

A Data-Driven Approach for a City-University Mobility Plan: The Case of the University of Pisa

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Abstract. University campuses concentrate people movement within a city, being places of study, work, research, and co-presence. In that aspect, the university community travel patterns must be addressed through Commute Management Plans (CMPs) which provide guidelines to policymakers' actions which envision a transition towards sustainable mobility alternatives. CMPs are accessories to Sustainable Urban Mobility Plans (SUMPs), focused on analysing supply and demand for transport, the university staff movement patterns, and the origin-destination dynamics between their households and workplaces. Moreover, besides the staff-oriented evaluation, universities must also consider the students' commute patterns, as those comprise a significative part of their community. While in most cases, university structures are placed in few campuses, with movement concentration towards those areas and within them, many Italian Universities, such as the University of Pisa, present a distinct spatial organization, as its various structures are parcellated and diffused within the city area; a paradigmatic case of a "city-university" where moving in-between and within the university sites is moving within the city itself. Such characteristics require a data-driven approach that integrates spatial, configurational, and transportation analyses. Considering this, the paper discusses computational methods used to elaborate the University of Pisa's CMP and how a data-driven approach that integrates multi-domain analyses can highlight the movement patterns in a "city-university" context. The discussions and findings can serve as examples to other CMPs for universities within similar contexts – important, given their requirement by law in several European countries – or even as approaches to be incorporated in urban mobility and city master plans.

Keywords: Mobility Plan · University Campuses · Urban Analysis

1 Introduction

Sustainable Urban Mobility Plans (SUMPs) are designed to outline the urban and regional policies that encourage the shift towards sustainable transportation modes and foster projects in line with the UN Sustainable Development Goal for Cities and Human Settlements (SDG 11) [1, 2]. In Europe, since the Urban Mobility Package of 2013

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[3], SUMPs are established as the main guidelines for transportation systems' infrastructure development, being a central instrument to improve accessibility of urbanized areas and to provide to the population high-quality mobility solutions and transport options towards, throughout, and within the cities [1, 3]. Through the investigation of citizen and stakeholder demands regarding transport, those plans often propose to reshape the way that people move around urban spaces, which in turn affects the livability and economic vitality of the cities [4, 5]. By providing a comprehensive framework for transportation-oriented development, SUMPs can assure that mobility systems and solutions are designed to support the needs of all residents, above all: those without access to personal vehicles, those in low-income households, and those with disabilities. Additionally, SUMPs can aid in the environmental component of cities' sustainability, by reducing traffic congestion and improving air quality, as well as by promoting actions towards public health through the encouragement of pedestrian and cycling movement [2, 6, 7].

In recent years, certain demographics have been subject to detailed Commute Management Plans (CMPs) which address the transportation requirements and criticalities that are specific to these populational groups. In their principle, CMPs are accessories that are to be integrated to the SUMPs [8], being focused plans produced for the municipality or regional mobility manager by the mobility managers of public and private corporate entities with over a stipulated number of members in their community; therefore, that impact urban or regional movement in a significative manner [9]. CMPs focus in reducing the commute impact of these groups within the city, through the planning of better workplace routines, and the encouraging of the use of public transport or micromobility options where possible, instead of personal vehicles usage. In Italy, University CMPs' consist in one of these specific cases; moreover, as regulated by the ministerial decree of May 12, 2021, they are mandatory, as universities are public institutions [10]. CMPs become a rather particular mobility plan within the universities' context since, beyond an often-large personnel component (professors, researchers and technicians), they are structures that generate and receive movement from an even larger populational group, the students, which have a daily commute towards and within the campus [11].

Planning instruments such as the CMPs assume an even greater importance in a world still be marked by the consequences of the Covid-19 pandemic [12]. In the last three years, the restrictions on national and international travel, plus the shops, schools and universities closures have led to a significant decrease in the demand for mobility which has also contracted the public transport supply [13]. The City of Pisa, in Italy, where the case was developed, has suffered a dramatic impact in those terms, as its social and economic structure is rather dependent on activity and movement generated by tourism and, above all, by the university activities. In effect, the University of Pisa community has grown over the last decades to a much greater extent than the dynamics of the city's demographic trend, assuming a large size compared to that of the resident population: a community of about 53,000 people associated to the university in a city with less than 90,000 inhabitants [14]. Moreover, the specificity of the University of Pisa case resides in the manner in which its buildings (administrative, research and teaching) are spatially structured. The patterns follow a parceled and capillary distribution over the

urban territory, so as to represent the most paradigmatic example of a "city-university" (Fig. 1).

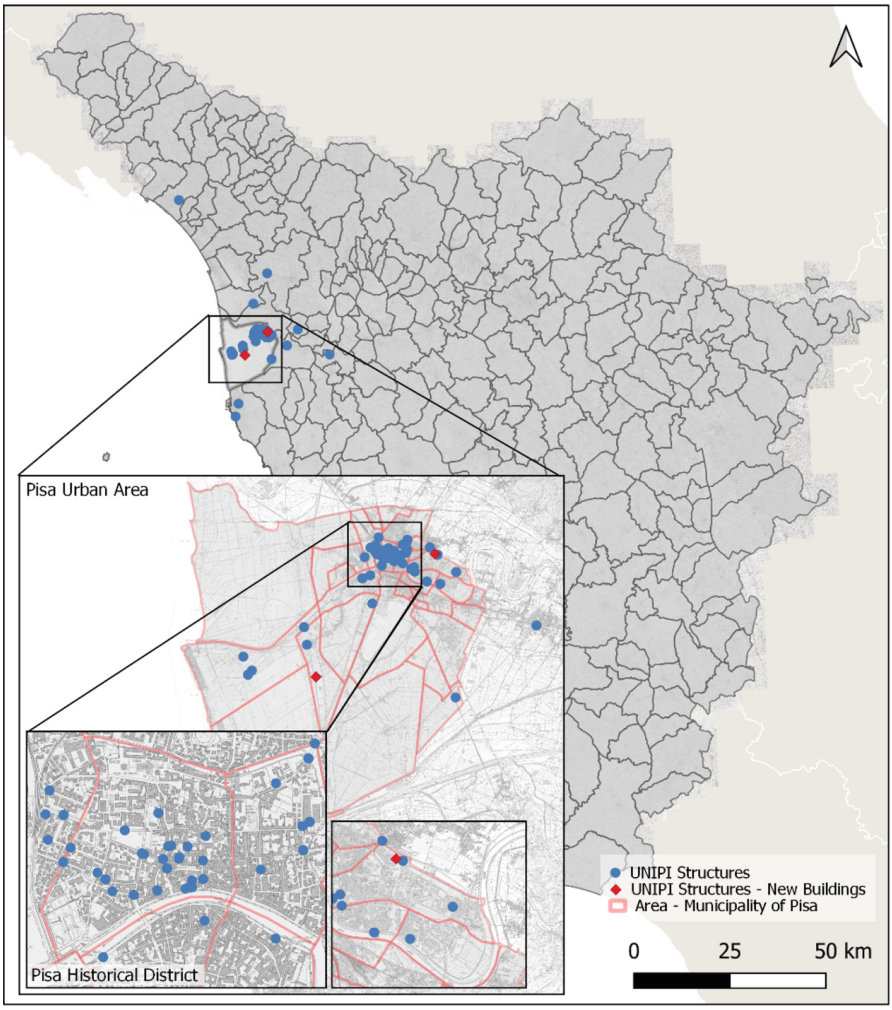

Fig. 1. The University of Pisa structures distribution: a "City-University".

In this sense, it is a university in which the spatial diffusion of its various buildings and campuses within the urban space materializes the integration that exists between its community and the city, as well as attest the interdependence between university issues and city-oriented issues.

While the pandemic brought economic challenges for the City of Pisa, it has also fueled some positive phenomena regarding urban mobility. The period verified a decrease in the use of public transport, yet it also shown an increase in pedestrian movements, in the use of bicycles, as well as verified a large increase in electric-based micromobility

solutions [15], which all had an impact on the general traffic within the city. In that aspect, changes in the way urban planners structure SUMPs and CMPs in terms of data collection and analysis are needed to cope with the following period of changes and re-growth in transportation demand, as well as to understand the new realities and challenges of an urban mobility planning that is not only focused on mass public modes.

Considering the questions involved in data collection, treatment, organization and spatialization for the construction of Commute Management Plants, and their specificities regarding data precision, this paper discusses some computational-aided methods used to elaborate the University of Pisa's CMP and how a data-driven approach that integrates multi-domain analyses can highlight the transportation issues and the movement patterns in a "city-university" context. The discussions and findings can serve as examples to other CMPs for universities within similar contexts – important given their requirement by law in several European countries – or even as approaches to be incorporated in urban mobility and city master plans across the world.

2 Guidelines, Datasets and Variables for Constructing a Commute Management Plan

The *Linee Guida per la redazione e l'implementazione dei Piani degli Spostamenti Casa-Lavoro (PSCL)* [16] is the ministerial decree that establishes the guidelines and the methodological practices to be observed for to the construction and implementation of Commute Management Plans (CMPs) in Italy. In accordance with this document, CMPs must abide, at a minimal, to the following structure:

- An informative section, that describes the context – both urban and relative to the institution structures' location and personnel characteristics – in which the CMP is inserted.
- A section focused on assessing the criticalities in the community's mobility, consisting of an origin-destination study, a transportation supply and demand analysis, and an examination of the community's willingness to alter its commute habits.
- A project-oriented section dedicated to the design and implementation of mobility solutions, improvement strategies, plus the monitoring and ex-post-implementation evaluation based on the analyses results.

Even though the third section represents the main objective of a CMP, its effectiveness is dependent on the completeness of the first two sections. Considering this, a data-driven approach is important to assure up-to-date information regarding the community in question and its commute habits, as a manner to support the planning and sections of a mobility plan. Where possible, CMPs tend to employ internal-community surveys to collect metadata and construct the origin-destination datasets, to be used in conjunction with other – if available open-sourced – territorial and transportation supply datasets in the spatial analyses. In that aspect, University CMPs tend to differ from their corporate counterparts as they often deal with multiple destinations (structures, laboratories and campuses) and must accommodate the requirements of a larger and more heterogeneous community, as other than the university personnel, that itself comprehend several categories (professors, researchers, and technicians) all with different

routines and demands, it also comprises the students, also with their different routines and demands [17]. Therefore, assuring the survey participation of the different communities within a community is also a challenge, that must be addressed through design. Moreover, there are several issues regarding data collection and aggregation that must be addressed. The next sections will provide an overview of the survey design and data collection procedures, as well as methods to spatialize the obtained datasets in a GIS environment, and the spatial databases and methods employed in the analysis [18].

2.1 Commute Behavior and Origin-Destination Survey Datasets – The Case of the University of Pisa

The University of Pisa Commute Management Plan survey was tailored to highlight the academic community's commute behavior and criticalities. The data collection period lasted for 40 days, from 6 June 2022 and ending on July 14, 2022. A website was created to redirect to, detail, and explain the survey, its objectives, and procedures [19].

Drafted and applied through the *Microsoft Forms* platform [20], the survey consisted of 25 individual questions, organized in ramifications that divided the paths for personnel and students-oriented questions, to understand particularities about these groups. Of these, 20 were structured as "multiple-choice" with two being "open multiple-choice" questions regarding critical aspects in the commute and the propension to change transportation modes, thus allowing more than one answer. The remaining 5 questions were proposed as "open-answer" questions, to allow respondents to express criticalities not foreseen in the survey. The time to complete the survey was predetermined to be between 3 and 10 min, with an observed average response time of 5:48 min [17].

The response rate was significative, as 11,812 people have completed the survey, corresponding to 22.4% of the University of Pisa community (52,669 individuals), a sample that allowed statistical significance and very high confidence levels to be reached (Fig. 2).

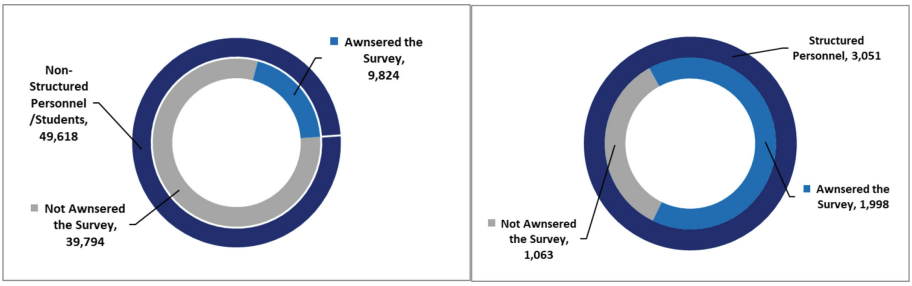

Fig. 2. Survey response rate, divided by group, in relation to the University of Pisa community total.

In accordance with demographics, this percentual is divided into 16.8%, associated to the structured personnel (professors, researchers, and technicians) – around 65.2% of

the total of this group. The remainder 83.2%, correspond to the aggregate between non-structured personnel (post-graduate researchers and doctoral students) and undergraduate students. (Fig. 2). Despite included in the students' component, the non-structured personnel (mainly associated to research duties) have commute habits that are similar to the structured personnel, with designated departments and office spaces. Hence, for the analysis procedures, they were incorporated into the structured personnel group.

The construction of datasets based on the surveyed information was carried out under the binding requirement to ensure the anonymity of the respondents in accordance with the European legislation on data protection and privacy (GDPR - Regulation (EU) 2016/679, as amended on 23 May 2018) [21]. In effect, this presents an important issue regarding the spatial accuracy in the origin-destination analysis since precise origin addresses could not be collected, georeferenced, and spatialized.

To resolve this problem and attain a sufficient precision, while still in compliance with the GDPR, the survey used the Italian Postal Code *(Codice di Avviamento Postale – CAP)* as means to identify the respondents place of residence. From each CAP a set of

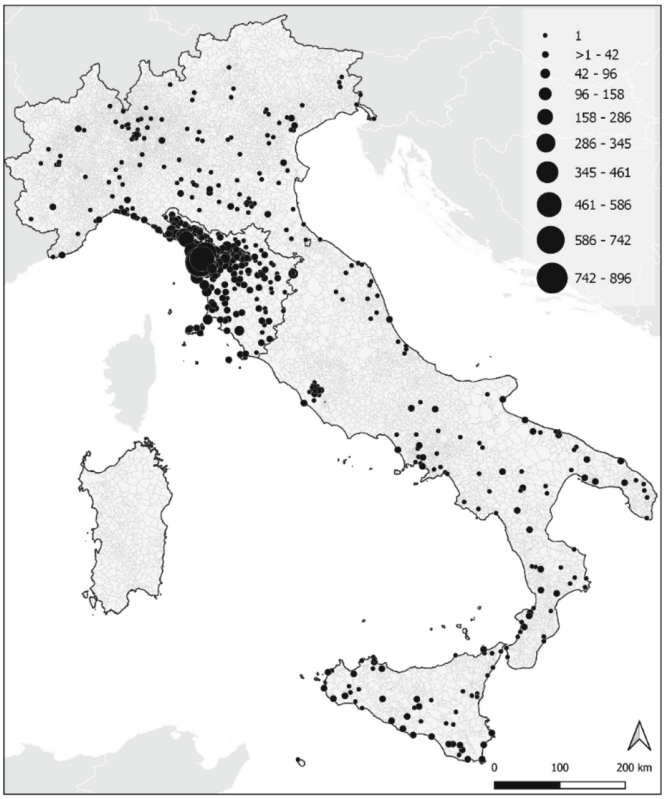

Fig. 3. Origin points distribution – information incorporates all survey answers without commute frequency distinctions.

coordinates was generated through the application GPS Visualizer [22] then aggregated according to their frequency and point-georeferenced on GIS (Fig. 3) [18].

Further on, the origin points dataset was incorporated with data regarding the commute frequency to differentiate regular from occasional commuters and to identify any respondents that do not commute at all – mostly students in distance learning.

The surveyed metadata is outlined in a diagram (Fig. 4). It describes the connections between the fields and highlights the general method/type of analysis used.

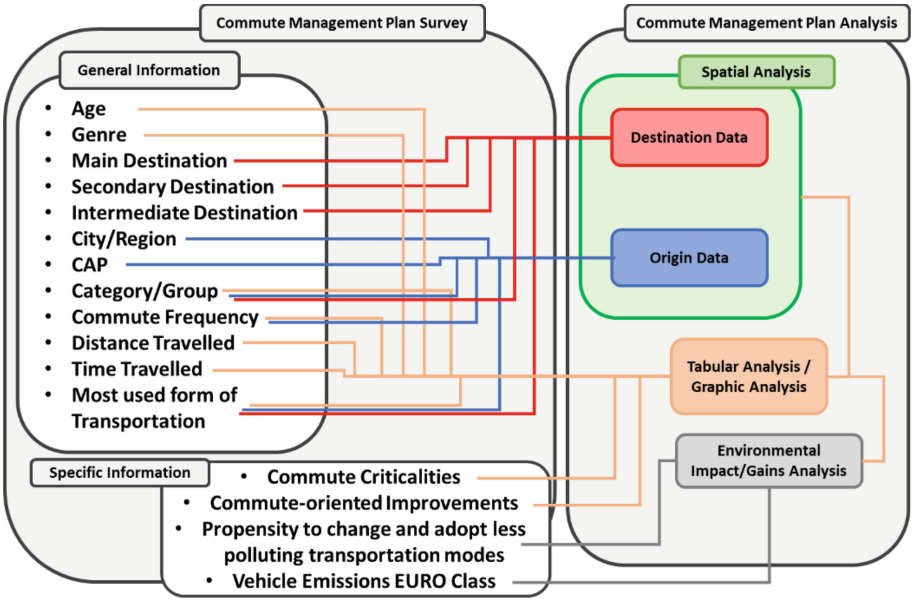

Fig. 4. CMP survey structure outline, contents, connections, and analysis diagram.

The results from the survey are divided in general information and specific information – this mainly collected from "open multiple-choice" and "open answers". From the general information data, origins and destinations datasets are aggregated, respectively, by "CAP" and by "Structure of Destination" (divided among main, secondary, and intermediate). This data is predominantly used to structure the base spatial analysis made in GIS [18] and is incorporated with variables such as the respondents' category/group, commute frequency, and most used form of transportation. Transportation related variables, when associated to the points of origin and destination allow to highlight specific dynamics related to the structures usage/accessibility to determined types of transport (Pedestrian, Bicycles, Public Transport and Automobiles) and to the movement towards and between the university structures.

Regarding identifying the inner-city movement patterns, several network models based on the Space Syntax methodology [22] were used to represent movement potentials within the City of Pisa. Those describe the relative accessibility and the *preferential routes* towards each university building. The use of *Space Syntax* is a rather innovative approach made in the University of Pisa CMP, and was intended to explain the urban

dynamics given the university structures dispersion, a pattern that configures Pisa as a "city-university".

2.2 Spatial Datasets – University Within the City of Pisa Urban Context

The spatial structure of an urban aggregate has decisive effects on the settlement context and on the general conditions of accessibility towards its various spaces. Therefore, analyzing urban road-network morphology and configuration can reveal differences in accessibility, or the *relative accessibility* hierarchies. Understanding which spaces are more accessible than others allow to make comparisons and evaluate to what extent these characteristics influence the distribution of movement potentials within the city. In that respect, the methodological approach of configurational analysis known as *Space Syntax* [23] provides a suitable set of operational instruments and models to detect, through network analysis, the distribution of *relative accessibility* in urban spaces. Moreover, its measures can also highlight the *preferential routes*, selected by users in their presumed choices of movement within the city.

Compared to other approaches for the morphological and relational analysis of space, the *Space Syntax* is characterized by its capacity to combine tangible factors (the distribution of movement, the organization of land use, the internal geography of inhabited areas) with intangible factors of a social and cultural nature (the cognitive and behavioral modes of individuals, individual and collective social interaction relations), thus constituting the conceptual basis of reference for a series of non-discursive techniques of analysis of built space, and in particular of the urban environment.

The methodological approach of the Space Syntax draws its analysis tools from discrete mathematics, in particular from graph theory, in which road-graphs are analyzed to determine the spatial-configurational relations between the streets and spaces of the built environment, so as to attribute to each road-element their own characteristics of network centrality. Such an analysis can be conducted either on a general global scale (the entire network corresponding to the grid of a settlement), or by setting specific limits or radii corresponding to the size of the analysis area (whether metric or topological), demonstrating considerable flexibility of use. The existence of a proven correlation between pedestrian movement, vehicular movement and the configuration of urban space, following decades of theoretical and applicative experience [23–26], attests to the solid methodological foundation of Space Syntax, whose set of analysis tools lends itself to being used individually or in various forms of combination.

Space Syntax was used for the University of Pisa's CMP in order to model the movement structure in-between its several buildings. The analysis, carried out using road-graph data obtained from OpenStreetMap [27], focused on two indicators: the *Angular Integration index* and the *Angular Choice* index, in its normalized forms. The metrics were calculated through the software DepthMapX 0.8 [28] on a global scale (Rn) – the entire extension of Pisa's urban network – focused on estimating vehicular traffic, and using a radius limited to 1,200 m (R1200), equivalent to the average distance that can be covered in 15 min on foot [29]. *Angular Integration* and *Angular Choice* definitions, as well as the formulas used in the normalized measures [24] are summarized in Table 1.

Once completed, the *Space Syntax* models were exported to a GIS environment, where, combined with the University of Pisa's structures' location datasets, made available by the University and organized by the authors for the CMP (Fig. 1), a comparative analysis was made to highlight the movement patterns within the city global and local structures.

Table 1. Space Syntax ASA metrics – Angular Integration and Choice

Space Syntax	Graph Theory Equivalent	Formulas: Space Syntax	Concept
Integration (int.)	*Closeness Centrality*	$NAIN = \frac{n^{1.2}}{ATD_{\alpha}^{\ell}(x)}$ $NAIN_{RM\,1200} = \log(AInt + 2)$	Depicts *relative accessibility* (to-movement) – or the topological proximity of one road-element to all other road-elements
Choice (ch.)	*Betweenness centrality*	$NACH = \frac{Log(ACh_{\alpha}^{\ell}(x)+1)}{log(ATD_{\alpha}^{\ell}(x)+3)}$ $NACH - M_{RM\,1200} = \log(ACh + 2)$	Indicates the *preferential routes* – or the most travelled paths (through-movement) within the system, given the shortest path between a road-element and all other road-elements

Besides the configurational analysis, other kinds of spatial analysis were also part of the CMP. Another data-driven computational analysis was the isochrones-based approach to assess the correlation between the University of Pisa's structures' location and the micromobility stations (i.e. city bikes, e-bikes and electric scooters). Data on the station distribution was provided by the City of Pisa's Urban Mobility Agency – PISAMO [29] and covered the municipality designated spaces for the positioning of the mobility equipment. While these transportation modes function as "soft mobility" and have capillary availability within the city, meaning they are also available throughout the cities outside the designated parking spaces, the municipality designated spaces concentrate the locations with highest availability at any time.

The combined spatial datasets are used to evaluate the *accessibility* patterns from the university structures towards the micromobility stations given a set radius established by the isochrones' areas. The isochrones curves, constructed through the OpenRouteService (ORS) [30] and correspond to travel-times of 2 min and 5 min on foot from the university structures, considering the morphology of the area. Correlations are established when there is a designated parking space within the isochrones' radius.

3 A Data-Driven Approach for the Commute Management Plan – A Discussion of the Results Obtained for the University of Pisa CMP

Given the characteristics of the urban environment of Pisa, that has a rather small urbanized area, in comparison to the total municipality territory, the University of Pisa's Commute Management Plan objectives were structured in two main areas: promote an increase in micromobility usage in movements towards and between the structures; and reduce the usage of combustion-engine personal vehicles, through pedestrianization or mixed mobility solutions (train + pedestrian; bus + pedestrian; train + micromobility). In that aspect, the analysis of the movement dynamics within the urban area was important to define in which areas and structures the governance practices should be adopted.

The analysis of the global *relative accessibility* (Normalized Angular Integration index - NAIN) for the municipality of Pisa road-circulation network (Fig. 5, NAIN) reveals a rather particular urban movement concentration. This is characterized by the fact that the road-elements with the highest *relative accessibility* scores (here, represented in the red color) correspond to the extra urban roads, highways that extend around the medieval walls that encircle the historical centre – area where most of the university buildings are located.

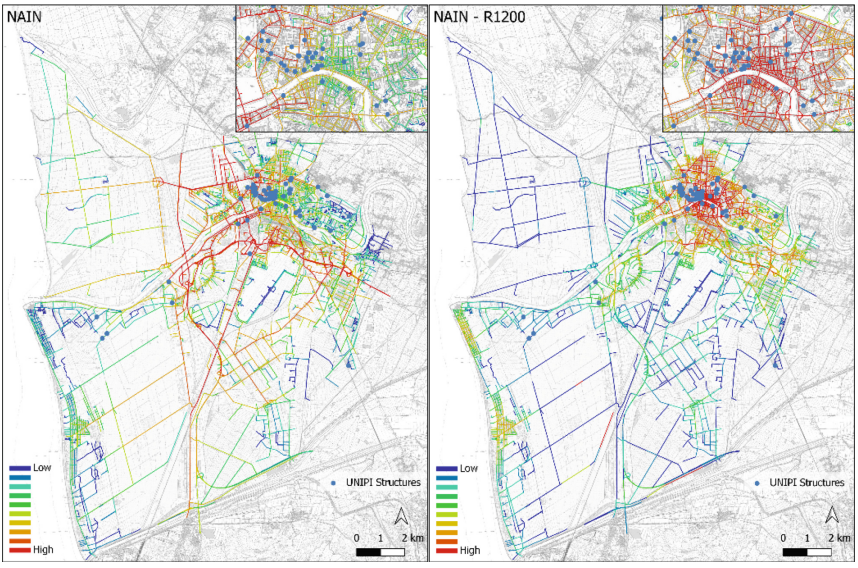

Fig. 5. NAIN and NAIN R1200 – University of Pisa Structures (Color figure online)

On the other hand, the innermost area of Pisa's historic centre presents intermediate values of integration (here, highlighted in the shades of yellow and green) (Fig. 5, NAIN), which attest a just modest *relative accessibility* and a lower potential of attractiveness of

movement at a global scale (Fig. 5). From this standpoint, the analysis' results demonstrate that even if the historical centre was not already regulated as a Limited Traffic Zone (LTZ or ZTL), the area would only, marginally, attract vehicular traffic. This highlights the vocation of Pisa's historical center as a pedestrian area, since its configuration naturally concentrate movements outside the innermost areas. Furthermore, the axes constituted by the two Arno River marginal roads represent the "load-bearing" elements of *relative accessibility* in the historic center. In that aspect, it is justified that they are excluded from the LTZ by the municipal authority. Due to the distance of the road axes that correspond to the spatial elements of greater centrality, the coastal area is considerably more segregated than the other urban spaces, presenting many areas characterised by a modest degree of relative accessibility (here, highlighted in blue) (Fig. 5, NAIN). Such a situation is also emphasised by the presence of individual connections to the historic centre area that lead to high values of the integration index on a limited number of street elements.

The movement potentials' distribution change considerably if a limited sphere of analysis – the 1,200 m radius – is considered (Fig. 5, NAIN R1200). The road-elements located within Pisa's historic centre are now assigned the highest values for *relative accessibility*, a pattern of increase that also observed in the centres of the coastal urban agglomerates. Since the metric radius of 1,200 m corresponds approximately to the distance that can be covered in 15 min on foot [28] or in 5 min by bicycle or scooter, it is conceivable that this pattern reproduces the distribution of accessibility levels for pedestrian movements or other forms of micromobility. In this respect, the measure highlights the historic centre of Pisa as its portion most suited to pedestrian use or with soft forms of mobility. Moreover, it can be stated that Pisa itself is a *15-min city*, since its *relative accessibility* core, at a metric radius advance into the residential areas positioned in the immediate vicinity of the historical centre, meaning that it is possible to walk towards the city centre, where most urban equipment – and university structures – are located, without a dependence on public transportation.

The global *choice* index (*Normalized Angular Choice* - NACH) provides a restitution of the hierarchy of *preferential vehicular routes* in the road system of Pisa (Fig. 6, NACH). The distribution of the *choice* index values confirms the patterns of movement potentials observed in the global *integration* index, where the most travelled routes (here, depicted in red) are those in the margins of the historical centre area, being the same as those with the highest *relative accessibility* roads. Furthermore, it can be observed that the innermost areas of the historical centre are – likewise with the *integration* – devoid of preferential routes at global scale, thus, vehicular movement would not tend to naturally pass through this area of the city. The *choice* index, once again, demonstrates the role of Arno River's marginal axes as "load-bearing" structures, as those road-elements concentrate through movement within central Pisa (Fig. 6, NACH).

The patterns of through-movement change considerably when *choice* modelling is restricted to a radius (Fig. 6, NACH – R1200). The innermost areas of the historical centre once again become the locus of through-movement in Pisa. In that aspect, the road-elements denote the sub-structure oriented to local pedestrian and bicycle movements.

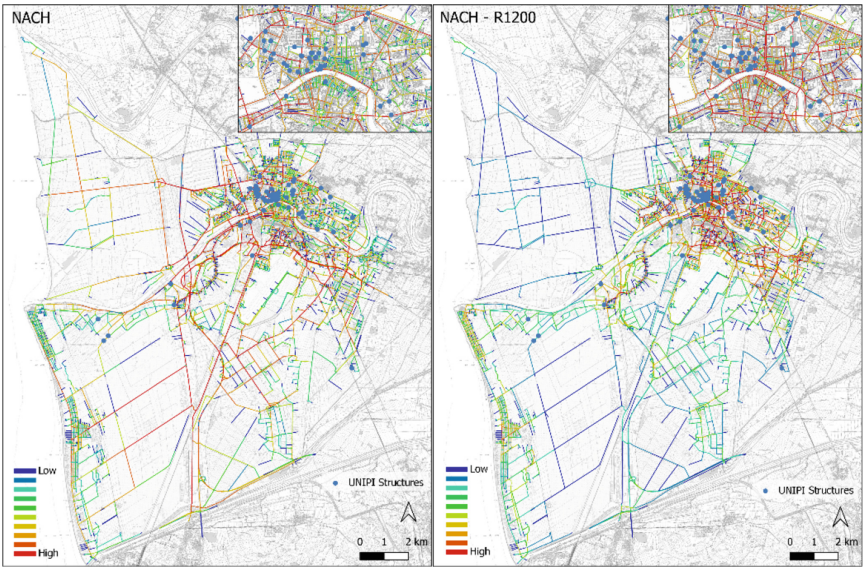

Fig. 6. NACH and NACH R1200 – University of Pisa Structures (Color figure online)

The local *choice* index (Fig. 6, NAIN R1200), when confronted with the distribution of the cycling roads and designated spaces for the micromobility stations (Fig. 7) reveal interesting patterns regarding the movement dynamics within Pisa's urban area, and the accessibility towards the University Structures. Moreover, it also describes how the historical centre is linked to the residential areas through soft mobility.

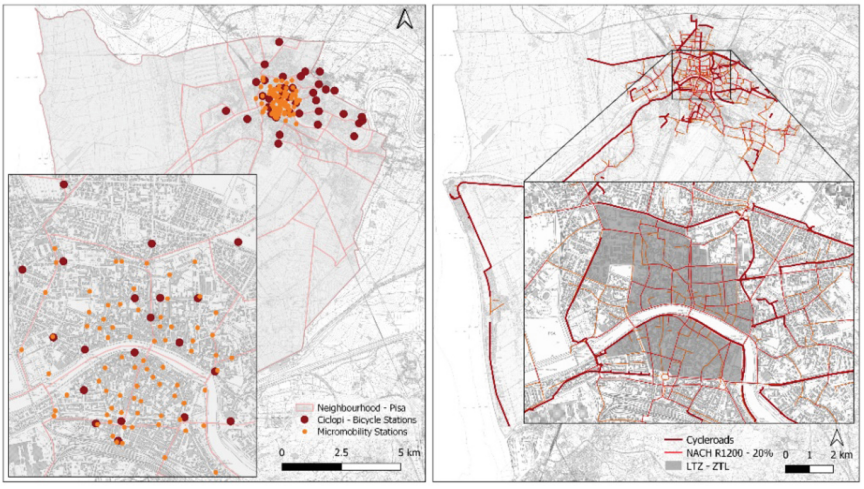

Fig. 7. Micromobility stations and NACH R1200 20% structure of movement

The cycleroads (Fig. 7) form a grid, together with the local through-movement structure – which is mostly located within the Limited Traffic Zone (LTZ – ZTL). This grid constitutes a continuity of spaces for micromobility and bicycle traffic, allowing access from the residential areas towards the centre and, by extent, towards the university structures.

In that regard, when considering the spatial correlation among the distribution of the micromobility stations (Fig. 7) in relation to the University of Pisa structures (Figs. 5, 6 and 8), it can be observed that the most of the buildings located in the central area are accessible in 2 min on foot and all within 5 min on foot. This coverage begins to rare near the outermost structures (Engineering building to the west and the University Hospital to the east), demonstrating some polarization in their immediate availability. In that aspect, potentializing the availability towards other areas not yet covered should be the main focus of the university actions towards incentivizing micromobility solutions.

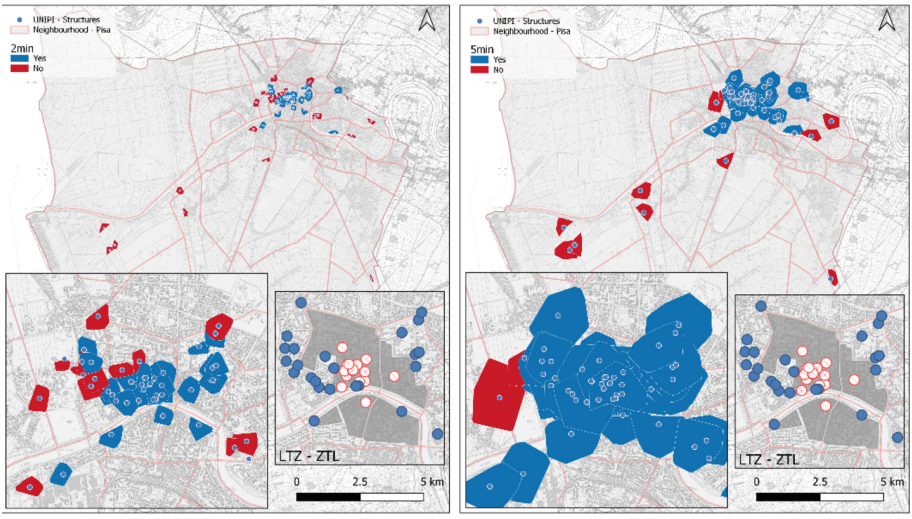

Fig. 8. Correlation between the University of Pisa structures and the designated spaces for the placement of micromobility structures. Isochrones calculated for 2 min and 5 min.

These proposals and conclusions regarding an improvement on micromobility conditions can be highlighted in Fig. 9, that spatializes the survey data regarding destinations in accordance with the most frequently utilized transportation mode. It is possible to see that, beyond pedestrian movement, bicycle movement correspond to the most frequently used transport modes towards the University of Pisa structures. However, the car component is still expressive on the outermost areas that are still accessible through pedestrian and bicycle movement – as seen on the previous analysis – but have a lower degree of *relative accessibility*. These results demonstrate that a data-driven approach can aid in the decision-making processes, and individuate actions based on movement estimation.

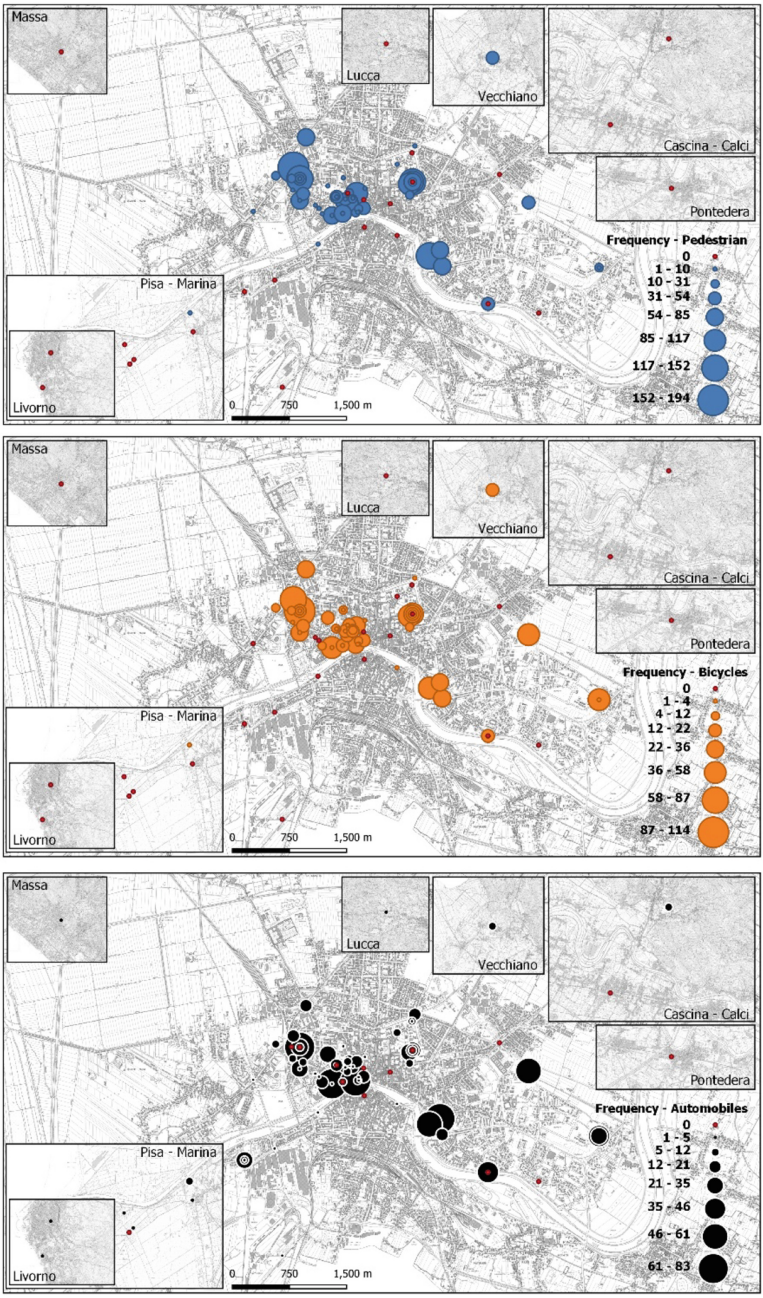

Fig. 9. Transport modes frequency towards the University of Pisa Structures – pedestrian movement, bicycle movement and automobiles movement

4 Concluding Remarks

Pisa proves to be an emblematic case as a city-university. With a large academic community, the University of Pisa's CMP becomes an essential instrument in the overall assessment and management of the mobility of the city and its interconnected surrounding areas. University of Pisa's uniqueness is also due to the diffuse location of its university facilities, which, given their spatial displacement and the functions contained in each one of the facilities, can be considered an almost as its own 15-min city. Nevertheless, the methodological approach thought and adopted to construct this CMP is independent of the uniqueness of the city and can be replicated in the most diverse urban contexts, for the realization of other CMPs. In this way, it would be possible to compare qualitatively and quantitatively structurally different contexts, deepening the fundamental relationships - which play a key role in university cities - between urban form, location of university facilities, infrastructure, and transport services.

In general, the conclusions made with the aid of the CMP, for the improvement of University's mobility can be summarized in 3 points: interventions to be promoted to improve urban sustainability, which are the direct results of the analysis discussed so far; methodological evaluation and efficacy; general considerations on CMPs.

The actions planned on the basis of the analyses carried out can be divided into two categories: actions that can be implemented directly by the university administration and larger-scale actions to be implemented in concert with external, public or private organizations. The former includes the following proposals: increasing parking spaces for bicycles and scooters, improving the usability of these areas and increasing their safety, implementing policies to encourage the use of sustainable means of transport and creating a permanent sustainability office. The latter, instead, include the following measures: stipulating students-specific conventions with lower prices, enhancing the regional and urban transport offer, strategical deploying of bike-sharing and scooter services, increasing the safety and recognizability of existing cycle routes and creating new strategic routes. It is this very second set of interventions that clearly demonstrates the need for close collaboration between universities and external organizations to make the city's mobility more efficient and sustainable. However, for the specific discussion of these interventions and the specific rationale behind them, please refer directly to the CMP [17].

From the methodological point of view, the effectiveness of Space Syntax theory in the reading of the urban fabric for the determination of preferential routes and the potential for movement – both from a vehicular as well as from a bicycle and pedestrian point of view – is confirmed. This, therefore, allowed multiscale analysis and, consequently, the determination of the criticalities of the existing network and services. In addition, the use of movement isochrones together with the configurational analysis described above made it possible to assess the actual use of mobility services by the university community. This made it possible to analyze the existing flows and assess the potential of the actual service without the need for modelling tools that include additional – unnecessary, for this type of analysis – complexity. Moreover, the importance of the movement data of specific classes of users emerges, as well as the difficulty in obtaining them –purposely designed and targeted surveys the only way. From an analytical standpoint, the need for sufficiently large samples with a significant composition (stratified sample) emerges.

This implies the need to raise the university community's awareness of the issue and promote a bottom-up approach, which is in fact part of the measures proposed by the CMP.

From a general point of view, it emerged that CMPs are an excellent instrument for assessing mobility and proposing guidelines to reduce pollution. In particular, they can contribute significantly – especially in university towns with large university communities – towards the goal of sustainable urban mobility.

According to this, it is illogical that CMPs could potentially not include the students, which represent the most consistent part of the community. It also emerged that the lack of integration of the CMP and SUMP in university cities - and in diffuse ones – represents a strong criticality considering that flows related to the university community represent a significant part of the city flows. In addition to causing a lack of comprehensive analyses, this lack of integration also means that it is impossible to implement effective and integrated project proposals that can effectively affect urban and suburban mobility. For this reason, it is highly recommended a greater integration between these plans and also between local, municipal and regional transport authorities, in order to fully include the CMP in city planning and promote sustainable urban mobility accordingly to the sustainability goals (SDGs) promoted by the UN.

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