New strategy of sustainable neighborhood planning
Five Principles

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Background

UN-Habitat supports countries in developing urban planning methods and systems that address current urbanization challenges, such as urban sprawl, poverty, inequality, pollution, congestion, as well as urban biodiversity, urban mobility and energy.

Since last decades, because of the rapid urban population growth, the landscape of the city has significantly changed. A major feature of fast growing cities is urban sprawl. Urban sprawl drives the occupation of large areas of land and is normally accompanied by many serious issues including: low efficiency of land use, high dependence on car, low density and high segregation of uses, etc. To address these challenges and achieve sustainable development, UN-Habitat proposes a guideline summarized and refined from the existing sustainable urban planning theories, to help to build a new and sustainable relationship between urban dwellers and urban space, and increase the value of land.

This guideline includes Five Principles of sustainable neighborhoods, which represent a general reference to be adapted to the specific context: They are:.

1. Adequate street density and efficient street network – the street network takes at least 30% of the land, and at least 18km street length per km².
2. High density - at least 15,000 people per km², i.e. 150 people/ha or 61 people/acre.
3. Mixed land-use - at least 40% of the floor space is allocated for economic uses in any neighborhood.
4. Social mix - availability of houses in different price ranges and tenures in any given neighborhood to accommodate different incomes, 20 to 50 % of the residential floor area is distribute to low cost housing, and each tenure type should be not more than 50 % of the total.
5. Limited land use specialization - to limit single function blocks or neighborhoods; single function blocks covering less than 10% in any neighborhood

To facilitate application and comprehension by the public, Five Principles use simple language and propose a series of numerical standards as reference. They do not represent a comprehensive theory, and only cover some basic characteristics of sustainable urban planning. The public can use them to make a quick and intuitive judgment on whether the community possesses the capacity of sustainable developing, meanwhile. The Five Principles also help to draft future urban scenarios and future urban plans.

High density urban growth V.S. urban sprawl

Barcelona Ensanche, Spain as an example of a compact city
Source: UN-Habitat / Laura Petrella

Urban sprawl around St. George, Utah, USA.
Source: http://www.wildhorizons.com/wp-content/gallery/Part%201_GilaMonsters/images/page117.html

Objectives

The objectives of the Five Principles include:
1. To promote high density urban growth, alleviate urban sprawl, and maximize land efficiency
2. To promote sustainable, diversified, socially equal and thriving communities in economical ways
3. To encourage walkable neighborhoods and reduce car dependence
4. To provide an interconnected network of streets which facilitate safe, efficient and pleasant walking, cycling and driving[1]
5. To foster local employment, local produce, local consumption
6. To provide a variety of lot sizes and housing types to cater for the diverse housing needs of the community, at densities which can ultimately support the provision of local services[2]
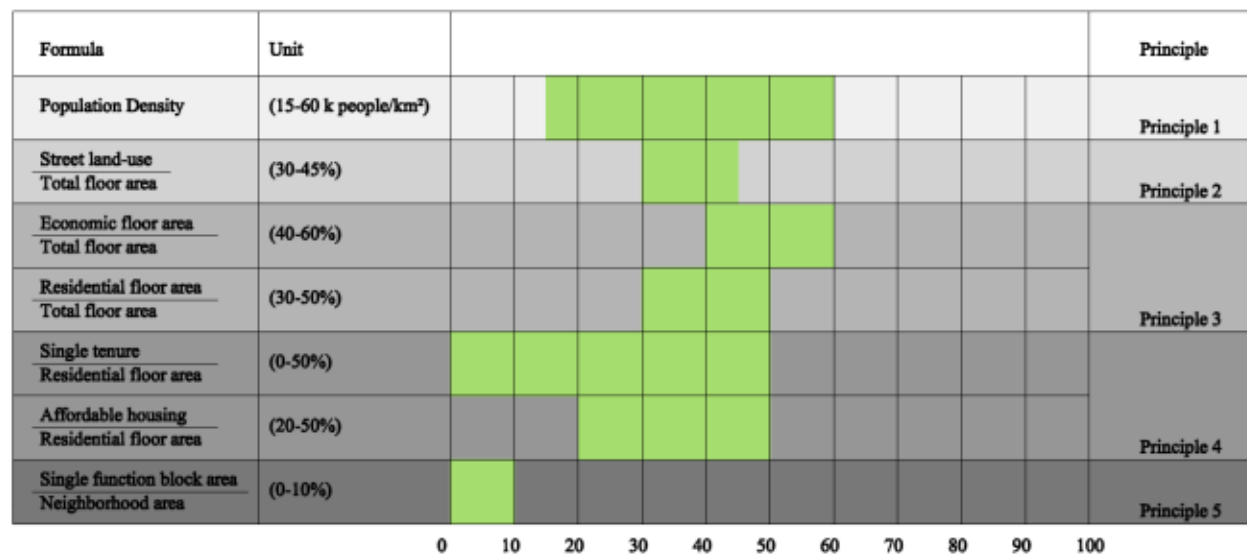
Areas of Application

The Five Principles can be applied in the following contexts:
1. Fast growing cities: Five Principles help cities that have to provide land, infrastructure and public services to a fast-growing population as a result of natural growth, rural immigrants seeking employment in cities, and in some cases internally displaced persons fleeing conflict or disaster.
2. New urban settlements and urban extensions: Five Principles can be applied in the new urban areas to avoid repeating past mistakes.
3. Urban renewal and renaissance: declining cities can apply the Five Principles for revitalization.
4. Urban densification: growing cities which have no land to extend any further can use the Five Principles to assist in a smoother densification process.

Status Analysis – neighborhood profiling

The Five Principles provide a set of quantitative measurements to analyze a neighborhood. The chart (Figure 1) below gives the recommended ranges of the quantitative measurements (ranges in green). City or neighborhood statistical data can be plotted on the chart, and the development status of that area can be visualized. The chart, combined with more traditional criteria of sustainability, may allow to assess a neighborhood, and it may point to possible actions to improve the profile or support public discussion on the same.

Figure 1: Sustainability status of a neighborhood

Formula	Unit		Principle
Population Density	(15-60 k people/km²)	(green range ~15–60)	Principle 1
Street land-use / Total floor area	(30-45%)	(green range ~30–45)	Principle 2
Economic floor area / Total floor area	(40-60%)	(green range ~40–60)	Principle 3
Residential floor area / Total floor area	(30-50%)	(green range ~30–50)	
Single tenure / Residential floor area	(0-50%)	(green range ~0–50)	Principle 4
Affordable housing / Residential floor area	(20-50%)	(green range ~20–50)	
Single function block area / Neighborhood area	(0-10%)	(green range ~0–10)	Principle 5

Scale: 0 10 20 30 40 50 60 70 80 90 100

Principle 1: Adequate street density and efficient street network – the street network takes at least 30% of the land, and at least 18km of street length per km².

Principle 1 aims to develop an adequate level of street network that not only works for vehicles and public transport but also specifically aims to attract pedestrians and cyclists. [3] It will include a street hierarchy with arterial routes and local streets based on traffic speed differences. Meanwhile, the street network will also shape the urban structure which sets the pattern of development blocks, streets, buildings, open spaces and landscape making up the urban areas.[4] Principle 1 provides the material basis for the sustainable urban development.

To design the street network in a city of high density, how much land is needed for the road and parking? According to a research on urban impervious surface coverage (Figure 2), complex functions and high population density require high street coverage. In this research, 20-30% of urban land is used by the road and parking, and 40-60% of commercial center land is used by the road and parking. In high density mixed-use urban areas, it is recommended to allocate at least 30% of land for road and parking.

Figure 2: Surface coverage(Arnold and Gibbons 1996) [5]

This figure illustrates land coverage in various urban conditions.
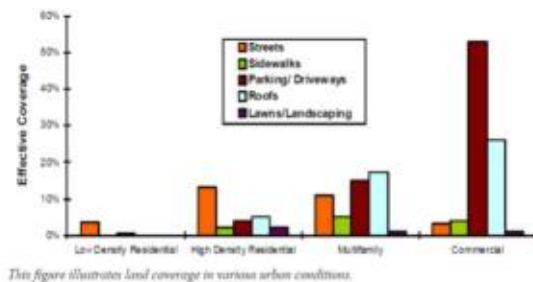
To develop sustainable mobility, the design of the street network is different from the modernist practice in the following aspects:
- Streets are to be walkable and cyclists friendly
- Public transportation is encouraged
- Road hierarchy is to be highly interconnected
- Sufficient parking place is provided

These characteristics should be reflected in the street design and construction.

Public transportation catchment is an important factor in designing street hierarchy. (See Table 2). Walkability in a neighborhood can be measured by

the walking distance, and, normally, 400m-450m is the walkable distance. Combining these two factors, 800m-1000m is suggested to be the distance between two arterial routes. This distance is the constraint for the street grid design, urban structure design and neighborhood size.

Table 1 Catchment areas for several transport forms.

	Stop Interval	Corridor width	Area served	Catchment per stop
Minibus	200 M	800 M		320 -640
Bus	200 M	800 M		480–1,760
Guided Bus	300 M	800 M		1,680–3,120
Light Rail	600 M	1,000 M		4,800–9,000
Rail	1,000 M+	2,000 M+		24,000+

Source: Urban Design Compendium
(ww2.newham.gov.uk/Documents/UDC.pdf)

To explain the reason of 18km street length per km², figure 3 shows a simple street network model. In an area of one km², nine vertical and nine horizontal streets are designed to form a street network. Distance between two adjacent streets is 111m, and the total street length is 18km. In this street network model, both street hierarchy and block size are considered. This simple model demonstrates the balance between street and other land uses. City management and urban planner "could adjust" the design pattern of the street network, but a similar street density level as recommended in the model should be mantained.

Figure 3: Street network model design
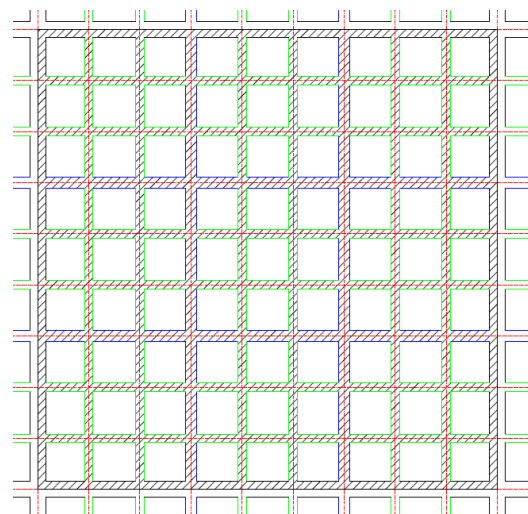
Principle 1 encourages efficient traffic, sustainable accessibility, social interaction, public safety and amenity.

Principle 2: High density - at least 15,000 people per km²; it means 150 people/ha or 61 people/acre

Principle 2, as a direct result of the worldwide population explosion and rapid urbanization, provides a basis to accommodate population growth.

In order to prevent urban sprawl and promote sustainable urban extension, it is key to achieve high density which is the foundation of sustainable neighborhood. High density essentially means concentration of people and their activities. The table below gives a summary of the density of the built-up area of some selected cities.

Table 2: 16 selected cities listed by population density

Rank	City / Urban area	Country	Population	Built up area (in Km²)	Built up area Density (people per Km²)
1	Dhaka	Bangladesh	9,196,964	165.63	55,530
2	Hong Kong	China	5,179,089	97.63	53,050
3	Mumbai	India	16,161,758	370.90	43,570
4	Rajshahi	Bangladesh	599,525	20.26	29,590
5	Milano	Italy	17,335,085	635.17	27,380
6	Casablanca	Morocco	3,004,505	114.31	26,280
7	Cairo	Egypt	13,083,621	569.17	22,990
8	Seoul	Korea, Republic of	14,546,082	706.14	20,600
9	Ho Chi Minh City	Vietnam	4,309,449	210.33	20,490
10	Singapore	Singapore	4,309,797	245.24	17,570
11	Mexico City	Mexico	17,224,096	1,058.53	16,270
12	Santiago	Chile	5,337,512	438.51	12,170
13	Bangkok	Thailand	9,761,697	1,025.93	9,510
14	Beijing	China	11,866,211	1,576.38	7,530
15	Paris	France	9,519,527	1,482.08	6,420
16	Castellon	Spain	268,712	82.03	3,280

Source: A Global Sample of 120 Cities, 1990-2000 (http://www.lincolninst.edu/subcenters/atlas-urban-expansion/global-sample-cities.aspx)

The table above shows that high density can be seen in cities at different development levels and contexts. According to the same source, the average built-up area density was 129 p/ha in cities in developing countries in 2000. [6] To promote high density and stop the downward trend of urban population density worldwide, Principle 2 defines a minimum of 150 p/ha for sustainable neighborhood, which is feasible, though slightly above the average density mentioned above. However, the cities in the land rich or developed countries could use 150 p/ha as a reference, but set a lower target to achieve adequate density and create more vitality.

Compared with low density, high density has economic, social and environmental benefits:

- Efficient land use slows down urban sprawl, as high density neighborhoods can accommodate more people per area
- Reduced public services costs - high density neighborhoods tend to decrease the costs of public services such as police and emergency response, school transport, roads, water and sewage, etc.[7]
- Support of better community service
- Reduced car dependence and parking demand and support of public transportation
- Provision of social equity
- Support of better public open space
- Increased of energy efficiency and decreased of pollution

Many may worry about perceived connection between density and social problems, such as crime, poverty, and depression, but academic studies show no such correlations when factors such as income and class are accounted for. [8] A well designed and organized high density neighborhood can be safe and comfortable, but a high quality design is essential to achieve viable high density areas.

In the context of fast urbanization, high density is a smart choice and is the core of sustainable urban planning.

High density neighborhood - Churchill Gardens, London[9]
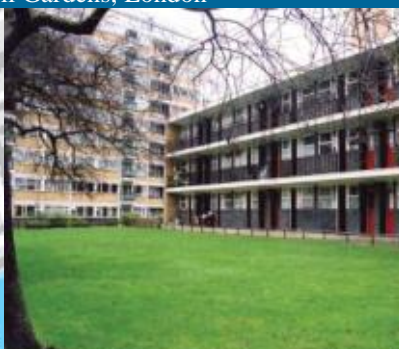
Location: Churchill Garden, London
Density, parking and site area:

Site area (hectares)		12.48
Parking (space per unit)		0.5
Tenure	Private	843
	Social rented	940
Density (**Dph**)		142
Density (**Hrh**)		557

Note: Dph-Dwellings per hectare
Hrh- Habitable rooms per hectare

Principle 3: Mixed land-use - at least 40% of the floor space is allocated for economic uses in any neighborhood

Principle 3 aims at developing a range of compatible land uses close together in appropriate locations, which is flexible to be changed over time according to the changing market. The purpose of mixed land-use is to create local jobs, promote local economy, reduce car dependence, encourage pedestrian and cyclist traffic, reduce landscape fragmentation, provide closer public services and support mixed communities. Mixed land-use can be applied at different spatial levels: city, neighborhoods, blocks and buildings. Principle 3 focuses on the neighborhood and block level.

At the end of the 19th century, with the introduction of modern urban planning concepts, the land use zoning scheme has been applied and single functional communities came into existence in cities all over the world. The adoption of single-use zoning strategies has resulted in serious problems for cities. Urban sprawl has increased, the quality and vitality of many urban centers have declined, and car dependence and traffic congestion affect everyone. To solve these problems, new urbanism promoted the core concept of mixed land-use. Mixed land-use requires some combination of residential, commercial, industrial, office, or other land uses. If different functions are mixed in one neighborhood, economic and residential land-use should be well balanced by careful design and management.

According to a research, done in 1950's, on the land use in Central Business Districts, 68% is the optimum floor area distributed to the economic uses, 22% for residential and 10% for public service. [10] The table below gives a summary of the allocation of floor area of several CBDs.

Table 3: Allocation of floor area of five CBD.

		Beijing Chaoyang CBD	Shanghai Lujiazui CBD	Shenzhen CBD	*Paris la Defense CBD*	Tokyo's Waterfront Subcentre
Area (km²)		4.02	1.7	4.13	1.6	4.48
Total Floor areas	Mm²	10.72	4	7.8	3.5	7
	%	100	100	100	100	100
Economic uses floor areas	Mm²	7.19	3.27	4.8	2.9	3.8
	%	67	81	62	82	55
Public service floor areas	Mm²	0.55	0.43	100	6	1.15
	%	5	11	13	2	16
Residential floor areas	Mm²	2.97	0.3	200	54	2.05
	%	28	8	25	16	29

Source: CBD规划策划重点分析研究
http://wenku.baidu.com/view/1c07d5630b1c59eef8c7b42f.html

However, if too little area is assigned for residential use, the CBD or neighborhood will decline. For example, in 1990s, the inner city of Los Angeles was on the wane. New Urbanism applied mixed use concept to reform L.A., and people were brought back to the city center. In 1998, downtown L.A. was home to around 18,000 people, but now, it houses nearly 50,000 residents. [11] Downtown L.A. has now shifted from a 9 to 5 CBD to a 24-7 prosperous neighborhood.

Based on the above research and analysis on CBDs, for a sustainable neighborhood, the suggested floor area distribution is 40-60% to economic uses, 30-50% to residential and 10% for public services. The set of standard recommended is a range for different cities to flexibly adapt according to their own situations. Mixed land-use is inherent to the nature of cities, and one of the pillars of sustainable urban development.

High density mixed-use neighborhood - Addison Circle, Addison, Texas[12]

Land size:
-501800 m²
Residential floor area:
-436600 m²
Dwelling:
-4800Unit
Density:
-95Du/Ha
Economic use floor area:
-557400 m²

Principle 4: Social mix - availability of houses in different price ranges and tenure types in any given neighborhood to accommodate different incomes, 20 to 50 % of the residential floor area is distributed to low cost housing, and each tenure type should be no more than 50 %.

Principle 4 aims to promote the cohesion and exchange of different social classes in the same community and accessibility to equitable urban opportunities by providing different types of housing. Social mix provides the basis for healthy social network, which in turn is the driving force of city life.

Social mix and mixed land-use are interdependent and promote each other. Mixed land-use and appropriate policy guidance leads to social mix. In a mixed land-use neighborhood, job opportunities are generated for the resident from different backgrounds and income levels. These people live and work in the same neighborhood and form an diverse social network. Social mix is a socio-spatial concept, with the following objectives:

- to promote more social interaction and social cohesion across groups;
- to generate job opportunities;
- to overcome place-based stigma;
- to attract additional services to the neighborhood;
- to sustain renewal/regeneration initiatives; [13]

Although social mix is a socio-spatial concept which is difficult to analyze quantitatively, it is still possible to set a numerical standard from the empirical evidence based on the good practice in Europe. In Holland, VINEX areas are locations earmarked for new housing, 30 % of which must be affordable. In Ireland new 'set aside' policies stipulate that 20 % of all new development must be set aside for affordable housing (inclusionary zoning). In the UK the system is known as *planning gain* and the thresholds for affordable housing are normally set at around 25 %,

with the exception of London where the percentage is being raised to between 30 and 50 %. [14] By analyzing the above information, it is recommended to distribute 20 to 50 % of the residential floor area to affordable housing, and one single tenure type should not exceed 50 % of the residential floor area. The recommendation has a wide range to enable urban planners and city management to follow the national or regional owned-to-rented ratio. To implement this recommendation, market factors should not be overlooked.

In order to ensure the smooth implementation of the above criteria and achieve social mix, there are many possible policy options. According to the social and economic development stage of their city, city management should select proper policies to make a policy package to promote balance developed local community. Possible policies include:

- promoting Social mix by mixing tenures and developing sales programs within public estate;
- achieving Social mix through allocation policies and the dispersal of poverty;
- investing in and improving public housing;
- achieving Social mix by urban and housing design;
- promoting multilevel employment within the community;
- working with private developers to increase public housing supply[15]
- providing plots in different size and with different regulations, to increase the diversity of housing styles

Social mix is not an urban planning panacea to social problems, such as poverty and social segregation, but it can contribute significantly to the solution. Combined urban planning approaches need to be used to tackle these urban challenges. Social mix principle is not to be applied in a short term manner, but it should be applied with caution and over time.

Social mixed neighborhood - Greenwich Millennium Village, London[16]

Greenwich Millennium Village Masterplan
1 Phase 1 housing court
2 Commercial and community buildings
3 Ecology Park and lake
4 School and health centre
5 Boat club
6 Bus route to North Greenwich station and Greenwich town centre
7 Pedestrian route to North Greenwich station
8 Commercial zone with supermarket and leisure complex

Location: Greenwich Penninsula, London
Density, parking and site area:

Phase		1	2	3	4	total
Site area (hectares)		2.44	4.72	3.17	4.86	15.19
Parking (space per unit)		0.93	1.10	0.83	1.24	1.03
Tenure	Privat	444	354	424	335	1557
	Affordabl	43	85	81	276	485
Density (**Dph**)		199	93	159	126	134
Density (**Hrh**)		579	276	454	371	371

Note: Dph-Dwellings per hectare
            Hrh- Habitable rooms per hectare

Principle 5: Limited land use specialization - to limit single function blocks or neighborhoods; single function blocks covering less than 10% in any neighborhood

Principle 5 aims at adjusting/limiting the use of functional zoning to implement mixed land-use policiesy. Zoning is a device of land use planning employed by local governments and urban planner in most countries. Zoning may be use-based (regulating the uses to which land may be put), or it may regulate building height, lot coverage, and similar characteristics, or some combination of these. [17] This principle focuses on the land use aspect.

At the city level, the unilateral application of land use specialization creates many single-function neighborhoods, which is the source of contemporary urban challenges including city congestion, segregation, car dependence, etc. Limiting land use specialization is important to create mixed land-use. There are two ways to adjust zoning policies and apply Principle 5:

- to combine compatible land-uses into one block and neighborhood
- to introduce mixed land-use zoning, respecting market demand and cities urban by-laws and regulations.

In the process of implementing Principle 5, adjusting the zoning policy according to the needs is important. To further illustrate how to implement limited land-use specialization, the example of Vancouver - Burrard Slopes IC Districts is shown below.

Burrard Slopes IC Districts, with an area of 0.55km², was created in the 1990's as industrial-only area. Since 1993, the zoning policies of Burrard Slopes have been adjusted several times, and now, it has become an Industrial, Commercial, Residential and Mixed Use Zone. In this district, economic and residential land-use is well balanced by careful design and management. In Burrard Slopes, service and light industrial jobs have increased; residential development projects have been introduced; population density and activities are growing.

The successful experience from Burrard Slopes IC Districts, shows how a single-function zoning neighborhood is not only a challenge but also an opportunity for local governments and urban planners.

Principle 5 is an urban planning tool to ensure the implementation of mixed land-use neighborhood and to increase economic diversity.

Figure 4: Industrial, Commercial, Residential and Mixed Use Zones, Burrard Slopes, City of Vancouver, British Columbia
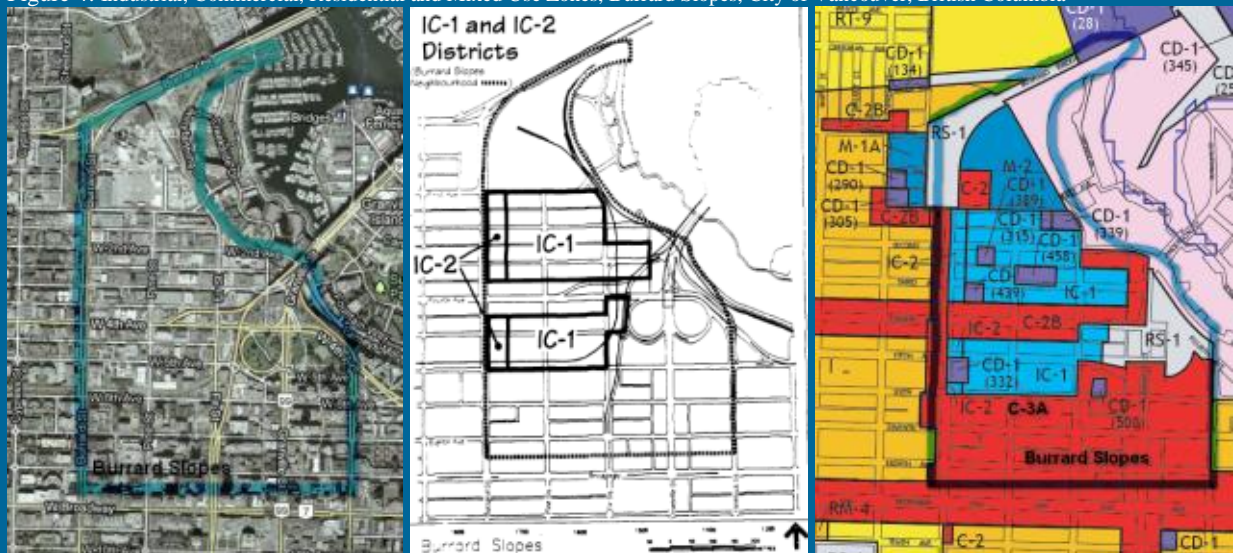
Source: Google map, BURRARD SLOPES IC DISTRICTS INTERIM POLICIES, City of Vancouver Zoning map

Industrial Commercial Mixed Use Zones, Burrard Slopes, City of Vancouver, British Columbia.:
Key milestones: BURRARD SLOPES IC DISTRICTS INTERIM POLICIES
Adopted by City Council June 24, 1993
Amended April 21, 1994, July 23, 1996 and September 10, 1996
BURRARD SLOPES IC DISTRICTS INTERIM REZONING POLICIES AND GUIDELINES
Adopted by City Council on November 29, 2007
Amended January 19, 2010

Conclusion:

The Five Principles are highly interrelated, and support each other. High density provides the population and activity basis for a sustainable neighborhood; adequate street density is the material basis; mixed land use and Social mix shape the land-use and social life in the neighborhood; limited land use specialization is the first step towards mixed neighbourhoods.

Five Principles balance population growth, economic growth, rapid urbanization, sustainable urban development and other factors, and try to establish a new urban ecological system. In this system, population and urban infrastructure accomplish economies of scale; diversified social networks and the diversity of land-uses are supporting each other and developing together; in this way, urban space and urban dwellers live and develop in harmony.

Besides good planning and design decisions, the application of these principles further requires: legal frameworks, analysis of local society and economy, infrastructure technology and capacity, institutional capacity to enforce decisons.

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