Chapter 5
Three Cities

Abstract The fifth chapter addresses contemporary cities, with both inherited and emerging urban forms, investigating the main urban agents and city-building processes. Three case studies were selected: three clearly distinct cities, with different weaknesses and threats, and with specific strengths and opportunities. These cities are New York, Marrakesh and Porto. Founded in the early seventeenth century by the Dutch settlers, the city of New York has been continuously growing, in a remarkable process of urban evolution, marked by the 1811 plan (establishing its orthogonal layout), that culminated in today's magnificent metropolis, structured in five main areas (Manhattan, Brooklyn, Queens, Bronx and Staten Island) and the place of residence for more than eight million inhabitants. The urban forms of Marrakesh are clearly different from the urban forms of New York. Marrakesh, one of the four imperial cities of Morroco, was founded in mid eleventh century by the Almoravids. Ten centuries of urban history are today present in the remarkable medina of Marrakesh. The city with almost one million inhabitants is also composed of areas developed in the twentieth century, such as the *Guéliz* and the *Hivernage* neighbourhoods. The urban forms of Porto are very different from the urban forms of the American and Moroccan cities described in this chapter. Founded in mid-eleventh century, as Marrakesh, Porto grew from a small castel town to an area twelve times larger in a period of two centuries. In a unique location facing the Atlantic Ocean and the Douro River it is the second largest city of Portugal and the centre of a metropolitan area with 1.7 million inhabitants.

Keywords Cities · Marrakesh · New York · Porto · Urban form

5.1 New York

After being explored by Giovanni da Verrazano, for France in 1524, and by Henry Hudson, for the Netherlands in 1609, the area that would be named New Amsterdam (and renamed New York in 1664) was settled by the Dutch West India

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Fig. 5.1 Reproduction of the *Afbeeldinge Van de Stadt Amsterdam in Nieuw Neederlandt* by Jacques Cortelyou, 1665–1670 (*Source* Public domain)

Company in 1625. In the next year, Peter Minuit, the first Director-General of New Netherland, purchased Manhattan Island from a local tribe.

Figure 5.1 presents a map of New Amsterdam in the end of the Dutch occupation in the mid-seventeenth century. New Amsterdam was a small settlement surrounded by water at east, south and west and by a wall (in what would be Wall Street) at north. The pattern of streets was very irregular. One main street emerged in this irregular set, the *Breede Wegh* constituting a pre-existence of the former indigenous occupation (the *Weekquaesgeek*). Later it would be called Broadway. The map in Fig. 5.1 shows a set of 20 street blocks of irregular size and shape, with different number of plots—also of different sizes and shapes—and with a higher density of buildings in the southern street blocks. Fort Amsterdam stands out as an exceptional built structure. Despite the construction of new streets, the street pattern of today's Lower Manhattan is very similar to this pattern of the seventeenth century.

In 1664 New Amsterdam was conquered by the British and renamed New York. Under the British Government the city flourished and the population had a significant increase. From about 1000 inhabitants in 1650 it grew until 20,000 inhabitants in its late colonial days (see Table 5.1). Figure 5.2 presents a map of the city in those days. On the one hand, it shows a moderate expansion of the urban area—the city was about three times larger than New Amsterdam 100 years earlier—extending until the Commons (now the City Hall Park). On the other hand, it shows the beginning of a new pattern of orthogonal streets and street blocks promoted, not by public action and planning but, by private initiative. This is the case of the areas between Broadway and Hudson River, in the west part of Manhattan, and to the east of Bowery Lane, in the eastern part of the island.

Table 5.1 Evolution of resident population in New York, 1790–2010 (*Source* Department of City Planning, DCP)

1790	33,131
1800	60,515
1810	96,373
1820	123,706
1830	202,589
1840	312,710
1850	515,547
1860	813,669
1870	942,292
1880	1,206,299
1890	1,515,301
1900	3,437,202
1910	4,766,883
1920	5,620,048
1930	6,930,446
1940	7,454,995
1950	7,891,957
1960	7,783,314
1970	7,894,798
1980	7,071,639
1990	7,322,564
2000	8,008,278
2010	8,175,133

After the independence from Britain, this preference for a regular layout would have its greatest expression in the beginning of the nineteenth century. In 1807 the New York State Legislature appointed and empowered three commissioners—Gouverneur Morris, Simeon De Witt and John Rutherfurd—to prepare the future of the city, with a deadline of 1811 to complete the plan. They hired John Randel Jr as surveyor general. The 1807 Act set few design guidelines, fixing the plan's baseline at the edge of the dense settlement at Houston St., anticipated squares and three types of streets, and established specific implementation procedures.

The plan was based on an apparently futuristic growth scenario. At a time when the city with a population of 96,000 inhabitants crowded south of Canal St, the plan envisioned it reaching 155th St and forecasted a population of 400,000 in 1860. The population of Manhattan in 1860 would be 813,500, doubling the Commissioners' projections for that year (Ballon 2012).

The plan proposed a division of the territory north of Houston St into a grid layout of 12 avenues wide and 155 streets long. Figure 5.3 shows the pre-existent layouts (dark grey shaded blocks) and the proposed grid—almost 2000 new blocks. Although the grid looks uniform, it contains two primary patterns that create variety. The first is the streets width: the avenues are 30 m wide, the standard cross streets are 18 m and the major cross streets are 30 m (they exceed both the norms in

Fig. 5.2 Reproduction of 'A Plan of the City of New York and its Environs', by John Montresor, 1766 (*Source* Public domain)

Lower Manhattan and the minimum stipulated by the 1807 Act). The second is the blocks dimensions: all blocks are 60 m wide (north to south), but their lengths (east to west) varies, diminishing from the centre of the island to the shorelines. One key characteristic of the plan was that all of its streets and avenues were numbered rather than named.

Due to the high land values of Manhattan the plan has restricted the number of squares and parks, believing that the Hudson and East rivers provided sufficient open space. The existing small and scattered parks were retained.

The plan did not dictate plot dimensions, but the blocks had a modular system, all are divisible by 6 and 7.5 m—20 and 25 ft (Fig. 5.4). A standard plot was 30 m deep (half of the block depth) and 6 or 7.5 m wide. The regulations on buildings height were related to the streets width: taller buildings in the avenues and lower rise buildings in the side streets.

Plan implementation was a long process—it took about 60 years for the grid to be built up to 155th St—including significant modifications: (i) the insertion of

Fig. 5.3 Reproduction of 'The Brigdes map' by William Bridges, 1811 (*Source* Public domain)

Broadway (which would become the counterpoint of the grid, particularly in its diagonal stretch from 10th to 72nd Street[1]); (ii) the construction of two new avenues linking the northern and southern parts of island (Lexington, between 3rd and 4th avenues, and Madison, between 4th and 5th avenues); (iii) the creation of new open spaces—neighbourhood parks and squares (from Union Square to Bryant Park), in a first stage, and Central Park (covering an area of three blocks wide and 51 blocks long, and promoting the role of the 5th Avenue as the meridian separating the east and the west sides), in a second stage; (iv) the enlargement of some axes (Park Avenue north of 47th Street, Lenon Avenue, Adam Clayton Powell Boulevard, and 17 of the east-west streets); and finally, (v) the removal of the

[1]Broadway crosses from 4th to 10th avenues, producing seven exceptional intersections as follows (from 4th to 10th): Union Square; Madison Square Park, marked by the remarkable Flatiron building; Herald Square; the notable Times Square; Colombus Circle, in the southwestern entrance of Central Park; Lincoln Square; and finally, Verdi Square.

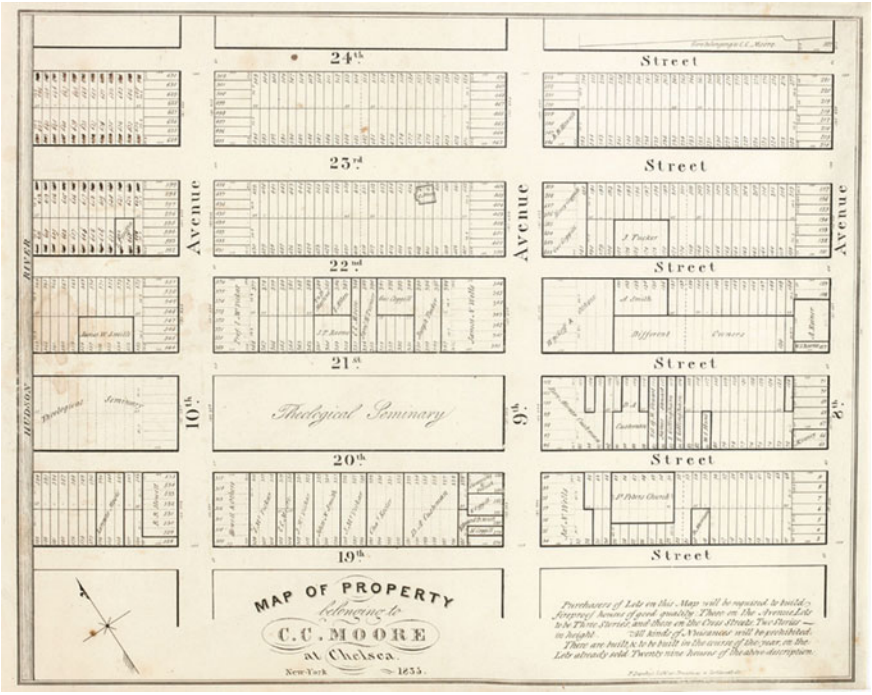


Fig. 5.4 Reproduction of the 'Map of property belonging to C.C. Moore at Chelsea', 1835 (*Source* Public domain)

military parade ground (or its dramatic downsize to Madison Square Park), the Observatory and most of the proposed squares.

Despite the levelling of hills and filling of valleys to produce a more horizontal surface, today's topography still has a striking resemblance to conditions in the early nineteenth century. Most of the streets of the plan ran through private property. To build these streets, the State Legislature defined the street opening system, an early form of eminent domain allowing the construction of streets and squares for the city and the financial compensation of the owners (Ballon 2012).

New York first expanded along the East Side. Its low and flat topography invited construction, unlike the West Side's rugged hills and valleys. The 1830s brought about a residential housing boom and in the end of the decade the city had opened gridded roads to 52nd Street. The improvement of the West Side only began in the mid-1860s. The erection of the Dakota in 1884 had a symbolic nature, an elegant apartment building in the rural backwater of the West Side. The establishment of Morningside and St. Nicholas Parks and the undulating Riverside Drive are some examples showing of the presence of the topography. Similarly, the planning of Upper Manhattan (north of 155th), carried out more than 50 years after the 1811 plan, would give more pre-eminence to its rugged landscape (Ballon 2012). In the end of the nineteenth century the Brooklyn Bridge physically linked Manhattan and

Table 5.2 Evolution of resident population in the five boroughs of New York, 1990–2010 (*Source* DCP 2012)

	1990	2000	2010
Bronx	1,203,789	1,332,650	1,358,108
Brooklyn	2,300,664	2,465,326	2,504,700
Manhattan	1,487,536	1,537,195	1,585,873
Queens	1,951,598	2,229,379	2,230,722
Staten Island	378,977	443,728	468,730
New York City	7,322,564	8,008,278	8,175,133

Brooklyn. In 1898, these two, joined by the Bronx, Queens and Staten Island, consolidated into the five borough metropolis.

The technological advances of the twentieth century exaggerated the grid, as skyscrapers climbed higher with the help of steel skeletons and passenger elevators. Before 1916, the grid could be extended straight up into the sky along the boundary lines of streets and plots. In 1916, the first zoning law was approved restricting the height of buildings, requiring them to step back as they rose in order to protect a measure of sunlight on the street and lower stories. There were five variations of the formula applied in different districts, based on the width of the street and the angle of the setback. In 1961 a new zoning law was approved aiming to encourage builders to incorporate open space into their plots, allowing them to build taller towers (Ballon 2012).

Another important element in the twentieth century was the incorporation of superblocks into the grid, created by erasing some street sections. While some were formed for monumental buildings (New York Public Library, Grand Central Terminal), others contained monumental ensembles (Columbia University, Rockefeller Center, Lincoln Center). From the 1930s through the middle of the century, some sections of the grid were obliterated to create large housing projects. Although the housing superblocks fit neatly into the orthogonal street system, they changed the grain of the city; they did not have the grid's walkable character or their mixed-use quality. In the turning from the twentieth to the twenty-first centuries the prevailing trend has been to reasserty the grid, as the recent developments of Battery Park and Ground Zero demonstrate (Ballon 2012).

In the turning to the twenty-first century New York achieved eight million inhabitants (Table 5.2). This number increased 2.1 % in 2010, with 2.5 and 2.2 millions of residents in Brooklyn and Queens (the two largest boroughs in terms of total land area), 1.6 and 1.4 millions in Manhattan and the Bronx, and about 470,000 inhabitants in Staten Island. The population of the city as a whole and of each of the five boroughs has always been increasing between 1990 and 2010 (the city as a whole has been increasing since 1790, except for two decades, 1950s and 1970s). Manhattan holds the highest population density. The highest densities within the island can be found in Upper West Side, Upper East Side and on the eastern strip between Sutton Place and Stuyvesant Town (respectively Community Districts 7, 8 and 6).

The diversity of the different neighbourhoods of New York is one of its most important characteristics. The brief description that follows moves from south to north in Manhattan, and from there to the Bronx, Queens, Brooklyn and Staten Island.

The built environment of Lower Manhattan is marked by the pattern of streets of both Dutch and English settlements (Fig. 5.5b). It was the site of the first capital of the United States and, after 1792, of the financial capital of the world. It includes the Ground Zero that, after the terrorist attacks in September 2001, is emerging in the area showing the strength of the city. At north-east of Lower Manhattan we will find the Seaport and the Civic Center. This was mainly developed after independence. The area gathers the City Hall, different court houses and some key buildings, such as the Woolworth Building. It has a strong linkage with the water and in its northeast part it receives the Brooklyn Bridge. Lower East Side—located north of the Seaport and the Civic Center and south of the 1811 grid—is the traditional gathering point for newly arrived immigrants of many cultures. Little Italy and Chinatown are the most visible examples of the presence of these communities. Soho and Tribeca[2] are two of the trendiest (and most expensive in which to live) neighbourhoods of New York, with an intense artistic life, full of galleries, cafés and shops. Soho is also widely known due to its remarkable architecture, one of the world's most significant set of buildings in wrought iron (Fig. 5.5d).

Let us move north of Houston Street. Greenwich Village combines the south-western part of the 1811 grid, around the vibrant Washington Square, with a more irregular pattern of streets, around Sheridan Square (Fig. 5.5f). It has been a gathering place for 'free spirits' of all kinds. Unlike Greenwich Village, Gramercy and the Flatiron District are dominated by the pattern of streets defined by the 1811 plan. While Gramercy is mainly a residential area structured around the park built in the 1830s, the area around the Flatiron Building and Madison Square has a mixture of uses. South of Central Park we find the Theater District. The Theater District first began to attract theatres and restaurants to the neighbourhood after the Metropolitan Opera House moved there in 1883. The district includes some of the most important buildings (New York Public Library, Rockefeller Center), squares and parks (Times Square, Bryant Park) of New York. At east of the Theater District we find Midtown. It is an area marked by a large set of skyscrapers, from the Chrysler Building erected in Lower Midtown in 1930 to the Lever House and the Seagram Building built in Upper Midtown in the 1950s. It has a number of fundamental musems such as the Museum of Modern Art (MoMA). It is clearly marked by the presence of the 5th Avenue and it is inhabited by a high-income population. This high-income population has lived in Upper East Side since the turning to the twentieth century. Today it is gathered in the 5th and Park avenues. Madison Avenue holds a number of shops and galleries. The area gathers some important museums located in remarkable buildings such as the Guggenheim, the Whitney and the Metropolitan.

[2]SoHo and TriBeCa are the names for 'South of Houston' and 'Triangle Below Canal' (the triangle of streets below Canal Street).

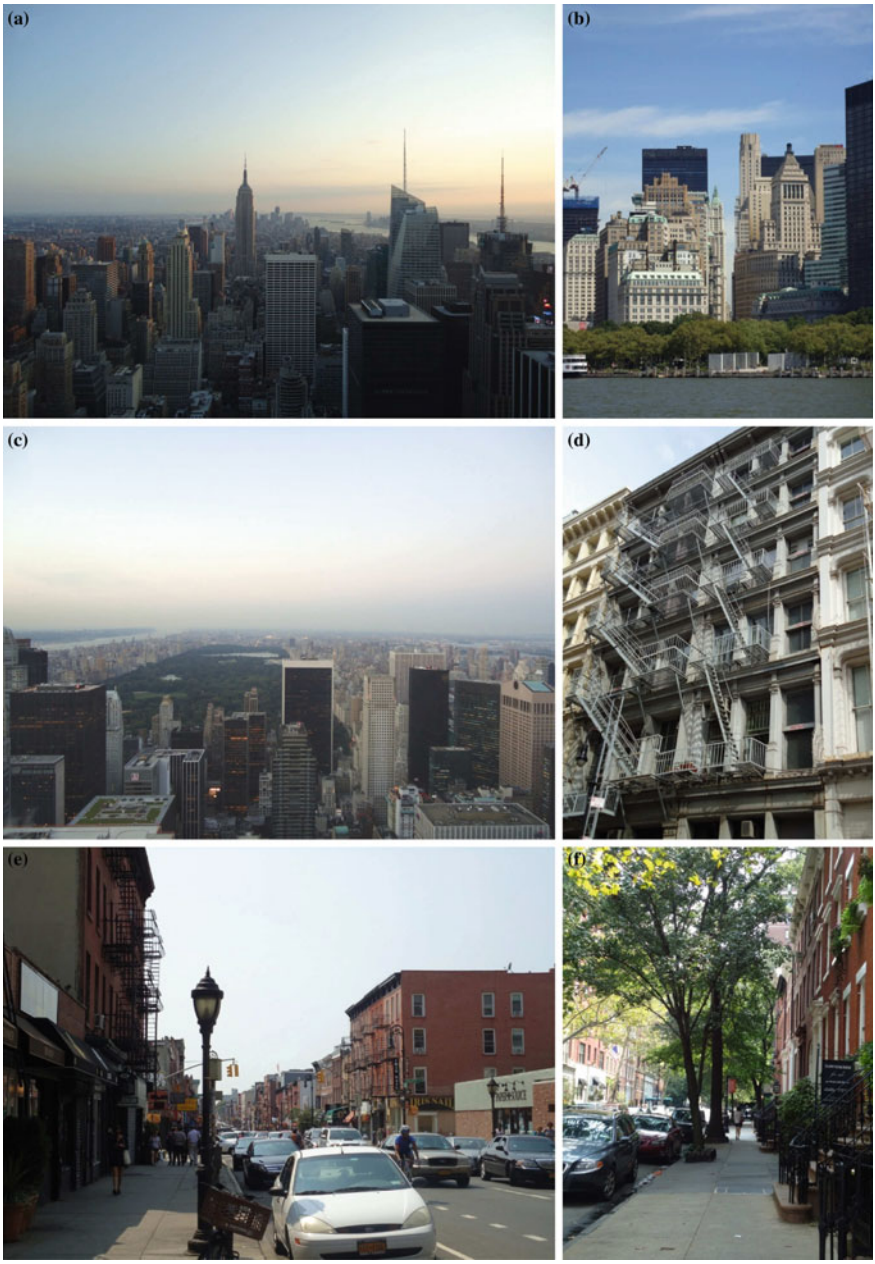


Fig. 5.5 New York: **a** the southern part of Manhattan, **b** Lower Manhattan, **c** the northern part of Manhattan, **d** Soho, **e** Brooklyn, **f** Greenwich Village (*Source* Photographs by the author)

Despite its latter occupation, after the construction of the elevated trains and of the Dakota Apartments a number of buildings have been progressively built in Broadway and Central Park West. Today, the Upper West Side is a very diverse place from high-income population in Riverside Drive and Central Park West to mid- and low income in Amsterdam Avenue. It is also the place of fundamental cultural buildings such as the Lincoln Center and the American Museum of Natural History. The northern part of the island is the Harlem, the vibrant centre of African-American culture. The neighbourhood is structured by the 125th St (Martin Luther King Jr Boulevard) that includes key buildings of the culture of the city, such as the Apollo Theater.

The Bronx is almost two times larger than Manhattan. Its pattern of streets is clearly different from Manhattan, more fragmented and structured by main undulated streets. It holds some singular buildings and open spaces such as the Yankee Stadium, the Botanical Garden and the Bronx Zoo. Queens has the largest area and the second highest population of the five boroughs. One of its more dynamic areas is Long Island City, connected to Manhattan by the Queensboro Bridge or 59th St Bridge. One of the major expressions of the artistic life of Queens is the PS1 MoMA, a part of the Museum of Modern Art. Brooklyn (Fig. 5.5e) is the largest borough of New York in terms of population (it would be the fourth largest city of the United States if it was a city by itself) and the second largest in terms of area. It is probably the area with the soundest ethnical diversity. Three of the most important areas of the borough are Downtown Brooklyn, Brooklyn Heights and Park Slope, near the remarkable Prospect Park. Both Brooklyn and Queens have a pattern of streets somehow close to the dominant pattern of Manhattan. Finally, Staten Island has a street system more fragmented that the Bronx street system. It is a borough with an area larger than the Bronx and with about 470,000 inhabitants.

5.2 Marrakesh

Marrakesh is located in southern Morocco, between the Atlantic Ocean and the Mediterranean Sea and at the foot of the Great Atlas mountains. It is one of the four imperial cities, together with Fes, Meknes and Rabat. The city, which gave its name to the Moroccan Empire, was founded in mid eleventh century by the Almoravids, a Berber[3] dynasty established in 1056 that lasted until 1147. The city became the capital of these conquering nomads who would succeed in stretching their empire from the Sahara to Spain and from the Atlantic to Algeria. The original layout of the medina dates back to the Almoravid period, which included the construction of the city walls (built in 1126–27), a large palace (destroyed), a mosque, and the so-called *khettaras*, a sophisticated system of subterranean channels for irrigation

[3]The Berbers are an ethnic group indigenous of North Africa.

that is still in use. Youssef ben Tâchfine and, particularly his son, Ali ben Youssef were the main promoters of the urban development of the city in this dynasty.

In 1147 the so-called Red City was taken by the Almohads (1147–1269). While most of the existing monuments—palaces and mosques—were destroyed by the victors, Marrakesh was maintained as the capital and it did experienced unprecedented prosperity. The magnificent Koutoubia Mosque[4] was built in this period upon the ruins of the Almoravid foundations. The Almohads built new quarters extending the city wall, the Kasbah (1185–90) which was a prolongation of the city to the south with its own ramparts and gates (*Bab Agnaou*, *Bab Robb*), its mosque, palace, market, hospital, parade ground and gardens (UNESCO 2009). Contrarily to the Almoravid buildings, constructions erected by the Almohads had a great simplicity and no decoration.

After the Almoravid and the Almohad dynasties, the city has gone through different cycles of decline or stagnation and of prosperity. The first period of decline came with the Merinid dynasty that ruled the empire for more than two centuries and established Fez as the main city. The last years of this dynasty in Marrakesh were marked by famine and ruin.

The Saadians conquered the city in 1522. The new dynasty has given the city a period of great prosperity, including some major works, namely: the reconstruction of the notable Ben Youssef *Madrasa* in the northern part of the Medina; the construction of the *El Badi* Palace, in an abandoned Almohad garden northeast of the Kasbah, inspired in the Alhambra (Granada); and the erection of the Saadian Tombs, whose precious architecture is isolated from the rest of the Kasbah by a wall. The *Mellah*, or Jewish quarter, was built in the end of the sixteenth century for the largest Jewish population in Morocco. It is one of three areas of the traditional city, together with the medina and the Kasbah (Gottreich 2007; Métalsi et al. 1999). Figure 5.6 shows what is probably the first cartographic representation of the city in the second part of the sixteenth century.

A period of stagnation came in 1688 with the Alawite dynasty (which is still the ruling house of Morocco) favouring, first, the city of Fes, then Meknes, and finally Rabat. Nevertheless, some sultans of the dynasty have developed important works giving the city a new mosque, *madrasas*, palaces and residences harmoniously integrated into the homogeneous unit of the old town, which was surrounded by 10 km of clay and lime and beaten-cob ramparts. The great traditional areas of greenery—the palm groves, the *Menara* and, to the south, the *Agdal* gardens—were located beyond the walls (UNESCO 2009). In the end of the nineteenth century the *Al-Bahia* Palace was erected, northeast of the *El Badi*. The nineteenth century is also marked by internal fights encouraged by different European countries.

In the first half of the twentieth century, under the umbrella of the French protectorate, a new city outside (northwest) the medina was designed. The *Guéliz*

[4]It is one of the largest mosques in the Muslim West (90 m large and 58 m width) and can receive 20,000 persons. The Mosque minaret is more than 70 m high. The harmony of its proportions, 5:1 according to the Almohad canons was the model for the construction of the Giralda in Seville and of the Hassâne tower in Rabat.

Fig. 5.6 Reproduction of the Antonio da Conceiçâo map, 1549–1589 (*Source* Public domain)

neighbourhood was conceived by Marshall Lyautey, Captain Landais and the planner Henri Prost. Figure 5.7 shows the plan of the city after the construction of the *Guéliz* neighbourhood linked with the medina by the *Doukkala* gate.

Nowadays, Marrakesh is a vibrant city of about one million inhabitants. It is an extremely sensorial city with intense colors and odours. The patterns of streets, plots and buildings within and outside the medina are significantly different (Fig. 5.7). The elements of urban form within the medina are a remarkable example of an Islamic City as described in Chap. 4. The medina of Marrakesh is surrounded by the city wall, a notable structure of irregular shape with 10 km length, 6–9 m high and 1.5–2 m wide. Ten monumental gates establish the connections between the medina and the immediate surroundings.

The exterior open spaces within the medina are mainly composed of two rather different elements, the intricate pattern of narrow streets and the large *Jemaa-el-Fna* Square—see Fig. 5.8 for an aerial view and Fig. 5.9 for some daily life photographs. The medina is indeed a notable example of the liveability of open spaces. The relation between built space and exterior space is clearly favourable to the first, in a proportion that distinguishes the interior of the medina from both western cities and the 'city' outside the medina, namely the *Guéliz* and the *Hivernage* neighbourhoods. *Jemaa-el-Fna* is a rather unusual square. It has a very irregular shape,

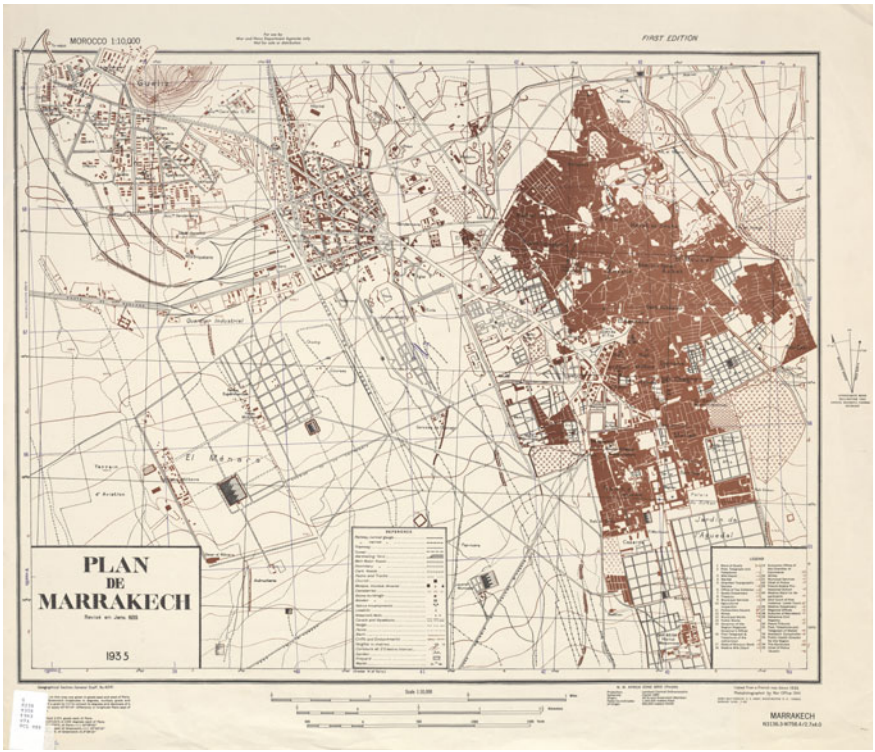


Fig. 5.7 Reproduction of the Plan de Marrakesh, 1935 (*Source* Public domain)

Fig. 5.8 Marrakesh: the intricate pattern of narrow streets and the large *Jemaa-el-Fna* Square (*Source* Google Earth)

Fig. 5.9 Marrakesh: **a** *Jamaa-el-Fna* Square; **b** and **d** streets in the Medina; **c** street in the *Gueliz* neighbourhood; **e** Ben Youssef *Madrasa*; and **f** the *suqs* (*Source* Photographs by the author)

with more than 250 m in its largest axe, and it is configured by rather ordinary buildings. Yet, as Times Square in New York, it is always crowded both by residents and tourists at any time of the day. Activities in the square change during the day, from market in the morning to musical and cultural performances in the evening.

One particular type of street, as described in the previous chapter is the *suq*, composed of a large number of individual shops and organized according to the products for sale (Fig. 5.9f). The *suqs* of Marrakesh with their narrow streets are located north and east of Jemaa-el-Fna. The most ancient areas of the *suqs* are located between *Suq Smarine*, in the south, and the Ben Youssef Mosque, in the north, and include the *Rahba Kedima*, the 'old square' (a former slave market that is a centre for different types of healers).

Contrarily to other imperial cities, the *Kasbah* and the medina are strongly connected in Marrakesh. Except for the palace, the streets of the *Kasbah* are very similar to those of the Medina. This is also the case of the *Mellah* that has lost its original population becoming very similar to the other areas within the Medina.

The Ben Youssef area is one of the most important cultural and spiritual areas within the Medina. Three singular buildings are predominant in this area, the Marrakesh Museum, the Ben Youssef Mosque and the Ben Youssef *Madrasa* (Fig. 5.9e). The *Madrasa* is one of the most remarkable buildings of the city. It has a squared shape and two storeys. It is organized around a symmetrical axe including the central patio with a rectangular pool, the prayer room and the *mihrâb*. Two galleries of student cells, both in the ground floor and in the first floor, are structured around this axe.

The *Bab Doukkala* connects, literally, two different worlds, the Medina and the *Guéliz* neighbourhood. Indeed, the radial patterns of streets—built around the 16 November Square and the Mohammed V Avenue—and the relation between open space and built space is significantly different outside and inside the medina. The built environment of the *Guèliz* (and *Hivernage*) is less adapted to the climatic conditions than the one of the medina. Despite the intense transformation of the building stock of *Guèliz* for the production of office buildings and multifamily residential buildings that occurred in the last decades it is possible to find some modernist single-family buildings surrounded by gardens erected in the first half of the twentieth century (Fig. 5.9c).

The high-income *Hivernage* neighbourhood extends the *Guèliz* south. Although it presents a similar pattern of streets, plots tend to be larger and the building coverage lower. Despite the qualification of streets (for instance with trees), many of these are configured by high walls with no visual contact between the street and the different plots and buildings. Further than the luxury houses the *Hivernage* includes hotels, clubs, theatres and casinos. At west of the neighbourhood, and 2 km of the *Bab Jdid*, the *Ménara* gardens, with the large reservoir built in the twelfth century and the green roof palace erected in the nineteenth century, constitute a remarkable piece of landscape design.

5.3 Porto[5]

Despite some previous forms of human occupation developed since the eighth century BC, the history of Porto as a town began in 1123 with the attribution of the so-called *foral*. The town in the twelfth century was a small settlement with 3.5 hectares. By then, it was mainly constituted by a small castle town surrounded by a Romanesque city wall with four gates. The city wall was probably built in the sixth century and it included a cathedral, a residential building for the clergy, a small market and a number of small houses. Outside the wall the land had mainly agricultural uses. One of the most important streets within the Romanesque wall was *Rua D. Hugo*. It is a small (about 300 m long) and very irregular street, not only in terms of plan but also in terms of the topographical differences. The form of the 20 plots of this street is also very irregular, including plot frontages from 3.5 to 70 m. The diversity of its buildings is also substantial. Building coverage is, in most of the cases, very high, although there are some exceptions. In terms of the buildings height it goes from one to four storeys, although the large majority of buildings are two storeys high.

In the fourteenth century (1336–47), a new city wall with sixteen gates was built, including an overall area that was twelve times superior to the former. The new walled area included the Ribeira which was by then the main port of the city. The increasing port activity in the beginning of the sixteenth century, mainly based on the Porto wine trade with Britain, led to the introduction of some changes in the medieval city, such as the construction of new streets within it and some improvements in the city wall. One of these streets was *Rua das Flores*. In morphological terms, *Rua das Flores* was substantially different from *Rua D. Hugo*. The construction of *Rua das Flores* started in 1521 linking two existing squares (with a sound religious presence), the *Largo de S. Domingos* and the *Praça de S. Bento da Avé Maria* which included one of the gates of the city wall. The street is 350 m long and 9 m width, and it is constituted by 100 plots. The permanence of its plot structure over the centuries is remarkable. In 500 years of urban history all (but one) plots kept their original form. Plot frontages are considerably less diverse than the ones in *Rua D. Hugo*. Yet, they have some variety. In general, plot frontages are larger in the part of the street originally designated *Rua das Flores* than in the part of the street initially named *Rua dos Canos*. The variety of building types is lower than in the *Rua D. Hugo*. The height is, as it might be expected, higher than within the Romanesque wall, varying between two and six storeys.

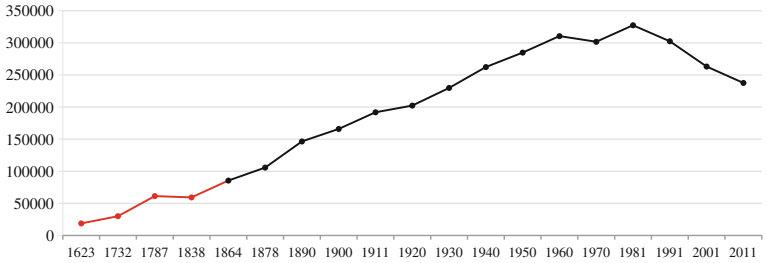
Despite some references to two different maps from the eighteenth century, the first map of Porto, encompassing what was then the whole city, was prepared in the beginning of the nineteenth century, in 1813, by George Balck—the so-called *Planta Redonda* (Fig. 5.10). Eight decades later, the map of 1892, designed by Telles Ferreira, would be a milestone in Portuguese cartography (Fig. 5.11).

[5]A first version of this paper was published in the journal 'UrbanForm and Design' under the title 'The urban form of Porto' (Oliveira 2015).

Fig. 5.10 Reproduction of the *Planta Redonda* by George Balck, 1813 (*Source* Public domain)

Fig. 5.11 Reproduction of the *Carta Topographica da Cidade do Porto* by Telles Ferreira, 1892 (*Source* Public domain)

Table 5.3 Evolution of resident population in Porto, 1623–2011. The first official census in Portugal took place in 1864 (all data prior to this census is represented in a brighter colour)



In the beginning of the eighteenth century, the economic development of the city, supported by Brazilian gold and diamonds, allowed the construction of a set of Baroque buildings or the reconstruction of existing buildings (or of its facades) in a Baroque style. In the eighteenth century Porto had a significant increase of population: in about one century it grew from less than 20,000 inhabitants to about 30,000 inhabitants (Table 5.3). As a consequence, the local authority asked for the intervention of the Crown and in 1758 the *Junta das Obras Públicas* was established as the public agency responsible for urban planning and management. The *Junta* focused on two different areas, the historical kernel and the territory outside the city wall. Figure 5.12 shows, in black, the fourteenth century wall and, in a brighter colour, the new streets that were built in the second half of the eighteenth

Fig. 5.12 The new streets designed by the *Junta das Obras Públicas* (*Source* Barata 1996)

century and in the first half of the nineteenth century. The *Junta*, supported by favourable legislation on land and building expropriation, designed not only the street itself but also a street facade (including the width and height of buildings, the design of doors and windows, the design of balconies, to name just a few) for the different buildings in each street. It also provided land subdivision processes into regular plots with a standard width (between 5 and 6 m) and a variable depth. These plots are very different from the ones that can be found within the first and the second city walls. In 1784 the vision and the main guidelines of the *Junta* were gathered in the *Plano de Melhoramentos*. The work developed by the *Junta* over eight decades is one of the most interesting periods in the urban history of Porto.

A symbolic street of this period is the *Rua do Almada* (already mentioned in Chap. 2) which has the name of the first president of the Junta, João de Almada e Melo. The street was designed in 1761, as part of the *Bairro dos Laranjais* plan, and built in 1764. With more than 800 m long, linking the walled city to a new square at north, it is far longer than *Rua das Flores* and *Rua D. Hugo*. The average width of the street is very similar to *Rua das Flores*. As mentioned in Chap. 2, *Rua do Almada* includes ten street blocks and 215 plots. A significant part of these plots has a front of 5 m and a depth ranging between 20 and 90 m. This type of plot led to the emergence of a particular type of building. Due to the small size of the plot frontage, the building had to be developed 'in depth', which means that this type of building typically has a depth of more than 15 m.

The history of Porto in the first half of the nineteenth century was marked by two military events, the second Napoleonic invasions in 1809 (Portugal was invaded by the French three times between 1807 and 1813), and the civil war involving conservative and liberals carried out between 1826 and 1833. The civil war, and the victory of the liberals, led to the establishment of a Constitutional Monarchy in Portugal and to the extinguishment of the *Junta* in 1833.

In the urban expansion of Porto outside the second city wall, after the opening of the first streets designed by the *Junta*, the new streets were planned and built on a territory structured by five roads leading to different cities in the north of Portugal, *Matosinhos*, *Viana do Castelo*, *Braga*, *Guimarães* and *Penafiel*. The urban landscape was marked by the development of industrial activities and by the emergence of a new housing typology, locally called *ilhas*. This typical residential solution for the working class consisted in rows of houses built on narrow and long plots connected to the street through strips of open private space, and located on the back of larger *bourgeois* town houses facing the street.

Despite some common features there is a sound diversity of the existing *ilhas* both in terms of size and form. The left part of Fig. 5.13 presents the main types of *ilhas*: (i) the *ilha* within one single plot; (ii) the *ilha* in two plots, organized by one open corridor in the middle of the houses; (iii) the *ilha* in two plots, organized by two open corridors giving access to two rows of back-to-back houses; and finally, (iv) the *ilha* built in one single plot that, contrarily to the former cases, does not have a main house facing the street. The right part of the figure presents: first, the

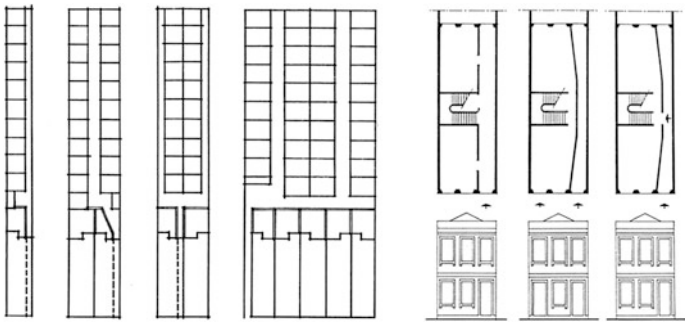
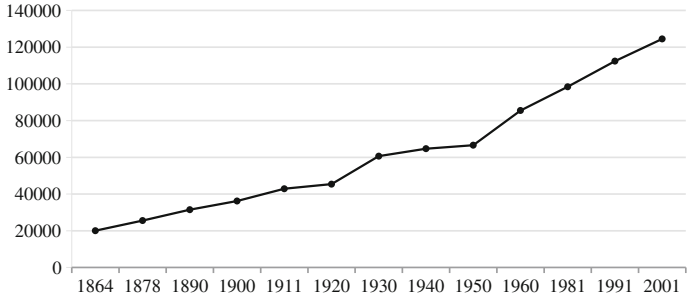


Fig. 5.13 The *ilhas* of Porto (*Source* Teixeira 1996)

Table 5.4 Evolution of dwellings in Porto, 1864–2001 (data for 1970 is not available)



original plan and façade of a middle-class house; second, the design of a second door allowing the access to the *ilha*; and third, the same door on the façade allows the access to the main house and to the *ilha*. In the end of the nineteenth century, Porto had 140,000 inhabitants; this number would continuously grow until the 1960s (Table 5.3).

In 1892, the northern and western expansions of the city were supported by two main axes, *Avenida da Boavista* and *Rua da Constituição*. The construction of *Boavista* (*Rua da Boavista* and *Avenida da Boavista*) and of *Constituição* took a long period in time. The first map of Porto, the *Planta Redonda*, already represented the eastern part of the Boavista axe (Fig. 5.10). This street linked the *Praça da República* with one of the five gateway roads to some of the most important nearby cities in the north of Portugal. In 1813, Boavista was 11 m width, 500 m long, and 80 % of it had already been occupied with buildings. More than 150 years later, in 1978, the street length was thirteen times higher, being that, the main enlargement has corresponded to the period between 1839 and 1892. Although the beginning of

the construction of *Rua da Constituição* can be traced to 1843, the first map to include this street was the 1892 map. Despite its apparent unitary form, *Constituição* had been built in three moments: first its central part between a square, *Marquês*, and another gateway road, *Antero de Quental*; then, a western extension; and, finally, a eastern expansion. The percentage of building facade along the street was not very high, particularly in the eastern part. The street length had remained the same between 1892 and 1932, and it had increased between 1932 and 1978. The percentage of building façade has been growing in a regular rhythm, from 20 % by the end of the nineteenth century, to 58 % by the end of the 1970s.

The urban fabric of Porto, in the first half of the twentieth century, is marked by the construction of the first social housing blocks, trying to eradicate all the *ilhas* from the city. In a first phase, these housing interventions corresponded to single-family houses with one or two storeys, erected in the peripheral parts of the city. Table 5.4 presents the evolution of dwellings in Porto between the second half of the nineteenth century and the beginning of the twenty-first century. In this period, the number of dwellings in Porto increased to a number six times higher than the initial. The most significant change occurred between 1950 and 1960, corresponding to an increase of 28 % and to the construction of 19,000 new dwellings. The smallest variation occurred in the previous period, 1940–1950, representing an increase of 2 %—2000 dwellings.

The first multifamily housing block promoted by the Porto City Council was built in 1940 providing 117 dwellings for the working class. During the 1940s, two other neighbourhoods were built. In the 1950s, on the contrary, there was a massive public investment on housing, contributing for the significant increase above mentioned. Part of this investment corresponded to an important housing programme designed for the city of Porto, the so-called *Plano de Melhoramentos*, which lead to the construction of 6072 dwellings in 16 separate neighbourhoods. This second phase of housing promotion continued throughout the next two decades corresponding to larger neighbourhoods composed by several apartment blocks usually four storeys high and clearly separated from the street. These dwellings were always very small and following a strict standard interior layout.

The end of the twentieth century is marked by the construction of heavy road infrastructure partially overlapping the traditional urban fabric of Porto. This whole set of fast circulation roads represents a radical change in mobility policies and in the structuring and organization of the urban fabric. Concerning major facilities and public equipments, the city acquires two new university campus, a new museum of contemporary art, and an urban park on the west side nearby the seafront.

Despite some variations in the 1960s and in the 1970s the city achieved its maximum population in the beginning of the 1980s with 330,000 residents. Since then, Porto has been continuously losing population to its metropolitan area, particularly to the surrounding cities of *Maia*, *Valongo*, *Matosinhos* and *Vila Nova de Gaia* which, in the period between 2001 and 2011, had population increases of

between 4.7 and 12.6 %. In 2013, Porto had 220,000 inhabitants and its metropolitan area had 1.7 million inhabitants, which is a rather unusual proportion between a city and its metropolitan area (almost 1:8).

If we look at the data of the last census in 2011, we can see that the 238,000 inhabitants of Porto—45.5 % men and 54.5 % women—were aggregated in 101,000 families, meaning that the average number of persons per family is 2.4. In the beginning of the decade the city had 138,000 dwellings organized in 44,000 buildings, meaning 3.1 dwellings per building, expressing a sound presence of single-family housing and small-dimension multifamily housing.

The following paragraphs describe the main parts of the city. The historical centre of the city corresponds to the area once contained within the fourteenth century wall (Fig. 5.14a). The streets and plots of this area are very irregular. There is a high building density. Buildings are narrow, normally three storeys high, although some are five storeys high. Although buildings are always positioned on the frontage of the plot, building coverage is very high. This is a part of the city where change has been, and should continue to be, slow. *Mouzinho da Silveira*, at the end of the nineteenth century, and *D. Afonso Henriques*, in the middle of the twentieth century, were the last streets to be built.

The *Baixa* (Downtown) is located north of the historical centre in the immediate surroundings of the demolished fourteenth century wall. This is a part of the city that was partly built according to plans prepared in the second half of the eighteenth century and includes buildings dating from then until the beginning of the twentieth century. In this area, streets and blocks are regular, the plot is normally a rectangle with an average width of 6 m and a depth that can attain 100 m. Most of the blocks have a continuous commercial use on the ground floor. It includes the civic centre of the city that was built in the first half of the twentieth century after the demolition of a number of street blocks (Fig. 5.14c). It also includes a number of small and medium size gardens such as the *Palácio de Cristal* (Fig. 5.14e).

Steadily after the 1960s—and the construction of a new bridge linking this area with the city of *Gaia* in the south bank of the *Douro*—the *Boavista* area emerged as the main financial and services centre of the city. The area is structured around the *Rotunda*, a large green roundabout with a diameter of more than 200 m, gathering eight different streets with a sound variety in terms of patterns of plots and buildings. In the last years some exceptional buildings such as the *Casa da Música* were erected in this area reinforcing an image of modernity (Fig. 5.14f).

Traditionally, the residents of the western part of the city hold higher income than the inhabitants of the eastern part of Porto. The size of a dwelling is also larger in the western part. The western part of the city combines, from north to south, the city park—linked to the seaside, a regular grid built after the end of the nineteenth century, and the *Foz Velha* with an irregular patterns of streets, plots and buildings very similar to that of the historical centre.

Fig. 5.14 Porto: **a** and **b** the historical centre; **c**, **d** and **e** *Baixa*; and **f** Boavista (*Source* Photographs by the author)

References

Ballon H (ed) (2012) The greatest grid: the master plan of Manhattan 1811–2011. Museum of the City of New York and Columbia University Press, New York

Barata F (1996) Transformação e permanência na habitação Portuense–as formas da casa na forma da cidade. FAUP Publicações, Porto

DCP, Department of City Planning (2012) Community District Needs—Fiscal Year 2013. Department of City Planning, New York

Gottreich E (2007) The Mellah of Marrakesh—Jewish and Muslim space in Morocco's red city. Indiana University Press, Bloomington

Métalsi M, Tréal C, Ruiz JM (1999) Les villes impériales du Maroc. Terrail, Paris

Oliveira V (2015) The urban form of Porto. U + D Urban form and Design 2: 10–19

Teixeira M (1996) Habitação popular na cidade Oitocentista–as ilhas do Porto. Fundação Calouste Gulbenkian/Fundação para a Ciência e a Tecnologia, Lisbon

UNESCO (2009) Medina of Marrakesh. Available at http://whc.unesco.org/en/list/331. Accessed 31 July 2015