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The role of underground transportation inside Milano's Smart City perspective

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ABSTRACT

Making a Smart City out of a city is a complex process involving deep-rooted innovation with regard to: tangible and intangible infrastructures, the lifestyles of citizens; the regeneration and design of public spaces, strategies and tools to develop the economy and the handling of complexities.

Public administration on its own cannot transform a city into a smart city, but it does have the task of creating a favourable environment where the best and blue chip players within its area work successfully towards common and shared goals. Milano Smart City is committed to a systemic and coordinated management of urban mobility, which means reorganizing the transport demand effectively, improving the use of public transport services and providing better short-term and long-term parking systems.The city wants to enhance liveability by promoting all forms of sustainable mobility where getting around the city becomes a pleasure, a moment of conscious choice with no waste nor waiting and with a reduced environmental impact. Mobility is smart if it leads to a better quality of life through effective, accessible and intelligent tools aimed at the optimization of resources for all citizens, tourists and city users.The paper briefly recalls the key theme related to Smart City, with a focus on Smart Mobility, then after a historical digression on Milan, describes the Transport Integrate System which connects Metro System, Railway System and Airports. The experience of Metro line 5 closes the paper, underlining the rule of underground transportation inside a Smart City Perspective.

Key Words: Smart City, Underground Transportation, Infrastructures, Integrate System.

1. INTRODUCTION

Rapid urbanization is a global phenomenon. In 2008, for the first time in human history, there were more urban dwellers than rural, and the trends show that this is not going to be reversed. The United Nations estimates that by 2030, over 60% of the global population of will be living in "megacities" (10+ million), large (5-10 million), medium (1-5 million), and smaller cities and peri-urban communities, increasingly concentrated in Asia, Africa, and Latin America. This fraction could rise to two thirds by 2050. The recent Intergovernmental Panel on Climate Change (IPCC) report on Human Settlements, Infrastructure and Spatial planning states that the expansion of urban areas (urban centres and suburbs) is on average twice as fast as the urban population growth, and that the anticipated growth in the first three decades of the 21st Century will be larger than the cumulative urban expansion in all of human history. (United Nations 2014).

In 1950 about 65% of the population worldwide lived in rural settlements and 35% in cities and this number will be reversed by 2050, where 70% will be urban and 30% rural. Almost 6 billion people will be living in urban areas by 2050. Figure 1 reflects the projections of urban populous by the year 2050.

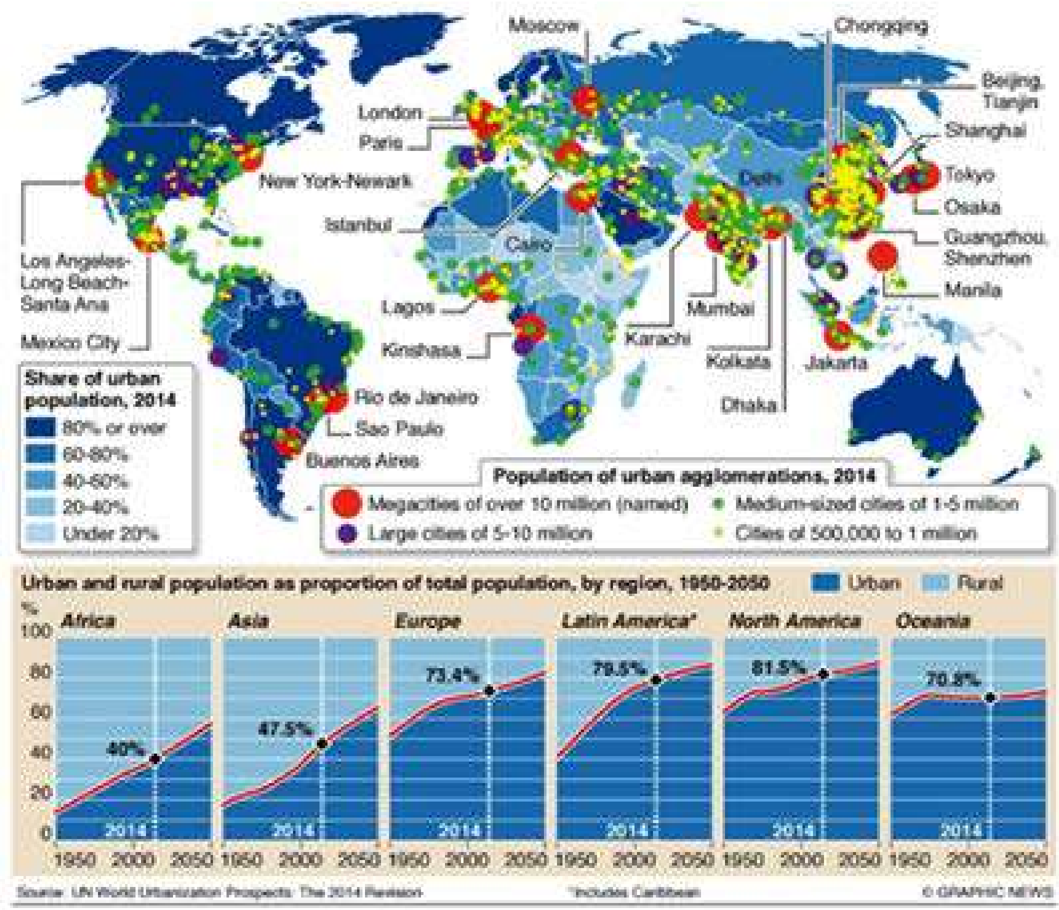


Figure 1. Urban population trends (United Nation, 2014).

Estimates from the United Nations Environment Programme and the Sustainable Urbanization Policy Brief suggest that cities contribute to approximately 70% of global energy use and greenhouse gas emissions but only occupy 5% of the earth's landmass. This is accompanied by the unprecedented increase in demand for water, land, building material, food, pollution control measures and waste management from urban areas. Therefore, cities are constantly under pressure to provide better quality services, promote local economic competitiveness, improve service delivery, increase efficiency and reduce costs, increase effectiveness and productivity, address congestion and environmental issues. These pressures are motivating cities to turn to 'smart' solutions and experiment with various smart infrastructure applications (United Nation, 2014).

2. SMART CITY DEFINITION

There is no standardized, commonly accepted set of terminologies or definitions, which would help to aptly describe a "Smart City". Followings the authors recall some of them:

• The main objective of the Smart City is to develop, share and disseminate actionable frameworks and best practices to catalyse action at the global and regionallevel to resolve the infrastructure gap. (The World Economic Forum -www.weforum.org).

• A smart city thoughtfully and sustainably pursues development with all of these components in mind with the additional foresight of the future needs of the city. This approach allows cities to provide for its citizens through services and infrastructure that address both the current needs of the population as well as for projected growth. (World Bank-http://blogs.worldbank.org/sustainablecities/what-is-a-smart-city-and-how-can-a-city-boost-its-iq).

• A smart city is a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses. (European Council - https://ec.europa.eu/digital-agenda/en/smart-cities).

Different definitions of smart cities reveal that different definitions emphasize different aspects of smart cities. However, there are several common characteristics of smart cities which may be grouped under the following broad six themes listed in Figure 2, namely, smart mobility, smart economy, smart living, smart governance, smart people and smart environment (Smart cities - Ranking of European medium-sized cities - http://www.smart-cities.eu/download/smart_cities_final_report.pdf). But specific factors associated with these themes evolve over time and are dependent on the specific context of each city and its stage of development. The table also lists some of the main factors associated with these key characteristics of Smart Cities.

SMART ECONOMY *(Competitiveness)*	SMART GOVERNANCE *(Participation)*	SMART ENVIRONMENT *(Natural resources)*
• Regional/global competitiveness • Entrepreunership& Innovation Momentum • High Levels of Productivity • Broadband access for all citizens and businesses for business opportunities • Independent of location, helping maintain population in rural areas, • Electronic business processes (e.g., e-banking, e-shopping, e-auction)	• Participatory Decision Making • Public & Social Services • Transparency • Democratic processes and inclusion • Interconnecting governmental organizations and administrations • Improving community access to services	• Pollution Monitoring • Use of Sustainable Technologies • Environmental/ sustainable /Energy consumption • Reducing energy consumption through novel technology innovations while promoting energy conservation and material re-use
SMART MOBILITY *(Transport)*	**SMART LIVING *(Quality of life)***	**SMART PEOPLE *(Social and Human Capital)***
• Improved Accessibility • Safe Transportation • More efficient and intelligent transportation systems • Leveraging networks for efficient movement of vehicles, people, and goods, to reduce gridlock • New 'social' attitudes such as car sharing, car pooling, and car-bike combinations	• Better Quality of Life • Social Aspects - Education, healthcare, Public Safety, Housing • Access to high-quality healthcare services (including e-health or remote healthcare monitoring), electronic health records management • Home automation, smart home and smart building services • Access to social services of all kinds.	• Social & Human Capital • Qualified, Creative and Educated Citizenry • Able to utilize the ICT based smart services • Delivering a more consistent educational experience in both urban and rural areas • e-education solutions (remote learning and collaboration) to have citizens better informed

Figure2. Key themes related to Smart City

2.1. Smart City infrastructure

Smart city infrastructure differentiates itself from the traditional urban infrastructure through its ability to respond intelligently to changes in its environment, including user demands and other infrastructure, to achieve an improved performance. It provides foundations to all the six key themes related to a smart city, but the smart infrastructure components are highly context specific and their nature is determined by the level of development of the cities as well as by the specific developmental challenges.

For a city in a developing country, the immediate need is to provide adequate urban infrastructure to meet the increasing pace of urbanization.In developed countries, the challenge is to maintain the legacy infrastructure systems, which cannot be abandoned due to cost, space and other considerations.However, in both developing and developed country contexts, the primary motive behind smart infrastructure applications is that they respond to the sustainable development needs of the society.

3. SMART MOBILITY& TRANSPORT

Smart Mobility and Transport are best described to be approaches which reduce congestion and foster faster, greener and cheaper transportation options. A Smart City transport infrastructure aims to optimize those journeys that take place within a city, save energy and reduce carbon emissions. Most smart transportation management systems use data collected from a variety of sources about mobility patterns in order to help optimize traffic conditions in a holistic manner. Smart Mobility and Transport systems can be divided into the following areas: mass transit, individual mobility and intelligent transport systems.Mobility within cities has to adapt and become smarter to handle the rapidly increasing population. Intelligent Transport Systems (ITS) integrates the whole array of multimodal transport options in a city, including both individual mobility and mass transit options, in an efficient manner. Though ITS dates back to 1950s, its components have evolved and the contemporary versions of ITS form an integral part of smart cities mobility infrastructure. Modern ITS normally comprises of, inter alia, network of sensors, connected cars, GPS tracked public transportation, dynamic traffic lights, passenger information panels, automatic number plate readers, CCTV systems, navigation facilities, signalling systems and most importantly the capability to integrate live data from most of these sources. This can lead to major improvements in safety, network management, traffic congestions, environmental performance, accessibility, convenience and public perception.

4. THE CITY OF MILAN

Strategically placed at the gateway to the Italian peninsula, Milan's origin goes back to 400 B.C. and from that time, the city had an important role inside the economic and politic European context.Each period of historical crisis, advance, and consolidation has been reflected in the organic structure of Milan. For a thousand years, the core of the city was located just southwest of the Duomo, and was made up of the rectangular, four-gated city of Mediolanum, with roads thrusting out from each gate to the surrounding countryside, together with an irregular outer defence consolidated in Carolingian times (8th–9th century). This core has influenced the city plan down to modern times.Dynastic struggle and the imposition of transalpine authority (Spanish, Austrian, and French) brought further changes. The city was razed in 1162, and afterward an enlarged oval was constructed—the course of its outer walls is still traceable in contemporary streets. Spanish domination brought the erection of still another outer ring, the result of 16th-century reconstructions (Figure 3. a)).Several times since the late 19th century, city planners have laid down the basis of a more organic plan, bypassing the traditional radial street plan, so that new districts might have wide streets and avenues intersecting at right angles.

The city grew and changed under the guidance of the first masterplan: the Beruto's Plan (Figure. 3 b)). The city centre, then enclosed within the Spanish walls (-1549 1560), became the place that represented the ideals and interests of the emerging Milanese bourgeoisie. General Urban Development Plan by Cesare Beruto (architect and chief engineer of the city) offered a moderately international vision in terms of its content, choices and techniques used.The first railway stations (the Stazione Centrale in Piazza dellaRepubblica, the funeral train station in Porta Romana and Stazione di Porta Genova), urban facilities (the CimiteroMonumentale, the San Vittore prison), and some modest gardens. At the time, Milan had a little over 350 thousand inhabitants; the municipal area measured, even counting the inclusion of the Corpi Santi in 1873, just less than 7,500 hectares (compared to the current 18,000 hectares). This date marks the beginning of significant changes in the city, becoming the second largest city in Unified Italy in terms of demographic size, surpassed only by Naples, but much more populous than Rome.The economic dynamism that characterised Milan in the years after unification powered a strong increase in demand for local and regional mobility. The answer was found in a public transport system that adapted and grew as new traction technologies emerged.The 20th century also saw the development of entire industrial districts outside the city boundaries and the centres of the newer suburban areasare linked to the core of the ancient city by major arteries and public transportation.

Figure 3. a) Historical evolution of the Milan's Walls; b) Beruto's General Urban Development Plan (1889)

4.1. The Public Transportation System

Public transport service in Milan dates back to 1801, operated with horse-drawn carriages. After the relocation of the Capital of the Italian Kingdom in Milan in 1805, national and international transport services were inaugurated, all operated with carriages, to Vienna, Marseille and several Italian cities. Transport via the Navigli canals (Figure. 4 a)) was also an important transport mode in that period. The first bus line was opened in 1827, connecting Milan to Lodi. The first railway, to Monza, was inaugurated in 1840. The Milan tram network dates back to 1876, when the first horse driven tram line began operation (Figure. 4 b)). In 1878 the first steam powered tram was launched and by 1901 all the lines were electric powered. In 1910 line numbers were first introduced. At that time the network was already consisting of 30 lines. Beginning from the late 1950s and until the end of the 1970s the tram network wasreduced, being replaced in some areas by the new Metrolines or by more flexible bus lines.


a) b)

Figure 4.a) Martesana Canal ("Naviglio") b)Horses Tram, Line Milan-Monza, corso Venezia, 1900-1877

The historical digression is fundamental to understand clearly the character of the modern city. Strategically placed at the gateway to the Italian peninsula, Milan, from its origin, had an important role inside the economic and politic European context. The industrialization process and the related economic progress contributed to increase the city's population and drive the transportation development of the 20th century. The most important steps were: Italian State Railway (1905, private licences have been revoked),Tram network (30 lines in 1910), Bus Network (1922), New Central Railway Station (1931), Linate Airport (inaugurated in 1937), Malpensa Airport (1948), Garibaldi Railway Station (1963), Metro Line 1964) 1), Metro Line 1969) 2), Metro Line 1990) 3). This complex infrastructure system required the development of an integrated transport system. AziendaTrasportiMilanesi (ATM) is a Public Limited Company owned by the Milan Municipality and founded in 1931. ATM manages the public transport in the Lombard capital and in 46 provincial towns, serving an area with a population of 2.51 million people.

4.2. The Integrate Transport System

An integrated transport systemrefers to a multi-modal transport system where different modes of transport are efficiently linked with each other. This translates into the smooth movement of freight over various modes of transport like roads, railways, metro line and civil aviation. Different modes of transport differ in their capital intensity and technical and operational capabilities. The capacity of each mode of transport has to be developed to meet its specific demand viewed within the total demand for all modes of transport.

In 1980,the Piano ComunaledeiTrasporti (Municipal Transport Plan, a planning instrument connected with the Master Plan), creates a strict integration between the settlement trend and the planned infrastructures. The Piano ComunaledeiTrasporti contains the PassanteFerroviario (railway bypass), a crucial infrastructure for the entire Lombard railway system. This integration, connecting the FerroviedelloStato (Italian State Railways) and Ferrovie Nord railways, lays the path for the construction of the present-day regional railway service, posing Milan as its hub. The PassanteFerroviariomarks the beginning of the studies on big “area planning” (progettid’area), while sustaining the functional renewal and redevelopment of parts of the city. During this period thorough studies are carried on about the new Portello, the new Bicocca and the very same areas of Garibaldi-Repubblica that, with the introduction of the new infrastructure, become extremely easy to access both at regional and national level. The connection of the by-passing system with the whole airport system, and the now consolidated urban underground system, makes it the preeminent setting for the relations at regional level and beyond.

The Integrate Transport System (Figure. 5) laid the foundation of the Intelligent Transport Systems (ITS) which is the main component of the smart mobility (cfr. par.3).

Figure 5.Milan’s Integrate Transport System

To guarantee the regional connection to Milan down town an important service related to the metro line are the multi-storey interchange car parks. There are 22 car parks managed by ATM (Figure 6) located in the vicinity of public transport routes or areas with high traffic flow: underground stations, railway stations, airportsand FieraMilanoCity. These car parks are either multi-storey or street-level.Milan is the second-most populated Italian city, with 1.35 million inhabitants in themunicipal area and about 3.2 million in the whole metropolitan area. 850.000 peopleenter the city (and 270.000 exit) every day.Due to high traffic levels, Milan has been experiencing relevant problems related toair pollution and traffic congestion. Bike Sharing is a practical and ecological service,designed to promote user mobility, it is not just a simple bike rental service but a real public bicycle transport system to be used for short trips supplemented by ATM traditional transport vehicles (Figure 7).It’s a big project that sees “BikeMi” stations (n.280) located in strategic points all over the city, starting downtown: train stations and universities, hospitals and tourist attractions, underground stations, administrative offices, malls and parking lots. This will allow all registered users to pick up a bike, ride it and leave it at the station closest to their destination.

Bike Sharing is agood way to reduce traffic, queues and pollution which combines convenience with fun. The increasingly fast pace of life doesn›t often leave us time for physical activities. With this new way of getting around you can exercise outdoors, taking advantage of short trips, even for work, to stay in shape and fight stress.This is the so called “social” attitude of the smart mobility (Figure 2).

Figure 6. Milan’s Metro Line Parking

Figure 7. BikeMi: the bike shearing managed by ATM

5. THE DEVELOPMENT OF METRO LINE

The strategic plan for the network that provides the metro with new extensions to the threeexisting lines and the construction of two new lines, new management and signalling systemsthat allow shorter intervals, and a redesign of the surface network on the basis of moremodern and functional concepts (Figure 8). Micro-transportation represents an effective integration between the surface layer (i.e bike sharing for short distance) and the deepest layer of Metro and Railway Bypass (i.e. linking opposite city sides or regional connection). The world-wide trend of increased urbanisation creates problems for expanding and newly-developing cities alike(Figure.1). Population increase leads to an increased demand for reliable infrastructure, nowadays combined with a need for increased energy efficiency and a higher environmental awareness of the public. The use of underground space can help cities meet these increased demands while remaining compact, or find the space needed to include new infrastructures in an existing city landscape. The most recognized problem is the need for congestion relief in city streets. The mass transit systems offer other benefits, as they tend to require less surface area than road traffic. Studies show that car traffic takes up 30 to 90 times more space than metro systems. Similarly, public road transport takes 3 to 12 times more space (Thewes et al., 2012). By moving from above ground car traffic to underground mass transit systems, enormous amounts of surface land can be freed up for other uses. The surface land is a critical issue in all the big cities especially for those that have also a large historical centre.

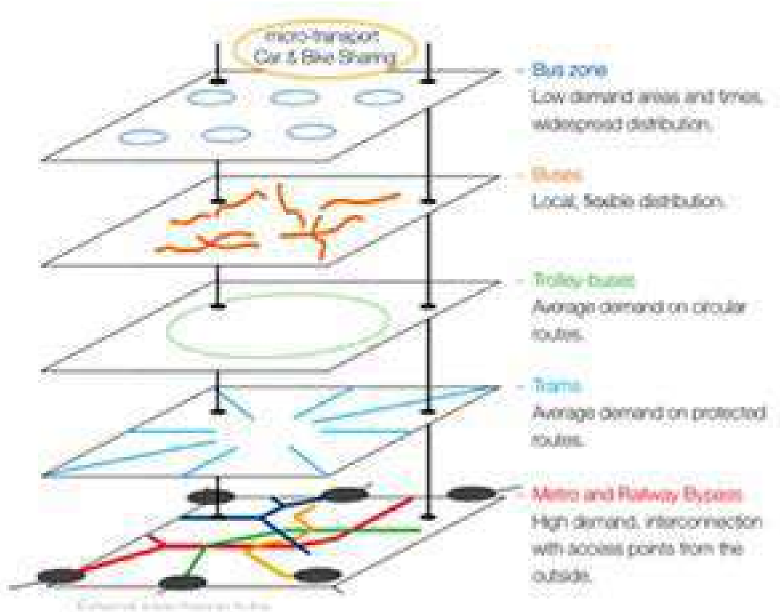


Figure 8. Functional concepts of Milan'stransport network (ATM, 2009)

Actually, the metro network in Milan has 4 lines, characterized by 113 stations with a development of 96 km; in 2022 with the line M4 and the extension of line M1, the network will increase up to 136 stations and 112 km while extension of M1, M2, M3 and M5 are at the Design Stage. The Metro lines M4 (currently under construction) and M5 provide quicker andeasier access to the city centre from the surrounding areas, the former runs east–west, and the latter north–west (Figure 9).Line M5 (purple) runs entirely underground and was completed in two different operational sections using the project finance formula. The first section, between Bignami and Garibaldi stations, has already been in operation since 2014; the second, known as the EXPO extension, which connects the Garibaldi and San Siro Stadium stations, come into operation during May 2015.The line has a total of 19 stations in a total of 12.9 km, 6.2 km in the Bignami–Garibaldi section and 6.7 km in the Garibaldi-San Siro section. The tunnels were completely excavated by a single EPB TBM (twin-track tunnel with a diameter of 8.85 m) for the first section and four smaller EPB TBMs (single- track tunnels with diameters of 6.70 m) for the second.Line M4 will cross Milan with a length of about 15 km fromwest to east along VialeLorenteggio, passing south of the old town up to Linate Airport.Line M4 will be a "fully automated light rail" system, driverless, and with automatic platform doors and a CBTC (Communication Based Train Control) signalling system. The trains will be 50 m long, considerably shorter than rolling stock in circulation today. Likewise, the 50 m long stations will also be shorter than the 110 m stations on lines

M1, M2 and M3.

The new line M4 will pass through neighbourhoods with high population densities, so the construction methods have been planned to minimize impact at the surface and adapt to an underground affected by a great amount of infrastructure and by the presence of a significant amount of water. There are currently two interchanges with existing Metro lines, one with the red line at San Babila station, and one with the green line at Sant' Ambrogio station. In future there will be three interchanges with suburban railway lines, one with Lines S5, S6 and S9 at Forlanini FS station, one with Lines S1, S2, S5, S6, S13 at Dateo station, and one with Line S9 at San Cristoforo station, where there is also a connection to the Milan-Mortara railway. And lastly, an interchange with Linate airport is planned.


a)


b)

Figure 9.Milan's Metro Line: a) M4 - blue line; b) M5 - purple line

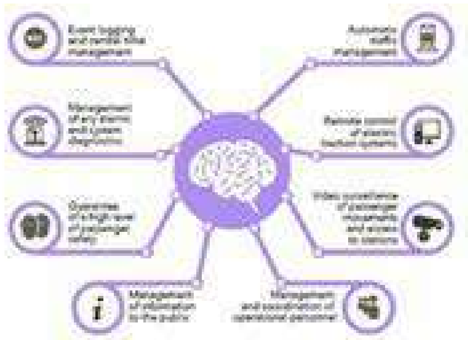
Most of the underground construction on the route will be carried out by mechanized tunnelling with the use of two TBM geometries, one with a bored diameter of 9.15 m andthe other with a bored diameter of approximately 6.36 m. The TBMs with diameters of approximately 6.36 m will be used for the sections from Manufatto Ronchetto, in the SanCristoforo area, to the Parco Solari station and from Linate Airport to the Tricolore station. The TBM with a diameter of9.15 m will be used for the section from the Parco Solari to the Tricolore station.Construction will be completed by 2020 and the line will in operation by 2022.

5.1. The Smart Metro Line

The Purple Line (M5) is the first fully automated medium-capacity line inthe Milan Metro system (M4 will use the same system). Full automation makes it possibleto achieve similar capacity to that of conventional highvolumetransit systems, resulting in a significant reductionin cost and construction time, even using shorter trains.The line, which provides interchanges with all other undergroundand surface lines completed to date, has beendesigned for a maximum capacity of 25,728 passengers/h/direction assuming a train frequency of 75 s, and for an averagecapacity of 12,060 passengers/h/direction assuming atrain frequency of 160 s.The "driverless" system with no driver aboard (Figure 10.a), allows flexible operating programs (number of trains) putting more trains in line of function for public use along the day creating: higher operating flexibility (number of trains, speed and break time at stations), better security in stations, less operating cost. The M5 is a driverless light rail transit controlled by a single Central Control Room (CCR) to which all information is sent and from which any commands necessary to ensure the proper functioning of the line and the safety of passengers, operating (itinerant agents) and maintenance personnel and citizens can be issued (Figure 10.b).

The Purple Line ensures the highest safety standards. The driverless system is adopted throughout the world for intelligent traffic control and in order to ensure passengers the highest safety standards.The access platform is completely separated from the tracks and moving trains: as with elevators, the doors of the glass partitions – which separate waiting passengers from the tunnel – open exclusively once the train has stopped at the station. This device prevents accidental falls and prevents access by unauthorized persons.

The platform door system for the Line 5 of Milan is designed, manufactured and installed so as to provide partitions made of high quality materials, such as glass and anodised aluminium, between the tracks and the platforms passengers have access to. Great care was devoted to the glass components in order to ensure maximum transparency.The invisible structure in galvanized steel covered with anodised aluminium was minimized while remaining capable of withstanding both overall and specific weights.



b)Figure 10.Milan's Metro Line M5: a) "driverless" system;
b) Central Control Room Functions

This type of partition provides a partition element capable of isolating the areas of the station where air conditioning is active from the tunnels, thus reducing the outflow of treated air from the station.The partitions also contribute to increasing the level of passenger safety by separating the platforms from the tracks. In this manner it is impossible for passengers to place their foot between the front of the platform screen doors and the train when the latter stops in the correct position with its doors corresponding to those of the platform. This is also prevented by the presence of a special "baffle" profile in the lower part of the sliding door. At the same time, the partitions in question do not represent per se any additional danger for passengers or personnel.

The structure of the platform screen doors is designed for trains with four cars having two doors per carriage. Each partition has an overall length that varies between 49.30m and 50.00m depending on the station and consists of eight identical modules of the same length separated by doors equipped with "panic" handles for emergency evacuation (EED).The system is inserted and integrated in the structure and architecture of the station and with regard to the operational aspect, in the ATC signalling system.

The Purple Line accepts the challenge of environmental sustainability in order to improve the quality of life of citizens.Welcoming the challenge of environmental sustainability and higher quality of life. A city with less traffic on the streets is a less polluted and more liveable city.The new metro line promises the concrete reduction of air and noise pollution: it is estimated that the M5 line will lead to a reduction of 15 million private car trips a year and, therefore, a significant decrease in pollutants. Moreover, savings equal to 8,470 tonnes of oil per year is expected as well as 260 less road accidents a year in the city.Thanks to the 12.8 kilometres and 19 stations of the entire purple line, it will be possible to transport between 15 and 18 thousand passengers per hour per direction (pphpd), with an average demand of -6,500 7,500 pphpd, and will offer a peak frequency of 90 seconds, which may reach 75 on the line. This cutting-edge mobility system in terms of performance and safety is able to accommodate 60 million passengers per year.

Milan becomes greener with the purple line. Greenery in the city is not only beautiful but also useful because it has positive effect on air quality and the ecosystem. Where possible, trees are simply moved from the surface of the construction sites and planted in alternative sites before returning home once the works have been completed.The creation of the M5 metro line immediately delivers Milan a new heritage of green public spaces.

According to the logic of biodiversity and environmental advantage, the number of trees will increase: more than three new trees (more precisely: 3.6 shrubs at least twelve years of age) will take root in the city for every tree removed during the construction phase.

This compensation is perfectly in line with the Kyoto Protocol and is set to triple the current levels of fine dust and carbon dioxide absorption.

6. CONCLUSION

Milano Smart City is a European and international city, a hub of economic, social and cultural networks, which are truly global. The actual character of the city is strictly related to its historical development. Each period of historical crisis, advance, and consolidation has been reflected in the organic structure of Milan.Public transport dates back to 1801 and under the guidance of the first masterplanBeruto's General Urban Development Plan (1889)the city stared to grew and change. The industrialization process and the related economic progress contributed to increase the city's population and drive the transportation development of the 20th century up to 1980 when the Municipality define the "Municipal Transport Plan", a planning instrument connected with the Master Plan, which created a strict integration between the settlement trend and the planned infrastructures.

The Integrate Transport System laid the foundation of the Intelligent Transport Systems (ITS) which is the main component of the smart mobility.An integrated transport system refers to a multi-modal transport system where different modes of transport are efficiently linked with each other.

Milan promotes the integration between underground mass transportation system, such us Metro and Railway By-Pass, and "social" transportation system (i.e. bike shearing).

The Metro lines M4 (currently under construction) and the M5 (in operation) are based on Driverless System, by this way, they represent a safe and intelligent transportation system. The new Lines running from east to west, and from north to west,provide quicker and easier access to the city centre from the surrounding areas, improving the accessibility. Their integration with the existing infrastructures guarantee an efficient movement of people not only locally, but also to a regional scale.

Making a Smart City out of an existing city full of historical layer is a complex process involving deep-rooted innovation with regard to: tangible and intangible infrastructures and the lifestyles of citizens.A smartcitynot only cultivates itstechno logicalcomponent,butalsocombines:economicdevelopmentand social inclusion, in novationandtraining,researchand participation,and,atthesame time,acquiresallthet oolsnecessarytoprovidethestrategicframework, theinternal coordinationand thesyn ergy,bringingtogetherthedifferentplayers.

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