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RECENT CYCLING MOBILITY TRENDS OBSERVED IN THE CITY OF BOLOGNA[1]

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Abstract: *Sustainable Urban Mobility Plans (SUMPs) aim to provide a significant contribution to reaching the European climate and energy targets set by EU institutions. Furthermore, they aim to improve: transport efficiency and cost-effectiveness for both persons and goods; safe, secure and seamless transport; accessibility to/from key destinations and services; the development of an inclusive, equitable and resilient transport system and society. Measures regarding cycling mobility are typically recommended among the most important ones to plan and be implemented, under a multimodal perspective, in order to achieve the goals defined by SUMPs. Cycling mobility is taken into particular consideration by the SUMP elaborated for the city of Bologna (Italy), where 16% of the trips performed by car cover less than 1 km and 33% of them is between 1 km and 5 km long, according to the data provided by the Municipality of Bologna. Indeed, cycling mobility is expected to assume an increasingly important role in the future development of transport system in the city of Bologna and in many other European cities as well. In this research, some recent trends are presented and discussed, with regard to the cycling mobility in the city of Bologna. Data are available as a result of a series of counting and monitoring activities conducted for more than 10 years, up to now. They also account for the response of bike flows to the limitations imposed by the pandemic crisis to several social and economic activities. In general, observed data can prove to be useful for interpreting current mobility patterns and emerging trends and thus for supporting decisions by urban transport policy makers.*

Keywords: *sustainable transport, bike transport, SUMP, traffic counts*

INTRODUCTION

In the last decade, the EU institutions have promoted the preparation of Sustainable Urban Mobility Plans (SUMPs), with the goal to support the transition towards more efficient mobility systems in European cities, for a better quality of life (European Commission, 2013). SUMPs are expected to provide a significant contribution to meet the European climate and energy targets set by EU institutions. Furthermore, SUMPs are designed and implemented with the following objectives: transport efficiency and cost-effectiveness for both persons and goods; safe, secure and seamless transport; accessibility to/from key destinations and services; the development of an inclusive, equitable and resilient transport system and society (European Commission, 2013)

In this framework, the main aim of Bologna SUMP (Città Metropolitana di Bologna, 2019) is to put people instead of vehicles at the heart of the transport system in the metropolitan area, which accounts for 55 Municipalities and 7 Unions of Municipalities, with a total number of 1 million of inhabitants, among which 400,000 live in the Municipality of Bologna. Bologna SUMP sets the following main objectives: to promote accessibility, climate protection, road safety and to reduce air pollution. All the above-mentioned objectives are supposed to provide a significant contribution in

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order to enhance the attractiveness and liveability of the Metropolitan City of Bologna as a whole (Città Metropolitana di Bologna, 2019).

More in detail, Bologna SUMP aims to reduce emissions due to transport operations by 40% within year 2030, compared to the levels reached in 1990, with 440,000 daily trips shifted from cars to active modes and public transit, with reference to the period 2016-2030[2]. In the same period, the expected diversion of car trips towards green modes of transport will lead to significant changes in modal shares, with cars dropping from 42% to 22% of the total number of trips, as far as the territory of the Municipality of Bologna is concerned, and public transit and mainly bikes increasing their market shares accordingly, as shown in Table 1 (Città Metropolitana di Bologna, 2019).

Table 1.

Modal share and related variation for trips involving the territory of the Municipality of Bologna

Transport Mode	2016	2030	2016-2030 Variation
Private Cars	42 %	22 %	- 48 %
Public Transit	21 %	28 %	+ 33 %
Bikes	5 %	18 %	+ 260 %

In 2030, following the implementation of Bologna SUMP and compared to current levels, the Municipality of Bologna is expected to accommodate an increase by 1,280,000 km in distance covered by passengers of public transport services, an increase by 780,000 km in distance covered by bike trips and also an increase by 11,000 km in walking mobility (Città Metropolitana di Bologna, 2019).

Cycling mobility is taken into particular consideration by Bologna SUMP, also based on the consideration that, at the time being, 16% of the trips performed by car cover less than 1 km and 33% of them is between 1 km and 5 km long, with reference to the trips involving the territory of the Municipality of Bologna. Indeed, a specific Bike Plan is included in Bologna SUMP, with 156 million of Euros assigned to pay the total investment cost for the development of infrastructure dedicated to cyclists (Città Metropolitana di Bologna, 2019). In the European Union and outside the European Union, cycling mobility is expected to assume an increasingly important role in the future development of urban transport systems (Novikov et al., 2021) and measures regarding cycling mobility are typically recommended among the most important ones to plan and be implemented, under a multimodal perspective, in order to achieve the goals defined by SUMPs.

DATASET AND METHODOLOGY

This research is based on data regarding bike flows in the Municipality of Bologna, which have been collected and processed, year by year, since 2009, in the period from mid-September to the end of October, with reference to 20 or more road sections (Rupi et al., 2020; Rupi et. al., 2019; Bernardi et al., 2016, Bertoni & Rupi, 2013).

Monitoring bike flows is an important step to be performed within the transport planning process, as a decision support activity that can be very helpful for territorial policy makers. The main reasons why cyclist monitoring is important can be summarised as follows:

1) to detect changes and trends;
2) to establish a baseline, i.e. a starting point for usage in target setting and comparison;
3) to provide information and details on traffic levels and characteristics;
4) to evaluate performances, i.e. to quantify the effect on cycling of new strategies and technical measures.

[2] At the time being, a total number of 2,700,000 daily trips can be estimated to be performed in the Metropolitan City of Bologna, among which 1,600,000 daily trips are performed by car; it can be noted that 700,000 of the 1,600,000 car trips involving the Metropolitan City of Bologna are performed to/from (50%) or within (50%) the territory of the Municipality of Bologna.

In this study, cyclist monitoring has been performed based on a combination of manual as well as automatic observations. On one hand, instrumental stations can provide continuous data counts. Automatic counts have been collected by means of (Bertoni and Rupi, 2013):

1) "Wavetech" radar traffic counters (Fig. 1) and

2) "Apollo Diamond" pneumatic traffic counters (Fig. 2).

On the other hand, manual monitoring is useful to: analyse cyclists' characteristics (age, gender, bike type, etc. - and not only volumes); determine the usage of cycle lanes compared to parallel lanes shared with motorised vehicles (indeed, most of the instruments cannot measure bike flows on the road carriage due to interferences with motorised vehicles); calibrate the output collected by automatic instruments and evaluate their precision.

Fig. 1. "Wavetech" radar counter

Fig. 2. "Apollo Diamond" pneumatic counter

As far as the 2020 and 2021 campaigns are concerned, about 400 hours have been performed of manual observations, mainly in peak hours, from mid-September to the second half of October, together with not less that 7 days (24/24 h) of automatic counting in each section. In the last 2020 and 2021 campaigns, 20 sections have been monitored in the city center and immediate surrounding areas, as shown in the map presented in Fig. 3. The vast majority of road sections included in the study sample refer to road sections with either mono-directional or bi-directional separate bike lanes. Since 2020, collected data include counts of electric scooters too.

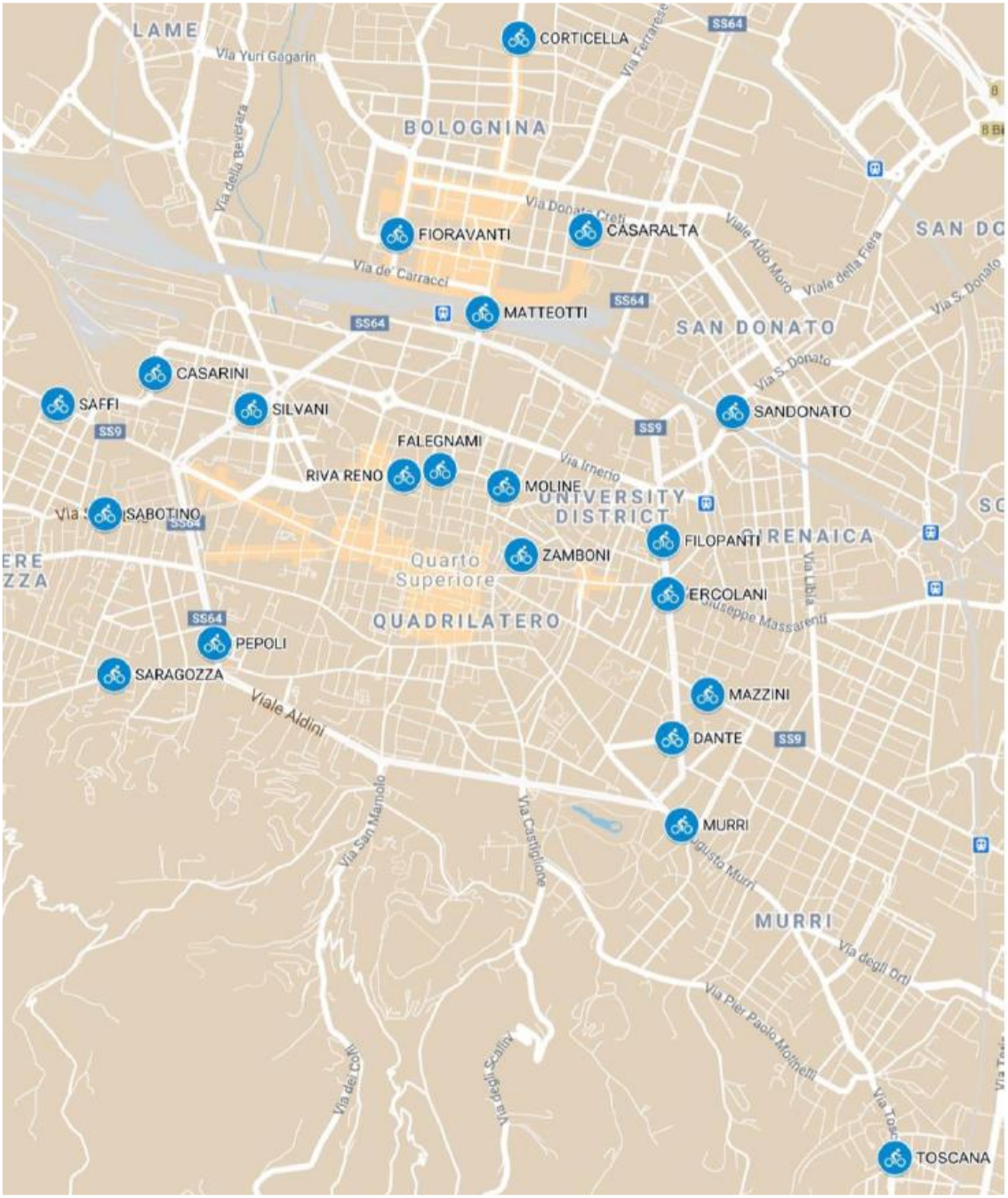

Fig. 3. Map of the road sections monitored in the most recent 2020 and 2021 campaigns

MAIN RESULTS

Fig. 4 shows a chart drawn, as an example, on the basis of continuous automatic bike counting activities conducted in the monitoring section located in Via Matteotti, which represents one of the most crowded section of the whole study sample. Such type of observations can help practitioners and decision makers to identify peak and non-peak hours during the working days within the city of Bologna.

Fig. 5 presents a chart, which reports the average hourly bike flow, i.e. the average number of cyclists per hour counted in the whole sample of sections, in both directions, during each annual campaign conducted in the city of Bologna, since 2008. In the period 2008-2021, the average hourly bike flow is equal to 224 veh/h. Measures refer to rather homogeneous weather conditions, as the results of monitoring activities conducted under extreme meteorological events have been excluded from the analyses.

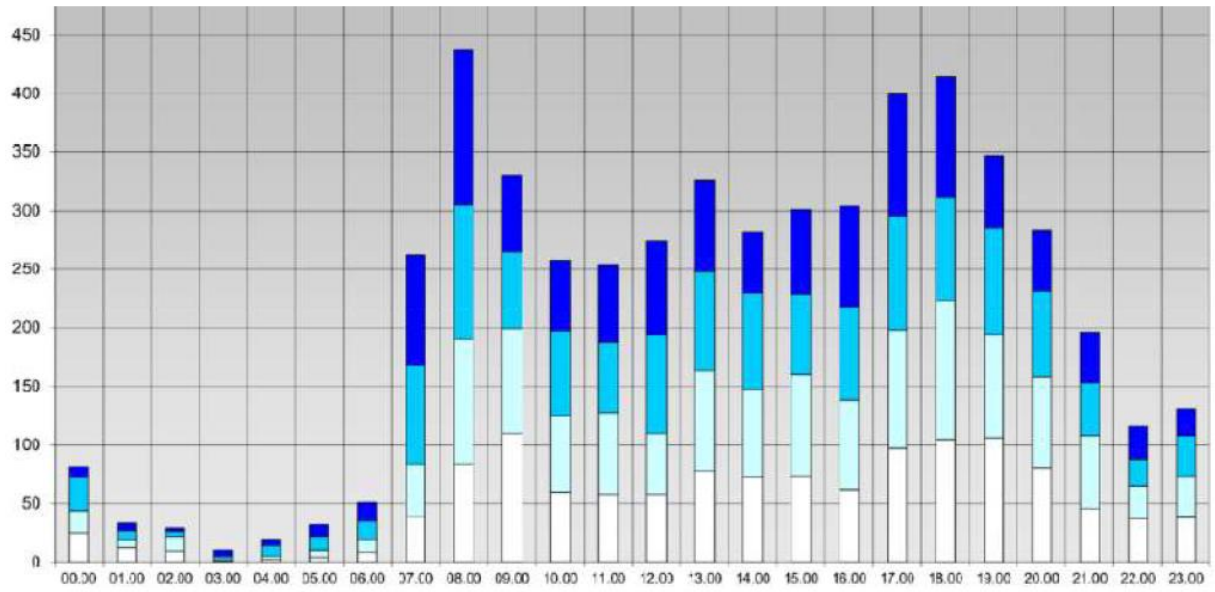

Fig. 4. Average hourly bike flow (veh/h) registered by automatic counters in the road section located in Via Matteotti, during a 24h/24h counting activity conducted from 22nd September 2020 to 1st October 2020 (only working days were considered)

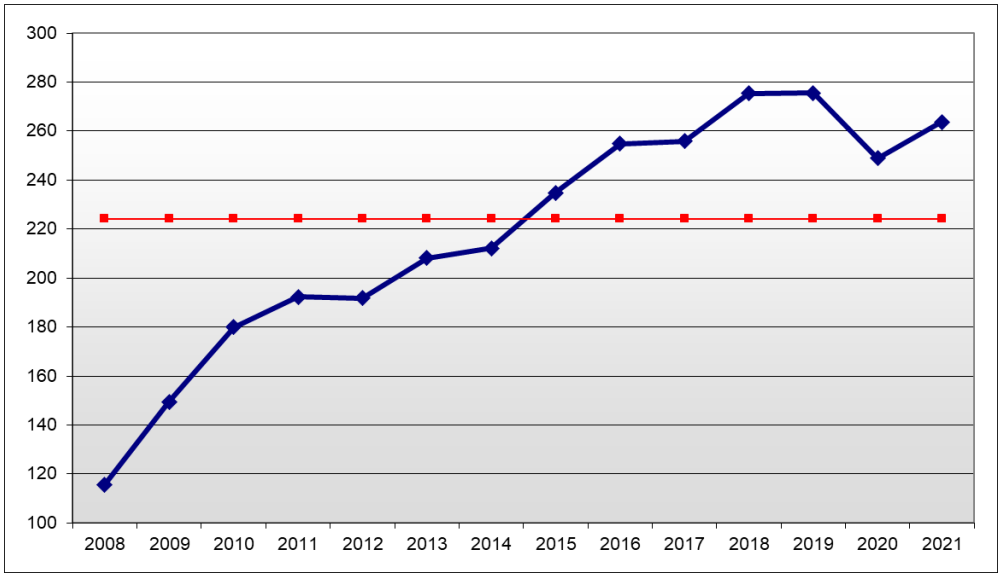

Fig. 5. Average hourly bike flow (veh/h) calculated with reference to the whole sample of road sections where monitoring activities have been conducted from 2008 to 2021

The 2020 campaign represents the first cyclist monitoring campaign conducted after the entrance of Italy and Europe into the pandemic emergency, so that the drop registered by bike flows in 2020 and 2021, compared to previous years, e.g. a decrease by 9% from 2019 to 2020 and a decrease by 4% from 2019 to 2021 can be explained accordingly. Indeed, lower travel demand has been recently registered in the city of Bologna, due to reduced levels of socio-economic activities, as well as emerging phenomena, such as telework and on-line teaching, with special regard to the possibility for students to attend academic lectures remotely.

Nevertheless, an increase by more than 40% can be observed in the 2011-2021 period, which shows a relevant increase in bike usage in the last decade within the city of Bologna. Furthermore, usage of bike lanes by cyclists in the road sections where they are available has significantly increased over the years (Fig. 6), from 65% in 2010 to almost 87% in 2021, so that a decreasing number of cyclists still prefer to ride their bike along the road lanes shared with motor vehicles instead of using dedicated (or shared with pedestrians) bike lanes.

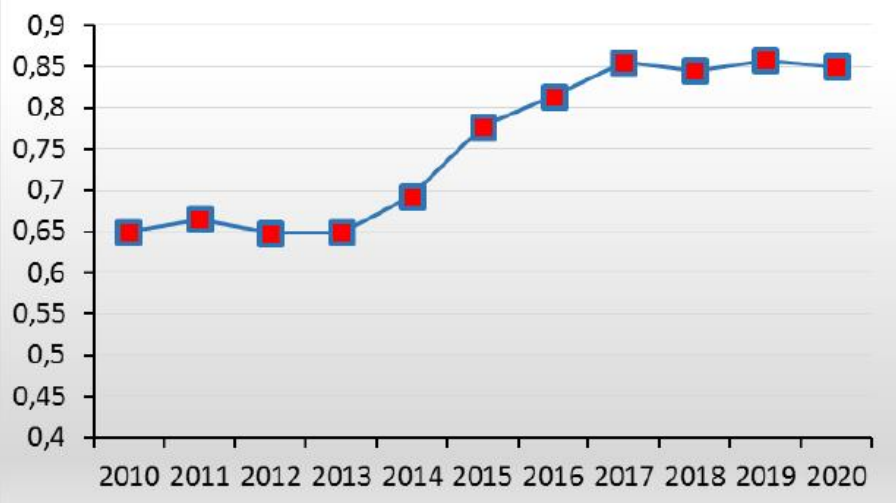

Fig. 6. Fraction of cyclists using the bike lanes where available on the total number of cyclists crossing the road sections

Finally, a new trend has recently emerged, which regards the usage of electric scooters. The 2021 campaign has registered a an average value of 6% on the total number of bikes and electric scooters crossing the road sections. It can be noted that manual observations have revealed that users of electric scooters are mainly male (82% in 2021), while female cyclists account for 45% of the total number of cyclists, with a significant trend emerging towards a more perfect balance, compared to the value of 36% female cyclists registered in year 2015.

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