COMPARISON

9 MILANO MUNICIPIOS

OF A HEALTHY CITY

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CONTENTS

1. INTRODUCTION

1.1 BACKGROUND

Urban places and the city planning processes that shape them-particularly those processes governing land use, housing, transportation, job opportunities, social services, the quality of urban environment and opportunities for pubic participation in local government-are increasingly understood as powerful determinants of population and health.

With the continuous increase of world population and urbanization, people's physical and mental health are more and more impacted on surrounding urban environment. Simultaneously, with the convenient and modern urban society, diseases and psychological problems caused by urban factors are increasingly prominent. The impacts of urbanization on mental health of urban residents has been stated having significant effects on brain functions, which result of the increase incidence of mental illness and the aggravation of disease.

City planners and designers in the twenty-first century are increasingly faces with the added challenge of revitalizing neglected urban neighborhoods in ways that improve health and promote greater equity.

In 1984, the concept of "healthy city" was first put forward at the international conference held in Toronto, Canada. Healthy city is a term used in public health and urban design to stress the impact of policy on human health. Many jurisdictions which have healthy community programs and cities can apply to become a WHO-designated "Healthy City". WHO defines the Healthy City as "one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and in developing to their maximum potential."

As the second largest city in Italy and one of the four economic centers in Europe, a world historical and cultural city, studying the health degree in different municipios of Milan may reveal some characteristics on the relationship between urban and health. Furthermore, it is a good opportunity to look at the current situations and searching ideas for future development.

1.2 AIM

The project compares 9 Milan municipals of a healthy city, finding out the advantages and disadvantages in healthy environment perspective, and giving different suggestions for future environmental development of Milan.

1.3 FARMWORK

Based on the theory of "healthy city", the research determines the evaluation factors

according to different evaluation indicators and the characteristics of GIS, Milan is taken as a case to study, collecting and analyzing the data, and draw a conclusion finally.
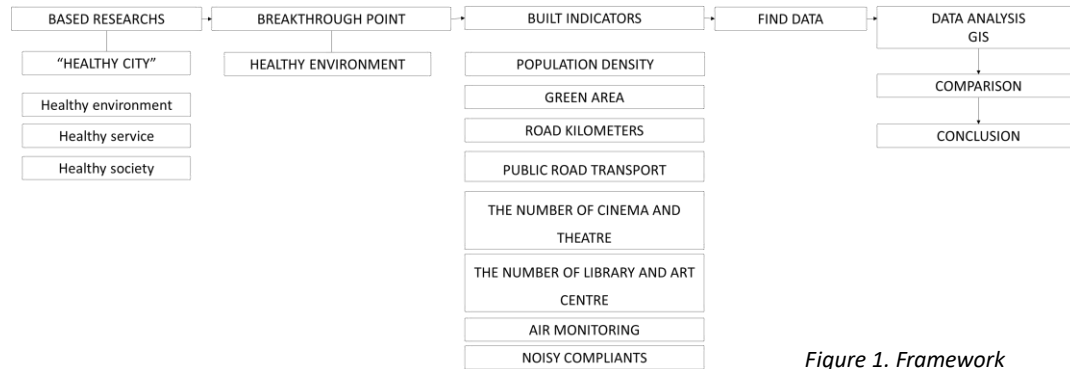

Figure 1. Framework

2. BASED THEORIES

2.1 WHO(EUROPE) – HEALTHY CITY

Figure 2. Concept of Healthy

WHO proposed that healthy city vision including people, participation, prosperity, planet, place, peace.

PEOPLE: Prioritized investment in people focusing on improving equity and inclusion though enhanced empowerment.

PARTICIPATION: Participatory governance processes undertaken in pursuit of the common good

PROSPERITY: Enhanced community prosperity and strengthened assets, though values-based governance of common goods and services.

PLANET: The health of both people and the planet are at the heart of all city policies.

PLACE: Physical, social and cultural environments that enable and drive health and well-being for all.

PEACE: Inclusive societies that focus on places, participation, prosperity and the planet, while putting people at the center of all policies and actions.

World Health Organization mainly gives the definition and aspects which may influenced in healthy city. However, it doesn't include how to measure a healthy city, what is the indicator to analysis and comparation. Therefore, the last report about healthy city in China could take as a reference in how to measure the city or regions.

2.2 CHINA – HEALTHY CITY

The Health City Professional Committee and the Tongji University Health City Laboratory follow the principles of comprehensiveness, scientific, and practicality. Referring to the classification of the four dimensions of the WHO, refer to the indicators of the National

Health City Evaluation Index System and use the three-level indicators for evaluation.

Table 1. Indicators of Healthy City

HEALTHY ENVIRONMENT	LANDUSE	Per capita green space
		Green coverage rate
		Population density
		Woody plant coverage rate
		Forest coverage rate
	TRANSPORTATION	Per capita urban road area
		Bus per capita
		Bus lines
	FACILITIES	Number of theatre and opera
		Number of library and museum
		Average number of books per person in public libraries
	POLLUTION CONTROL	Percentage of days with good ambient air quality
		Days with heavy pollution or above
		Sewage treatment rate
		PM2.5
		Urban rubbish treatment rate
		Road traffic equivalent acoustic levels
		Environment noise equivalent acoustic levels
HEALTHY SERVICE	HEALTH FUND	Proportion of health expenditure in general
		financial expenditure
	DISEASE PREVENTION	Number of centers for disease control
		Number of medical institutions per square kilometer
		Number of registered nurses
	SOCIETY TREATMENT	Number of practitioners
		Number of operation beds
	SOCIETY GUARANTEE	Number of medical insurance participants
		Medical insurance participation rate
	SOCIETY SUPERVISION	Number of health supervision centers
HEALTHY SOCIETY	ECONOMY DEVELOPMENT	Engel coefficient
		per capita disposable income
	EMPLOYMENT SECURITY	Unemployment rate
		Total unemployment
	SOCIAL WELFARE	Minimum wage
	HEALTHY LEVEL	Child immunization rate
		Infant mortality rate
		Average lifespan

3. PROJECT PROCESS

3.1 BUILT INDICATORS

In order to combine healthy city with GIS, considering the data analysis and representation, the project is only focus on 'Healthy Environment' in healthy city. The indicators are mainly taking reference of the indicators proposed by Chinese institution. We select relevant indicators which are important in different aspects of 'Healthy City' and amend some indicators to make it suit for European situation.

Table 2. Indicators of Milan Healthy City

INDICATORS	EXPLAINATION
POPULATION	Population is a basic data that important to analysis different indicators. population density refers to the number of people living in an area per kilometer square.
GREEN	Green space is very important for the physical and mental health of residents. Green area, green space rate and per capita green area are important indicators for measuring green space.
ROAD KILOMETERS	Highway mileage is an important indicator reflecting the scale of highway construction development and significant measurement of social and economic development. Road kilometers and per capita highway mileage are two important indicators.
PUBLIC ROAD TRANSPORT	A healthy public transport system is the basic supportive environment for a healthy city. The number of bus stops and the coverage of bus routes are important indicators of healthy cities.
NOISY COMPLIANTS	It means that people complain about noise in this place. Noise not only causes hearing damage, but also has adverse effects on human cardiovascular system, nervous system and endocrine system, which endangers people's physical and mental health.
AIR MONITORING	Air quality monitoring station is the basic platform for air quality control and reasonable assessment of air quality. It is also the infrastructure for urban air environmental protection.
THE NUMBER OF CINEMA AND THEATRE	Cinemas and theaters are important places for citizens to entertain and cultural life. To some extent, the number of cinema and theatre can indicate the richness of people's cultural and entertainment life.
THE NUMBER OF LIBRARY AND ART CENTRE	Public libraries and museums are an important part of urban culture and an indispensable cultural element of the city. The number shows the cultural construction situation of the city.

3.2 DATA ANALYSIS AND COMPARISON

3.2.1 POPULATION

Population is a basic information that important to analysis different indicators. Population density refers to the number of people living in an area per kilometer square, which is helpful to evaluate different indicators.

This mapping shows the population density of different municipios in gradation of color. It can be found that the population density of Municipio 2 is the largest and the Municipio 5 is the smallest. Furthermore, the population is denser in north area than south.
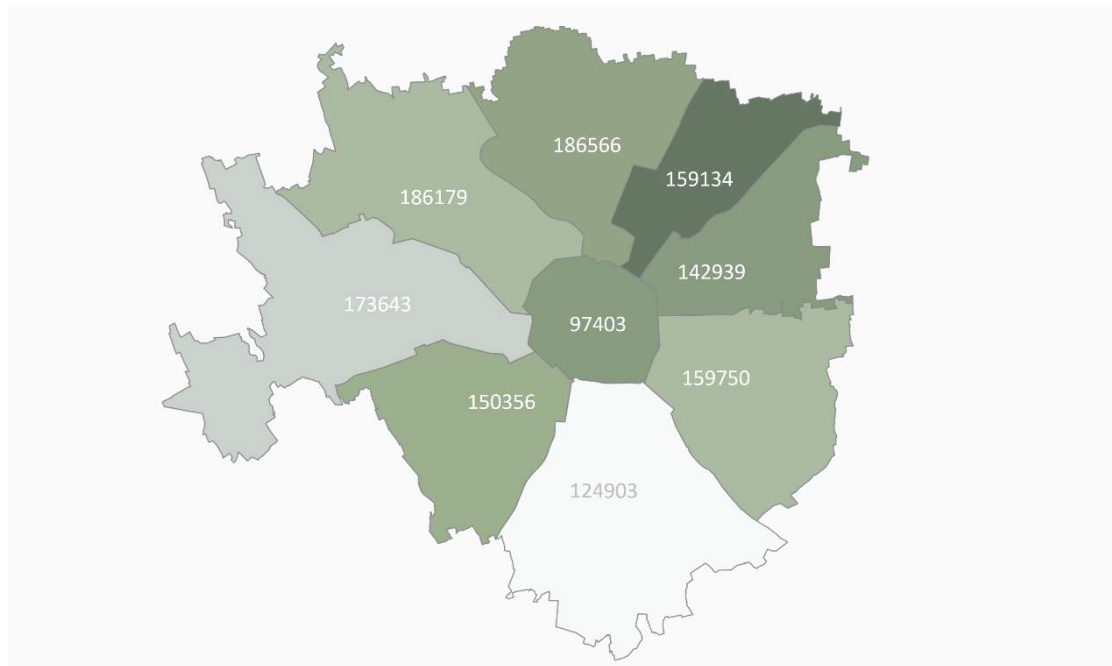
Figure 3. Population density of different districts in Milan

3.2.2 GREEN

Green space is very important for the physical and mental health of residents. Research on environmental perception shows that, compared with built environment, more exposure to natural environment has a restorative effect on the physical and mental health of urban residents. Green area, green space rate and per capita green area are important indicators for measuring green space.

Firstly, we need to know the distribution of green space. We download the green data including farmland, farm yield, forest, grass, cemetery, grass filed, orchard, village green and meadow, which are visited by citizens and having more influence on urban environment. Here is the result shown in QGIS.
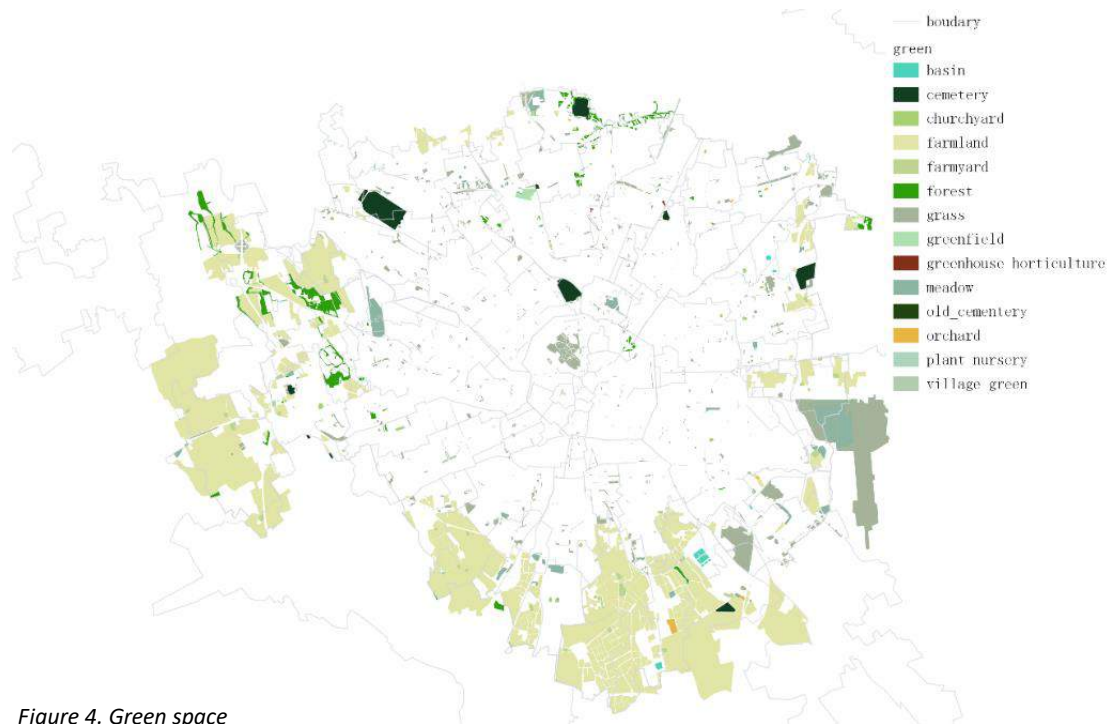
Result:

Figure 4. Green space

To compare different municipios, we clip the green based on the boundary of each municipios. Subsequently, we calculate the total green area in the municipols. We calculate each green area in open attribute table first, and then use the 'basic data analysis' we could got the sum of the whole green area. Then divide the green area by the municipio area and population, we got the data of green space rate and per capita green.
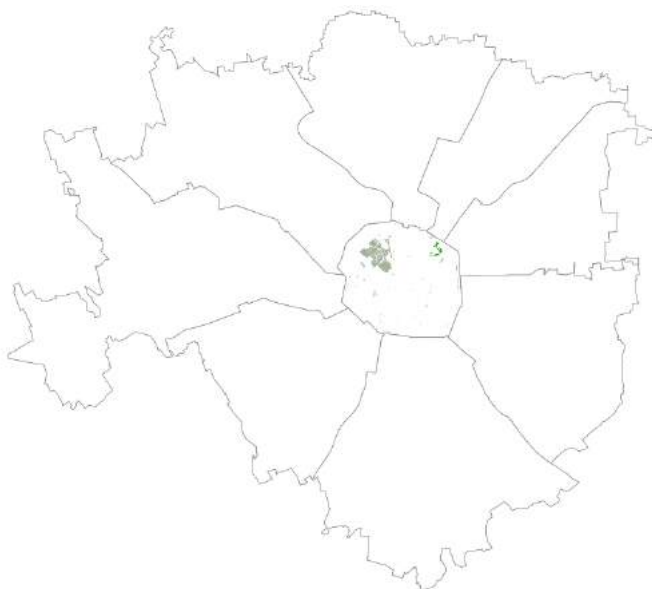
Results:

Figure 5. Green space in Municipio 1

Figure 6. Green space in Municipio 2

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
503641	5.17	5.34

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
339245	2.13	2.69
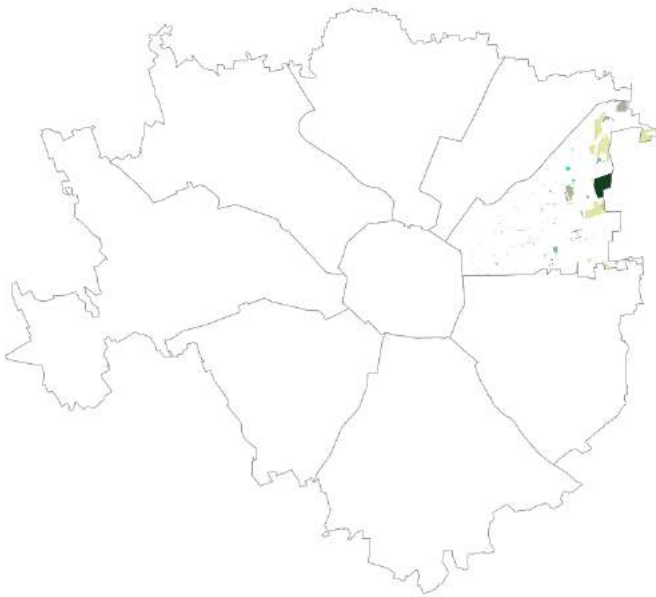
Figure 7. Green space in Municipio 3

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
1279592	8.95	8.86

Figure 8. Green space in Municipio 4

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
3323813	20.81	16.06
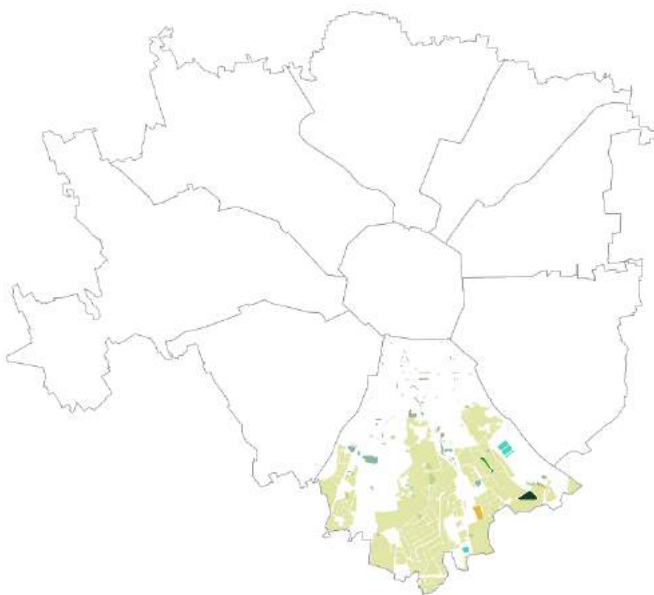
Figure 9. Green space in Municipio 5

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
11780232	94.32	39.32
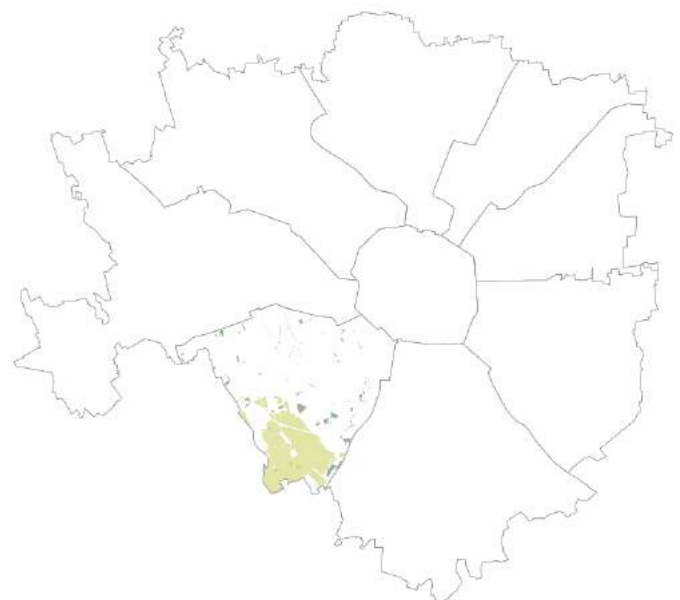
Figure 10. Green space in Municipio 6

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
3376421	22.46	18.41
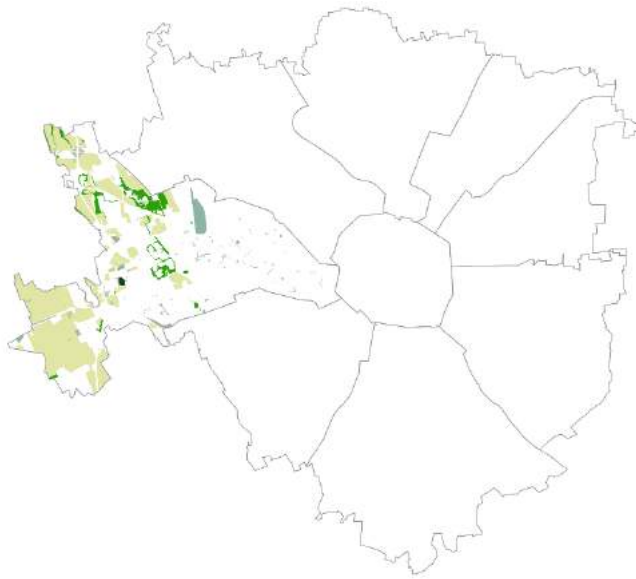
Figure 11. Green space in Municipio 7

Figure 12. Green space in Municipio

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
9213491	53.06	29.38

8

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
2714058	14.58	11.35
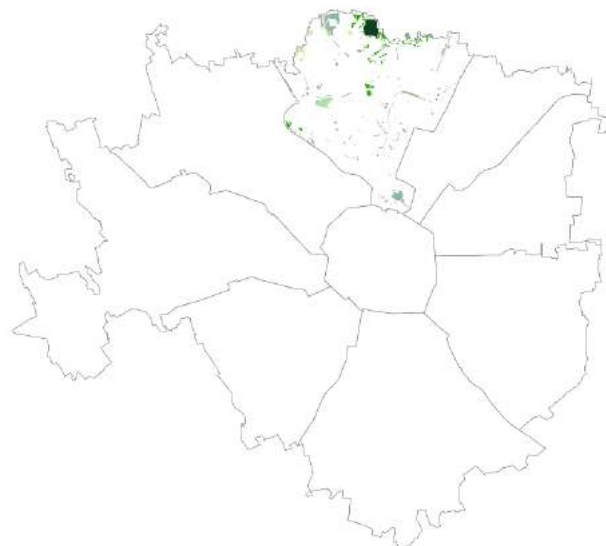
Figure 13. Green space in Municipio 9

Green Area (㎡)	Per capita Green Area (㎡/per)	Green rate(%)
1452467	7.79	6.91

Steps: firstly, calculate the area of each green space, we need to upload the clipped layer, open attribute table > editing > open field calculator > geometry > $area, input output field name, then we can get the result. Secondly, calculate the whole green area, vector > analysis tools > basic statistics for numeric fields, choose the layer and the statistics > run. Then we can use Excel to calculate the per capita green area and green rate.

Result:

Table 3. Green space status

ZONE	Green Area (㎡)	Per capita Green Area (㎡ /per)	Ranking	Green Rate	Ranking
MUNICIPIO 1	503641	5.17	8	5.34%	8
MUNICIPIO 2	339245	2.13	9	2.69%	9
MUNICIPIO 3	1279592	8.95	6	8.86%	6
MUNICIPIO 4	3323813	20.81	4	16.06%	4
MUNICIPIO 5	11780232	94.32	1	39.32%	1
MUNICIPIO 6	3376421	22.46	3	18.41%	3
MUNICIPIO 7	9213491	53.06	2	29.38%	2
MUNICIPIO 8	2714058	14.58	5	11.35%	5
MUNICIPIO 9	1452467	7.79	7	6.91%	7

According to the analysis, it could show that the green rate and per capita green area ranking are consistent. The green space in the municipio 5 is the best, the per capita green area is 94.32 square meters, the green land rate is 39.32%, and the municipio 7 is the second. The green area in municipio 2 is the worst, with a per capita green area of only 2.13 square meters and a green rate of only 2.69%. green rate and per capita green area of south area are much higher than north. However, at the sometime, farmland is domain the green in the south area, such as minicilio 5, 6, 7.

3.2.3 ROAD KILOMETERS
Road mileage is an important indicator reflecting the scale of car road construction development and significant measurement of social and economic development. Road kilometers and per capita road mileage are two important indicators.

Firstly, we upload the data of car road, excepting pedestrian, path, and cycleway.


Figure 14. Distribution of roads

To compare different municipios, we clip the map based on the boundary of each municipios. Subsequently, we calculate the total road kilometers in each area. We calculate each road kilometers in open attribute table first, and then use the 'basic data analysis' we could get the sum of the whole road kilometers. Then divide them by population, we got the data of per capita road mileage.

Result:
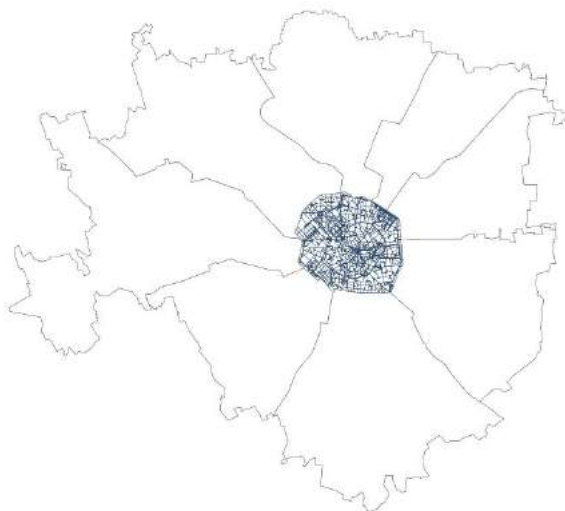
highway mileage(m)	Per capita highway mileage(m/per)
344584	3.54

Figure 15. Roads in Municipio 1
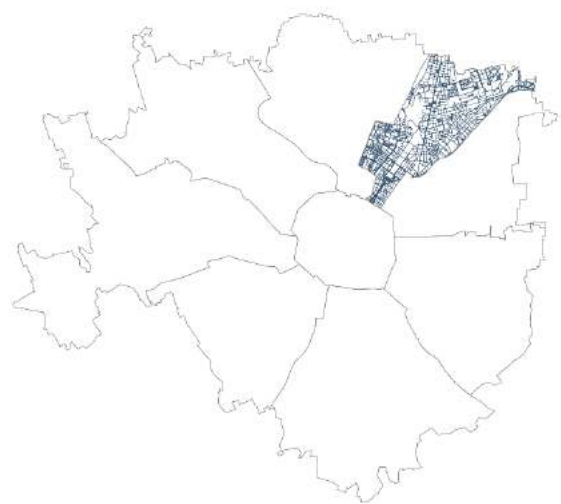
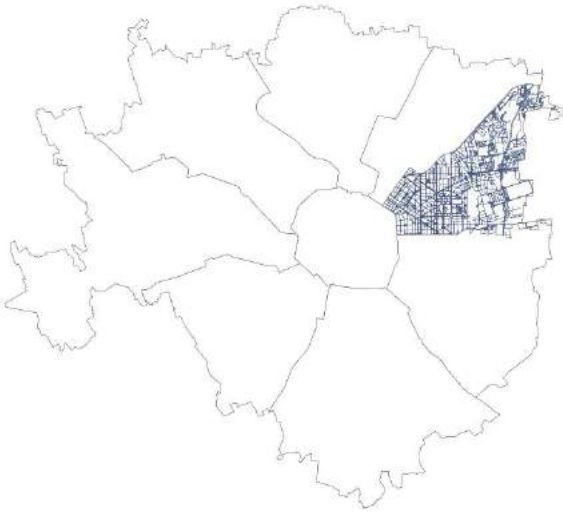| highway mileage(m)	Per capita highway mileage(m/per)
380832	2.39

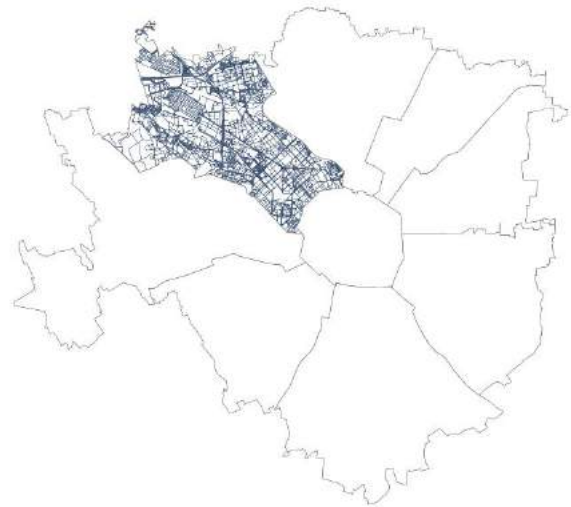*Figure 16. Roads in Municipio 2*

Figure 17. Roads in Municipio 3
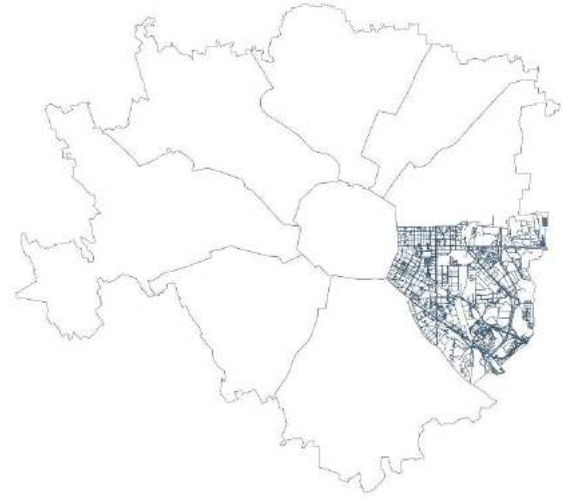
Figure 18. Roads in Municipio 4
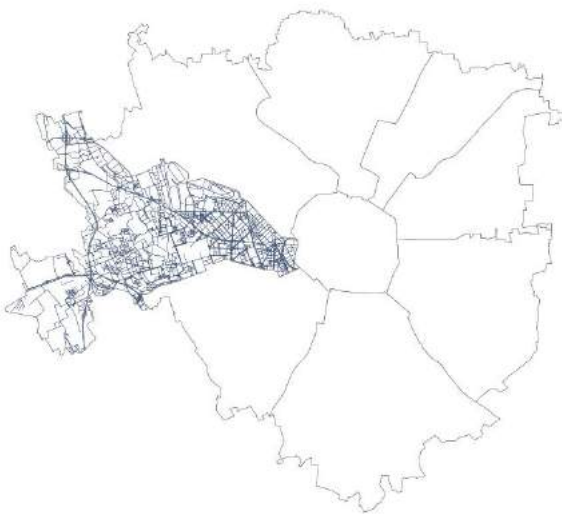
highway mileage(m)	Per capita highway mileage(m/per)
429435	3.00

Figure 19. Roads in Municipio 5

highway mileage(m)	Per capita highway mileage(m/per)
467168	3.74

highway mileage(m)	Per capita highway mileage(m/per)
554048	3.47

Figure 20. Roads in Municipio 6

highway mileage(m)	Per capita highway mileage(m/per)
467168	3.74
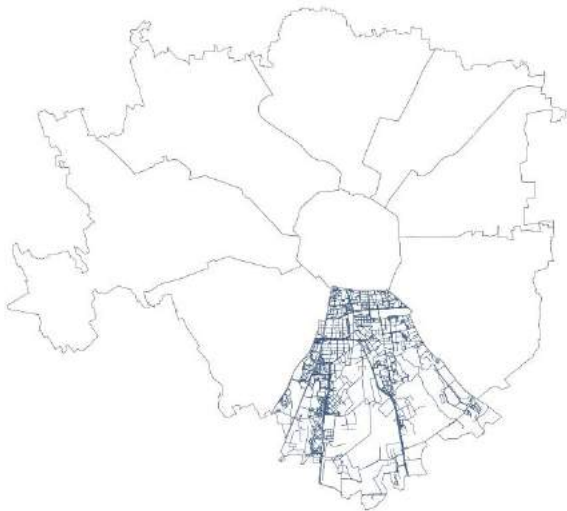
Figure 21. Roads in Municipio 7

highway mileage(m)	Per capita highway mileage(m/per)
586649	3.38
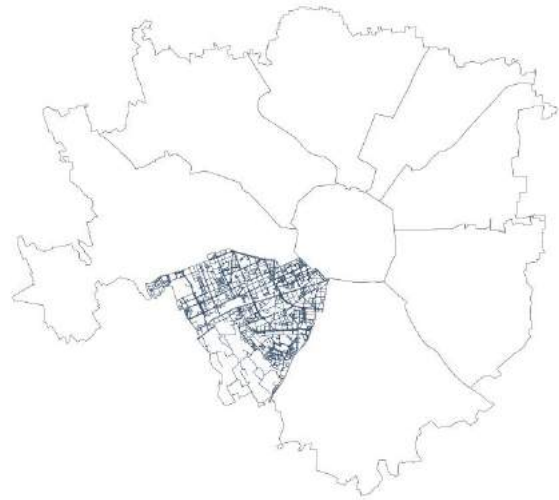
Figure 22. Roads in Municipio 8

highway mileage(m)	Per capita highway mileage(m/per)
765415	4.11
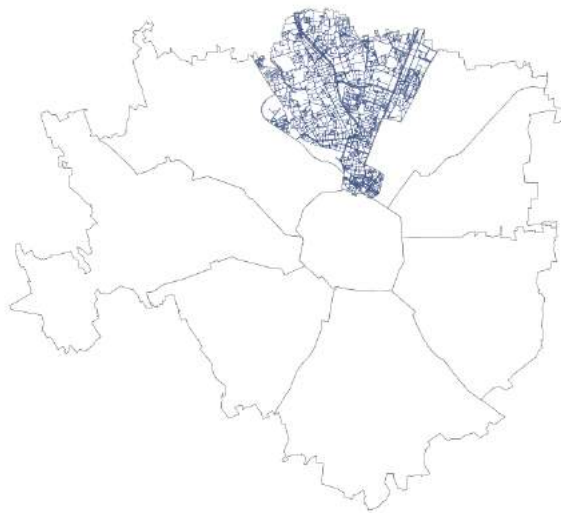
Figure 23. Roads in Municipio 9

highway mileage(m)	Per capita highway mileage(m/per)
622761	3.34

Steps: firstly, calculate the mileage of each road, we need to upload the clipped layer, open attribute table > editing > open field calculator > geometry > $length, input output field name, then we can get the result. Secondly, calculate the highway mileage, vector > analysis tools > basic statistics for numeric fields, choose the layer and the statistics > run. Then we

can use Excel to calculate the per capita highway mileage.

Result:

Table 4. Road mileage status

ZONE	highway mileage(m)	Per capita highway mileage(m/per)	Ranking
MUNICIPIO 1	344584	3.54	3
MUNICIPIO 2	380832	2.39	9
MUNICIPIO 3	429435	3.00	8
MUNICIPIO 4	554048	3.47	4
MUNICIPIO 5	467168	3.74	2
MUNICIPIO 6	451857	3.01	7
MUNICIPIO 7	586649	3.38	5
MUNICIPIO 8	765415	4.11	1
MUNICIPIO 9	622761	3.34	6

Road mileage among different municipios has little difference. The development of road construction is relatively balanced, with the highest per capita of 4.11m in Municipio 8 and the lowest per capita in Municipio 2, only 2.39m.

3.2.4 PUBLIC ROAD TRANSPORT

A healthy public transport system is the basic supportive environment for a healthy city. The number of bus stops and the coverage of bus routes are important indicators of healthy cities shows the public environment.
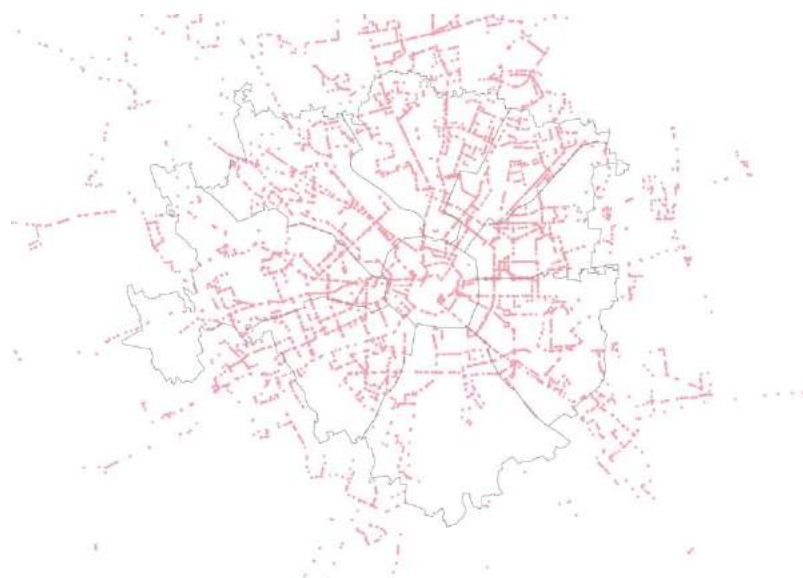

Figure 24. Bus Stops in Milan

To compare different municipios we must clip the layer with each municipios, the steps are
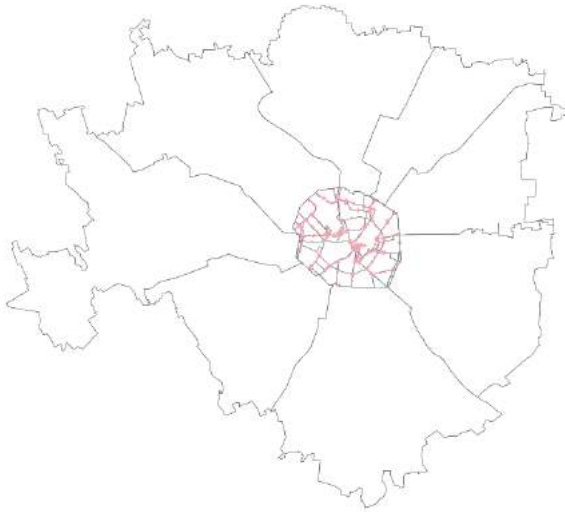
basically same as the road milage.

Figure 25. Public road transport in Municipio 1

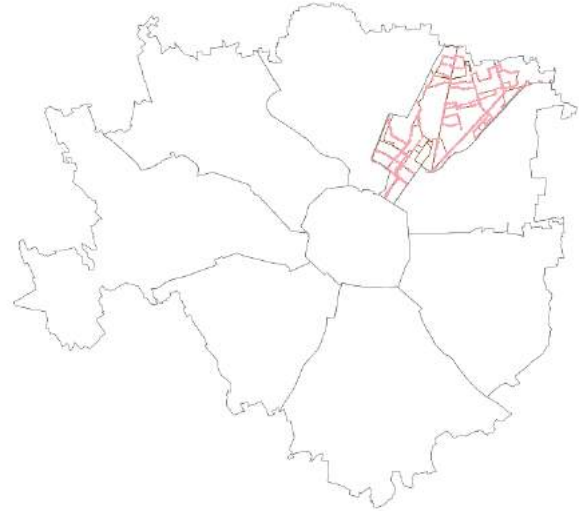| Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
436	225639	65.48

Figure 26. Public road transport in Municipio

2

Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
834	225605	59.24

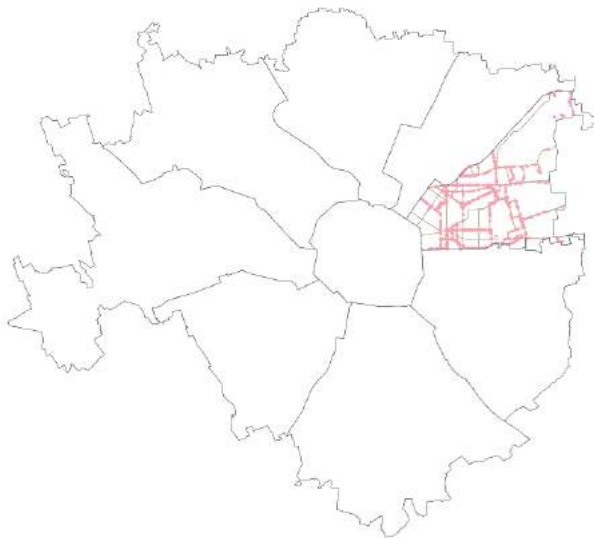*Figure 27. Public road transport in Municipio 3*

Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
834	225605	59.24

Figure 28. Public road transport in Municipio 4

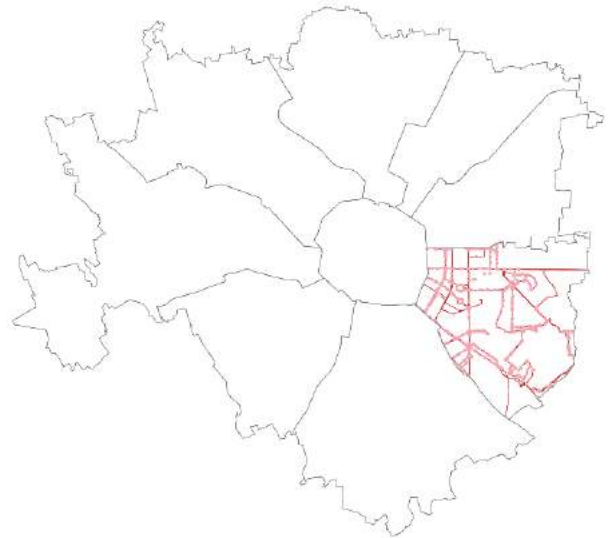| Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
834	225605	59.24

Figure 29. Public road transport in Municipio 5

Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
432	242846	51.98

Figure 30. Public road transport in Municipio 6

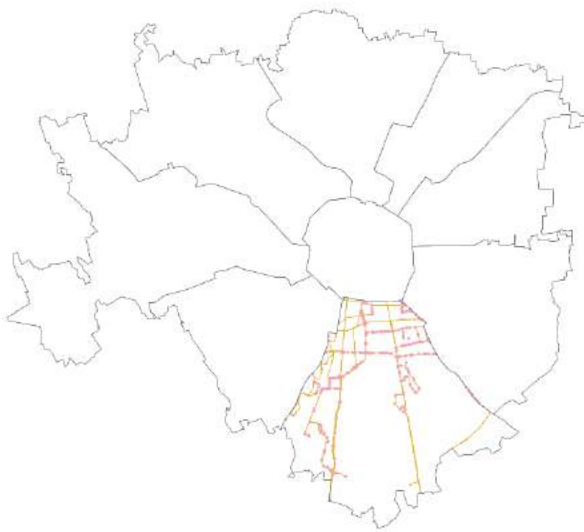| Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
1042	297584	65.86

Figure 30. Public road transport in Municipio 7

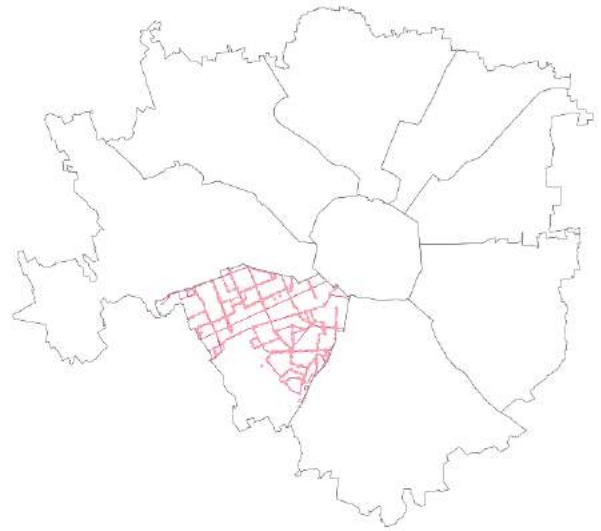| Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
1085	290470	49.51

Figure 31. Public road transport in Municipio 8

Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
1007	272999	35.67

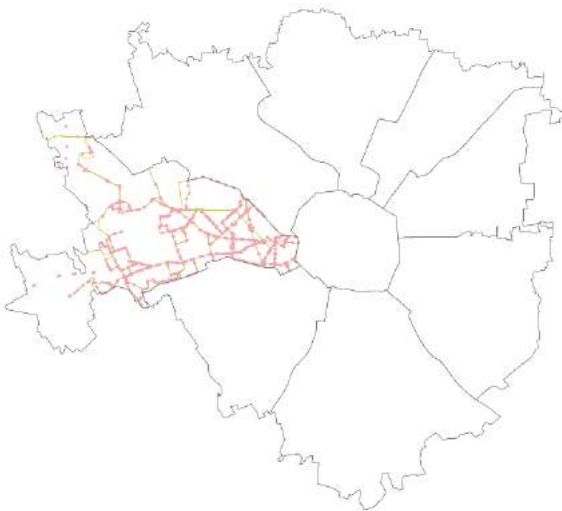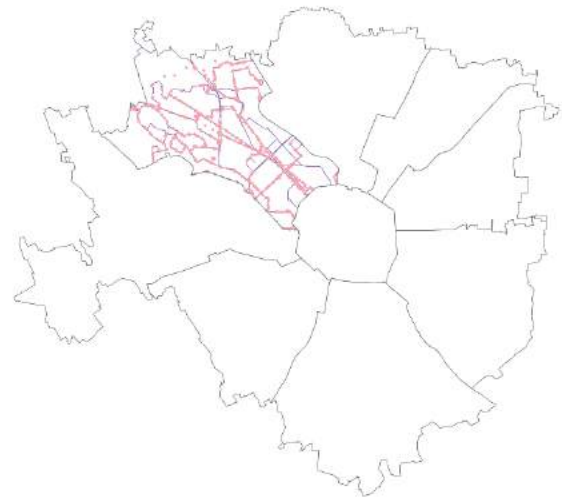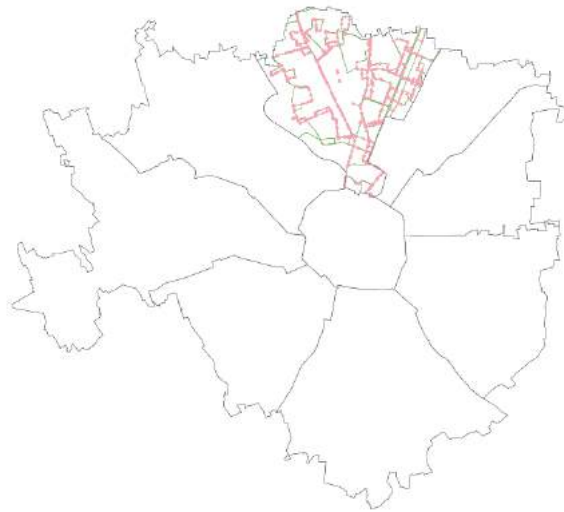*Figure 32. Public road transport in Municipio 9*

Stops	Public transport mileage (m)	Public transport mileage to road mileage ratio(%)
1129	323383	51.93

Steps: firstly, calculate the mileage of each route, we need to upload the clipped layer, open attribute table > editing > open field calculator > geometry > $length, input output field name, then we can get the result. Secondly, calculate the total mileage, vector > analysis tools > basic statistics for numeric fields, choose the layer and the statistics > run. Then we can use Excel to calculate the per capita highway mileage.

Result:

Table 5. Public road transport status

ZONE	Stops	Stops/Area(km2)	Ranking	Public transport mileage (m)	Public transport mileage to road mileage ratio (%)	Ranking
MUNICIPIO 1	436	46.25	6	225639	65.48%	3
MUNICIPIO 2	834	66.04	1	225605	59.24%	5
MUNICIPIO 3	823	57.02	2	300346	69.94%	1
MUNICIPIO 4	814	39.33	8	332545	60.02%	4
MUNICIPIO 5	432	14.42	9	242846	51.98%	6
MUNICIPIO 6	1042	56.83	3	297584	65.86%	2
MUNICIPIO 7	1085	34.59	4	290470	49.51%	8
MUNICIPIO 8	1007	42.12	7	272999	35.67%	9
MUNICIPIO 9	1129	53.73	5	323383	51.93%	7

It is not easy to find relationship between the average number of bus stops and the public transport mileage to road mileage ratio. The ranking of stops/area shows municipio 2 have maximum number of stops while municipio 5 is the worst, only 14.92 stops per km2. Other areas are roughly the same. Considering about the data of public transport mileage to road mileage ratio, the development of public system in each area is similar.

3.2.5 NOISY COMPLIANTS
Noise not only causes hearing damage, but also has adverse effects on human cardiovascular system, nervous system and endocrine system, which endangers people's physical and mental health. Within some references, we find the noise complain points in Milan.
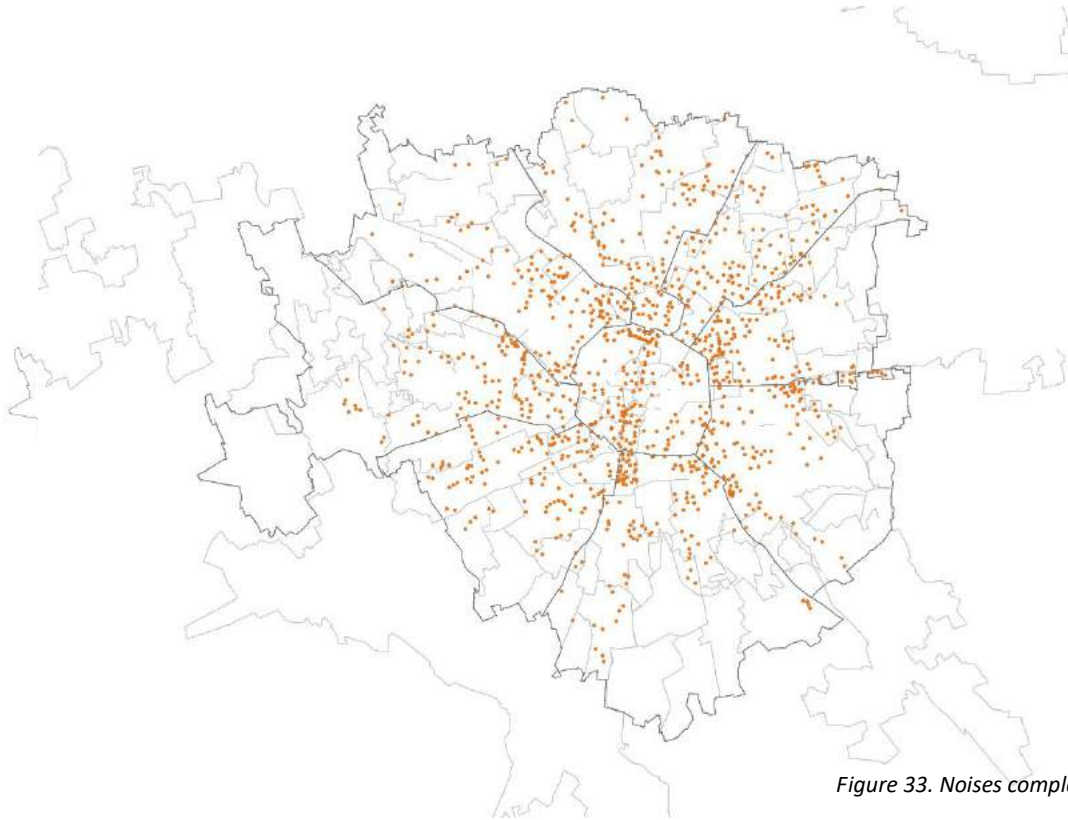

Figure 33. Noises complain points in Milan

Figure 34. Noises complain points in Municipio 1

Figure 35. Noises complain points in Municipio 2

POINTS	SPOTS/AREA(KM2)
152	16.12

POINTS	SPOTS/AREA(KM2)
114	9.03
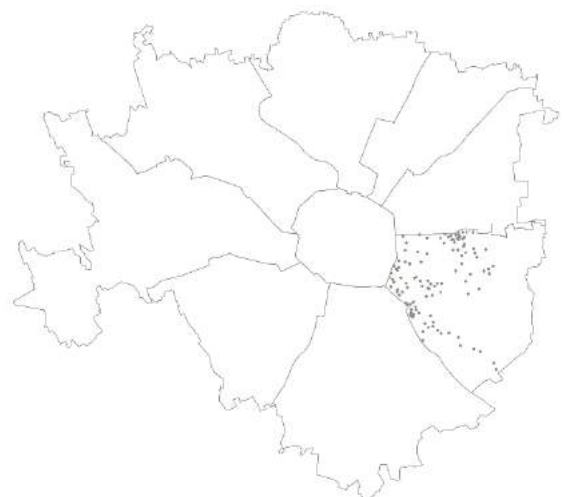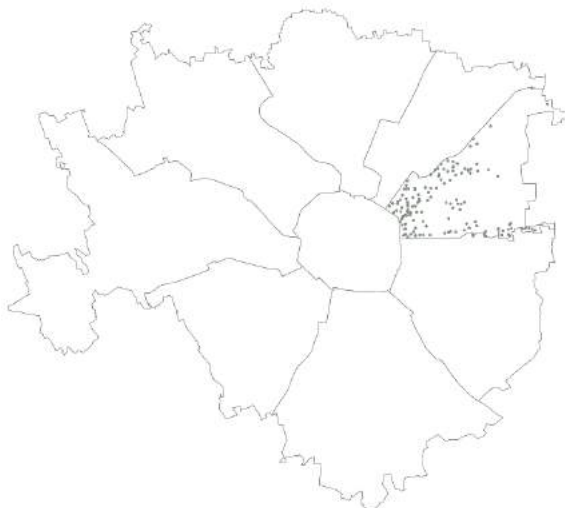
Figure 36. Noises complain points in Municipio 3

POINTS	SPOTS/AREA(KM2)
114	9.03

Figure 37. Noises complain points in Municipio 4

POINTS	SPOTS/AREA(KM2)
114	5.51
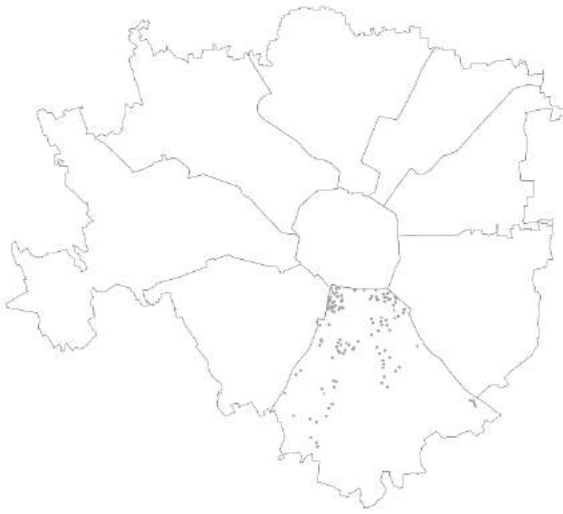
Figure 38. Noises complain points in Municipio 5

POINTS	SPOTS/AREA(KM2)
122	4.07
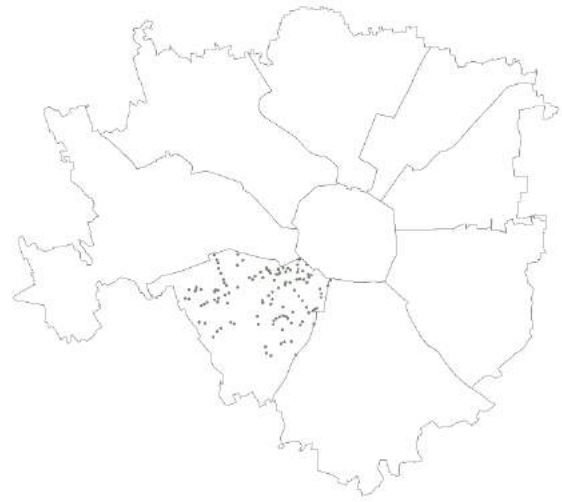
Figure 39. Noises complain points in Municipio 6

POINTS	SPOTS/AREA(KM2)
118	6.44
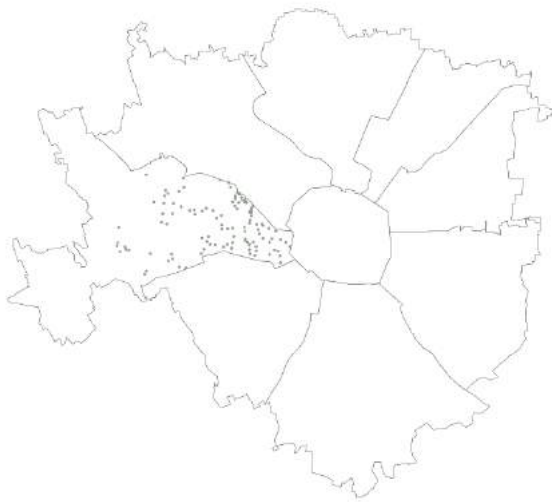
Figure 40. Noises complain points in Municipio 7

POINTS	SPOTS/AREA(KM2)
112	3.57
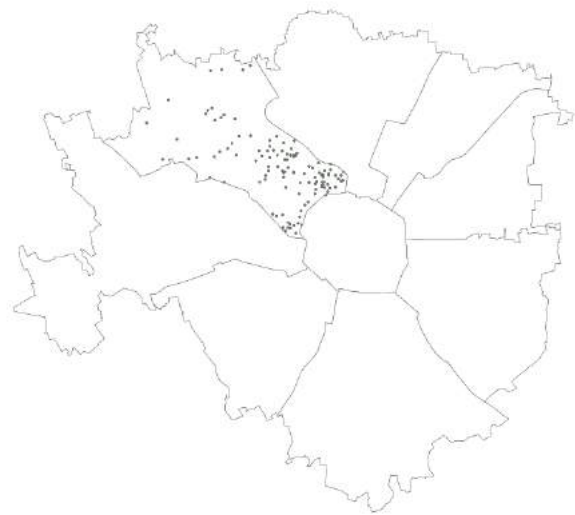
Figure 41. Noises complain points in Municipio 8

POINTS	SPOTS/AREA(KM2)
112	3.57
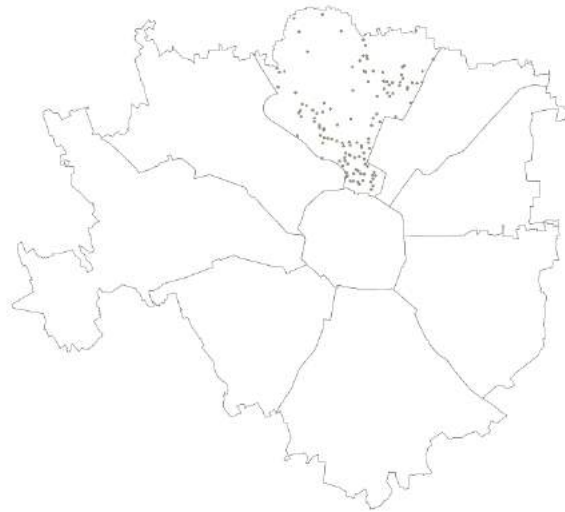
Figure 41. Noises complain points in Municipio 9

POINTS	SPOTS/AREA(KM2)
112	3.57

Table 6. Public road transport status

ZONE	Noisy Points	POINTS/AREA(KM2)	Ranking
MUNICIPIO 1	152	16.12	9
MUNICIPIO 2	114	9.03	7
MUNICIPIO 3	133	9.21	8
MUNICIPIO 4	114	5.51	4
MUNICIPIO 5	122	4.07	2
MUNICIPIO 6	118	6.44	6
MUNICIPIO 7	112	3.57	1
MUNICIPIO 8	119	4.98	3
MUNICIPIO 9	123	5.85	5

The noise complaint points in the central area are the highest, while the noise points in the Municipio 7 are the least. There may be a relationship between noise and the dense of the population, development of transportation and social activities.

3.2.6 THE NUMBER OF CINEMA, THEATRE & LIBRARY, ART CENTRE

Cinemas and theaters are important places for citizens to entertain and cultural life which related to people mental health. To some extent, the number of cinema and theatre can indicate the richness of people's cultural and entertainment life. The cinemas and theatres are built around the downtown, and there are few theaters on the edge of the city. Public libraries and museums are an important part of urban culture and an indispensable cultural element of the city. The number shows the cultural construction situation of the city.
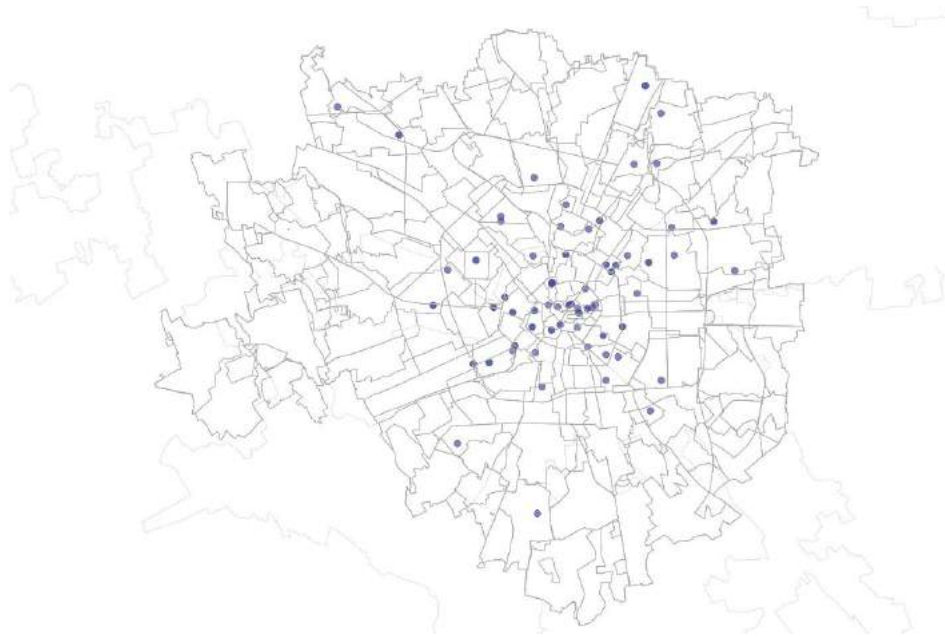

Figure 42. Cinemas and theatres in Milan
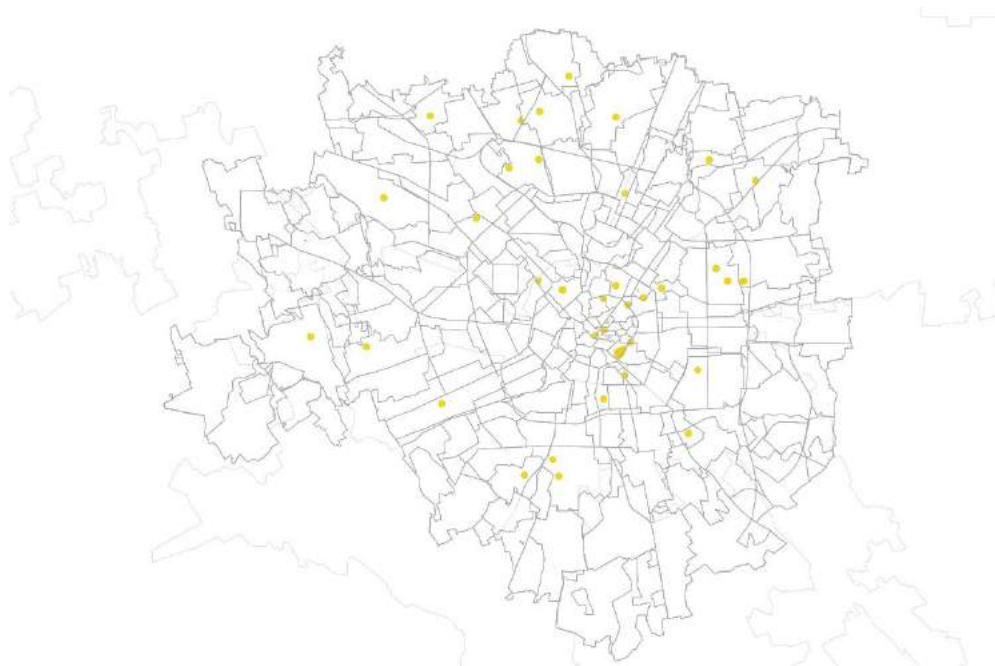
Figure 43. Libraries and art centers in Milan

It could see in the diagram that the cinemas and theaters are mainly located in the center of Milan. The library and art centers in spread over different area, which is good for people mental entertainment.

3.2.8 AIR MONITORING

Air quality monitoring station is the basic platform for air quality control and reasonable assessment of air quality. It is also the infrastructure for urban air environmental protection.

According to the data collected from the air monitoring points, we can find that the distribution of the monitoring points in Milan is not balanced. There are four monitoring points in Municipio 8, while most municipios have only one monitoring point.

Figure 44. Air monitoring stations in Milan

4 CONCLUSIONS AND SUGGESTIONS

ZONE	Green Rate	Per capita highway mileage	Stops/Area	Public transport mileage to road mileage ratio	POINTS/AREA	AVERAGE
MUNICIPIO 1	8	3	6	3	9	4.83
MUNICIPIO 2	9	9	1	5	7	5.17
MUNICIPIO 3	6	8	2	1	8	4.17
MUNICIPIO 4	4	4	8	4	4	4.00
MUNICIPIO 5	1	2	9	6	2	**3.33**
MUNICIPIO 6	3	7	3	2	6	3.50
MUNICIPIO 7	2	5	4	8	1	**3.33**
MUNICIPIO 8	5	1	7	9	3	4.17
MUNICIPIO 9	7	6	5	7	5	5.00

Based on the above results, the healthy cities in Municipio 5 and Municipio 7 rank higher, while Municipio 2 ranks lowest.

According to the analysis, green space in the municipio 5 is the best, the per capita green area is 94.32 square meters, the green land rate is 39.32%, and the municipio 7 is the second. The green area in municipio 2 is the worst, with a per capita green area of only 2.13 square meters and a green rate of only 2.69%. green rate and per capita green area of south area are much higher than north. However, at the sometime, farmland is domain the green in the south area, such as minicilio 5, 6, 7. More green space should develop in the north part of milan. Road mileage among different municipios has little difference. The development of road construction is relatively balanced, with the highest per capita of 4.11m in Municipio 8 and the lowest per capita in Municipio 2, only 2.39m. The ranking of stops/area shows municipio 2 have maximum number of stops while municipio 5 is the worst, only 14.92 stops per km2. Other areas are roughly the same. Considering about the data of public transport mileage to road mileage ratio, the development of public system in each area is similar. The noise complaint points in the central area are the highest, while the noise points in the Municipio 7 are the least. There may be a relationship between noise and the dense of the population, development of transportation and social activities. Cinemas and theaters are mainly located in the center of Milan. The library and art centers in spread over different area, which is good for people mental entertainment. More cinemas and theaters should consider building in the sounding area of Milan to enhance the mental activities of citizens.

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