of vehicle and kind of fuel. The buses are not considered since their veh-kms are deducible by contracts between transit firms and local administrations.

A research developed by APAT (2005a) reports an estimation of average yearly distances covered in Italy by each kind of vehicle and the percentage of these distances on urban roads, extra-urban roads and motorways; these has been estimated for being used inside the COPERT model.

Since the yearly distances covered are average values for Italy, in order to improve the estimation's precision, they have been corrected taking in account the yearly average fuel (petrol, diesel and gas) consumption per vehicle in Italy and the same value in Campania (data available by ACI, 2005b). This correction leads to reduce the average distances covered by petrol vehicles of 20 % and by diesel vehicles of 22 %, and to increase them of 22 % for gas vehicles.

Vehicle	Number
Petrol cars	2,312,050
Diesel cars	740,670
Gas cars	165,865
Not identified cars	428
Total	*3,219,013*
Petrol light trucks (under 3.5 t)	25,111
Diesel light trucks (under 3.5 t)	171,149
Petrol heavy trucks (over 3.5 t)	1,142
Diesel heavy trucks (over 3.5 t)	89,664
Not identified trucks	19,624
Total	*306,690*
Motorcycles	391,130
Motor bicycles *(estimation)*	453,739
Total	*844,869*

Circulating vehicles in Campania (elaboration of data by ACI, 2005a)

Therefore, the formula adopted for estimating veh-kms/year in a region is the following:

$$VKM^R_j = VEH^R_j \times ADC^{IT}_j \times ACON^R_j / ACON^{IT}_j$$

where

VKM^R_j indicates the estimated veh-kms/year in the region for the kind of vehicle j;

VEH^R_j indicates the number of circulating vehicles of kind j in the region;

ADC^{IT}_j is the average yearly distances covered by vehicles of kind j in Italy;

$ACON^R_j$ is the average yearly fuel consumption per vehicle of kind j in the region;

$ACON^{IT}_j$ is the average yearly fuel consumption per vehicle of kind j in Italy.

It is necessary to specify that the veh-kms so estimated are the ones produced by Campania vehicles even if a part of them is performed outside the region; moreover, some veh-kms on the Campania's roads are generated by outside vehicles. These errors can be considered acceptable because in part they compensate each other and in part because the external costs regard the whole society (also the inhabitants of other regions). Table 2 summarises the results of the veh-kms estimation.

Vehicle	Veh-km/year (Urban)	Veh-km/year (Extra-Urb.)	Veh-km/year (Motorways)	Veh-km/year (Total)
Petrol cars	7,047,620,872	8,382,280,084	951,420,454	16,381,321,410
Diesel cars	1,552,923,762	5,956,232,646	3,499,115,802	11,008,272,210
Gas cars	1,153,698,649	1,538,264,865	1,153,698,649	3,845,662,162
Not identified cars	970,243	1,325,535	619,399	2,915,177
Total	*9,755,213,526*	*15,878,103,129*	*5,604,854,304*	*31,238,170,959*
Petrol light trucks (under 3.5 t)	59,646,100	131,221,420	47,716,880	238,584,400
Diesel light trucks (under 3.5 t)	597,820,698	1,315,205,535	478,256,558	2,391,282,790
Petrol heavy trucks (over 3.5 t)	1,117,120	3,351,360	1,089,192	5,557,672
Diesel heavy trucks (over 3.5 t)	361,953,813	1,172,682,537	1,441,247,730	2,975,884,080
Not identified trucks	66,055,509	184,646,489	140,368,892	391,070,890
Total	*1,086,593,239*	*2,807,107,341*	*2,108,679,252*	*6,002,379,832*
Motorcycles	1,421,626,530	829,282,143	118,468,878	2,369,377,550
Motor bicycles	1,429,277,563	612,547,527	0	2,041,825,090
Total	*3,463,451,620*	*1,441,829,669*	*118,468,878*	*4,411,202,640*
Buses *(contracts 2003)*	107,168,422	236,272,317	0	343,440,740
Total	*107,168,422*	*236,272,317*	*0*	*343,440,740*

Table 2 – Estimation of veh-km/year in Campania.

Greenhouse gas emissions

Earth's atmosphere is composed of several gases; the more important are oxygen (O), carbon dioxide (CO_2) and water steam (H_2O). Other gases present in the atmosphere are methane (CH_4), nitrogen protoxide (N_2O) and ozone (O_3) that are produced by natural sources, and other artificial compounds. The carbon dioxide and the water steam are the gases that produce the greenhouse effect, that makes it possible that the sun energy, which arrives on the Earth, is not entirely dispersed towards the space, allowing that the average temperature of the planet is about 34° C.

Without the greenhouse effect the life should not be possible on the Earth.

In last decades, the excessive production of carbon dioxide by industries, combustion engine vehicles, thermoelectric power stations and houses (heating) have been increased the CO_2 concentration in the atmosphere, causing the well-known global warming (increase of the average temperature of the planet). This temperature increase can produce catastrophic climate changes.

In order to tackle this situation, the Kyoto Protocol commits the industrialised countries to reduce the yearly CO_2 emissions before the 2010 respect to the emissions at year 1990.

The estimation of external costs due to greenhouse gases generally is obtained (INFRAS/IWW, 2004; UNITE, 2005) estimating the total emissions of equivalent CO_2 and multiplying these quantities by a unitary cost; this last one represents a shadow value of a CO_2 ton that, in most cases, is assumed as the average cost that the country should bear for reducing the emissions, in order to respect the Kyoto Protocol. The definition of the shadow value is not univocal and not simple to fix; the values proposed in the literature vary from 20 €/t to 135 €/t (INFRAS/IWW, 2004).

In particular, the minimum value (20 €/t), that it is adopted in this paper for estimating the external costs for the region of Campania, represents the lowest limit for the costs that are necessary for complying with the Kyoto Protocol (Capros and Mantzos, 2000) and it is the value assumed in the Italian case study by the european project UNITE (2005).

The greenhouse gases considered in the estimates are carbon dioxide (CO_2), methane (CH_4) and nitrogen protoxide (N_2O); the emissions of the last two ones are converted in CO_2 equivalent ton by the following conversion rates: 1 t CH4 = 21 t CO_2 eq.; 1 t N_2O = 310 t CO_2 eq.

The estimation of the greenhouse gas emissions due to road transportation is obtained by the specific emissions per veh-km, deducible by the APAT (2005a) inventory (see table 3), and by veh-km/year in Campania (see table 2).

The results are summarised in table 4.

Vehicle	Urban roads [g/veh-km]			Extra-urban roads [g/veh-km]			Motorways [g/veh-km]		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Petrol cars	279.435	0.278	0.030	141.703	0.032	0.012	175.674	0.019	0.027
Diesel cars	262.170	0.009	0.027	150.297	0.005	0.027	188.823	0.013	0.027
Gas cars	230.325	0.109	0.015	134.863	0.033	0.015	173.037	0.023	0.015
Not identified cars	270.878	0.215	0.028	144.264	0.022	0.018	183.341	0.016	0.025
Petrol light trucks (under 3.5 t)	470.821	0.291	0.024	201.115	0.034	0.010	200.860	0.020	0.017
Diesel light trucks (under 3.5 t)	355.668	0.010	0.017	197.794	0.005	0.017	262.248	0.005	0.017
Petrol heavy trucks (over 3.5 t)	699.645	0.140	0.006	466.430	0.110	0.006	513.073	0.070	0.006
Diesel heavy trucks (over 3.5 t)	975.521	0.126	0.030	604.087	0.051	0.030	689.209	0.053	0.030
Not identified trucks	582.618	0.068	0.022	379.985	0.027	0.022	573.530	0.041	0.027
Buses	975.521	0.126	0.030	604.087	0.051	0.030	-	-	-
Motor bicycles	99.388	0.203	0.001	99.388	0.203	0.001	-	-	-
Motorcycles	92.537	0.200	0.002	84.202	0.200	0.002	111.576	0.200	0.002

Table 3 – Specific road traffic greenhouse gas emissions (source: APAT, 2005a).

For rail transportation the total emissions due to electric traction have been estimated multiplying the kWhs consumed by rail public transportation firms in Campania (data given by the firms) by the estimated CO_2 eq. specific emission, equal to 489 g/kWh; this value (ENEA, 2003) was estimated on the basis of data provided by the national energy operator (GRTN), by ENEL (Italian electricity distributor) and by other public electric energy producers. Table 5 shows the results for the rail system.

For the air transportation, only the emissions produced in the phases of landing and taking-off (LTO-cycles) have been considered; more precisely, only the flights of the Napoli Capodichino airport have been referred to, differentiated in national and international flights.

The air traffic data are obtained from ENAC (2005) for the year 2003. The specific emissions are obtained by APAT (2005a) inventory and are summarised in table 6.

Greenhouse gas	Urban roads [t/year]	Extra-urban roads [t/year]	Motorways [t/year]	Total [t/year]
CO_2	3,653,690	3,630,739	2,250,210	9,534,639
CH_4	2,761	727	199	3,687
N_2O	302	357	194	853
CO_2 equiv.	*3,805,313*	*3,756,645*	*2,314,420*	*9,876,378*

Table 4 – Estimation of total CO2 eq. road traffic emission in Campania.

Transit firm	kWh/year	Specific CO_2 eq. [g/kWh]	Yearly emission [t/year]
A.N.M.	5,500,000		2,690
Circumvesuviana	33,195,000		16,232
MetroCampaniaN.E.	2,800,000		1,369
Metronapoli	30,000,000	489	14,670
SEPSA	12,240,000		5,985
Total	*83,735,000*		*40,946*

Table 5 – Estimation of total CO2 eq. rail emission in Campania.

Flight	Greenhouse gas [g/LTO] CO_2	CH_4	N_2O
National	2,147.21	169.99	100.00
International	2,804.07	355.39	300.00

Table 6 – Specific greenhouse gas emissions from air traffic (source: APAT, 2005a).

Table 7 reports the estimation of total greenhouse gas emissions due to air traffic of Napoli Capodichino airport; the LTO cycles are the half of the movements reported on the stats: indeed, the movements are the sum of landing and take-off operations.

	National flights	International flights	Total
LTO/year	19,101	9,340	*28,441*
CO_2 [t/year]	41	26	67
CH_4 [t/year]	3	3	7
N_2O [t/year]	2	3	5
CO_2 equiv. [t/year]	*701*	*965*	*1,666*

Table 7 – Estimation of total CO2 eq. air traffic emission in Campania.

Table 8 summarises the estimated external costs due to greenhouse gas emissions in Campania, that amount almost to 200 million euros per year and are nearly totally due to road transportation.

Mode	Yearly emission [t CO_2 eq /year]	Specific external cost [€/t CO_2 eq.]	Total external cost [€/year]
Road	9,876,378		197,527,560
Rail	40,946		818,920
Air	1,666	20	33,317
Totale	*9,918,990*		*198,379,797*

Table 8 – Estimation of greenhouse gas external costs in Campania.

Air pollution

The air pollution is one of the main reasons of quality of life reduction in the great cities; it damages people's health, cultivations and buildings.

Accurate descriptions of pollutants, of their damages and of the influence of transportation on total pollution can be found in the wide literature (see for instance Bickel and Friedrich, 2001).

An estimation of air pollution external costs produced in Italy by road transportation is reported in Danielis and Chiabai (1998).

In this paper the estimation of air pollution external costs produced by transportation systems in Campania is obtained in function of the total emissions of the main pollutants: sulphur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM10), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOC).

The specific emissions, as well as for greenhouse gases, are deduced by the APAT (2005a) inventory, for the different vehicle categories (see table 9).

Total emissions are obtained by multiplying the veh-km/year of each kind of vehicle (see table 2) by the corresponding specific emission, in the different contexts (Urban, Extraurban, Motorway). Table 10 summarises the obtained results. Similar results can be obtained by using the COPERT (2005) software to the region of Campania; indeed, the APAT inventory data are based on the COPERT model.

Total emissions of rail transportation have been estimated in function of kWhs consumed every year from the rail firms in Campania (see table 5) and of the unitary pollution emissions per kWh (see table 11); these last ones are deduced by the study by ENEA (2003). In table 11 are summarised also the total emission in Campania due to rail transportation.

Similarly to the procedure adopted for greenhouse gas emissions, air pollution emissions due to air transportation are estimated in function of LTO cycles of Capodichino airport (ENAC, 2005) and of the specific emissions (APAT, 2005a) reported in table 12. Table 13 summarises the results for air transportation.

	SO_x	NO_x	PM10	CO	NMVOC
			Urban roads		
Petrol cars	0.011	1.063	0.034	24.458	3.733
Diesel cars	0.047	0.949	0.275	1.089	0.267
Gas cars	0.000	1.343	0.045	8.935	1.697
Not identified cars	0.015	1.078	0.074	18.902	2.940
Petrol light trucks	0.019	1.792	0.047	48.740	6.276
Diesel light trucks	0.064	2.399	0.366	1.383	0.274
Petrol heavy trucks	0.028	4.353	0.488	66.313	6.567
Diesel heavy trucks	0.176	12.027	0.890	3.891	2.119
Not identified trucks	0.101	5.780	0.533	5.111	1.286
Buses	0.176	12.027	0.890	3.891	2.119
Motor bicycles	0.004	0.029	0.127	13.296	8.102
Motorcycles	0.004	0.122	0.042	19.996	2.255
			Extra-urban roads		
Petrol cars	0.006	0.837	0.025	3.548	0.534
Diesel cars	0.027	0.554	0.120	0.368	0.092
Gas cars	0.000	1.877	0.038	1.659	0.497
Not identified cars	0.013	0.832	0.062	2.172	0.365
Petrol light trucks	0.008	1.995	0.047	4.557	0.621
Diesel light trucks	0.036	0.918	0.217	0.677	0.099
Petrol heavy trucks	0.019	7.255	0.488	52.103	5.159
Diesel heavy trucks	0.109	6.308	0.502	1.941	0.970
Not identified trucks	0.067	3.390	0.336	1.502	0.521
Buses	0.109	6.308	0.502	1.941	0.970
Motor bicycles	0.004	0.029	0.127	13.296	8.102
Motorcycles	0.003	0.240	0.042	19.642	0.885
			Motorways		
Petrol cars	0.007	1.162	0.023	3.988	0.448
Diesel cars	0.034	0.829	0.169	0.331	0.032
Gas cars	0.000	2.237	0.035	14.819	0.318
Not identified cars	0.022	1.175	0.117	3.934	0.162
Petrol light trucks	0.008	2.340	0.047	8.983	0.662
Diesel light trucks	0.047	1.199	0.264	0.885	0.094
Petrol heavy trucks	0.021	7.255	0.488	42.103	3.283
Diesel heavy trucks	0.124	6.772	0.464	1.650	0.776
Not identified trucks	0.102	5.311	0.405	1.664	0.609
Buses	-	-	-	-	-
Motor bicycles	-	-	-	-	-
Motorcycles	0.005	0.383	0.042	29.614	1.928

Table 9 – Specific road traffic pollutant emissions in g/veh-km (source: APAT, 2005a).

	SO_x	NO_x	PM10	CO	NMVOC
Urban roads	291	18,300	1,635	237,790	45,094
Extra-urban r.	430	24,428	2,158	63,596	13,178
Motorways	342	17,832	1,513	29,069	2,418
Total	*1,063*	*60,560*	*5,306*	*330,455*	*60,690*

Table 10 – Estimation of total pollutant emissions due to road traffic in Campania (t/year).

Pollutant	Unitary emission [g/kWh]	Total emissions [t/year]
SO_2	2.0020	167.64
NO_x	0.7136	59.75
PM10	0.0793	6.64
CO	0.0679	5.69
NMVOC	0.0136	1.14

Table 11 – Unitary (source: ENEA, 2003) and total (in Campania) emissions due to rail transportation.

Pollutant	Unitary emission (national flights) [kg/LTO]	Unitary emission (international flights) [kg/LTO]
SO_2	0.674	0.879
NO_x	8.252	10.854
PM10	0.384	0.462
CO	7.331	11.637
NMVOC	1.601	3.347

Table 12 – Specific air transportation pollutant emissions (source: APAT, 2005a).

Pollutant	National flight emissions [t/year]	International flight emissions [t/year]	Total emissions [t/year]
SO_2	12.87	8.21	21.08
NO_x	157.62	101.38	259.00
PM10	7.33	4.32	11.65
CO	140.03	108.69	248.72
NMVOC	30.58	31.26	61.84

Table 13 – Estimation of total emissions due to air transportation in Campania.

The estimation of external costs due to air pollution can be obtained multiplying total emissions by a unitary damage cost (€/t), different for every pollutant and for urban and extra-urban areas.

As unitary damage costs can be adopted the ones proposed in the study developed by ENEA (2003); these values have been estimated on the basis of results of the European project EXTERNE (2005), on the exposed population and on the effects on the health due to pollutants.

The unitary damage costs reported in the ENEA study are estimated assuming a Value of Life (VOL) equal to 3,700,558 €. For adopting these estimates in this paper making comparable the results of air pollution with the other external costs that are based on VOL value (noise and accidents), it has been necessary to reduce the unitary damage costs in function of the value previously estimated (1,242,545 €).

The monetary unitary damage costs so obtained are reported in table 14.

For calculating the total external costs the following hypotheses are assumed:

– the emissions due to road transportation on extra-urban roads and on motorways are produced in extra-urban ambit, the other ones in urban ambit;
– the emissions due to rail transportation are produced in extra-urban ambit (since the thermoelectric power stations are generally sited outside urban areas);
– the emissions due to air transportation are produced in urban ambit, since the Capodichino airport is located inside Naples urban area.

The estimated results are summarised in table 15; they overcome 1.5 billion € per year.

Pollutant	Urban ambit [€/t]	Extra-urban ambit [€/t]
SO_2	14,818.22	3,899.06
NO_x	5,063.52	3,538.31
PM10	748,695.19	4,619.47
CO	9.42	1.09
NMVOC	1,260.81	376.32

Table 14 – Unitary damage costs due to pollutant emissions (elaboration on ENEA, 2003, data).

	SO_2	NO_x	PM10	CO	NMVOC
Emissions			*Urban ambit*		
Road transportation (t/year)	291	18,301	1,635	237,790	45,094
Air transportation (t/year)	21	259	12	249	62
Total (t/year)	*312*	*18,560*	*1,646*	*238,039*	*45,156*
Costs					
Unitary cost (€/t)	14,818.22	5,063.52	748,695.19	9.42	1,260.81
Total (€/year)	*4,618,537*	*93,976,805*	*1,232,679,439*	*2,241,643*	*56,933,357*
Emissions			*Extra-urban ambit*		
Road transportation (t/year)	773	42,260	3,671	92,665	15,595
Rail transportation (t/year)	168	60	7	6	1
Total (t/year)	*940*	*42,320*	*3,678*	*92,670*	*15,597*
Costs					
Unitary cost (€/t)	3,899.06	3,538,31	4,619.47	1.09	376.32
Total (€/year)	*3,666,533*	*149,739,936*	*16,990,501*	*100,695*	*5,869,326*
			Total costs		
Urban ambit (€/year)			1,390,449,782		
Extra-urban ambit (€/year)			176,366,991		
Total costs (€/year)			*1,566,816,773*		

Table 15 – Estimation of external costs due to air pollution in Campania.

Noise

The noise caused by transportation systems generally is assumed as a real source of pollution that has effects on human health and on quality of life.

The calculation of external costs due to noise is not simple, particularly for lack of data; indeed, several studies in the literature (Amici della Terra and Ferrovie dello Stato, 2002; INFRAS/IWW, 2004; UNITE, 2005) are based on the number of people exposed to different noise levels. They used data on the people exposed to several noise levels in the cities with more than 10,000 inhabitants, disaggregated for transportation mode. Since specific data for the Campania Region are not available, it is necessary to assume that the exposition rate in Campania is equal to the Italian average. Table 16 reports people exposed to different noise levels in Campania's cities with a population over 10,000 inhabitants.

Generally, it is possible to calculate the external costs due to noise considering the following items:

– willingness to pay for reducing the noise;
– costs related to heart disease risk;
– medical treatment costs.

The first item represents how much is the willing to pay for reducing the noise level under the threshold of 65 dB(A) by day and of 55 dB(A) by night. The estimation of this willingness to pay should require a specific Stated Preference survey.

In this paper we use the values reported in the INFRAS/IWW (2004) study, adapted to the Campania's pro-capita GDP. Table 17 reports

these values for different transportation modes and different noise levels.

Noise level [dB(A)]	Road	Rail	Air
55-65	1,561,752	295,514	119,768
60-65	1,025,402	211,329	86,354
65-70	594,065	109,787	37,319
70-75	178,350	33,847	16,924
>75	50,771	8,245	9,981

Table 16 – Estimation of people exposed to different noise levels in Campania.

Leq dB(A)	55-65	60-65	65-70	70-75	>75
Road transportation	44	132	219	307	395
Rail transportation	0	44	132	219	307
Air transportation	44	132	219	307	395

Table 17 – Estimation of willingness to pay for reducing noise levels in Campania (€/person year).

Using these values for the willingness to pay, the corresponding item of external cost should amount to 476,528,003 €/year.

The second item is related to the increment of death risk due to noise; Babish et al. (1993, 1994) showed that the increment of acute myocardial infarction is 20 % for people that are exposed to a noise level between 65 and 75 dB(A) and 70 % if the noise level is over 75 dB(A).

For estimating the deaths due to noise can be adopted the following formula:

$$DIC_{NOISE} = (x_{65} - x_{NE})\ PC65 + (x_{75} - x_{NE})\ PC75$$

where

- DIC_{NOISE} represents the heart disease deaths in Campania due to noise;
- x_{NE} is the heart disease risk per inhabitant exposed to noise under 65 dB(A);
- x_{65} is the heart disease risk per inhabitant exposed to noise between 65 and 75 dB(A);
- x_{75} is the heart disease risk per inhabitant exposed to noise over 75 dB(A);
- PC65 is the Campania population exposed to noise between 65 and 75 dB(A), equal to 970,292 inhabitants (see table 16);
- PC75 is the Campania population exposed to noise over 75 dB(A), equal to 68,997 inhabitants (see table 16).

The heart disease risks can be estimated solving the following equation system:

$$DIC = x_{NE}\ PC75 + (x_{65} - x_{NE})\ PC65 + (x_{75} - x_{NE})\ PC75$$

$$x_{65} = 1.2\ x_{NE}$$

$$x_{75} = 1.7\ x_{NE}$$

where DIC represents heart disease deaths in Campania, equal to 2,905 (ISTAT, 2005d).

Solving the equation system the heart disease risks are equal to:

$$x_{NE} = 0.00048870$$

$$x_{65} = 0.00058645$$

$$x_{75} = 0.00083080$$

With these values, the heart disease deaths in Campania due to noise can be estimated in 118 that, multiplied by the VOL (1,245,545 €), gives an estimated total cost equal to 147,167,747 €/year.

The third cost item is related to the medical treatment costs borne by society due to noise. The research MOSCA (2002) estimated for Germany that each person exposed to a noise level over 65 dB(A) bears an additional cost for medical treatments equal to 130 €/year. Assuming the same value, the medical treatment cost can be estimated equal to 135,107,150 €/year.

Summing the three cost items, the estimated total external cost produced by noise is equal to 758,803,320 €/year.

Accidents

Every year in European Union the road accidents cause over 40,000 fatalities and 1 million injuries; over the social problems, economic damages are caused.

In a first estimate of European Union the damage amount about to 160 billion euros per year.

One of the objectives declared by European Commission, as reported in the White Paper on transport policy (European Commission, 2001), is to reduce the road accidents of 50 % between 2000 and 2010.

As regards Italy, the data (ISTAT, 2005b) show 225,141 accidents, 6,015 fatalities and 318,961 injuries. In Campania the registered accidents are over 9,400 and they caused 347 fatalities and over 14,000 injuries. Table 18 reports accident data subdivided by province. The ISTAT specifies that the registered data are probably underestimated for several reasons: are registered only accidents that caused damage to people and only fatalities that occurred within 30 days by accident; many accidents with light injuries are not declared.

Anyway, in this paper it has been preferred to use the official data, without amplifying those using uncertain corrective coefficients.

The external cost items due to road accidents estimated in this paper are:

– people damage;
– productivity and consumption losses;
– other costs (medical treatments, administrative and judiciary costs).

Province	Accidents	Fatalities	Injuries
Avellino	648	40	926
Benevento	448	15	756
Caserta	1,087	81	1,832
Napoli	4,604	128	6,869
Salerno	2,650	83	3,938
Campania	*9,437*	*347*	*14,321*

Table 18 – Accidents registered in Campania at 2003 (source: ISTAT, 2005b).

The material damage are not assumed as external costs since they are fully covered by insurances that are paid by users.

For estimating the people damage costs, it is necessary to establish a unitary cost for fatality, for serious injury and for light injury. As regards the fatality cost, the value previously estimated is adopted (1,242,545 €); INFRAS/IWW (2004) proposes a medium value equal to 200,000 € for serious injury and equal to 15,000 € for light injury. Adapting these values to pro-capita GDP of Campania's inhabitants, the values of 165,673 € per serious injury and of 12,425 € per light injury are obtained. ISTAT estimates that the 80 % of injuries can be assumed light and the 20 % can be assumed serious; under this assumption in Campania in the year 2003 there were been 2,864 serious injuries and 11,457 light injuries.

The estimated people damage cost in the Campania Region amounts to 1,048,038,315 €/year.

Following the suggestions of UNITE (2005) project, the productivity and consumption losses can be estimated assuming 10 inactivity days for light injuries and 25 inactivity days for serious injuries. For Campania Region the daily production loss is equal to 89.36 € per employed person, while the consumption loss is equal to 21.74 € per unemployed person (both vales are estimated adapting UNITE values to pro-capita GDP in Campania). In Campania Region the percentage of employed people is 26 % (ISTAT, 2005e); assuming the same percentage among casualties, the costs due to productivity and consumption losses is 7,321,354 €/year.

From available ISTAT (2005a) data it is possible to estimate the average medical treatment cost per accident equal to 2,796.33 €, inclusive of hospital, first aid and rehabilitation costs. Using this value the total medical treatment cost amounts to 26,388,966 €/year.

From the same ISTAT data it is possible to estimate the administrative and judiciary costs per accident as 8,830.51 €; the total cost due to these items is equal to 83,333,474 €/year.

Therefore, the total external cost due to road accidents is estimated equal to 1,165,082,109 €/year.

This cost is partially already internalised by insurances (paid by users); indeed, in Italy a part of insurance premium is devolved directly to National Health Service. Another part of premium indemnities material damage (that are not considered external costs) and people damage; a study for estimating the part of accident costs already internalised will be object of further research.

Congestion

The congestion affects mainly the road transportation, especially in urban areas. The evaluation of externalities due to congestion can be obtained by estimating the time lost by users in the congested system respect the case of absence of congestion. Other more effective methods can be based on the users' surplus evaluation, but they should require studies on the demand elasticity.

In this paper the congestion costs will be estimated only for road transportation.

For estimating the external costs due to congestion, the total travel time that should be spent by car users in Campania if the congestion level is equal to the average in Italy has been estimated. This estimate is obtained by the veh-kms/year for each car category and by the average yearly speeds desumed by APAT (2005a), for each ambit (see table 19).

Car	Urban roads	Extra-urban roads	Motorways	Total
Petrol	187,903,146	132,719,606	29,587,615	*350,210,367*
Diesel	62,116,950	98,010,064	30,142,118	*190,269,132*
Gas	46,147,946	23,665,613	9,614,155	*79,427,715*
Not id.	38,810	21,351	5,417	*65,578*
Total	*296,206,852*	*254,416,634*	*69,349,306*	*619,972,792*

Table 19 – Estimation of hours spent in a year in car in Campania under the assumption that the average congestion is equal to the average Italian congestion.

The ISFORT (2005) survey shows that the average speed in Campania is equal to the 89.9 % of the average Italian value; the same survey shows that the 48.8 % of trips are made for job/study purposes.

Applying the ratio between average Italian speed and average Campania speed to the total hours of table 19, it is possible to obtain a total number of hours equal to 690,491,024; therefore the lost hours for congestion can be assumed equal to 70,518,232, of which the 48.8 % (34,412,897) for job/study trips. These hours has to be multiplied by the average car occupancy factor, which can be assumed equal to 1.3; therefore, lost hours are 91,673,702, among which 44,736,767 for job/study trips and 46,936,935 for other trips.

The external cost can be estimated multiplying lost hours for VOT (€/h); as seen in subsection 3.2, ENEA (2003) proposed 7.74 €/h for job/study trips and 1.93 €/h for other purpose trips. With these values the estimated congestion cost amounts to 436,850,858 €/year.

It is necessary to specify that the external cost so estimated is minimal, since the average Italian conditions cannot assumed uncongested and that the effects on freight transportation has been neglected.

Cost summary

Table 20 and Figure 2 summarise external costs produced by transportation system in Campania. It can be noted that the largest costs are due to air pollution (38.0 %) and accidents (28.2 %); noise amounts to 18.4 %, while less importance is assumed by congestion (10.6 %) and greenhouse gas emissions (4.8 %).

The total cost overcomes 4.1 billions euros per year, equal about to 4.7 % of regional GDP.

Cost item	**Total cost** [€/year]	**Cost per inhabitant** [€/inhabitant-year]
Greenhouse gases	198,379,809	34.79
Air pollution	1,566,816,773	274.79
Noise	758,803,320	133.08
Accidents	1,165,082,109	204.33
Congestion	436,850,858	76.61
Total	*4,125,932,870*	*723.60*

Table 20 – Estimation of external costs in Campania region.

In particular, the environmental costs (air pollution, noise and greenhouse gas emissions) are over the 60 % of total external costs.

Discussion

The estimation methods proposed in this paper are based on some assumptions and it is useful to discuss them in order to understand the goodness of obtained solutions.

The costs of greenhouse gas emissions are estimated in function of yearly traffic, specific emissions and unitary CO_2 cost.

The first two terms can be considered reliable; indeed, the procedure proposed for estimating the veh-kms/year is based on official data on number of vehicles and on the estimation of yearly distance covered by vehicles, proposed by a government agency on the basis of specific studies.

Other traffic data (air and rail transportation) are deduced by official stats and the specific emissions are also deduced by official data.

Moreover, the differentiation among kinds of roads (urban, extra-urban and motorways) allows to obtain good estimates. The unitary CO_2 cost, instead, is a term that is more uncertain and less reliable. Indeed, the adopted value is a minimum of a very wide interval (from 20 € to 135 €) and it was estimated (Capros and Mantzos, 2000) under optimistic assumptions for industrialised countries about the kind of the emission trade model (Full Trade). If this assumption is removed, the costs of greenhouse gas emissions should reach very higher values, up to over 6 times the estimated values. From this point of view, the estimated value can be seen as minimal.

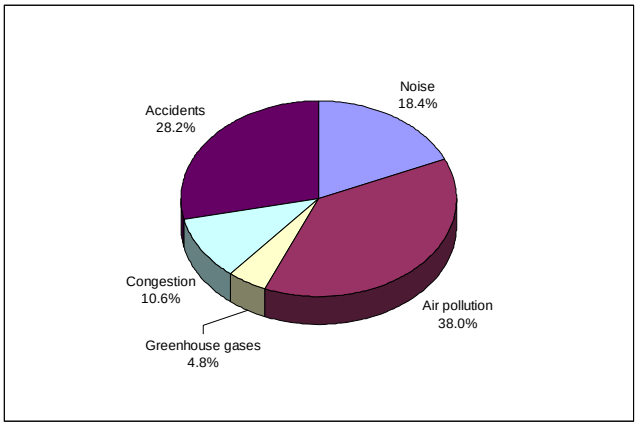


Figure 2 – External costs in Campania region (percentages).

Air pollution costs are estimated with a procedure similar to the previous one. Also in this case the uncertainty is related to the unitary emission costs (see table 14); these values are obtained adapting the values estimated by ENEA (2003) to the VOL assumed in this paper. The ENEA study elaborated data coming from several sources, among which the EXTERNE (2005) project, and they can be assumed valid as average values for Italy; the higher population density in Campania region probably amplifies the effects on people health, but at now it is not possible to obtain better estimates. This problem has to be studied in further researches.

About the noise costs, the uncertainties are related mainly to the willing to pay values; indeed, more times the "declared" willing to pay does not represent a "real" value. Therefore, in order to improve the results it can be useful to propose methods based on hedonic prices, which seem to be more suitable for estimating noise costs. Also in this case, they need specific surveys and studies that are not yet available in Campania region.

About the accident costs, the main uncertainty is related to the VOL; in particular, assuming the same VOL for accidents and for noise and air pollution can be seen as a forcing. Indeed, the average age of road accident victims is, generally, lower than the

victims caused by health damage due to air pollution and noise. So, other (greater) shadow values can be politically assumed, especially in the evaluation and comparison of transportation plans and policies aimed to reduce road accidents.

The estimation of congestion costs is based on a comparison between congestion in the region and average Italian congestion. The main limit of the procedure is related to the absence of congestion estimates for other transportation modes and for freight transport. Sometime these costs are not considered as external, since they are borne by users. About the monetary evaluation of road congestion, the main uncertainty is related to the VOT that should be different for different user classes: it should be estimated each time.

Even though these limits and uncertainties, the proposed procedures are useful for a first estimation of main external costs due to transportation; these approximate estimates can be used inside preliminary evaluations of transportation projects, plans and policies.

Conclusion

In this paper simplified methods for estimating the external costs due to transportation in regional areas are proposed. The advantages of proposed methods are related to the possibility to use input data easily available from official stats, without the necessity of providing specific surveys.

An approximate estimation of external costs is useful for evaluating transportation plans and policies, in particular if they are devoted to the reduction of environmental impacts.

The results obtained for the region of Campania show as the amount of external costs is equal about to 4.7 % of regional GDP and, in particular, as the environmental costs (greenhouse gas emissions, air pollution and noise) overcome the 60 % of total costs.

Further research will be addressed to improve the precision of proposed methods, mainly as regards the specific costs of air pollution and of greenhouse gas emissions.

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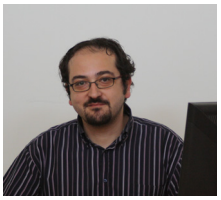

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