

TeMA

Journal of
Land Use, Mobility and Environment

The three issues of the 12th volume will think again about the debate on the definition and implementation of methods, tools and best practices connected to the evolution of the main scientific topics examined in depth in previous TeMA Journal volumes.

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).



THE TIMES THEY ARE A-CHANGIN'

Vol.12 n.2 Agust 2019

print ISSN 1970-9889 e-ISSN 1970-9870
University of Naples Federico II

TeMA

Journal of
Land Use, Mobility and Environment

THE TIMES THEY ARE A-CHANGIN’

2 (2019)

Published by

Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realized by CAB - Center for Libraries at "Federico II" University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | on line ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence

Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples
web: www.tema.unina.it
e-mail: redazione.tema@unina.it

The cover image is a photo processing of an original picture by SeanPavonePhoto, iStock

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.

The Italian *National Agency for the Evaluation of Universities and Research Institutes* (ANVUR) classified TeMA as scientific journal in the Area 08. TeMA has also received the *Sparc Europe Seal for Open Access Journals* released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe) and the *Directory of Open Access Journals* (DOAJ). TeMA is published under a Creative Commons Attribution 3.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

EDITOR IN-CHIEF

Rocco Papa, University of Naples Federico II, Italy

EDITORIAL ADVISORY BOARD

Mir Ali, University of Illinois, USA
Luca Bertolini, University of Amsterdam, Netherlands
Luuk Boelens, Ghent University, Belgium
Dino Borri, Polytechnic University of Bari, Italy
Enrique Calderon, Polytechnic University of Madrid, Spain
Roberto Camagni, Polytechnic University of Milan, Italy
Derrick De Kerckhove, University of Toronto, Canada
Mark Deakin, Edinburgh Napier University, Scotland
Aharon Kellerman, University of Haifa, Israel
Nicos Komninos, Aristotle University of Thessaloniki, Greece
David Matthew Levinson, University of Minnesota, USA
Paolo Malanima, Magna Græcia University of Catanzaro, Italy
Agostino Nuzzolo, Tor Vergata University of Rome, Italy
Rocco Papa, University of Naples Federico II, Italy
Serge Salat, Urban Morphology and Complex Systems Institute, France
Mattheos Santamouris, National Kapodistrian University of Athens, Greece
Ali Soltani, Shiraz University, Iran

ASSOCIATE EDITORS

Rosaria Battarra, National Research Council, Institute of Mediterranean studies, Italy
Gerardo Carpentieri, University of Naples Federico II, Italy
Luigi dell'Olio, University of Cantabria, Spain
Isidoro Fasolino, University of Salerno, Italy
Romano Fistola, University of Sannio, Italy
Carmela Gargiulo, University of Naples Federico II, Italy
Thomas Hartmann, Utrecht University, Netherlands
Markus Hesse, University of Luxemburg, Luxemburg
Seda Kundak, Technical University of Istanbul, Turkey
Rosa Anna La Rocca, University of Naples Federico II, Italy
Houshmand Ebrahimpour Masoumi, Technical University of Berlin, Germany
Giuseppe Mazzeo, National Research Council, Institute of Mediterranean studies, Italy
Nicola Morelli, Aalborg University, Denmark
Enrica Papa, University of Westminster, United Kingdom
Dorina Pojani, University of Queensland, Australia
Floriana Zucaro, University of Naples Federico II, Italy

EDITORIAL STAFF

Gennaro Angiello, Ph.D. at University of Naples Federico II, Italy
Stefano Franco, Ph.D. student at Luiss University Rome, Italy
Federica Gaglione, Ph.D. student at University of Naples Federico II, Italy
Carmen Guida, Ph.D. student at University of Naples Federico II, Italy
Rosa Morosini, Ph.D. student at University of Naples Federico II, Italy
Andrea Tulisi, Ph.D. at Second University of Naples, Italy

TeMA

Journal of
Land Use, Mobility and Environment

THE TIMES THEY ARE A-CHANGIN'

2 (2019)

Contents

123 EDITORIAL PREFACE
Corrado Zoppi

FOCUS

127 **Ecosystem services-based impact assessment for low carbon transition processes**
A. Pilogallo, L. Saganeiti, F. Scorza, B. Murgante

139 **Implementing the environmental dimension of the EU's urban agenda 2014-2020. The strategy for sustainable development in the medium-sized cities of Western Sicily**
I. Vinci, F. Cutaia

LAND USE, MOBILITY AND ENVIRONMENT

147 **Mobility: exploratory analysis for territorial preferences**
A.G.T. Santos, A.C.M. Moura

157 **Sport and the city, between urban regeneration and sustainable development**
M. Ladu, G. Balletto, G. Borruso

165 **Land Suitability Assessment of Green Infrastructure Development**
E. Ustaoglu, A.C. Aydinoglu

179 **The prominent values of the Mustapha Pacha hospital of Algiers at different scales**
N. Ghida, K. Boussora, C. Atzeni

191 **Walkability and urban design in a post-earthquake city**
D. Di Ludovico, P. Rizzi

197 **REVIEW PAGES**
Gennaro Angiello, Federica Gaglione, Carmen Guida,
Rosa Morosini, Andrea Tulisi

TeMA

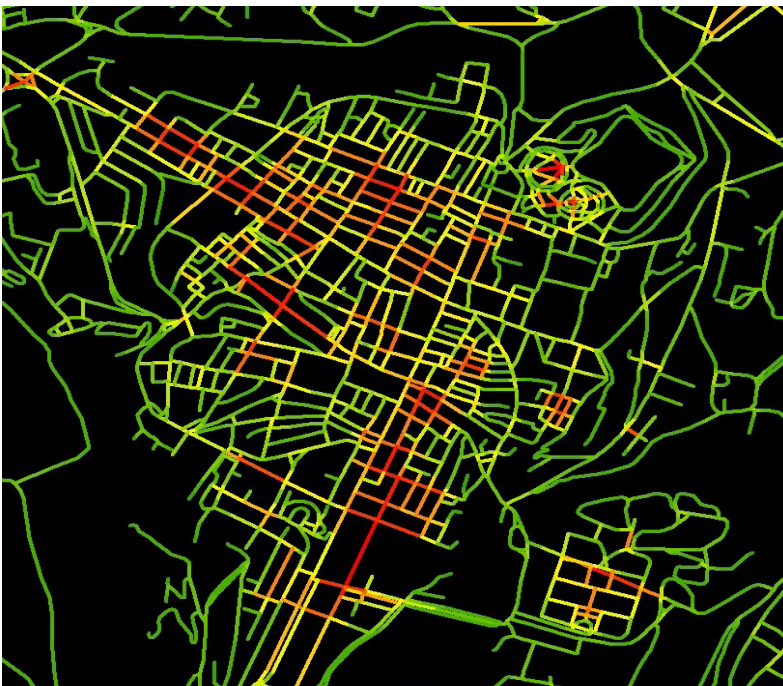
Journal of
Land Use, Mobility and Environment

TeMA 2 (2019) 189-196
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/6126

review paper received 2nd June 2019, accepted 23th July 2019
Licensed under the Creative Commons Attribution - 4.0 International License
www.tema.unina.it

How to cite item in APA format:

Di Ludovico, D. & Rizzi, P. (2019) Walkability and urban design in a post-earthquake city. *Tema. Journal of Land Use, Mobility and Environment*, 12(2), 189-196. doi: <http://dx.doi.org/10.6092/1970-9870/6126>



WALKABILITY AND URBAN DESIGN IN A POST-EARTHQUAKE CITY

Donato Di Ludovico^a, Palola Rizzi^b

^{ab} Department of Civil, Construction-Architectural
and Environmental Engineering
University of L'Aquila
e-mail: donato.diludovico@univaq.it; paola.rizzi@univaq.it
URL: <http://diceaa.univaq.it/>

^a ORCID: <https://orcid.org/0000-0002-4650-4808>

ABSTRACT

The research described in this article concerns the issue of accessibility with a focus on the walkability in a city that is under reconstruction, such as the city of L'Aquila struck by a destructive earthquake in 2009. The reconstruction is determining a new urban layout in which there is a chaotic overlap of flows of the movements of vehicles and people, quite exceptional with respect to the configuration of an ordinary city. For example, the flows of heavy vehicles and work machines, linked to building reconstruction, and which also generate strong noise pollution and therefore a new soundscape, increase considerably. It is a city in which the return to the residences mixes with large building sites, in which urban transformations are very fast and must be governed through appropriate urban design instruments.

The main aim of this research is to define a strategy to realize a method able to calculate at the same time an overlapping indexes in order to classify streets according to how friendly they are for the pedestrian and bike. This theme is approached to a methodological level and is related to the interacting theme of urban design and new centralities. The tool used for this integration is the Strategic Urban Project, which the research experience has found to be more effective and with greater performance than the more traditional Land Use Planning. The design approach and methodology is to integrate urban design techniques with spatial planning techniques, in order to obtain a higher performance of pedestrian networks.

KEYWORDS:

Walkability; Urban Design; Spatial Planning; Transport

TeMA

有关土地使用、交通和环境的杂志

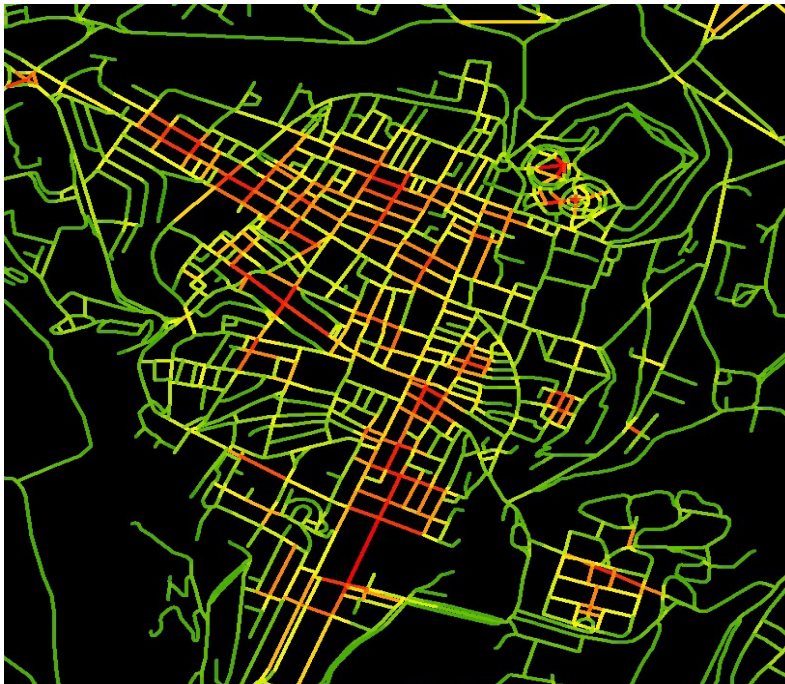
TeMA 2 (2019) 189-196
print ISSN 1970-9889, e- ISSN 1970-9870
DOI: 10.6092/1970-9870/6126

review paper received 2nd June 2019, accepted 25th July 2019

Licensed under the Creative Commons Attribution - 4.0 International License
www.tema.unina.it

How to cite item in APA format:

Di Ludovico, D. & Rizzi, P. (2019) Walkability and urban design in a post-earthquake city. *Tema. Journal of Land Use, Mobility and Environment*, 12(2), 189-196. doi: <http://dx.doi.org/10.6092/1970-9870/6126>



地震灾后城市的步行适宜性和市区设计

Donato Di Ludovico^a, Palola Rizzi^b

^{ab} Department of Civil, Construction-Architectural
and Environmental Engineering
University of L'Aquila
e-mail: donato.diludovico@univaq.it; paola.rizzi@univaq.it
URL: <http://diceaa.univaq.it/>

^a ORCID: <https://orcid.org/0000-0002-4650-4808>

摘要

本文所述的研究主要是关于通达性的问题，其重点在于城市在重建过程中的步行适合程度，例如2009年遭受地震严重破坏的拉奎拉市。重建工作决定了城市的新布局——其中存在人流与车流重叠存在的混乱状况，这与正常城市的情形截然不同。例如，由于房屋重建的需要，重型车辆和工程机械的车流会大幅度增加，并且也会产生巨大的噪音污染和不同以往的声音环境。在居住区域重建与大型建筑工地相互混杂的城市中，其城市化带来的转变非常迅速，必须通过适当的城市设计措施进行管控。

本研究的主要目的是制定一种策略，以确立某种方式来计算某个期间的重叠索引，根据街道对于行人和自行车的便捷程度对其分类。我们从方法学的角度来处理这一主题，并将其与城市设计和重建后集中度的相互作用关联起来。这项整合工作所使用的工具为战略性城市项目法。研究经验证明，该方法比传统的土地使用规划法具有更高的效率和成效。采用的设计方式和方法，是将城市设计技术与空间规划技术相结合，以实现效果更佳的步行网络。

关键词:

步行适宜度；城市设计；空间规划；交通

1 INTRODUCTION

This article describes the basics of a research in its preliminary stages, It concerns the project and the performance of the walkable and cycling-walkable networks of a city characterized by an exacerbated polycentrism (Espon, 2005), like the city of L'Aquila which is going through a strong urban, social and economic transformation due to the 2009 post-earthquake reconstruction process which is still in progress. This accelerated process is taking place without a real government of transformations, without the idea of the city in the future, without a vision, all also without an assessment of the sustainability and performance of the reconstruction. The research is grafted onto this situation, in which L'Aquila is a paradigmatic case, But this condition also concerns other Italian cities where the level of physical and social fragmentation is very high. In this specific field the scientific literature focuses more on the themes of physical and economic reconstruction than social reconstruction and the issues of accessibility (Bono & Gutiérrez, 2011), sustainable mobility and in particular on walkability. Our study, which draws its origins from a more extensive research on the transformations of infrastructure and mobility in cities hit by natural and anthropic disasters (D'Ascanio, Di Ludovico & Di Lodovico, 2016; D'Ovidio, Di Ludovico & La Rocca, 2016; Di Ludovico & D'Ovidio, 2017), focuses on this last topic, walkability, tracing a model of city development that considers urban fragments as new urban centralities, innervated by a railway axis that operates as a subway serving these new centrality. In every centrality corresponds in the general vision of development. A Strategic Urban Project (Albrechts, 2006) is a large scale urban project (Di Ludovico & Properzi, 2012; Di Ludovico, 2017;) which is characterized by a high level of urban innovation, also in application of the principles of Smart city (Di Ludovico, Properzi & Graziosi, 2014; Di Ludovico & Properzi, 2018). It's a Plan design according with a concept of mobility model that favors sustainable public transport and discourages private (today predominant) and which prefers, within these new centralities, walkable and cycling-walkable movement. Section 2 describes the initial conditions of the post-earthquake city, an extremely fragmented city and its fragments develop along a linear infrastructural bundle about 14 km long. Section 3 briefly describes the general idea of sustainable development of the city in terms of spatial planning. Finally, the third section deals with the methodology for designing and assessment the performance of the walkable and cycling/walkable network. The conclusions essentially trace the future developments of the research.

2 L'AQUILA FRAGMENTED CITY

The 2009 earthquake has hit an economic system largely in crisis. Overall, the economy of the L'Aquila area before the earthquake was already declining substantially, with a fall in per capita and industrial value, a decrease in employee productivity and a weak performance of services before the earthquake (Cresa, 2011). After the 2009 earthquake, this crisis was accompanied by a first population decline followed by a fluctuation and in recent years by a stabilization of about 69,000 inhabitants. Because of this we must add a decrease in the number of university students, around 25,000 just after the earthquake, and today around 19,000, are based in L'Aquila. Around 12,000 of them are from off-site. The result of the first step in the emergency phase of recovery from the disaster is a large area which include the city where 19 new settlements have been built. They are the CASE projects (CASE is acronym for Sustainable and Environmentally Friendly Anti-seismic Complexes), erroneously called New Town, of 4,500 dwellings and 15,000 inhabitants. CASE was realized without a spatial planning strategy, without taking into account urban planning and territorial rebalancing, resulting in a substantial increase in settlement dispersion and unplanned land consumption (+ 6.7%). This situation is worsen by a sprawl in the agricultural pattern where more than 1,500 prefab houses in wood were built. The post-earthquake dispersion has also affected the commercial system, which has moved to the periphery of the city and has a changed shape. In fact, the small commercial network had characterized the city before the earthquake, after it was concentrated in some abandoned factories in the industrial areas, on the periphery of the city, thus composing a sprawl pattern of small "shopping malls" that did not exist before

the earthquake. All this has exacerbated the polycentrism of the city, results in a very high number of secondary poles composed of hamlets, of which one with 5,000 inhabitants, of 19 CASE projects, of industrial agglomerations that today are mainly commercial and directional (Fig. 1). This phenomenon is now accompanied by a strong propensity for urban innovation, with the tendency to apply the principles of smart city and smart growth to reconstruction (Duany, Speck & Lydon, 2010) and a model of sustainable mobility and urban transformation oriented to the needs deriving from contemporary social models (Touraine, 2010).



Fig. 1 L'Aquila, Urban centralities before and after the 2009 earthquake

3 RECONNECT THE URBAN FRAGMENTS

The redevelopment of a particular urban system, such as that of L'Aquila struck by the earthquake, has as its main strategy the "reconnection" of urban fragments derived from post-earthquake disintegration. The goal is to connect the fragments together through the development of sustainable urban networks, maintaining the polycentric post-earthquake urban structure, thus avoiding the environmental costs that would be necessary to recompose a city that already had clear signs of dispersion before the earthquake as well as obvious problems on the topic of urban mobility. The "reconnection" urban project is based on the following elements: the presence of urban fragments, that is urban parts without a coherent structure, isolated, which no longer have an efficient system of services and facilities and which are not effectively connected to the infrastructural network; the presence of an inefficient mobility system, with high transport costs, and an almost unused valley railway; the possibility of structuring efficient and integrated urban networks, both of an environmental nature and of an infrastructural material nature (mobility) and intangible nature (digital).

3.1 THE PROPOSED URBAN DEVELOPMENT MODEL

As can be seen in Fig. 2, the idea is to connect the fragments (urban parts, including the historic center) through the railroad that must be transformed into a metro with high-frequency trains. From the stations of this metro, feeder lines are connected that distribute the residents to the fragments that are generally residential settlements of about 1,000-2,000 inhabitants. Thus, many urban parts that are now isolated and incomplete with services and facilities are connected to the metro. The goal is to structure a Strategic Urban Project (Albrechts, 2006) for each of them that transforms these parts into self-sufficient urban nuclei pursuing the principles of sustainable development and smart growth. Looking for an analogy in the scientific literature, this development model can be related to Transit Oriented Development (TOD), developed in the 1990s in relation to sustainable mobility policy (Barton, 1998; Calthorpe, 1993), which is applied to parts of the city, centered on "transit stops" (such as metro stations), which are re-planned as mixed-use places, with specific urban densities and a high quality and easily accessible cycling-walkable network (Vale, 2015). However, the goal is not only the physical and spatial re-planning of the part but also the construction of a new system of social relations that makes the same urban part more livable, in which the local community also plays a major role (Dittmar & Poticha, 2004). In our model all these factors are fundamental, but there are some innovations.

First of all, the development area is not a district of the city but are settlement systems belonging to a polycentric structure, thus, they are fragments. Moreover, the transit stop, that is the connective node, is not only the station but also the distribution feeder line. Finally, sustainability is not achieved only by facilitating Walkability or Cyclability as much as possible but also by facilitating the use of zero-emission public transport. In the Strategic Urban Projects, which re-design the fragments to develop new small polycentric urban centralities, we pursue the following objectives: complete or implement the system of basic public services and facilities to make the centrality self-sufficient; improve accessibility and bring it back to a limit distance of 300 m, also applying innovative principles of urban densification (Jenks, Burton & Williams, 2005); improve the urban safety of centrality, both in physical terms and in social terms; innovate urban systems through the application of new Smart technologies also aimed at contrasting and mitigating the effects of climate change; supporting network development, that is centering the development on the network paradigm, integrating urban environmental networks (green infrastructure (EC, 2013)), sustainable infrastructural networks (also digital), networks of urban (and social) spaces.

These objectives must also be pursued through the construction of a system for assessing the social, economic and environmental performance of Strategic Urban Projects, an assessment that is considered essential to achieve an optimal design solution but above all to verify the performance of the projects ex-post. The next section describes, in the context of new centralities, the methodology for the evaluation of existing road infrastructure systems to be the site of safe cycling and walkable networks.

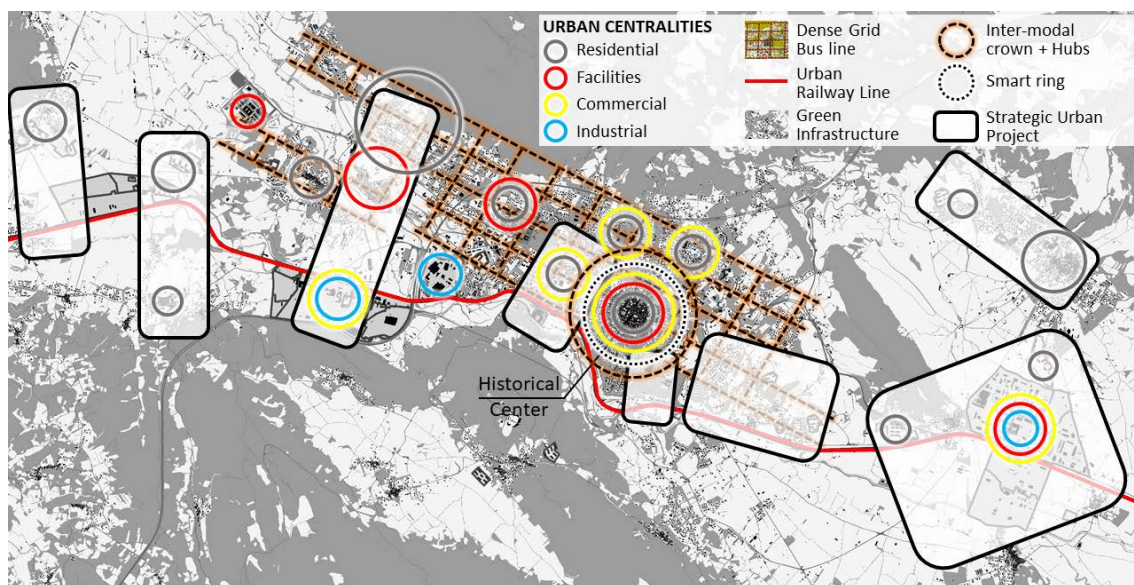


Fig. 2 L'Aquila, the Strategic Urban Projects

4 SECURE AND SAFE WALKABLE NETWORKS: THE ASSESSMENT METHODOLOGY

In our research, the road network (De Vico, Di Ludovico & Colagrande, 2014) is integrated with the other networks that refer to the concept of smart growth and resilience (Fekete & Fiedrich, 2018) such as green infrastructure (EC, 2013) and the system of public spaces together with the theme of urban security (Brand & Nicholson, 2016). These three networks (Transport, Green and Public Spaces) are integrated by a fourth the digital network, which is now rapidly developing in L'Aquila as application of the principles of the Smart city. A particular class of network, inside the mobility system, is the walkable or cycling-walkable network. In relation to urban physical characteristics and national legislation, for safety this network should have the minimum of intersections with roads and meet the following criteria oriented to accessibility and safety: sufficient road width to create a bicycle lane with a minimum width of 1.50 m in one direction or 2.50 m in two directions. This criterion concerns only Cyclability; sidewalk width sufficient to create a walkable lane with

a minimum width of 1.00 m in one direction or 2.00 m in two directions. This criterion concerns the Walkability. Also integrating Cyclability. These widths are increased by the quantities in the previous point; maximum index of alignment of the facades of buildings facing the road (absence of indentations); longitudinal slope less than 5%; horizontal curvature radii greater than 3.00 m; distance from the primary public services (collective services, public spaces, etc.), public facilities, from the feeder line and from the metro station less than 300m. Our research is based on the development of a GIS application able to automatically evaluate the aforementioned criteria, divided by Walkability (W), Ciclabilità (C) and Walkability + Ciclabilità (W + C), based on an urban analysis founded on geographical coverages that describes the settlement with vector primitives derived from the Regional Map on a scale of 1: 5.000. The expected result are maps in which the road axes are associated with summary indicators of suitability and performance, such as: I_W , I_C and $I_{W\&C}$. These indicators will make it possible to define the design lines for the Walkability of parts of the city, and to determine which parts of the infrastructural network can be dedicated exclusively to walkable traffic, eliminating private vehicular traffic. The aims are focused to define the abovementioned mathematical indexes to be used for evaluating new urban designs and strategies on turning cities into more walkable friendly places, considering also soft modes of transportation that are regarded as beneficial both in environmental and social in terms. This methodology seems to be promising but there are still several issues to be solved in order to achieve overarching and superimposable I_W , I_C e $I_{W\&C}$ indexes. The calibration process need to be elaborated by taking into account the overlapping of the three indexes at sametime.

5 CONCLUSION

The work presented in this research concerns a more focused and deeper aspect of a wider research on the transformations of cities hit by disasters of natural and anthropic origin. The general theme is the physical and social "reconnection" of fragmented cities due to a strong shock through Urban Design tools, within which the work group is developing the specific theme of Walkability, whose research is presented in this paper in the form of methodological assumptions. The scientific studies on the reconstruction of L'Aquila are demonstrating the need to intervene on the city with effective and rapid Strategic Urban Projects of large urban parts in the context of a long-term Vision. The Projects are presented in these studies as actions to build new communities and new urban centralities in this, to apply the principles of Smart City and Smart Growth as well as Sustainable Development. In this sense a sub-theme selected was that of mobility within which we are developing Walkability also in terms of performance. The expected result is that of progressively reducing private vehicular mobility in favor of zero-emission public mobility and in favor of pedestrianization, within large urban parts in a certain sense disintegrated and today undergoing strong uncontrolled transformation, without government. The design and assessment model of the proposed Walkability, in the future can be further characterized to support performance even in critical conditions (not in safety), such as those that occur after an earthquake or another catastrophe. In this case the criteria (4) must be further investigated and can also be linked to real-time assessment supported by measurements made with a sensor network or with drones.

REFERENCES

- Albrechts, L., (2006). Bridge the Gap: From Spatial Planning to Strategic Projects. *European Planning Studies*, 14:10, 1487-1500. Doi: <https://doi.org/10.1080/09654310600852464>.
- Barton, H., (1998). Eco-neighbourhoods: a review of projects. *Local Environment*, 3, 159-177. Doi: <https://doi.org/10.1080/13549839808725555>.
- Brand, D. and Nicholson, H. (2016). Public space and recovery: learning from post-earthquake Christchurch. *Journal of Urban Design*. 21:2, 159-176. Doi: <https://doi.org/10.1080/13574809.2015.1133231>.

Bono, F. and Gutiérrez, E., (2011). A network-based analysis of the impact of structural damage on urban accessibility following a disaster: the case of the seismically damaged Port Au Prince and Carrefour urban road networks. *Journal of Transport Geography*, 19, 1443–1455. Doi: <https://doi.org/doi:10.1016/j.jtrangeo.2011.08.002>.

Calthorpe, P., (1993). *The Next American Metropolis: Ecology, Community and the American Dream*. Princeton Architectural Press, New York.

Cresa, (2011). I caratteri di fondo dell'area del sisma. In: *L'Abruzzo e il cratere sismico: economie a confronto prima e dopo il terremoto*. Congiuntura Economica Abruzzese, 1.

D'Ascanio, F., Di Ludovico, D. and Di Lodovico, L., (2016). Design and urban shape for a resilient city. *Procedia Social and Behavioral Sciences*, 223, 764-769. Doi: <https://doi.org/10.1016/j.sbspro.2016.05.265>.

De Vico, B., Di Ludovico, D. and Colagrande, S., (2014). A new infrastructural-relation model for the post-earthquake city of L'Aquila. In: *The Sustainable City IX Urban Regeneration and Sustainability. Wit transactions on ecology and the environment*, 191, 221-232, <https://doi.org/10.2495/SC140191>.

Di Ludovico, D. and Properzi, P., (2018). Territori fragili vs Territori smart. *Urbanistica Informazioni*, 278, 18-22.

Di Ludovico, D., (2017). *Il Progetto urbanistico, prove di innovazione per il futuro della città*. Aracne editrice. Roma.

Di Ludovico, D., Properzi, P. and Graziosi, F., (2014). From a smart city to a smart up-country. The new city-territory of L'Aquila. *TEMA Journal*, Special issue, 353-364. Doi: <http://dx.doi.org/10.6092/1970-9870%2F2482>.

Di Ludovico, D. and Properzi, P., (2012). Progetti urbani e Progetti urbanistici nel governo dei paesaggi post-urbani. *Planum*, 25, 1-6.

Di Ludovico, D. and D'Ovidio, G., (2017). Transportation Network Role for Central Italy Macroregion Development in a Territorial Frames Model Based. *IOP Conference series: materials science and engineering*, 245, 1-10. Doi: <http://dx.doi.org/10.1088/1757-899X/245/4/042039>.

Dittmar, H. and Poticha, S., (2004). Defining transit-oriented development: the new regional building block. In: Dittmar, H., Ohland, G. (Eds.), *The New Transit Town: Best Practices in Transit-Oriented Development*. Island Press. Washington, Covelo, London. 19–40.

D'Ovidio, G., Di Ludovico, D. and La Rocca, G. L., (2016). Urban Planning and Mobility Critical Issues in Post-Earthquake Configuration: L'Aquila City Case Study. *Procedia Engineering*, 161, 1815-1819, Doi: <https://doi.org/10.1016/j.proeng.2016.08.670>.

Duany, A., Speck, J. and Lydon, M., (2010). *The Smart Growth Manual*. McGraw–Hill. New York.

EC, (2013). *Building a Green Infrastructure for Europe*. Publications Office of the European Union. Luxembourg. Doi: <https://doi.org/10.2779/54125>.

Espoon, (2005). *ESPON 1.1.1 Potentials for polycentric development in Europe - Project report*. Espoon. Luxembourg.

Fekete, A. and Fiedrich, F., (2018), *Urban Disaster Resilience and Security: Addressing Risks in Societies*. Springer International.

Jenks, M., Burton, E. and Williams, K., eds (2005), *The Compact City: A Sustainable Urban Form?*, Spon Press. Taylor & Francis. London and New York.

Touraine, A., (2010), *Après la crise*. Edition de Seuil. Paris.

Vale, D.S., (2015), Transit-oriented development, integration of land use and transport, and pedestrian accessibility: Combining node-place model with pedestrian shed ratio to evaluate and classify station areas in Lisbon. *Journal of Transport Geography*. 45, 70-80. Doi: <https://doi.org/10.1016/j.jtrangeo.2015.04.009>.

AUTHOR'S PROFILE

Donato Di Ludovico is an Ph.D, researcher of Urban and territorial planning and design, Urban design professor at the University of L'Aquila (Engineering). He carries out scientific research activities within the new forms of Spatial and Strategic planning, Urban planning and design security oriented, knowledge and assessment systems (SEA). With regard to the Spatial planning, his research is focused on new models and new policies. He is currently secretary of INU Abruzzo-Molise section (National Institute of Urban Planning); director of Urban Laboratory for the Reconstruction of L'Aquila (LAURAQ-INU/ANCSA); scientific responsible of AnTeA Laboratory (Territorial and Environmental Analysis) at the University of Aquila.

Paola Rizzi is an Professor at University of L'Aquila of Urban Design and Planning. Founder of Diver S City UrbLab, Director of International Summer School Awareness & Responsibility of Environmental Risk, member of the Advisory Board of Directors of CUPUM. She has designed and conducted gaming simulation in urban planning and design, decision making process, environmental education, emergency and risk preparedness and prevention, disaster mitigation. She

was and is consultant of public institution like APAT-ISPRA. She taught and teach urban design and planning in different countries as Poland, Germany, Austria, Indonesia, Romania, Russia, Thailand, US, Japan. She has been visiting research professor at Ritsumeikan University. Visiting Researcher at DMUCH-Ritsumeikan, visiting professor at Jagellonica University and Polytechnic of Cracow, Poland.