

XXV International Conference Living and Walking in Cities - New scenarios for safe mobility in urban areas (LWC 2021), 9-10 September 2021, Brescia, Italy

## The 15-minute city: interpreting the model to bring out urban resiliencies

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### Abstract

In a globally connected world and increasingly smart cities, the demand for living in a physical neighborhood where one can walk and cycle among familiar people and a variety of services is always alive. It is a quality of life which meets the deep desire of community and place identity. In this regard, the 15-minutes city is the contemporary version of the classical “human measure”. The model offers a refreshing chrono-centric vision for the city that prioritizes people’s time, energy and physio-psychological health by relieving their daily commutes. The recent pandemic clearly showed this potential; the daily outdoor movement by soft mobility allowed for social life even during lockdown periods. The paper is subdivided into two main components: a theoretical discussion of the 15-minute city model as part of a broader sustainable urban planning narrative, and a practical application mapping the potentials of Milan as a 15-minute city, focusing on population distribution and urban fabric structure as a measure of performance evaluation. The emergence of the 15-minute model rebalances the building volume concentration of the consolidated Transit Oriented Development paradigm; suggesting an innovative and more articulated vision. The 15-minute approach, rooted in the organic planning of the '60, is pushed by the covid-19 emergency, making treasure of the experience of urban regeneration masterplans of the last decade. The approach falls in line with real estate strategies for place making, which aim to create new sustainable urban districts that are pedestrian oriented and carbon free. After interpreting the international framework of urbanism trends with respect to the 15-minute model, the paper focuses on the Milan case. The potentials for neighborhoods across the city of Milan is investigated to conform to an inclusive 15-minute city model, using fully-fledged and innovative mapping of proximity. This analysis aims to explore the resilience of urban resources to support walkable living environments with a guaranteed basic level of accessibility to daily needs by walking. The support to this model offered by soft mobility modes and micro-mobility devices is also raised. The results show, in a number of urban neighborhoods, a limited level of walkability although related to a spatial city structure which is able to be regenerated as a dense and effective network of 15-minute neighborhoods through tactical urbanism actions on existing open spaces and soft mobility policies, combined with long term strategies (infrastructure capacity and digital upgrading). It is a first methodological test which opens up the research towards a new inclusive concept of accessibility.

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Peer-review under responsibility of the scientific committee of the Living and Walking in Cities

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*Keywords:* 15-minute city; walkability; open space

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## 1. The 15-minute city: conceptual approach and interconnected themes

The 15-minute city is the contemporary synthesis of the renaissance “ideal city”, where the classical “human measure” has now been interpreted, far away from a geometrical perspective, in the framework of current health and environmental risks. “Time” is no longer the twin concept of “space”, the foundation of the 20th century relativism: this timeframe becomes a climate agent, a therapy of a regenerative urban medical science. It is a very innovative model indeed but rooted in history, able to answer to the primary deep demand of community and sense of place, of which the historic center is the icon. The walkability of the public realm is the core of the model. It is a design and management concept: to allow access to the urban life experience (essential facilities and services) in a timeframe of a quarter of an hour from home, by walking or cycling, as defined by Moreno (2020). The city is in fact both polyrhythmic (individuals have different daily life rhythms) and polychronic (how places are used varies according to various schedules); the proposal reconceptualization therefore shifts the lens from ‘urban planning’ to ‘urban life planning’.

Forward-looking global cities have presented similar plans last year inspired by this concept (Paris’ Ville du quart d’heure; Ottawa and Melbourne’s 15/20-minute neighborhoods; Milano 2020 Adaptation Strategy Plan) and political agendas have called for a “transition” which evokes an incremental, participatory process. It is a regeneration scenario, where the ecological perspective is combined with digital and energy innovative programs in the framework of a green and circular economy. The overall goal is the quality of the urban life, in terms of wellness, livability and community relations (see Moreno, 2021, Pozoukidou and Chatziyiannaki, 2021), resulting in an increased time available for personal creative freedom. This model offers an appealing image of the urban life as well as a city branding strategy.

### 1.1. A lockdown legacy

The shared focus on this model is due to the extraordinary fact that it was forced worldwide during Covid-19 lockdown measures, simultaneously and for many months. This experience allowed to put in evidence already existing trends and to integrate them towards the rediscovery of the urban fine-grain texture: soft and shared eco-mobility, hybrid uses, convenience stores, new office layouts with shared workstations, coworking spaces and innovative timetable alternating plans. The open space of public use became the vital place to continue enjoying a social life during the pandemic. The 15-minute model could provide the legacy for the post-Covid city, making treasure of the lesson learned during the pandemic crisis. Even the real estate concept of “location”, based on physical proximity to subway or train stations, is becoming obsolete in comparison with the availability of outdoor living spaces and individual soft mobility options. The lockdown also revealed that remote working and the flexibility of working spaces are essential conditions to fully accomplish this innovative model.

### 1.2. 15-minute model versus transit-oriented development

The 15-minute model emerges in parallel to the outbreak of the crisis of the transit-oriented development (TOD) paradigm, so far dominant in planning disciplines. Building volume densification around stations, suggested by the TOD approach in combination with land saving, now constitutes a health risk due to the clustering of people. But the transit network will continue to provide the backbone at the inter-neighborhood scale, connecting it to the city/region: this neighborhood is connected indeed, by mobility and digital infrastructures, at all scales; it is “glocal”, combining place identity and access to the global world.

Therefore, instead of maximizing density we should better optimize uses and services around transit stations: the metaphor of a “crystallization” process could well suggest the evolution of the neighborhood core, as indicated by

Scholl et al. (2018), inside a vision of a multiscale network of 15-minute urban districts. The remodeling of the TOD model, together with the reduced density of nodes, faces the strategic issue of increasing the network “capacity”, which is crucial in order to guarantee the health sustainability of the public transport system, supporting the pedestrian 15-minute city. To vary timetables and calendars for working, educational facilities and other services will release capacity for the public transportation system, cutting off the peak hours and providing a better lifestyle (as in the case of Zurich). In other words, we have to rethink the densification/verticalization in favor of network systems and territorial displacements, as indicated by Tira (2020), in the perspective of an innovative multi-center city and territory.

The planning question raised by the lockdown crisis about whether or not we should reconsider a light-city settlement paradigm, leads us towards hybrid solutions where urban density will find balance with individual soft mobility, innovative timetables programs and the upgrading of public transport capacity.

### *1.3. Regenerative masterplans*

The 15-minute idea, rooted in the neighborhood concept of the ‘60s organic planning, blooms on recent best practices related to the regeneration of dismissed areas. The ultimate evolution of the masterplanning experience leads to design vibrant communities, featured by sharing spaces/services and a net zero balance of all environmental components, eco-villages, as described by Fossa (2018). Internationally shared guidelines (C40 Reinventing Cities and LEED for Districts) converge towards a sensitive, site-specific, participatory, resilient urban design, as pointed out by Deponte, Fossa and Gorrini (2020). The results are mixed-use neighborhoods, designed in the planning framework of an urban regeneration process towards a hybrid and pedestrian city.

The priority is for the green walkability of the public realm and its experience.

### *1.4. The central role of walking*

The 15-minute city concept contests car dependency and long public transport commuting patterns by reprioritizing active mobility as the main mode of transport, whether on foot or by non-motorized personal mobility vehicles such as the bicycle. However, the path to achieve the 15-minute city is intricately tied to the potentials to deliver safe and comfortable walking environments. In other words, the concept is deeply intertwined with the project of walkability. Speck’s (2013) General Theory of Walkability focuses on the importance of making cities appealing to pedestrians and the main ways to achieve that. This involves an intricate dynamic of infrastructure development, enhanced network connectivity, high land-use mix, vitality and distinction of urban character. Overall, walkability assessment criteria range from usefulness and safety to comfort and attractiveness. Road safety is a particularly pressing topic in today’s hyper-mobile urban reality. Pedestrians are some of the most vulnerable road users in urban scenarios, making up 26% of all victims along with cyclists and more than half of all road traffic deaths when grouped with motorcyclists as well (World Health Organization, 2018). The European Union Vision Zero project aspires to zero road fatalities in the region by 2050 (European Commission, 2020). In addition to road safety, the advantages of higher walkability have been linked to improvements in environmental sustainability, economic development, public health and community resilience.

In Milan, a global study on sidewalk conditions across the city was carried out by Systematica as a first attempt to evaluate the level of safety and comfort of the city’s walking infrastructure. The output of this study is an interactive open-access sidewalk map documenting sidewalk width across the city (Systematica, 2020). The analysis revealed that 45% of the city’s sidewalks by length are less than 2.4 meters in width - the recommended minimum for sufficient two-person movement, according to guidelines by GDCI&NACTO (2016).

## **2. Preliminary assessments for the city of Milan**

This section focuses on the practical case study applied to the city of Milan, which is developed as an attempt to study the potential of Milan to become a 15-minute city with sufficiently walkable neighborhoods and investigate the relationship between neighborhood walkability and population distribution as a way to gauge distributional inequalities between levels of walkability across the city.

## 2.1. Methodology of the study

This study is organized on 3 levels of analysis: (i) mapping resident population and the density of workers/employees at their place of work (workplace density) in Milan to offer a first reading of the mobility character of its various districts (i.e. which areas generate more trips and which areas attract more users on a daily basis); (ii) mapping basic daily services to understand which areas are better served in terms of static proximity of daily services (density and variety), and (iii) a compound walkability analysis using the patented Walk Score metric to offer a more holistic reading of walkability including the factor of travel time to give a dynamic understanding of walkable areas within the 15-minute timeframe. Factors considered include the proximity of services, population density and road network characteristics, such as block length and intersections density.

The first layer of analysis (i) aims to evaluate the density of the resident population and workplace population across Milan in relation to the pedestrian accessibility levels ensured by the morphology of the urban fabric. The main result is therefore mapped as a “cumulative” value in the sense that it represents not only the resident or workplace population present in each cell, but also includes those who are able to reach this cell in a given timeframe (i.e. 5, 10 and 15 minutes). As a result, this first level of analysis provides a clear idea of the characteristic tendencies of different zones across the city and, as a result, the predominant pattern of pedestrian mobility generated.

In (ii), the service proximity analysis is a pure compresence analysis based on distance buffers, showing areas where residents can reach on foot at least 7 out of 9 predefined macro-categories of services identified as crucial services supporting daily life activities of residents and contributing to a balanced lifestyle. These 9 service categories are: food/grocery stores, commercial stores (including clothes shops, electronics shops, etc.), cultural venues, educational facilities, parks and green spaces, restaurants, health facilities, sports facilities and other (post offices, banks, etc.). The choice of the macro-categories based on a reinterpretation of the Parisian approach as defined in the ‘Ville du quart d’heure’ plan, which looks at services related to a number of key life activities (Paris En Commun, 2020). Here, the list follows a spatial structure (categorized by land-use functions as opposed to activities), and it is adapted to the open data provided for Milan. Each of these macro-groups was further detailed into a list of services based on corresponding fields in the open-source datasets. A GIS-based analysis of the static compresence of these services was then performed based on a pure isometric analysis with respect to 3 walking buffers: 300, 600 and 900 meters.

The Walk Score mapping (iii) is a more holistic and comprehensive metric as it includes the variable of travel time to measure the actual accessibility levels through isochronal analysis. It is based on the analysis of accessibility to each macro-category in 15 minutes calculated on a graph with the cost of the links based on travel time and inversely proportional to the slope of the road. The results of the 9 pedestrian accessibility analyses were then reported as indicators of accessibility to each macro-category on a grid of 150 meters. These separate values were added up to obtain the final value of the Walk Score.

Data used in all studies are gathered from the open portal of the Municipality of Milan and other open-source datasets. For the analysis in (i), the spatial unit is the institutional census sections defined by the Italian statistical office (ISTAT). For the analyses of (ii) and (iii), the spatial unit used is the NIL (Local Identity Nuclei as institutionally defined by the Milano City Plan for spatial planning of public interest facilities) modelled in a spatial grid of 150 m space unit.

## 2.2. Main results: testing a population-based approach

By mapping and interpreting the above-mentioned analyses, the following series of maps demonstrate a thought experiment to conceptualize the chrono-centered mobility concept. The maps offer an alternative approach to chrono-centric mapping based on population density as opposed to service density, highlighting distributional differences at different time scales and, as a result, the specific main urban character of each district. This conceptual analysis demonstrates how isochrones change shape and intensity depending on the given timeframe. It is evident how micro-clusters of local centralities emerge from the 5-minute map, and the distinguished shape of Milan's second ring-road where the highest concentration of the resident population is located, emerges at the 15-minute scale.

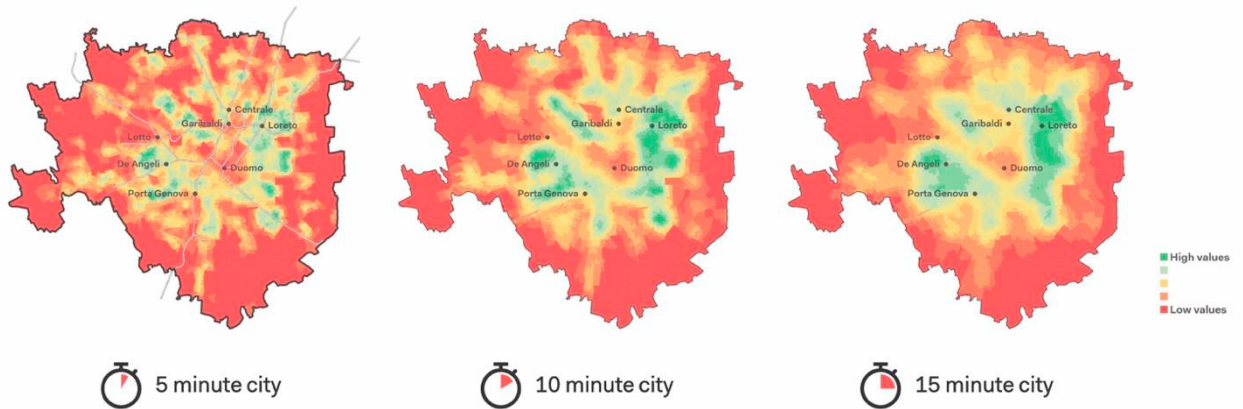


Fig. 1 Pedestrian access of the Milanese population to different census sections of the city in 5/10/15 minutes

A similar interpretation can be drawn from the distribution of the workplace population. The maps show a more balanced allocation in the 5-minute accessibility analysis, with a gradual solidifying of the central districts as the main cluster as the radius increases. The main centers at 15 minutes are the Duomo district followed by secondary concentrations in the north-east districts of Loreto, Centrale and Porta Garibaldi (figure 2). Areas left out of both clustering scenarios (resident population and workplace population) are peripheral neighborhoods or agricultural non-built areas, such as those occupying the southern portion of the municipality.

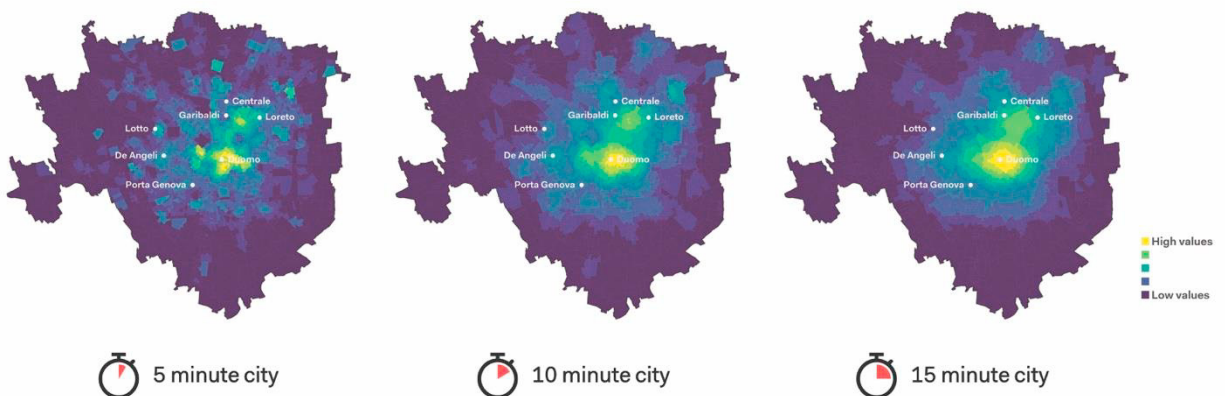


Fig. 2 Pedestrian access of the working population to different census sections of the city in 5/10/15 minutes

Analysing the location of services with an analogous pedestrian & NIL accessibility principle allows a cross-sectional reading of the city that includes both a population-based view and a service-oriented view can yield

additional insights into the efficacy of the urban structure in meeting population demands. The proposed service-compreence accessibility analysis highlights the need for service diversity in a walkable distance by measuring the number of different categories accessible in a 5, 10 or 15-minute range. This offers a first diagnostic reading of the city and the services available, serving as a preliminary evaluation of service accessibility and density. It is possible to appreciate that despite the high number of people within 15 minutes reach of the districts of De Angeli, Lotto and Porta Genova, some pockets lack the accessibility to at least 7 of the core service categories. Central areas of Milan predominantly outnumber peripheral areas in terms of density and variety of essential services offering. Further segmentation shows that most of these well-performing areas actually function as 5-minute and 10-minute centers; whereas the majority of the remainder of the city exceeds the 15-minute limit.

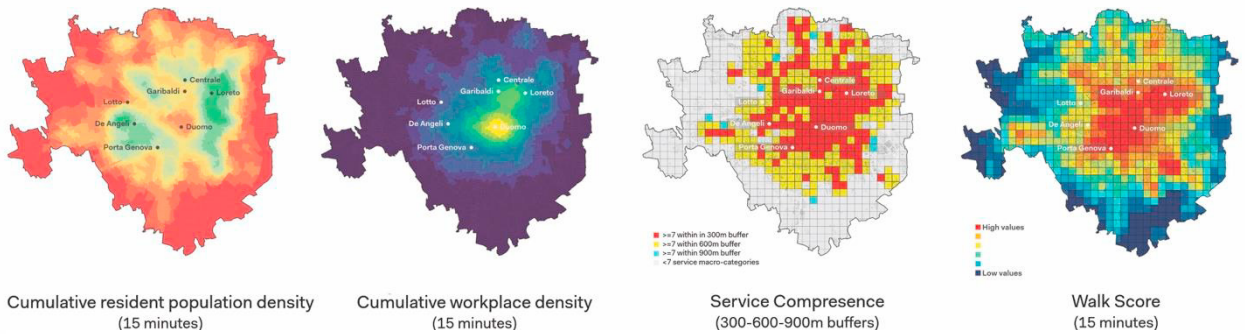


Fig. 3 Different analytical components of the 15-minute city model

The Walk Score analysis set at a 15-minute radius confirms the static findings of the service compreence map while also highlighting additional lower scoring areas in the north of Milan that, despite adequate service density, may be less walkable due to a lack of support of the urban structure for comfortable and efficient walking trips (figure 3).

A transversal neighborhood-based walkability analysis based on Walk Score conditions shows a striking correlation between nearness of a NIL neighborhood to the city center and high walkability levels (figure 4). This correlation does not translate, however, to population distribution trends. As shown in the chart below, apart from a few spikes in the number of people in close reach of well-performing and walkable districts such as Duomo and Porta Garibaldi-Porta Nuova, there is no clear trend in population distribution amongst the remaining neighborhoods. In fact, many neighborhoods with high population accessibility have low walkability scores such as Gorla, Cimiano and

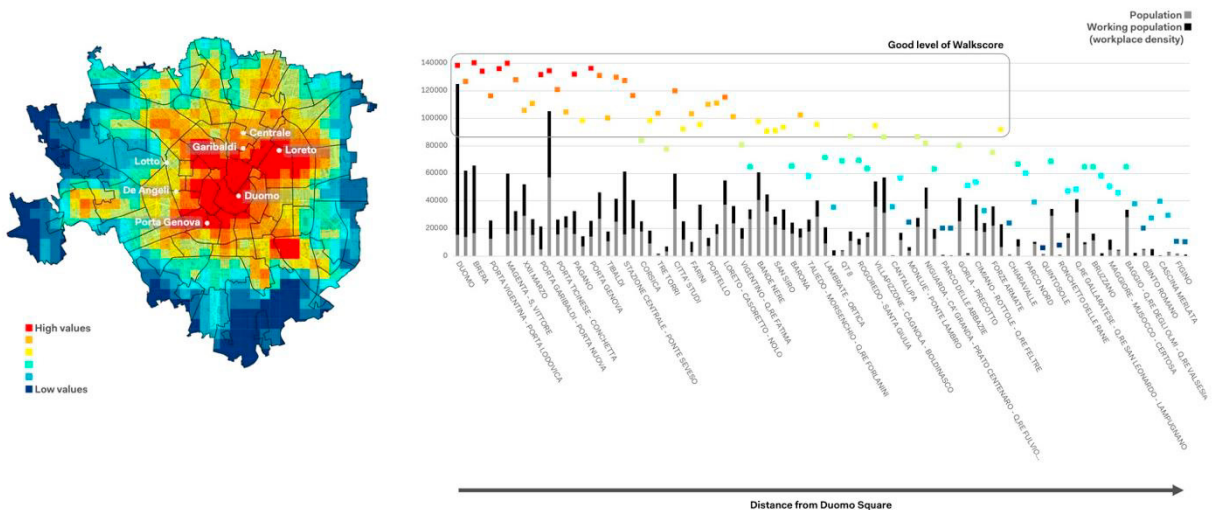


Fig. 4 Walk Score and 15-minute population accessibility by NIL neighborhoods

Gallaratese. These neighborhoods have high attraction potential but low pedestrian access to services. It is in these low-functioning yet populous areas that intervention is needed most in order to advance an egalitarian level of access to daily amenities on foot across the city.

### *2.3. Bridging the gap: micro-mobility and on-demand services to support the 15-minute city*

The 15-minute city idea is a radical one in its foundations. In essence, it requires a transformation of the urban structure to ensure adequate pedestrian accessibility to everyday life amenities in every part of the city. At the moment, only half of Milan enjoys that right, and, as indicated in the previous maps, it emerges that in a large number of semi-central/peripheral densely populated urban districts, a reasonable level of essential services offering (in terms of density and variety) is not coupled by adequate pedestrian accessibility levels. A practical short-to-medium-term solution to support the main objectives of the model (an equitable, viable and livable urban system) could be to boost first-and-last-mile energy-efficient mobility solutions to extend accessibility ranges while cutting time costs. Micro-mobility and on-demand services can be designed to satisfy different user group needs while maintaining the sustainable mobility approach and equitable transport access narrative of the 15-minute city concept.

Global trends show that shared and private micro-mobility devices contribute to intermodal transport and have a significant role in reducing the first-and-last-mile gap (Heineke et al., 2019). Studies also show that micro-mobility vehicles are short-range vehicles; generally used for trips under 5 kilometers and under 20 minutes of trip time (Boglietti et al, 2021; Zagorskas & Burinskienė, 2020). Surveys from the cities of Paris and Brussels show that 23% and 46% of scooter trips, respectively were part of multi-modal trips in 2019, often replacing walking trips and complimenting public transport (6t-bureau de recherche, 2019; SPRB – Bruxelles Mobilité, 2019). There is also a great tendency for trips made using micro-mobility devices to take place near urban centers (such as downtown and university zones/campuses), where land-use diversity and access to multimodal transit are higher (Boglietti et al., 2021). Extending micro-mobility services to peripheral areas with low population densities (and therefore low fleet distribution efficiency) remains a challenge for providers and the cities that regulate them. Issues of safety associated with these new travel modes are also a challenge (ibid.). With respect to the Milanese context, a first attempt to trace e-scooter injury locations across the city and investigate possible correlations between the density of e-scooter accidents and different spatial attributes has the potential to progress knowledge about the spatiality of micro-mobility safety, which could guide future mobility strategies (Transform Transport, 2021).

## **3. Discussion and Final Remarks**

This research highlights the importance of investing in walkability in cities. It progresses the view that 15-minute cities can only work if cities are not only efficient but are also designed to encourage more walking activity.

The walkability mapping analysis shows that Milan's human-scale spatial structure has the potential to become a 15-minute city, should distributional differences be addressed in recognition of potential pedestrian footfall of each neighbourhood based on cumulative population access. The 3-step analysis methodology offers a multi-perspective reading of the situation: by considering both demand-side factors (resident population and workplace population access) and supply-side factors (service proximity and neighbourhood walkability within 15-minutes), the combined series of maps captures not only the current state of the city, but the potential to extend its reach based on its intrinsic morphological capacity to attract daily users (i.e. residents and workers).

This assessment highlights walking infrastructure shortages could be overcome by broadening the perspective of the public realm as a whole and adopting a holistic approach of the walkable urban living model: short term flexible interventions on existing open spaces (such as sidewalk redesign and new low-speed mix of mobility) and micro-mobility policies combined with infrastructure capacity and digital upgrading. Tactical urbanism is integrated inside a vision which is supported by long-term strategies.

Inspired by - but not restricted to - the mobility sector, the public realm could be designed or re-designed in a way to fully deploy its resiliency: roads could become open spaces of general public use, where pedestrians coexist with outdoor cafés and various modes of slow-eco mobility. Roads resiliency could be enhanced by promoting the variety of micro-mobility means, their compatibility and complementarity in a hyper-low speed realm, a mixed-mobility and shared streets. Curbs defining sidewalks and bike lanes should be definitely avoided in 15-minute urban

neighborhoods. This reshaping of the road space is a revolution long required by “design for all” urban design criteria, especially in the current ageing population scenario.

A shift in the mindset of urban planners is forthcoming: focusing on walkability in cities, mobility and green infrastructure networks, traditionally separated, will be conceived as one system of open public spaces. An innovative, resilient system which should of course be “smart” and supported by Big Data, allowing real time reactions to unforeseen events, includes a new understanding and management of socio-spatial relationships and acknowledges the role of digital infrastructure in substituting physical trips to specific services (through various e-services). The changing nature of work today may have lasting effects on home-work trips with the fast development of home-based working systems, high tech co-working spaces and wireless technologies of digital accessibility. To consider the growth of zero-minute trips inside the 15-minute cities offers synergistic potentials of achieving equitable and sustainable urban living models through integrated planning of physical and digital urban systems. Ultimately, the proximity concept deployed in the 15-minute neighborhood model involves a new concept of accessibility: a hybrid, inclusive, multitask accessibility which prioritizes the issue of integrating urban density with transport capacity, alternating timetables and coworking hubs.

## Acknowledgements

The authors would like to thank Dante Presicce and Federico Messa for their contributions in developing the analysis for the practical exercise presented herein of the multi-dimensional 15-minute city assessment for Milan. Although this paper has to be considered a result of the common work of the authors, G. Fossa took primary responsibility for Section 1 while D. Deponte and L. Abdelfattah took primary responsibility for Section 2 and all three authors shared the conclusions in Section 3.

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