SecDev Urban Pandemic Preparedness Index: Methodology for the Municipality of Amsterdam

The COVID-19 global pandemic has hit most cities of the world with the same force, however, some areas became worst affected whilst others were able to fend more effectively than others. The SecDev Urban Pandemic Preparedness Index (the "SecDev Index" or "Index") looks at the resilience at a city level to understand the hazard characteristics in comparison to its environment across seven (7) dimensions: economic, social, demographic, quality of life, burden of chronic disease, clinical care capability and digital preparedness. Thus, quantifying risks helps better manage them.

A 'Resilience Map' of a city helps emergency planners and community executives to quickly (visually) identify the specific communities (or geographic areas) that are most vulnerable and hence need support before, during and after a pandemic outbreak. Moreover, the resilience map could help city executives to allocate (scarce) resources to prepare for, put forth mitigation plans, respond to and/or use it to help in the recovery phase of an epidemic.

Index Composition

The SecDev Index for the city of Amsterdam is composed of a total of **28 factors**. Parsimony and practicality (of both data collection and relevance) have been kept in mind while choosing these factors. The factors are chosen taking into account are classified under the following **7 themes**:

1. Economic factors (4)
    a. Below poverty
    b. Unemployment
    c. Income
    d. No high-school diploma
2. Demographic factors (4)
    a. 65 years or older
    b. 18 years or younger
    c. Disability population (older than 5 years)
    d. Vulnerable households (income deprived households that are affecting children, older population and single households with 65+ years living alone)
3. Social Factors (5)
    a. Minority (Immigrants)
    b. Public Transport
    c. Crowding (Housing Density)

    d. Constrained Living Spaces
    e. Social Cohesion Index
4. Quality of Life (1)
    a. Life Situation Index
5. Burden of (Chronic) Disease (4)
    a. Diabetes
    b. Heart and Vascular Diseases
    c. Musculoskeletal Diseases
    d. Health Condition
6. Clinical Care and Lifestyle Choices (8)
    a. Alcohol problem
    b. Smoking
    c. Mental health problems
    d. Low physical mobility
    e. Physical exercise
    f. Obesity
    g. Health care facilities per 1,000 inhabitants
    h. Welfare facilities per 1,000 inhabitants
7. Digital Preparedness (1)
    a. Internet usage

Ranking

The Municipality of Amsterdam is organized in five (5) levels:

1. Municipality of Amsterdam
2. City Districts (*Stadsdelen*): There are eight (8) City Districts.
3. Areas (*Gebieden*): Each City District is composed of Areas and there are a total of twenty-two (22) Areas.
4. Quarters (*Wijken*): There are ninety-nine (99) quarters.
5. Neighborhoods (*Buurten*): There are four hundred eighty one (481) neighborhoods in the Municipality of Amsterdam.

For the purpose of this analysis, the 5 water neighborhoods are excluded and an additional 13 neighbourhoods that have no population have been excluded. Thus for this analysis, only four hundred and sixty three (463) neighborhoods have been used.

The SecDev Urban Resilience Index would rank (and calculate an index) each neighborhood within the municipality of Amsterdam at three (3) levels:

- First level, would be on each of the 28 individual factors
- Second level, it would provide an index for each neighborhood on each of the 7 themes
- Third (final) level, it would provide an aggregated single index for each neighborhood

In other words, the methodology generated percentile rank among all tracts within the municipality of Amsterdam for each of the: (1) 28 individual factors, (2) 7 themes and (3) its overall position within a city. The theme rankings, for each of the 7 themes, are obtained by calculating a percentile ranking of the average (equally weighted sum) of the percentile rankings of the individual factors within that specific theme. Lastly, the overall neighborhood preparedness ranking is obtained by calculating a percentile ranking of the sums of each theme. The neighborhood rankings are based on percentile ranking. Percentile ranking values range between 0 and 100, with higher values indicating greater resilience and lower values implying vulnerability.

Percentile rank (PR) refers to the percentage of scores that is equal to or less than a given score and is calculated based on the total number of ranks, number of ranks below and above percentile. PR is useful to understand quickly as to how a particular score will compare to the other values or observations or scores in a given dataset or in a given distribution of scores. For example, the PR method is used to calculate student rankings within a specific grade and within a specific curriculum. This gives a measure to meaningfully and relatively compare performance of a specific cohort of students. For avoidance of doubt, the percentile rank of a class of students in grade 9 in Ontario cannot be compared to another student in grade 9 in Dallas, unless the data is standardized across both places.

Moreover, for ease of identification, the neighborhood in the bottom 10% (i.e, the lowest geographical areas in the 10th percentile) and top 10% (i.e, the lowest geographical areas at the 90th percentile values) are highlighted using two independent ‘flags’. In other words, the bottom 10% were assigned the *vulnerability flag* and the top 10% of the neighborhoods were assigned the *resilience flag*. These flags are calculated for each of the 28 factors and for the 7 themes and also at the unified overall index level.

Factors, Sources & Calculations

(Data is for 2019 and primary data source is the **Basic File Areas of Amsterdam** (BBGA), unless otherwise noted)

Variable Name	Description	Table Field Calculation	Additional Notes
		1. Economic Factors	
PVRTY_E	This indicator measures the proportion of the population experiencing deprivation due to low income. The indicator is a composite of four equally weighted variables: (1) percent of people receiving social assistance (IWWB_P), (2) percent of people living on social welfare and are distant from the job market (IWWB12_P), (3) percent of people who do not pay their social rent, health insurance, municipal taxes on time (IVEOA_P) and (4) percent of people receiving unemployment benefits (IWW_P).	The variable is an **equally weighted average of: (IWWB_P, IWWB12_P, IVEOA_P, IWW_P)**	The variable and its underlying factors are taken as a percent of people in the age group of 18 to 65. Specific notes on each variable: 1. **IWWB_P**: In the original dataset, out of the 463 neighborhoods, 139 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 10 social welfare receivers. 2. **IWWB12_P**: In the original dataset, out of the 463 neighborhoods, 152 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 10 social welfare receivers at big distance from the labor market. 3. **IVEOA_P**: In the original dataset, out of the 463 neighborhoods, 127 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 10 notifications. 4. **IWW_P**: In the original dataset, out of the 463 neighborhoods, 162 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 10 unemployment benefit receivers. *For the purpose of the SecDev index all the blanks are taken as 0.*
PVRTY_PLR	Percentile of persons below poverty estimate (Poverty Index)	Formula used is: PERCENTRANK.I NC on PVRTY_E array with 4 significant digits	The initial percentile rank that was based on % of population below poverty line, i.e, high poverty percentage would give a high percentile rank. However, to make this consistent with the SecDev scale, this initial percentile rank is inverted to the final percentile rank (PVRTY_PLR). In summary, high poverty rate, means low percentile rank (after inversion) and means highly vulnerable
PVRTY_ FLAG_ VLNRBL	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 10th percentile	PVRTY_PLR < = 0.10	This binary variable is 1 for all the most vulnerable neighborhood

	(1 = yes, 0 = no)		
PVRTY_ FLAG_ RSLNC	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 90th percentile (1 = yes, 0 = no)	PVRTY_PLR > = 0.90	This binary variable is 1 for all the most resilient neighborhood
UNEMP_E	This Domain measures the proportion of the working age population in an area involuntarily excluded from the labor market.	The variable used is: **PREGWERKL_P**	The variable, PREGWERKL_P, takes the percent of population within the age group of 18 to 65 that are unemployed. In the original dataset, out of the 463 neighborhoods, 126 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 25 registered unemployed inhabitants. *For the purpose of the SecDev index all the blanks are taken as 0.*
UNEMP_ PLR	Percentile Percentage of civilian deprived because of unemployment (Unemployment Index)	Formula used is: PERCENTRANK.I NC on UNEMP_E array with 4 significant digits	The initial percentile rank that was based on % of population that is deprived due to unemployment, i.e, high unemployment rate would mean a high percentile rank; however, to make this consistent with our scale, this initial percentile rank is inverted to the final percentile rank (UNEMP_PLR). In summary, a high unemployment rate, means low percentile rank (after inversion) and this means high vulnerability. And, vice versa.
UNEMP_ FLAG_ VLNRBL	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 10th percentile (1 = yes, 0 = no)	UNEMP_PLR <= 0.10	This binary variable is 1 for all the most vulnerable neighborhood
UNEMP_ FLAG_ RSLNC	A binary variable (Flag) that takes 1, if the % of persons in poverty is in the 90th percentile (1 = yes, 0 = no)	UNEMP_PLR >= 0.90	This binary variable is 1 for all the most resilient census neighborhood

PCI_E	This provides an average household income estimate by neighborhood.	Weighted average calculated as follows: **(OSTUDWO_P) x 65% + (OSTUDHBO_P) x 35%**	There was no data that was directly capturing income per capita for the year 2019. There was data available for 2018, however, that was only available for 384 (out of 463 neighborhoods). Therefore, in this case, a proxy was used to capture the same. We use professional higher education and university education as proxies. More specifically, there are two parameters for which data is available and they are used as proxy for income: 1. **University Education** - measures the number of residents in a neighborhood that are currently pursuing university education (OSTUDWO_P) 2. **Higher Professional Education** (this is equivalent to a Bachelor's education) (OSTUDHBO_P) However, we use unequal weights for both the factors. The University education is provided 65% weight, whilst the latter is given a weight of 35%. There is no scientific basis for these weights; however, we believe it is logical to give university education higher weights as the potential future earnings of university graduates is much higher in the longer term. Also, it is assumed the current higher professional education and university students stay in the same neighborhood post completion of their education. *This might be a hard assumption to justify, as higher education provides greater geographic mobility.* Specific notes on each variable: 1. **OSTUDWO_P**: In the original dataset, out of the 463 neighborhoods, 150 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 15 students at university. 2. **OSTUDHBO_P**: In the original dataset, out of the 463 neighborhoods, 181 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 15 students in school for higher professional education. *For the purpose of the SecDev index all the blanks are taken as 0.*

PCI_PLR	Percentile per capita income estimate (Income Index)	Formula used is: PERCENTRANK.I NC on PCI_E array with 4 significant digits	This index is straightforward as high index means resilient tract and vice versa, hence there is no need for inversion for this index
PCI_FLAG_ VLNRBL	A binary variable that takes 1, if the PCI index is less than 0.10, else 0	PCI_PLR < = 0.10	This is a binary variable that indicates all the most vulnerable LSOA
PCI_FLAG_ RSLNC	A binary variable that takes 1, if the PCI index is greater than 0.90, else 0	PCI_PLR >= 0.90	This is a binary variable that indicates all the most resilient LSOA
NOHSDP_E	The indicator measures the proportion of young people not staying on in school or non-advanced education above age 16. The higher score (or percentage) means higher deprivation on the education front.	The variable is calculated by: **OBOVENLEERPL x OLSV_P**	The share of young people aged 18 to 22 who have left education without a basic qualification. A basic qualification is a diploma HAVO, VWO, MBO level 2 or higher. The number of people in a neighborhood is calculated by multiplying: People aged between 18-22 (OBOVENLEERPL) **and** Percentage of Youth (aged between 18 and 22) who quit from high school without a qualification (OLSV_P) Specific notes on each variable: 1. **OBOVENLEERPL_P**: In the original dataset, out of the 463 neighborhoods, 25 neighborhoods have blanks; i.e, there are no people in this age group. 2. **OLSV_P**: In the original dataset, out of the 463 neighborhoods, 83 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 15 persons aged between 18-22. *For the purpose of the SecDev index all the blanks are taken as 0.*
NOHSDP_ PLR	Percentile Percentage of young people not staying on in school or non-advanced education above age 16 (Education Index)	Formula used is: PERCENTRANK.I NC on NOHSDP_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. So, a high NOHSDP_E means a low percentile rank meaning high vulnerability, and vice versa
NOHSDP_ FLAG_ VLNRBL	A binary variable that takes 1 for all the tracts that have a NOHSDP_ PLR <= 0.10	NOHSDP_PLR <= 0.10	This binary variable indicates the most vulnerable neighborhood

NOHSDP_ FLAG_ RSLNC	A binary variable that takes 1 for all the tracts that have a NOHSDP_ PLR >= 0.90	NOHSDP_PLR >= 0.90	This binary variable indicates the most resilient neighborhood
2. Demographic Factors			
AGE65P_E	Persons aged 65 and over, for 2019.	The indicator is: **BEV65PLUS**	Population that are 65 and older (BEV65PLUS). The neighborhoods that have a greater number of older population are considered more vulnerable.
AGE65P_ PLR	Percentile Percentage of population above 65 years.	Formula used is: PERCENTRANK.I NC on AGE65P_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. A high percentage of older population (AGE65P_E) means a low percentile rank after inversion and it means high vulnerability; and vice versa
AGE65P_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a AGE65+_PLR <= 0.10	AGE65+_PLR <= 0.10	This binary variable indicates the most vulnerable neighborhoods, i.e., areas with a higher number of older population.
AGE65P_ FLAG_ RSLNC	A binary variable that takes 1 for all the areas that have a AGE65+_PLR >= 0.90	AGE65+_PLR >= 0.90	This binary variable indicates the most resilient neighborhoods, i.e., areas with a lesser number of older population.
AGE18U_E	Persons aged below 18 years, for 2019.	The indicator is: **BEV0_18**	Population that are 18 years or younger (BEV0_18). The neighborhoods that have a greater number of population younger than 18 are considered more vulnerable.
AGE18U_ PLR	Percentile Percentage of population below 18 years.	Formula used is: PERCENTRANK.I NC on AGE18U_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. So, a high percentage of the younger population (AGE18U_E) means a low percentile rank after inversion and it means high vulnerability; and vice versa.
AGE18U_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a AGE18U_PLR <= 0.10	AGE18U_PLR <= 0.10	This binary variable indicates the most vulnerable neighborhoods i.e., areas with a higher number of younger population, means higher dependents.
AGE18U_FL AG_RSLNC	A binary variable that takes 1 for all the areas that have a AGE18U_PLR >= 0.90	AGE18U_PLR >= 0.90	This binary variable indicates the most resilient neighborhoods i.e., areas with a lower number of younger population, means lower dependents.

DISABL_E	Disability population (older than 5 years)	The indicator is: **IAO_P**	The dataset did not have any direct data that provides 'Disability Population'. From the BBGA dataset, for the purpose of this index we found a dataset that provides data about the % of people that receive disability benefits (IAO_P). The neighborhood that has a higher percentage of population that is receiving disability benefits, the more vulnerable it is. In the original dataset, out of the 463 neighborhoods, 81 neighborhoods have blanks; moreover, it is noted that numbers are only available for areas with at least 10 disability benefit receivers. *For the purpose of the SecDev index all the blanks are taken as 0.*
DISABLE_ PLR	Percentile rank of DISABLE_E (Disability Index).	Formula used is: PERCENTRANK.I NC on DISABLE_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. A high percentage of Disabled population (DISABLE_E) means a low percentile rank after inversion and it means high vulnerability; and vice versa.
DISBLE_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a DISABLE_PLR <= 0.10	DISABLE_PLR <= 0.10	This binary variable indicates the most vulnerable neighborhoods i.e., areas with a high number of physically challenged population
DISBLE_FL AG_RSLNC	A binary variable that takes 1 for all the areas that have a DISABLE_PLR >= 0.90	DISABLE_PLR >= 0.90	This binary variable indicates the most resilient neighborhoods i.e., areas with a low number of physically challenged population.
VLNRBL_ HHD_E	Vulnerable households (single parent households with children less than 18 years old and single households with 65+ years living alone)	The indicator is: **Weighted average of BEVENOUDERHH, BEV1P80PLUS, BEV1P65_79HH**	The variable is composed of three metrics:, we have considered households that are: (1) Single Parent Family (BEVEENOUDERHH); (2) One person HHD that are 80 years or older (BEV1P80PLUS) and (3) One person HHD that are between 65 and 79 years old (BEV1P65_79HH). The last variable is composed of two variables from the original dataset, BEV1P65_79_V and BEV1P65_79M, which are one-person households for females and males, respectively.
VLNRBL_ HHD_PLR	Percentile ranking of the vulnerable households.	Formula used is: PERCENTRANK.I NC on VLNRBL_HHD_E array with 4 significant digits	The original percentile is inverted to make it consistent with SecDev Scale. So, a high percentage of vulnerable households (VLNRBL_HHD) means a low percentile rank after inversion and it means high vulnerability; and vice versa.

VLNRBL_ HHD_ FLAG_ VLNRBL	A binary variable that takes 1 for all the areas that have a VLNRBL_HHD_PLR <= 0.10	VLNRBL_HHD_PLR <= 0.10	This binary variable indicates the most vulnerable neighborhoods i.e., areas with high number of vulnerable households
VLNRBL_ HHD_ FLAG_ RSLNC	A binary variable that takes 1 for all the areas that have a VLNRBL_HHD_PLR >= 0.90	VLNRBL_HHD_PLR >= 0.90	This binary variable indicates the most resilient neighborhoods i.e., areas with low number of vulnerable households
3. Social Factors			
MNRTY_E	Minority population is defined as the percentage of migrants from non-western countries as a proportion of total population, according to the 2011 Census.	The formula used consists of only migrants from non-western countries and is the sum of: **[(BEVSUR, BEVANTIL, BEVTURK, BEVMAROK, BEVOVNW)/ BEVTOTAAL]*100**	The BBGA dataset divided the population into three (3) sets: (1) migrants from non-western countries, (2) migrants from western countries and (3) local population. For the purpose of understanding the vulnerability, **only migrants from non-western countries** are considered and they consist of: • BEVSUR - Migrants from Suriname • BEVANTIL - Migrants from Dutch Antilles • BEVTURK - Migrants from Turkey • BEVMAROK - Migrants from Morocco • BEVOVNW - Migrants from other non-western countries • BEVTOTAAL - Total population of the neighborhood The higher this proportion, the more vulnerable the neighborhood.
MNRTY_ PLR	This calculates the minority population percentile rank per census tract.	PERCENTRANK.I NC on MNTRY_E array with 4 significant digits	The index calculation is inverted to be inline with SecDev scale where 0 is most vulnerable and 1 is most resilient
MNRTY_ FLAG_ VNRBL	A binary variable that takes 1 when percentile rank of minorities in a tract is high	MNRTY_PLR <= 0.10	The LSOA takes a value of 1, if the MNRTY_PLR <=10%
MNRTY_ FLAG_ RSLNC	The binary variable takes 1 when a tract has a very minimal number of minorities	MNRTY_PLR >= 0.90	The LSOA takes a value of 1, if the MNRTY_PLR >=90%
Public Transport_E	This variable measures the availability of public transport by neighborhood	The indicator used is a opinion survey of residents of neighborhoods about the adequacy of public transport; and the variable is:	In this case, an alternative measure of “Public Transport”, VKOV_R, was used; this is a survey of neighborhood residents, wherein they were asked their opinion about the sufficiency (adequacy) of public transport. They were asked to rank this on a scale of 1 to 10, where ‘1’ represents highly insufficient availability of public transportation, whereas, ‘10’ represents high

		VKOV_R	sufficiency. Note that 147 neighborhoods have no data provided (as the sampling was only done for neighborhoods that have a population of at least 20 respondents). In this case, we took the average of the existing data and ascribed this average to the neighborhoods where the data is missing. For 2019, the average score value is: 7.5.
Public Transport_ PLR	Percentile ranking of neighborhoods with adequate access to public transport	PERCENTRANK.I NC on PublicTransport_E array with 4 significant digits	The index is calculated and as this is a positive index it is not inverted.
Public Trasnport_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable census tracts	PublicTransport_ PLR <= 0.10	A binary variable where 0 indicates a neighborhood with lowest sufficiency of public transport (in the opinion of the residents of that neighborhood) and and 1 indicates the exact opposite
Public Transport_ FLAG_ RSLNC	This variable gives 1 for most resilient census tracts	PublicTransport_ PLR >= 0.90	
Housing Density_E	This variable measures the crowding of households in an area.	The variable from the BBGA dataset used is: **WDICHT**	The variable WDICHT measures the number of homes per sq.km land. There are 34 missing values for these areas and the average value of the data is taken for these missing areas (average number of homes per sq km of land: 6231). Higher density means more vulnerability. Thus the percentile ranking has been inverted to reflect more resiliency for higher scores.
Housing Density_ PLR	Percentile ranking of people who live in crowded households	PERCENTRANK.I NC on CROWD_PE array with 4 significant digits	The index is calculated and inverted to be in line with SecDev Scale.
Housing Density_ FLAG_ VLNRBL	This variable gives 1 for most Vulnerable census tracts	CROWD_PLR<= 0.10	On the inverted scale, 0 indicates neighborhoods with the highest percent of crowded households and 1 indicates the exact opposite.
Housing Density_ FLAG_ RSLNC	This variable gives 1 for most Resilient census tracts	CROWD_PLR>= 0.90	
Congested LivingAreas	This variable measures neighborhoods with houses with congested living spaces, more specifically, houses with living space less than 40m2	The variable used is: **WOPP0040_P**	There are 31 neighborhoods where the data is missing; for those neighborhoods we have taken the average value of 10.05%.

Congested LivingAreas _ PLR	Percentile ranking of Congested Living Areas	PERCENTRANK.INC on CongestedLiving Areas array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Congested LivingAreas _FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	CongestedLiving Areas_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates percentage of neighborhoods with highest percentage of congested living; and, 1 indicates the exact opposite
Congested LivingAreas _ FLAG_ RSLNC	This variable gives 1 for most resilient areas	CongestedLiving Areas_PLR >= 0.90	
Social Cohesion Index	This index measures social cohesion among residents of a neighborhood.	The variable used is: **LSOCCOH_R**	**Social Cohesion Index** (LSOCCOH_R) - is an index to understand the social cohesion among residents of a neighborhood. The minimum is 4.2 and maximum is 7.8. The average score is 5.6 and this is taken for neighborhoods where there is no data provided. The score for social cohesion is based on the level of agreement with the following statements: • The people in this neighbourhood hardly know one another. • The people in this neighbourhood have a pleasant relationship. • I live in a nice neighbourhood where there is a lot of solidarity. • I feel at home with the people living in this neighbourhood. The reactions are re-coded to report marks. Numbers are only available for areas with at least 50 respondents. Except for the numbers about buurten, those are a three-year-average based on at least 30 respondents.
Social Cohesion_ PLR	Percentile ranking of Social Cohesion Index	PERCENTRANK.INC on Social Cohesion array with 4 significant digits	This index is straightforward as high index means resilient tract and vice versa, hence there is no need for inversion for this index
Social Cohesion_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	SocialCohesion_ PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates percentage of neighborhoods with lowest social cohesion index; and, 1 indicates the exact opposite

Social Cohesion_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	SocialCohesion_ PLR >= 0.90	
4. Quality of Life			
LifeSituation Index_E	This variable measures the indoor living environment or the quality of life. This is a combination of two indicators: (i) housing in poor condition and (ii) houses without central heating. The variable created is an equally weighted average of these two indicators.	The indicator used is: **WZSLI_I**	The Life Situation Index (WZSLI_I) is used to measure quality of life. This index was developed by the Social Cultural Planning Office (SCP) and describes the quality of life in eight important social domains. The score 100 represents the Amsterdam average in 2004. The index is based on the score in the following domains: housing, health, consumer goods, leisure activities, mobility, social participation, sports activities, holidays and the social network. This index is only available at the Gebieden (Areas) level. For the record, the municipality is divided into 22 Areas. Also, this data is taken every two years, so the current available data is as of 2018. Moreover, the area B (Westport) has a GSD number of 99, however, the survey was not available for this area. Therefore, we have taken the base score of 100 for this area.
LifeSituation Index_PLR	Percentile ranking of Life Situation Index	PERCENTRANK.I NC on LifeSituation Index array with 4 significant digits	This index is straightforward as high index means resilient neighborhood and vice versa, hence there is no need to invert this index
LifeSituation Index_FLAG _ VLNRB	This variable gives 1 for most vulnerable areas	LifeSituationIndex_ PLR <= 0.10	A binary variable; on the inverted scale, 0 indicates LSOA with lowest indoor quality of life; and, 1 indicates the exact opposite
LifeSituation Index_FLAG _ RSLNC	This variable gives 1 for most resilient areas	LifeSituationIndex_ PLR >= 0.90	
5. Burden of Chronic Disease (both Morbidity and Mortality)			

Diabetes_E	The indicator provides an estimate of residents aged 19 or older with diabetes, as determined by a doctor.	Column name in the dataset is: **Residents aged 19 and over with Diabetes, as Diagnosed by Doctor (2016)**	The data is as of 2016; the data is only available at the Area level (there are 22 areas)
Diabetes_ PLR	Percentile ranking of the Diabetes indicator	PERCENTRANK.I NC on Diabetes_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Diabetes_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	Diabetes_PLR <=0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest percentage of people diagnosed with diabetes; and, 1 indicates the exact opposite
Diabetes_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	Diabetes_PLR >=0.90	
Heart Vascular Disease_E	The indicator provides an estimate of residents aged 19 or older with heart and vascular disease, as determined by a doctor.	Column name in the dataset is: **Residents aged 19 and over with Heart & Vascular Disease, as Diagnosed by Physician (2016)**	The percentage of residents aged 19 and older with cardiovascular disease diagnosed by a physician and it includes: stroke, cerebral haemorrhage, cerebral infarction, myocardial infarction, cardiac arrhythmias, other serious heart conditions. The data is available at the area level (there are 22 areas) and for the year 2016.
Heart Vascular Disease_ PLR	Percentile ranking of the Heart & Vascular Disease indicator	PERCENTRANK.I NC on Heart VascularDisease_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Heart Vascular Disease_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	HeartVascular Disease_PLR <=0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest percentage of people diagnosed with heart and vascular disease; and, 1 indicates the exact opposite
Heart Vascular Disease_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	HeartVascular Disease_PLR >=0.90	
Musculo skeletal Disorders_E	The indicator provides an estimate of residents aged 19 or older with musculoskeletal disorders, as determined by a doctor.	Column name in the dataset is: **Residents aged 19 and over with Musculoskeletal Disorder, as**	The percentage of residents aged 19 or older with musculoskeletal disorders, as diagnosed by a physician, including: joint wear of hips or knees, chronic joint inflammation, osteoporosis, severe back, neck, shoulder, elbow, wrist, or

		Diagnosed by Physician (2016)	hand disease. This data is collected every 4 years and the last data point available was for 2016. Also, the data is available for the 22 Areas (Geibeden) only.
Musculo skeletal Disorders_ PLR	Percentile ranking of the Musculoskeletal Disorders indicator	PERCENTRANK.I NC on Musculo skeletalDisorders_E array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Musculo skeletal Disorders_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	Musculoskeletal Disorders_PLR <=0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest percentage of people diagnosed with musculoskeletal disorders; and, 1 indicates the exact opposite
Musculo skeletal Disorders_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	Musculoskeletal Disorders_PLR >=0.90	
Perceived Health Condition	The indicator provides a survey of health conditions.	The indicator used is: **WZGEZOND_P**	**WZGEZOND_P** is defined as “Percentage of the population aged 19 and over that describe their own health in general as (very) good.” This is available for the year 2016. And, it is available at the 99 Quarters level (Wijken), i.e., a more granular level.
Perceived Health Condition_ PLR	Percentile ranking of the perceived health condition indicator	PERCENTRANK.I NC on PerceivedHealth Condition_E array with 4 significant digits	This index is straightforward as high index means resilient neighborhood and vice versa, hence there is no need to invert this index
Perceived Health Condition_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	Musculoskeletal Disorders_PLR <=0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods where residents perceive their health condition is low; and, 1 indicates the exact opposite

Perceived Health Condition_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	Musculoskeletal Disorders_PLR >=0.90	
6. Clinical Care and Lifestyle Choices			
Excessive Drinking	This indicator measures the extent of alcohol related problems.	Column name in the dataset is: **WZLAC_P**	This indicator (WZLAC_P) gives the percentage of the population aged 19 and over that are heavy or excessive drinkers. Excessive drinking for men is 21 glasses or more per week, and for women 14 glasses or more. Heavy drinking is 6 glasses in one day at least once a week. This indicator is available every four years; the last available data point is in 2016 and is available at the 22 Area (Geibeden) level.
Excessive Drinking_ PLR	Percentile ranking of Alcohol Problems indicator	PERCENTRANK.I NC on Excessive Drinking array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Excessive Drinking_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	ExcessiveDrinking_PL R <=0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest % of residents with alcohol problems and, 1 indicates the exact opposite
Excessive Drinking_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	ExcessiveDrinking_PL R >=0.90	
Smokers	This indicator measures the percentage of smokers in a neighborhood.	Column name in the dataset is: **WZROOK_P**	This indicator (WZROOK_P) gives the percentage of the population aged 19 and over that smoke. A smoker is someone that smokes (sometimes), irrespective of the frequency, the amount and the kind of tobacco product. This indicator is available every four years; the last available data point is in 2016 and is available at the Quarters (Wijken) level (there are 99 Quarters).
Smokers_ PLR	Percentile ranking of Smokers indicator	PERCENTRANK.I NC on Smokers array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index

Smokers_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	Smokers_PLR<= 0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest % of smokers and, 1 indicates the exact opposite
Smokers_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	Smokers_PLR>= 0.90	
Psychologic Problems	This indicator measures the mental wellbeing of residents in an area	Column name in the dataset is: **WZDEPR_P**	The indicator, WZDEPR_P, measures the percentage of the population aged 19 and over with serious psychological problems. The score is based on de K10 checklist that consists of 10 questions about one's state of mind during the past 4 weeks. This indicator is available every four years; the last available data point is in 2016. Also, it is available at the '99 Quarters' (Wijken) level.
Psychologic Problems_ PLR	Percentile ranking of Mental Health indicator	PERCENTRANK.I NC on Psychologic Problmes array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Psychologic Problems_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	PsychologicProblmes_ PLR <= 0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest mental health issues and, 1 indicates the exact opposite
Mental Health_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	PsychologicProblmes_ PLR >= 0.90	
Physical Health Problems	The indicator measures the percentage of the population with illness or physical health condition that limits their physical day to day activities	Column name in the dataset is: **WZOESO_P**	The indicator, WZOESO_P, measures the percentage of the population aged 19 and over with a physical impairment and having severe trouble with at least 1 of 7 activities that concerns hearing, seeing or moving. The data is available for 2016 and is available for the 99 Quarters (Wijken).
Physical Health Problems_ PLR	Percentile ranking of physical health problems indicator	PERCENTRANK.I NC on Physical HealthProblems array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Physical Health Problems_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	PhysicalHealthProblem s_PLR <= 0.10	A binary variable; on the inverted scale, 0 indicates neighborhoods with highest issues due to low physical health problems and, 1 indicates the exact opposite

Physical Health Problmes_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	PhysicalHealthProblems_PLR>= 0.90	
Physical Active	The indicator measures the percentage of the population that meet the activity standard and do enough regular exercise each week	Column name in the dataset is: **WZBEWEEG_P**	The indicator, WZBEWEEG_P, measures the percentage of the population aged 19 and over that meet the activity standard. The 'Activity Standard' is at least half an hour of moderate intense physical activity at 5 days of the week. This indicator is available every four years; the last available data point is in 2016. Also, it is available at the 22 Area (Geibeden) level.
Physical Active_PLR	Percentile ranking of Physical Active indicator	PERCENTRANK.INC on PhysicalActive array with 4 significant digits	The index is calculated and is not inverted, as it is a positive indicator.
Physical Active_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	PhysicalActive_PLR<= 0.10	A binary variable where 0 indicates neighborhoods with lowest percentage of population getting adequate physical exercise and, 1 indicates the exact opposite
Physical Active_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	PhysicalActive_PLR>= 0.90	
Obesity	The indicator measures the percentage of the population that are obese	Column name in the dataset is: **WZZWAAR_P**	The indicator, WZZWAAR_P, measures the percentage of the population aged 19 and over that are overweight (BMI between 25 and 30) or obese (BMI of 30 or more). This indicator is available every four years; the last available data point is in 2016. And, it is available at the 99 Quarters (Wijken) level.
Obesity_ PLR	Percentile ranking of obese indicator	PERCENTRANK.INC on Obesity array with 4 significant digits	The index is calculated and inverted, to make it inline with SecDev Index
Obesity_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	Obesity_PLR<= 0.10	A binary variable where 0 indicates neighborhoods with highest percentage of population that are obese and, 1 indicates the exact opposite
Obesity_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	Obesity_PLR>= 0.90	

HealthCare Facilities	The indicator measures the number of health care facilities per 1,000 inhabitants	The column name is: **WZGEZOND_1000INW**	The indicator, WZGEZOND_1000INW, measures the number of healthcare facilities registered in a neighborhood per 1,000 inhabitants. This data is available on a yearly basis. And it is available in 'neighborhoods'.
HealthCare Facilities_ PLR	Percentile ranking of health care facilities in a neighborhood	PERCENTRANK.I NC on HealthCareFacilities array with 4 significant digits	This index is straightforward as high index means resilient neighborhood and vice versa, hence there is no need to invert this index
HealthCare Facilities_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	HealthCareFacilities_PLR <= 0.10	A binary variable where 0 indicates neighborhoods with lowest number of registered health care facilities per 1,000 inhabitants and, 1 indicates the exact opposite
HealthCare Facilities_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	HealthCareFacilities_PLR>= 0.90	
Welfare Facilities	The indicator measures the number of welfare facilities per 1,000 inhabitants	The column name is: **WZWELZIJN_1000INW**	The indicator, WZWELZIJN_1000INW, measures the number of welfare facilities registered in a neighborhood per 1,000 inhabitants. This data is available on a yearly basis. And it is available in 'neighborhoods'.
Welfare Facilities_ PLR	Percentile ranking of welfare facilities in a neighborhood	PERCENTRANK.I NC on WelfareFacilities array with 4 significant digits	This index is straightforward as high index means resilient neighborhood and vice versa, hence there is no need to invert this index
Welfare Facilities_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable neighborhoods	WelfareFacilities_ PLR <= 0.10	A binary variable where 0 indicates neighborhoods with lowest number of registered welfare facilities per 1,000 inhabitants and, 1 indicates the exact opposite
Welfare Facilities_ FLAG_ RSLNC	This variable gives 1 for most resilient neighborhoods	WelfareFacilities_ PLR>= 0.90	
7. Digital Preparedness			
Internet Access	The indicator measures the access to the internet	Column name in the dataset is: **% of internet access at home**	The data is provided by the Municipality of Amsterdam, vide an email on 27 May 2021 to SecDev. In this email, they provided the internet usage by the 22 Areas (Geibeden). No other metrics were available for this city.

Internet Access_PLR	Percentile ranking of NoDevice indicator	PERCENTRANK.INC on NoDevice array with 4 significant digits	This index is straightforward as high index means resilient neighborhood and vice versa, hence there is no need to invert this index
Internet Access_ FLAG_ VLNRBL	This variable gives 1 for most vulnerable areas	InternetAccess_PLR<= 0.10	A binary variable where 0 indicates neighborhood with lowest percentage of access to internet at home and, 1 indicates the exact opposite
Internet Access_ FLAG_ RSLNC	This variable gives 1 for most resilient areas	InternetAccess_PLR>= 0.90	

Appendix 1 - Geography of the Municipality of Amsterdam

Statistics Netherlands uses three other definitions of Amsterdam (link accessed on 18 May 2021):

1. Metropolitan Agglomeration Amsterdam (*Grootstedelijke Agglomeratie Amsterdam)*
2. Greater Amsterdam (*Groot Amsterdam or Grootstedelijk Gebied Amsterdam*, a COROP region). Greater Amsterdam includes 15 municipalities and had a population of 1,293,208 in 2013.
3. Urban Region Amsterdam (*Stadsgewest Amsterdam*).[95]

Moreover, the *Amsterdam Department for Research and Statistics* uses a **fourth way** to classify the Amsterdam area: **City Region of Amsterdam** (*Stadsregio Amsterdam*). This City Region is similar to the Greater Amsterdam but includes: (i) the municipality of Zaanstad and (ii) the municipality of Wormerland; however, it excludes from Greater Amsterdam: (i) the municipality of Graft-De-Rijp. Also, of these four (4) metropolitan area configurations, only the ***Stadsregio Amsterdam* (City Region of Amsterdam)** has a formal governmental status. Its responsibilities include regional spatial planning and the metropolitan public transport concessions.

All the above mentioned definitions are composed of various municipalities. However, for the purposes of this exercise, we gather data and calculate indices only for the **Municipality of Amsterdam**. According to StatLine, the population of the Municipality of Amsterdam is 871,903, as of March 2021.

The Municipality of Amsterdam is organized in the following layers:

1. **Level 1** - Municipality of Amsterdam
    2. **Level 2 - City Districts (Stadsdelen)**: There are **eight (8)** City Districts.
        3. **Level 3 - Areas (Gebieden)**: Each City District is composed of Areas and there are a total of **twenty-two (22)** Areas.
            4. **Level 4 - Quarters (Wijken)**: There are **ninety-nine (99)** quarters.
                5. **Level 5 - Neighborhoods (Buurten)**: There are **four hundred seventy six (476)** neighborhoods in the Municipality of Amsterdam.

Basically, the Municipality of Amsterdam is composed of eight (8) boroughs or City Districts called *stadsdelen*, a system that was implemented gradually in the 1980s to improve local governance. The eight boroughs are:

1. **Centrum (A):**
    - **Area**: 8.04 Km^2;
    - **Population (2019)**: 86,862
    - **Level 3 - Areas (Gebieden):** There are two (2) areas within this district: (i) Centrum-West (DX01), and (ii) Centrum-Oost (DX02).
    - **Level 4 - Quarters (Wijken):** There are ten (10) quarters in this City District.
        i. **Centrum-West (DX01):** Burgwallen-Oude Zijde (A00); Burgwallen-Nieuwe Zijde (A01); Grachtengordel-West (A02); Haarlemmerbuurt (A05); Jordaan (A06).
        ii. **Centrum-Oost (DX02):** Grachtengordel-Zuid (A03); Nieuwmarkt/Lastage (A04); De Weteringschans (A07); Weesperbuurt/Plantage (A08); Oostelijke Eilanden/Kadijken (A09).
    - **Level 5 - Neighbourhoods (Buurten):** There are **seventy (70) neighbourhoods** in this City District. In the Centrum-West Area, there are 34 neighbourhoods and in the Centrum-Oost Area, there are 36 neighbourhoods.
2. **Westpoort (B)**: This City District covers the western harbor area of Amsterdam. Also, because it has a very few inhabitants it is governed by the Central Municipal Council.
    - **Area**: 10 Km^2;
    - **Population (2019):** 177
    - **Level 3 - Areas (Gebieden): N/A**
    - **Level 4 - Quarters (Wijken):** There is only one (1) Quarter in this City District: *Westelijk Havengebied* (B10).
    - **Level 5 - Neighbourhoods (Buurten):** There are **eight (8)** neighborhoods in this City District: Coenhaven/Mercuriushaven (B10a); Alfa-driehoek (B10b); Petroleumhaven (B10c); Westhaven Noord (B10d); Vervoerscentrum (B10e); Amerikahaven (B10f); Afrikahaven (B10g) and Westhaven Zuid (B10h).
3. **West (E):**
    - **Area**: 9.89 Km^2;
    - **Population (2019)**: 145,908
    - **Level 3 - Areas (Gebieden):** There are three (3) areas within this district: (i) Westpark (DX03), (ii) Bos en Lommer (DX04), and (iii) Oud-West, De Baarsjes (DX05).
    - **Level 4 - Quarters (Wijken):** There are twenty (20) quarters in this City District.
        i. **Westpark (DX03) has five (5) Quarters:** Houthavens (E12); Spaarndammer-en Zeeheldenbuurt (E13); Staatsliedenbuurt (E14); Centrale Markt (E15); and, Frederik Hendrikbuurt (E16).
        ii. **Bos en Lommer (DX04) has four (4) Quarters:** Sloterdijk (E36); Landlust (E37); Erasmuspark (E38); and, De Kolenkit (E39).
        iii. **Oud-West, De Baarsjes (DX05) has eleven (11) Quarters:** Da Costabuurt (E17); Kinkerbuurt (E18); Van Lennepbuurt (E19); Helmersbuurt (E20); Overtoomse Sluis (E21); Vondelbuurt (E22); Geuzenbuurt (E40); Van Galenbuurt (E41); Hoofdweg e.o. (E42); Westindische Buurt (E43); and, Chassebuurt (E75).

- **Level 5 - Neighbourhoods (Buurten):** There are a total of **sixty-seven (67) neighbourhoods** in this City District. In the Westpark (DX03) Area, there are 23 neighbourhoods; the Bos en Lommer (DX04) Area there are 14 neighborhoods, and in the Oud-West, De Baarsjes (DX05) Area, there are 30 neighbourhoods.

4. **Nieuw-West (F):**
   - **Area**: 32.38 Km^2;
   - **Population (2019)**: 157,964
   - **Level 3 - Areas (Gebieden):** There are four (4) areas within this district: (i) Geuzenveld, Slotermeer, Sloterdijken (DX06), (ii) Osdorp (DX07), (iii) De Aker, Sloten, Nieuw-Sloten (DX08) and (iv) Slotervaart (DX09).
   - **Level 4 - Quarters (Wijken):** There are fifteen (15) quarters in this City District.
     i. **Geuzenveld, Slotermeer, Sloterdijken (DX06) has five (5) Quarters:** Bedrijventerrein Sloterdijk (F11); Slotermeer-Noordoost (F76); Slotermeer-Zuidwest (F77); Geuzenveld (F78); and, Eendracht (F79).
     ii. **Osdorp (DX07) has four (4) Quarters:** Lutkemeer/Ookmeer (F80); Osdorp-Oost (F81); Osdorp-Midden (F82); and, De Punt (F83).
     iii. **De Aker, Sloten, Nieuw-Sloten (DX08) has two (2) Quarters:** Middelveldsche Akerpolder (F84); and, Sloter/Riekerpolder (F88).
     iv. **Slotervaart (DX09) has four (4) Quarters:** Slotervaart Noord (F85); Overtoomse Veld (F86); Westlandgracht (F87); and, Slotervaart Zuid (F89).
   - **Level 5 - Neighbourhoods (Buurten):** There are a total of **sixty-eight (68) neighbourhoods** in this City District. In the Geuzenveld, Slotermeer, Sloterdijken (DX06) Area, there are 22 neighbourhoods; the Osdorp (DX07) Area there are 14 neighborhoods; the De Aker, Sloten, Nieuw-Sloten (DX08) Area has 13 neighborhoods; and in the Slotervaart (DX09) Area, there are 19 neighbourhoods.
5. **Zuid (K)**
   - **Area**: 17.41 Km^2;
   - **Population (2019):** 145,966
   - **Level 3 - Areas (Gebieden):** There are three (3) areas within this district: (i) Oud-Zuid (DX10), (ii) Buitenveldert, Zuidas (DX11), and (iii) De Pijp, Rivierenbuurt (DX12).
   - **Level 4 - Quarters (Wijken):** There are sixteen (16) quarters in this City District.
     i. **Oud-Zuid (DX10) has six (6) Quarters:** Hoofddorppleinbuurt (K44); Schinkelbuurt (K45); Willemspark (K46); Museumkwartier (K47); Stadionbuurt (K48); and Apollobuurt (K49).
     ii. **Buitenveldert, Zuidas (DX11) has four (4) Quarters:** Zuidas (K23); Prinses Irenebuurt e.o. (K59); Buitenveldert-West (K90) and Buitenveldert-Oost (K91).
     iii. **De Pijp, Rivierenbuurt (DX12) has six (6) Quarters:** Oude Pijp (K24); Nieuwe Pijp (K25); Zuid Pijp (K26); Scheldebuurt (K52); Ijselbuurt (K53) and Rijnbuurt (K54).
   - **Level 5 - Neighbourhoods (Buurten):** There are a total of **seventy-six (76) neighbourhoods** in this City District. In the Oud-Zuid (DX10) Area, there are 34 neighbourhoods; the Buitenveldert, Zuidas (DX11) Area has 17 neighborhoods; and in the De Pijp, Rivierenbuurt (DX12) Area, there are 25 neighbourhoods.
6. **Oost (M)**

- **Area**: 30.56 Km^2;
- **Population (2019):** 140,300
- **Level 3 - Areas (Gebieden):** There are four (4) areas within this district: (i) Oud-Oost (DX13), (ii) Indische Buurt, Oostelijk Havengebied (DX14), (iii) Watergraafsmeer (DX15), and (iv) IJburg, Zeeburgereiland (DX16).
- **Level 4 - Quarters (Wijken):** There are fifteen (15) quarters in this City District.
    i. **Oud-Oost (DX13) has four (4) Quarters:** Weesperzijde (M27); Oosterparkbuurt (M28); Dapperbuurt (M29); and, Transvaalbuurt (M30).
    ii. **Indische Buurt, Oostelijk Havengebied (DX14) has three (3) Quarters:** Indische Buurt West (M31); Indische Buurt Oost (M32); and, Oostelijk Havengebied (M33)
    iii. **Watergraafsmeer (DX15) has four (4) Quarters:** Frankendael (M55); Middenmeer (M56); Betondorp (M57); and, Omval/Overamstel (M58).
    iv. **IJburg, Zeeburgereiland (DX16) has four (4) Quarters**: Zeeburgereiland/Nieuwe diep (M34); IJburg West (M35); IJburg Oost (M50); and IJburg Zuid (M51).
- **Level 5 - Neighbourhoods (Buurten):** There are a total of **seventy-eight (78) neighbourhoods** in this City District. In the Oud-Oost (DX13) Area, there are 12 neighborhoods; (ii) the Indische Buurt, Oostelijk Havengebied (DX14) Area has 18 neighborhoods; (iii) the Watergraafsmeer (DX15) has 27 neighborhoods and (iv) IJburg, Zeeburgereiland (DX16) Area has 21 neighborhoods.

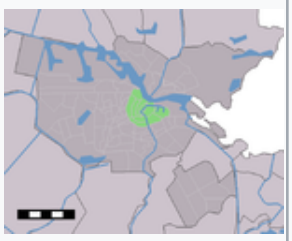
7. **Noord (N):**
    - **Area**: 49.01 Km^2;
    - **Population (2019)**: 97,200
    - **Level 3 - Areas (Gebieden):** There are three (3) areas within this district: (i) Noord-West (DX17), (ii) Oud-Noord (DX18), and (iii) Noord-Oost (DX19).
    - **Level 4 - Quarters (Wijken):** There are fifteen (15) quarters in this City District.
        i. **Noord-West (DX17) has four (4) Quarters:** Tuindorp Oostzaan (N65); Oostzanerwerf (N66); Kadoelen (N67); and Banne Buiksloot (N70).
        ii. **Oud-Noord (DX18) has seven (7) Quarters:** Volewijck (N60); IJplein/Vogelbuurt (N61); Tuindorp Nieuwendam (N62); Tuindorp Buiksloot (N63); Nieuwendammerdijk/Buiksloterdijk (N64); Noordelijke IJ-oevers West (N71); and, Noordelijke IJ-oevers Oost (N72).
        iii. **Noord-Oost (DX19) has four (4) Quarters:** Waterlandpleinbuurt (N68); Buikslotermeer (N69); Waterland (N73); and Elzenhagen (N74).
    - **Level 5 - Neighbourhoods (Buurten):** There are a total of **sixty-six (66) neighbourhoods** in this City District. In the Noord-West (DX17) Area, there are 18 neighborhoods; (ii) the Oud-Noord (DX18) Area has 23 neighborhoods; and (iii) the Noord-Oost (DX19) has 25 neighborhoods.
8. **Zuidoost (T):**
    - **Area**: 22.08 Km^2;
    - **Population (2019):** 88,610
    - **Level 3 - Areas (Gebieden):** There are three (3) areas within this district: (i) Bijlmer-Centrum, Amstel III (DX20), (ii) Bijlmer-Oost (DX21), and (iii) Gaasperdam, Driemond (DX22).
    - **Level 4 - Quarters (Wijken):** There are seven (7) quarters in this City District.

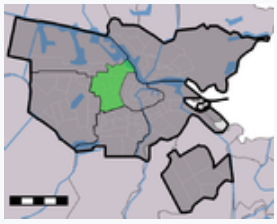
i. **Bijlmer-Centrum, Amstel III (DX20) has two (2) Quarters:** Amstel III/Bullewijk (T92) and Bijlmer-Centrum (D,F,H) (T93).
ii. **Bijlmer-Oost (DX21) has only one (1) Quarter:** Bijlmer-Oost (E,G,K) (T94)
iii. **Gaasperdam, Driemond (DX22) has four (4) Quarters**: Nellestein (T95); Holendrecht/Reigersbos (T96); Gein (T97); and Driemond (T98).

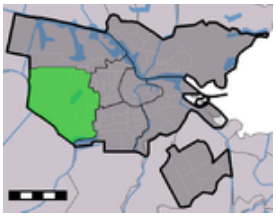
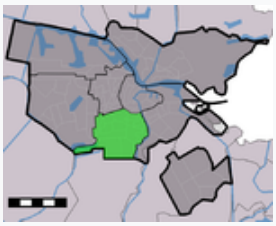
- **Level 5 - Neighbourhoods (Buurten):** There are a total of **forty-eight (48) neighbourhoods** in this City District. In the Bijlmer-Centrum, Amstel III (DX20) Area, there are 18 neighborhoods; (ii) Bijlmer-Oost (DX21) Area has 14 neighborhoods; and (iii) Gaasperdam, Driemond (DX22) Area has 16 neighborhoods.

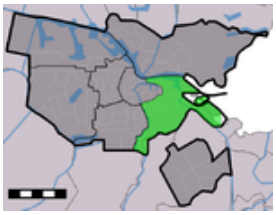
In essence, the eight boroughs have a **total land area of 179.37 Km²** and there are a total of 22 Areas (Gebieden), 99 Quarters (Wijken) and 476 Neighborhoods (Buurten).

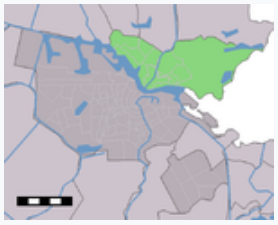
Below table summarizes the geographical information of the Municipality of Amsterdam:

Level 2: City District (Stadsdelen)	**Level 3: Areas** (Gebieden)	**Level 4: Quarters** (Wijken)	**Level 5: Neighbourhoods** (Buurten)
Centrum [A] (*Centre*) **Area**: 8.04 km² **Pop (2019)**: 86,862 **Areas**: 2 **Quarters**: 10 **Neighborhoods**: 70 	Centrum-west (DX01)	Burgwallen-Oude Zijde (A00); Burgwallen-Nieuwe Zijde (A01); Grachtengordel-West (A02); Haarlemmerbuurt (A05); Jordaan (A06)	**34**
	Centrum-Oost (DX02)	Grachtengordel-Zuid (A03); Nieuwmarkt/Lastage (A04); De Weteringschans (A07); Weesperbuurt/Plantage (A08); Oostelijke Eilanden/ Kadijken (A09)	**36**

Westpoort [B] (*West Gateway*) **Area**: 10.00 km² **Pop (2019)**: 177 **Areas**: - **Quarters**: 1 **Neighborhoods**: 8 	N/A	Westelijk Havengebied (B10)	Coenhaven/Mercuriushaven (B10a); Alfa-driehoek (B10b); Petroleumhaven (B10c); Westhaven Noord (B10d); Vervoerscentrum (B10e); Amerikahaven (B10f); Afrikahaven (B10g); Westhaven Zuid (B10h).
West [E] **Area**: 9.89 km² **Pop (2019)**: 145,908 **Areas**: 3 **Quarters**: 20 **Neighborhoods**: 67 	Westpark (DX03)	Houthavens (E12); Spaarndammer-en Zeeheldenbuurt (E13); Staatsliedenbuurt (E14); Centrale Markt (E15); and, Frederik Hendrikbuurt (E16)	**23**
	Bos en Lommer (DX04)	Sloterdijk (E36); Landlust (E37); Erasmuspark (E38); and, De Kolenkit (E39)	**14**
	Oud-West, De Baarsjes (DX05)	Da Costabuurt (E17); Kinkerbuurt (E18); Van Lennepbuurt (E19); Helmersbuurt (E20); Overtoomse Sluis (E21); Vondelbuurt (E22); Geuzenbuurt (E40); Van Galenbuurt (E41); Hoofdweg e.o. (E42); Westindische Buurt (E43); and, Chassébuurt (E75)	**30**

Nieuw-West [F] (*New West*) **Area**: 32.38 km² **Pop (2019)**: 157,964 **Areas**: Four (4) **Quarters**: 15 **Neighborhoods**: 68 	Geuzenveld, Slotermeer, Sloterdijken (DX06)	Bedrijventerrein Sloterdijk (F11); Slotermeer-Noordoost (F76); Slotermeer- Zuidwest (F77); Geuzenveld (F78); and, Eendracht (F79)	**22**
	Osdorp (DX07)	Lutkemeer/Ookmeer (F80); Osdorp-Oost (F81); Osdorp-Midden (F82); and, De Punt (F83)	**14**
	De Aker, Sloten, Nieuw-Sloten (DX08)	Middelveldsche Akerpolder (F84); and, Sloter/ Riekerpolder (F88)	**13**
	Slotervaart (DX09)	Slotervaart Noord (F85); Overtoomse Veld (F86); Westlandgracht (F87); and, Slotervaart Zuid (F89)	**19**
Zuid [K] (*South*) **Area**: 17.41 km² **Pop (2019)**: 145,966 **Areas**: Three (3) **Quarters**: 16 **Neighborhoods**: 76 	Oud-Zuid (DX10)	Hoofddorppleinbuurt (K44); Schinkelbuurt (K45); Willemspark (K46); Museumkwartier (K47); Stadionbuurt (K48); and Apollobuurt (K49)	**34**
	Buitenveldert, Zuidas (DX11)	Zuidas (K23); Prinses Irenebuurt e.o. (K59); Buitenveldert-West (K90) and Buitenveldert-Oost (K91)	**17**

	De Pijp, Rivierenbuurt (DX12)	Oude Pijp (K24); Nieuwe Pijp (K25); Zuid Pijp (K26); Scheldebuurt (K52); Ijselbuurt (K53) and Rijnbuurt (K54)	**25**
Oost [M] (*East*) **Area**: 30.56 km² **Pop (2019)**: 140,300 **Areas**: Four (4) **Quarters**: 15 **Neighborhoods**: 78 	Oud-Oost (DX13)	Weesperzijde (M27); Oosterparkbuurt (M28); Dapperbuurt (M29); and, Transvaalbuurt (M30)	**12**
	Indische Buurt, Oostelijk Havengebied (DX14)	Indische Buurt West (M31); Indische Buurt Oost (M32); and, Oostelijk Havengebied (M33)	**18**
	Watergraafsmeer (DX15)	Frankendael (M55); Middenmeer (M56); Betondorp (M57); and, Omval/Overamstel (M58)	**27**
	IJburg, Zeeburgereiland (DX16)	Zeeburgereiland/Nieuwe diep (M34); IJburg West (M35); IJburg Oost (M50); and IJburg Zuid (M51)	**21 (The Quarter M50 has five water tracts, M50a, M50b, M50c, M50e, M50f). Therefore, there are technically only 16 neighbourhoods.**
Noord [N] (*North*) **Area**: 49.01 km² **Pop (2019)**: 97,200 **Areas**: Three (3) **Quarters**: 15 **Neighborhoods**: 66	Noord-West (DX17)	Tuindorp Oostzaan (N65); Oostzanerwerf (N66); Kadoelen (N67); and Banne Buiksloot (N70)	**18**

	Oud-Noord (DX18)	Volewijck (N60); IJplein/Vogelbuurt (N61); Tuindorp Nieuwendam (N62); Tuindorp Buiksloot (N63); Nieuwendammerdijk/Buikslot erdijk (N64); Noordelijke IJ-oevers West (N71); and, Noordelijke IJ-oevers Oost (N72)	**23**
	Noord-Oost (DX19)	Waterlandpleinbuurt (N68); Buikslotermeer (N69); Waterland (N73); and Elzenhagen (N74)	**25**
Zuidoost [T] (*Southeast*) **Area**: 22.08 km² **Pop (2019)**: 88,610 **Areas**: Three (3) **Quarters**: 7 **Neighborhoods**: 48 	Bijlmer-Centrum, Amstel III (DX20)	Amstel III/Bullewijk (T92) and Bijlmer-Centrum (D,F,H) (T93)	**18**
	Bijlmer-Oost (DX21)	Bijlmer-Oost (E,G,K) (T94)	**14**
	Gaasperdam, Driemond (DX22)	Nellestein (T95); Holendrecht/Reigersbos (T96); Gein (T97); and Driemond (T98)	**16**

The shapefiles of the Municipality of Amsterdam are found at:
https://maps.amsterdam.nl/open_geodata/?LANG=en

There are a total of **481** neighborhoods. Of these there are **5** neighborhoods that are in the water, so we exclude them from our analysis. In addition, there are **13** neighbourhoods that

have no population (i.e., Blank). For the purpose of this analysis, it has been decided to **exclude** all of these, thus we are left with 481-5-13 = **463 neighborhoods**.