

HANDBOOK FOR COLLECTION OF
AMBIENT ENVIRONMENT DATA



Acknowledgements and Special Thanks

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ABBREVIATIONS & DEFINITIONS

QCM	Quantified Cities Movement
ESR	Environmental Status Report
ESI	Environmental Status Index
dB	Decibels
lux	The SI unit of illuminance, equal to one lumen per square meter
PSI	Pollution Standards Index
OSHA	Occupational Safety and Health Administration
kmph	Kilometer per Hour
Taxon	A taxonomic group of any rank, such as a species, family, or class. In our case a taxon represents one of the ways in which we classify a broadly defined collection of systems and processes in the city. plural. Taxa
Olf	1 olf is the strength of the smell produced by a healthy adult working a sedentary job, in a climate controlled environment, with a hygienic equivalent of 0.7 baths per day and a skin surface area of 1.8 square meters
Geo-reference	Aligning geographic data to a known coordinate system so it can be viewed, queried and analyzed with other geographic data. Geo referencing may involve shifting, rotating, scaling, skewing and in some cases warping, rubber-sheeting or rectifying the data.
Road Cross Section	Vertical plane at right angles to the road.
Vista	A pleasing view
Toxicology	A branch of Biology, Chemistry and medicine concerned with the study of the adverse effects of chemicals on living organisms.
Epidemiology	It is the science that studies the patterns, causes and effects of health in defined population.
Toxicant	Man-made (synthetic) substance that presents a risk of death, disease, injury, or birth defects in living organisms through absorption, ingestion, inhalation, or by altering the organism's environment. In comparison, a toxin is produced in nature by a living animal or plant.
Odour	The property of a substance that activates the sense of smell

QUANTIFIED CITIES MOVEMENT

What is the Quantified Cities Movement?

QCMTM

The importance of documentation of knowledge and information generated through work carried out in various fields cannot be underestimated. All over the world there are individuals studying, working and generally creating new knowledge. Every minute we are asking questions and answering them. This exciting process, a function of our curiosity and the need to make sense of what the world is all about, is being carried out in various ways all over the globe. In order to properly plan, implement and monitor a city or for that matter any space, we require relevant, accurate and timely data. Some of this data is being collected by the government authorities but, is it relevant? There is a need for more information about our city in order to plan it better and monitor its development? How do we create transparency in this process of planning? The citizens need to be involved in the process. How do we ensure that the authorities in charge are held accountable when they plan for our city and in turn affect our lives?

To answer these questions we have created the Quantified Cities Movement (QCM).

The purpose of the QCM is to

- Identify the data that is required.
- Provide technical assistance and training to Institutions and Individuals for collection of the required data.
- Create an online and real time repository for this data and give direction too, example.: www.punedata.org.
- Analyze the data, identify problems and their solutions and advocate for better planning, implementation and monitoring of the process.



AMBIENT ENVIRONMENT

How to use this handbook?

The handbook is for the use by interested citizens, civil societies organizations, NGOs, institutions and other organisations for data on ambient environment at the electoral ward level encompassing the seven indicators mentioned in the introduction below. A key is provided for each taxon and its indicators with instruction on each indicator enumerating the indicators' definition, the reason for its relevance, what instrumentation is required for collecting data for the indicator, step by step methodology for data collection, an example of how the results are mapped and finally the potential stresses that can occur due to unacceptable as well as ideal ranges for achieving a good quality of life. At the end of the handbook is provided the bibliography for further reading.

Introduction to Ambient Environment

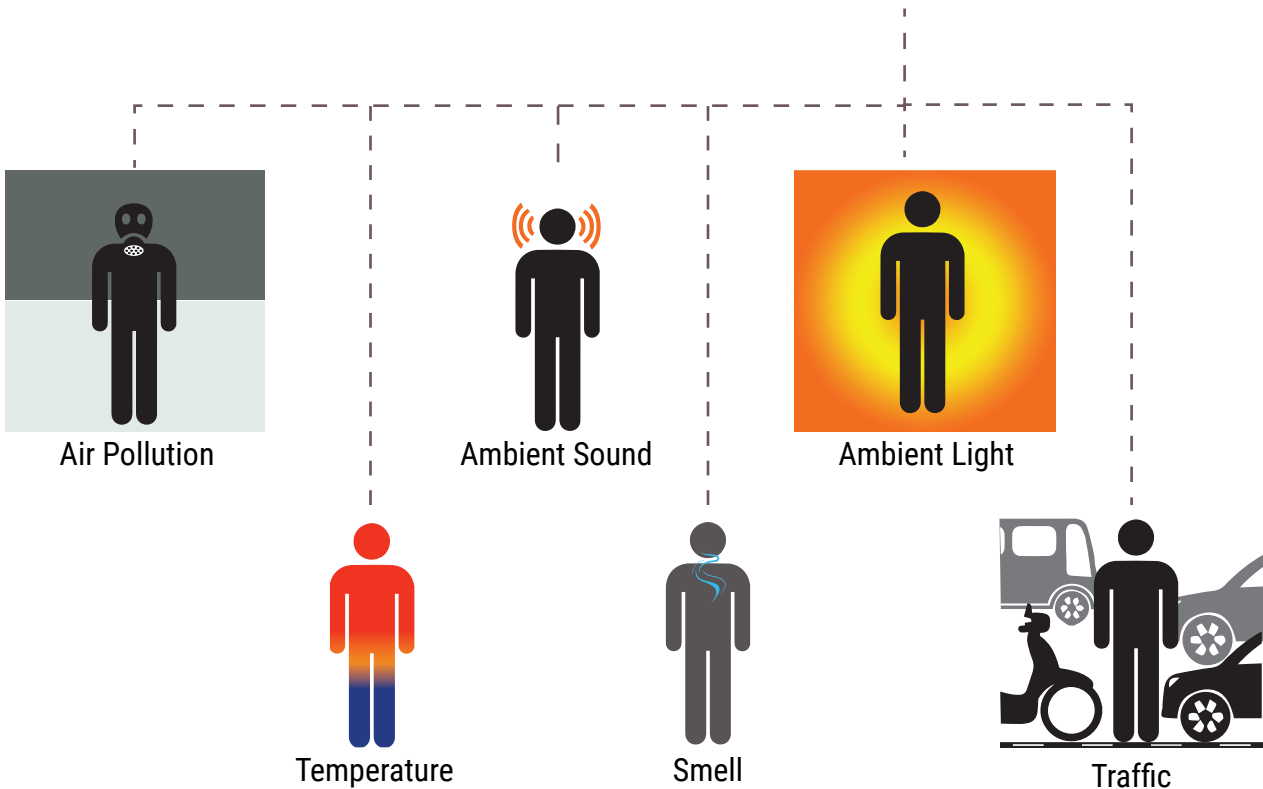
A city or any settlement is a place that we can call as our habitat. This habitat is made up of our natural want as well as built environment. We modify and adapt according to our needs, desires and aspirations. The fact that it is an environment that we live in presumes it will adhere to certain standards of quality and beauty we want our home environment to manifest. The most direct way in which to perceive our habitat is through the environment that surrounds us. We perceive the quality of a space through our five senses of perception and then decide whether the place is an acceptable choice to live and work and play in. Through the senses we qualify a place as good, acceptable, bad or uncomfortable.

The environment that surrounds us is called our Ambient Environment and is made up of a multitude of interlinking elements that affect one another. The right combination and balance of these elements decides whether this environment is habitable or not. There is no comprehensive method to precisely quantify an ideal environment. A large number of studies have taken place in an attempt to make sense of the various elements, enumerate and define them and understand their interrelation (refer Bibliography, Page 32). An attempt to do this in one project or to teach methods to study all the elements and their relationships in one handbook would be a gargantuan task. For the purpose of this handbook for collection of data on ambient environment, we will look at seven broad elements- Air pollution, temperature, ambient light, ambient sound, smell, aesthetics and traffic that our ambient environment is made up of. Elements which we are also calling taxa and treating as indicators to measure overall ambient environment in an electoral ward in a city are shown on the next page.

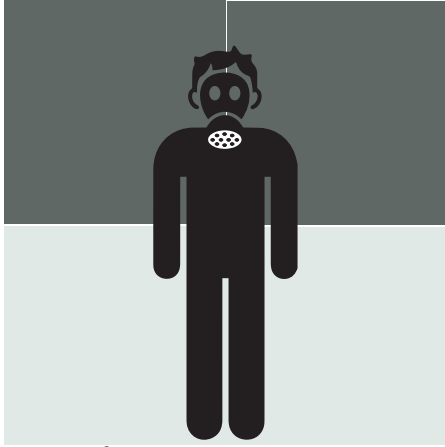
In order to ensure an ideal ambient environment all the elements we study must be within the ideal range that defines a good habitat to live in. Thus if all the ideal ranges are met in a given space we can say it has a good ambient environment. In case there are indicators that do not meet the ideal range or standard range, we shall identify them as stresses. These stresses lead to undesirable situations. For example if a space has low quality ambient environment, the demand for this space falls, this situation causes land values to drop affecting the local economy not to mention the sense of pride of the local population.

TAXA-INDICATORS

The Environmental Status Index is categorised into 5 taxa. These taxa have been further divided into indicators and sub-indicators. This handbook deals with one of the 5 taxa namely Ambient Environment. The flow chart below shows the different indicators that make up the taxon - Ambient Environment.



AIR POLLUTION



The presence of substances and heat in environmental media (air, water, land) whose nature, location or quantity produces undesirable environmental effects.

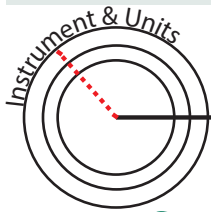
AIR POLLUTION: Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. It can cause respiratory and other diseases, that could be fatal.

Pollution from city life adds as much as ten percent to perceived aging.

Sub-Indicator List

Air Pollution:

1. Ozone
2. Nitrogen Dioxide
3. Sulphur Dioxide
4. Particle Matter
5. Lead
6. Carbon Monoxide



Aeroqual outdoor portable air monitors

Micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)
Parts per million (ppm) or parts per billion (ppb)

Significance

Short of survival, human concerns range from quality of life issue to health hazards. Since science holds experimental demonstration to be definitive, modern treatment of toxicity or environmental harm involves defining a level at which an effect is observable. Common examples where practical

measurement is crucial include automobile emissions control, industrial exposure (e.g. Occupational Safety and Health Administration (OSHA) PELs), toxicology (e.g. LD50), and medicine (e.g. medication and radiation doses)

Norms/ Standards

The Pollutant Standards Index, or PSI, is a type of air quality index, used to provide the public with an easily understandable indicator of how polluted the air is. The PSI is reported as a number on a scale of 0 to 500. The

index figures enable the public to determine whether the air pollution levels in a particular location are good, unhealthy, hazardous or worse by assigning them an index value and representing them on the bar as given in the next page.

Methodology



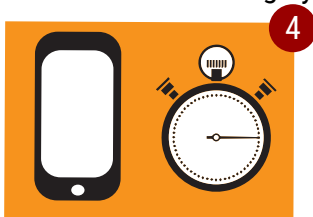
1. Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



2. Mention your name in the space provided and note down the time.



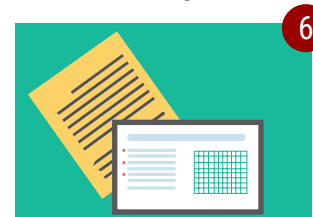
3. Identify and mark your location on the map in the field sheet from where you are going to take the readings.



4. Use the calibrated application from your mobile phone or the instrument required to collect the readings.



5. Note down the time. Note down the readings on the sheet provided.



6. Fill up the field sheet with the data and the readings collected.



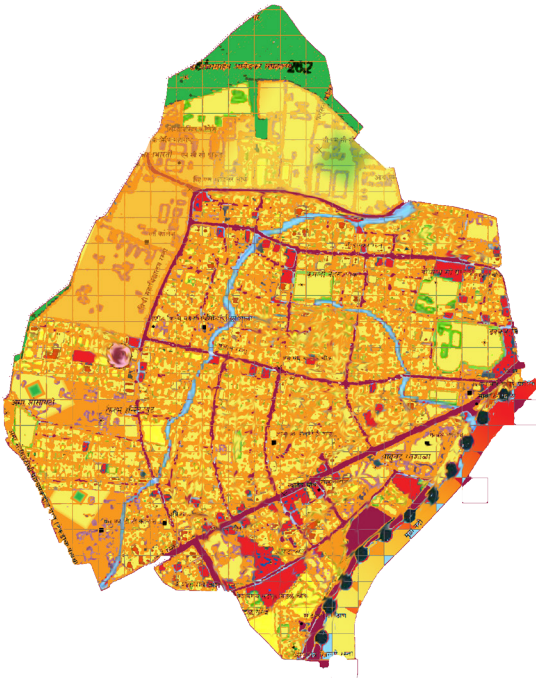
Result

The analysis of the pollution level in any given area will help us understand the

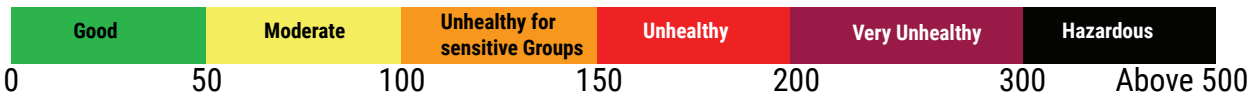
- i) The existing level of pollution
- ii) The comparison between the existing

pollution level and the acceptable level of the pollution

- iii) The major factors causing pollution and its impact on the area.

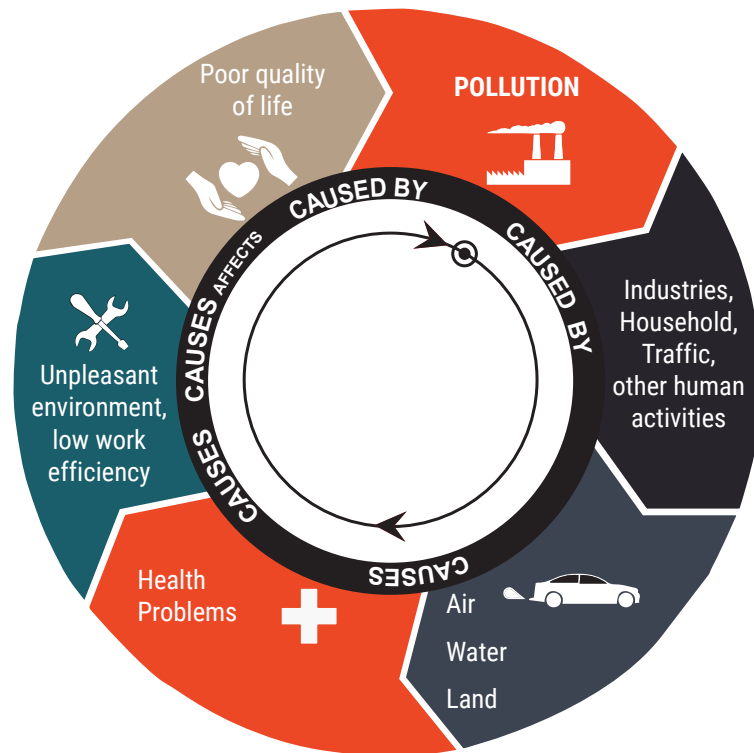


Map 1. : Heat map generated for air pollution in a ward.



Stresses

Pollution comes from both natural as well as man-made sources. Human-made pollutants are due to combustion, construction, mining, agriculture and warfare. Motor vehicle emissions, industrial waste, refineries, livestock farming also lead to air pollution. Adverse air quality can kill all organisms including humans and adversely affect the environment to a great extent. It can cause respiratory and cardiovascular diseases, throat inflammation, chest pain and congestion which compromises leading to poor quality of life.



Ozone [O₃]

1



Ozone at ground level – not to be confused with the ozone layer in the upper atmosphere – is one of the major constituents of photochemical smog. It is formed by the reaction of sunlight (photochemical reaction) with pollutants. These pollutants are nitrogen oxides (NO_x) from vehicles, industrial emissions and volatile organic compounds (VOCs) emitted by vehicles, solvents and industry. As a result, the highest levels of ozone pollution occur during periods of sunny weather.

Norms/Standards

100 µg/m³ 8-hour mean

Health Effects

Excessive ozone in the air can have a marked effect on human health. It can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases. In Europe, Ozone is one of the most

concerned air pollutant. Several European studies have reported that the daily mortality rises by 0.3% and that for heart diseases by 0.4%, per 10 µg/m³ increase in ozone exposure.

Concentration in Ambient Air

	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
Ozone	100	100	: UV photometric : Chemiluminescence : Chemical Method

Source: National Ambient Air Quality Standards, CPCB, 2009.

Nitrogen Dioxide [NO₂]

2



As an air pollutant, NO₂ has several correlated activities. At short-term, concentrations exceeding 200 µg/m³, it is a toxic gas which causes significant inflammation of the airways. NO₂ is the main source of nitrate aerosols, which form an important fraction of Particulate Matter 2.5 in the presence of ultraviolet light, of ozone. The major sources of anthropogenic emissions of NO₂ are combustion processes (heating, power generation, and engines in vehicles and ships).

Norms/Standards

40 µg/m³ annual mean
200 µg/m³ 1-hour mean

Health Effects

Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase with long-term exposure to NO₂. Reduced lung function

growth is also linked to NO₂, at concentrations currently measured (or observed) in cities of Europe and North America.

Concentration in Ambient Air

	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
Nitrogen Dioxide	40	30	: Modified Jacob & Hochheiser (Narsenite) : Chemiluminescence

Source: National Ambient Air Quality Standards, CPCB, 2009.

Sulphur Dioxide [SO₂]

3



SO₂ is a colourless gas with a sharp odour. It is produced from the burning of fossil fuels (coal and oil) and the smelting of mineral ores that contain sulfur. The main anthropogenic source of SO₂ is the burning of sulfur-containing fossil fuels for domestic heating, power generation and motor vehicles.

Norms/Standards

20 µg/m³ 24-hour mean
500 µg/m³ 10-minute mean

Health Effects

SO₂ can affect the respiratory system and the functions of the lungs, and also causes irritation of the eyes. Inflammation of the respiratory tract causes coughing, mucus secretion, aggravation of asthma and chronic bronchitis. Exposure to SO₂ increases the propensity to infections of the

respiratory tract. It has been noted that hospital admissions for cardiac disease and mortality increase on days with higher SO₂ levels. When SO₂ combines with water, it forms sulphuric acid (H₂SO₄); this is the main component of acid rain which is a cause of deforestation.

Concentration in Ambient Air

	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
Sulphur Dioxide	50	20	: Improved West and Geake : Ultra Violet Fluorescence

Source: National Ambient Air Quality Standards, CPCB, 2009.

Particulate Matter [PM]

4



The major components of PM are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles, of organic and inorganic substances suspended in the air. PM affects more people than any other pollutant.

Norms/Standards

PM2.5
10 µg/m³ annual mean
25 µg/m³ 24-hour mean
PM10
20 µg/m³ annual mean
50 µg/m³ 24-hour mean

Health Effects

Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer. The most health-damaging particles are those with a diameter of 10 microns or

less, (≤ PM10), which can penetrate and lodge deep inside the lungs. Breathing CO can cause headache, dizziness, vomiting, and nausea. If CO levels are high enough, a person may become unconscious or die.

Concentration in Ambient Air

	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
Particulate Matter	60	60	: Gravimetric : TOEM : Beta Attenuation

Source: National Ambient Air Quality Standards, CPCB, 2009.

Lead [Pb]

5



Lead is a naturally occurring toxic metal found in the Earth's crust. Its widespread use has resulted in extensive environmental contamination and significant public health problems in many parts of

the world. Because it is easily available to extract and to work with, lead has been used in a wide variety of products including Paint, Ceramics, Pipes, Solders, Gasoline, Batteries and Cosmetics.

Facts

Childhood lead exposure is estimated to contribute to about 6,00,000 new cases of children developing intellectual disabilities every year.

Health Effects

Lead exposure is estimated to account for 143 000 deaths per year with the highest burden in developing regions. Lead is a cumulative toxicant that affects multiple body systems and is particularly harmful to young children. Lead in the body is distributed to the brain, liver, kidney and

bones. It is stored in the teeth and bones, where it accumulates over time. Human exposure is usually assessed through the measurement of lead in blood. There is no known level of lead exposure that is considered safe. Lead poisoning is entirely preventable.

Concentration in Ambient Air

	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
Lead	0.50	0.50	:AAS/ICP method after sampling on EMP 2000 or equivalent filter paper :ED-XRF using Teflon filter

Source: National Ambient Air Quality Standards, CPCB, 2009.

Carbon Monoxide [CO]

6



Carbon monoxide (CO) is a poisonous, colorless, odorless, and tasteless gas. Although it has no detectable odor, CO is often mixed with other gases that do have an odor. CO is a common industrial

hazard resulting from the incomplete burning of natural gas and any other material containing carbon, such as gasoline, kerosene, oil, propane, coal, and wood.

Health Effects

On average, about 170 people in the United States die every year from CO produced by non-automotive consumer products. Still others die from CO produced by non-consumer products, such as cars left running

in attached garages. The Center for Disease Control and Prevention estimates that several thousand people go to hospital emergency rooms every year to be treated for CO poisoning.

Concentration in Ambient Air

	Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
Carbon Monoxide	02	02	:Non Dispersive Infra-Red (NDIR) spectroscopy

Source: National Ambient Air Quality Standards, CPCB, 2009.



According to World Health Organization..

Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma.

The lower the levels of air pollution, the better the cardiovascular and respiratory health of the population will be, both in long and short term

Outdoor air pollution in cities and rural areas was estimated to cause 3.7 million premature deaths worldwide in 2012.

Some 88% of those premature deaths occurred in low and middle income countries, and the greatest number under WHO Western Pacific and South-East Asia regions.

Policies and investments supporting cleaner transport, energy efficient housing, power generation, industry and better municipal waste management would reduce key sources of urban outdoor air pollution.

Reducing outdoor emissions from household coal and biomass energy systems, agricultural waste incineration, forest fires and certain agro-forestry activities (e.g. charcoal production) would reduce key rural and peri-urban air pollution sources in developing regions.

Reducing outdoor air pollution will also reduces emissions of CO₂ and short-lived climate pollutants such as black carbon particles and methane, thus contributing to the near and long term mitigation of climate change.

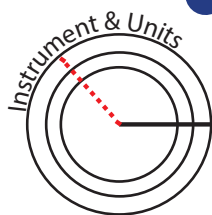
In addition to outdoor air pollution, indoor smoke is a serious health risk for some 3 billion people who cook and heat at their homes with biomass fuels and coal.

TEMPERATURE



The temperature of the surroundings, the degree or intensity of heat present in a substance or object, especially as expressed according to a comparative scale and shown by a thermometer or perceived by touch.

The differential heating of the atmosphere, resulting from temperature variation over the earth's surface, produces a number of ecological effects, including local and trade winds and hurricanes and other storms, but more importantly it determines the distribution of precipitation.



Thermometer

Degree celsius (C), Degree fahrenheit(F), Kelvin (K)

Significance

Quality of life depends on comfort levels that are strongly related to the ambient temperature of a place. Human beings usually find discomfort in temperatures that are too hot or too cold. Extreme temperatures can also

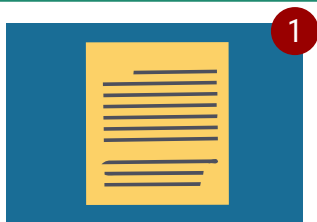
cause illness or even death. Regulating temperatures to mitigate discomfort and enable a pleasant and livable environment is an important policy issue, when planning residential areas in particular and all land uses in cities in general.

Norms/ Standards

1. Ideal Habitable temperature range 20-30°C
2. Acceptable Habitable temperature range 15-35°C

3. Slightly uncomfortable Habitable temperature range is 10°C to 5°C and 35°C to 40°C
4. Uncomfortable Habitable temperature range less than 10°C and more than 40°C

Methodology



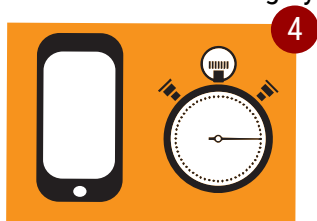
Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



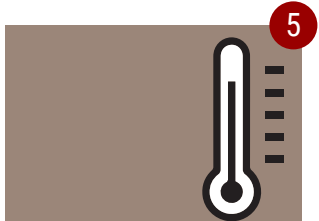
Mention your name in the space provided and note down the time.



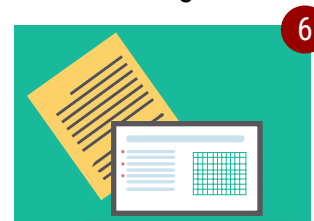
Identify and mark your location on the map in the field sheet from where you are going to take the readings.



Use the calibrated application from your mobile phone or the instrument required to collect the readings.

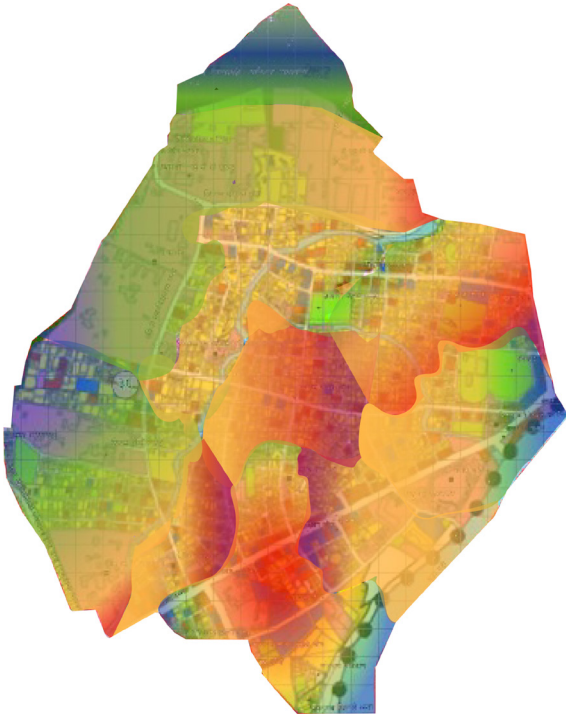


Note down the time. Make sure the thermometer sensor /bulb is not in contact with your body. Do not keep the thermometer in sunlight for too long. Note down the readings in the table on the sheet provided.



Fill up the field sheet with the data and the readings collected.

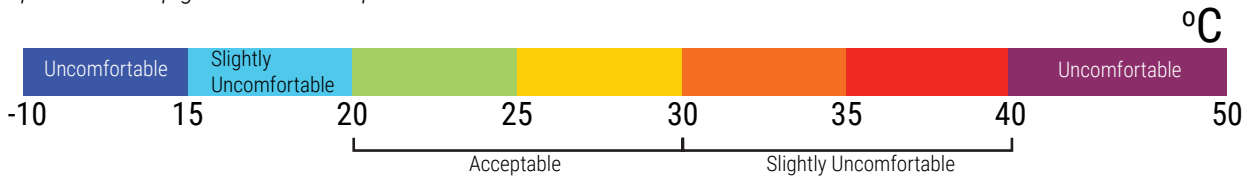
Outcome



Results

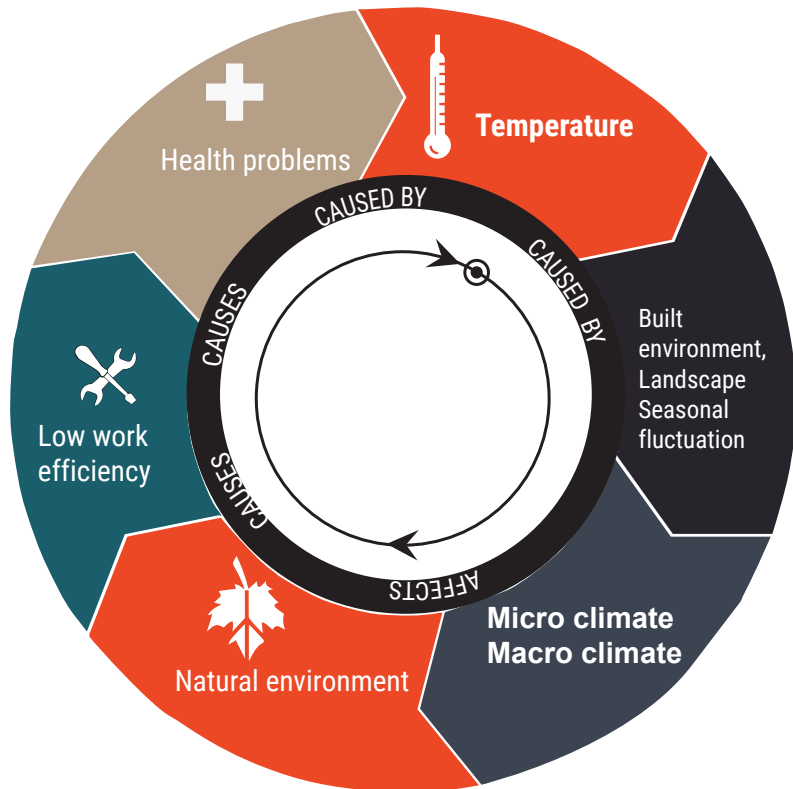
Although humans can tolerate a wide range of ambient temperatures, comfort and productivity are limited to a narrow range. The analysis of the ambient temperatures in a ward can lead to steps needed to be taken to bring it in the required range as shown below.

Map 2 : Heat map generated for temperature in a ward.

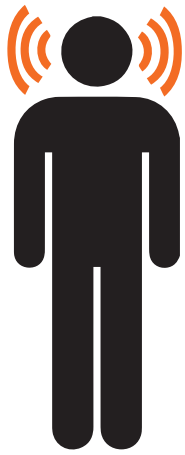


Stresses

Temperature determines change in conditions of land, air and water which affects the living environment. Temperature fluctuations lead to micro and macro climatic conditions. It predicts the comfort level of the living beings and the natural environment. These changes in temperature and natural environment can harm the health as well productivity of humans which leads to low efficiency and poor quality of life.



AMBIENT SOUND



The sound pressure levels associated with a given environment. Ambient noise is usually a composite of sounds from near and far sources none of which are particularly dominant. It is the level of total noise in an area.

Sound: A vibrational disturbance, exciting hearing mechanisms, transmitted in a predictable manner determined by the medium through which it propagates. To be audible the disturbance shall have to fall within the frequency range of 20 Hz to 20000 Hz.

Ambient Sound: An Ambient Sound is an acoustic summary of whatever encloses the listener, though it does so unintentionally. The main difference between music and ambient sound lies in the individual's choice of what kind of music to listen to, as opposed to the lack of agency one has in being exposed to noises around oneself.

Significance

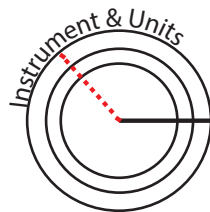
It is generally accepted that a quiet and peaceful environment is desired for residential areas. When planning such spaces one must make sure that residents are provided with such an environment. Spaces which

are noisy or have sustained loud noise can cause deafness and/or psychological problems to residents. For creating a quality of life index, measuring the noise levels of a place is a obvious requirement.

Norms/ Standards

A decibel is a standard for the measurement of noise. The zero on a decibel scale is at the threshold of hearing, the lowest sound pressure that can be heard.

20 dB is whisper, 40 dB is quiet office, 60 dB is normal conversation and above this level it causes hearing damage.



Sound Level Meter/ Noise Dosimeters

Decibel (Db)

Methodology



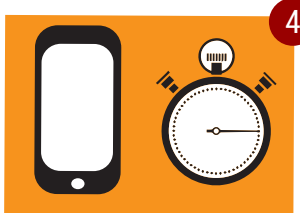
1 Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



2 Mention your name in the space provided and note down the time.



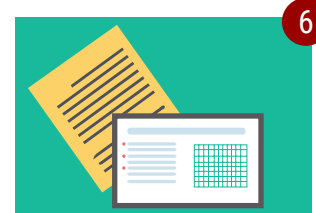
3 Identify and mark your location on the map in the field sheet from where you are going to take the readings.



4 Use the calibrated application from your mobile phone or the instrument required to collect the readings.

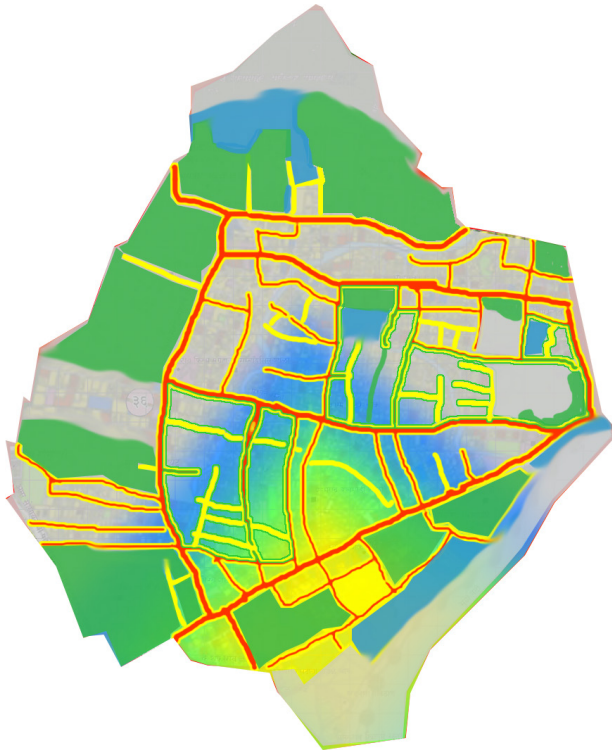


5 Note down the time. Take the readings in 4 directions. Stand in place and hold the phone such that it is away from your own shadow. Note down the readings on the sheet provided. Follow the same procedure for all the other samples.

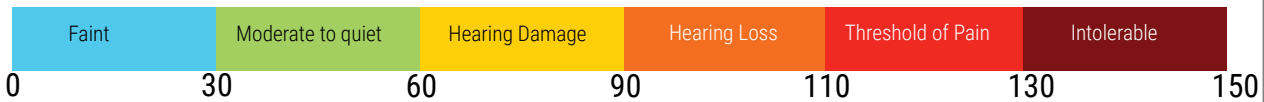


6 Fill up the field sheet with the data and the readings collected.

Outcome



Map 3. : Heat map generated for Ambient Sound in a ward.



RESULTS

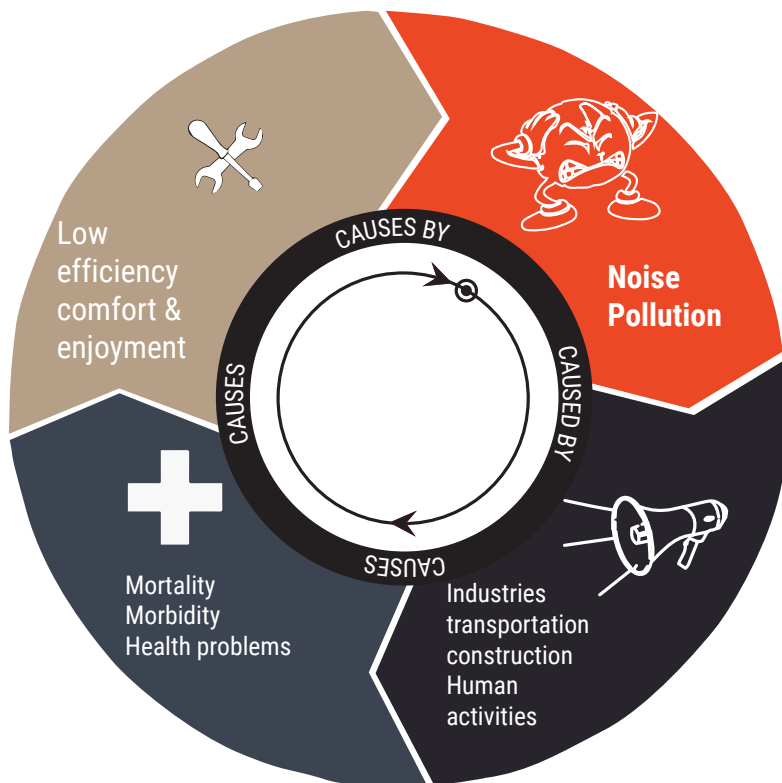
The analysis of the ambient sound levels should indicate the prevalent noise level in the area. The sound levels in excess of

10 dB(A) of the stipulated limit is counted as noise and a complaint can be lodged.

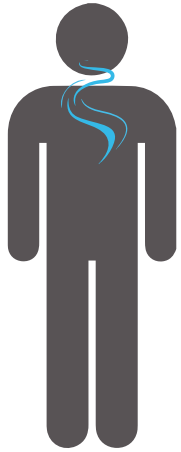
Any unwanted sound that our ears cannot filter can cause problems within the body.

Stresses

Noise pollution is the disturbing excessive noise that may harm the activity or balance of human/animal life. The source of most outdoor noise worldwide is mainly caused by machines and transportation systems, vehicles etc. Industrial and residential buildings can also result in noise pollution. High noise levels can contribute to cardiovascular effects and permanent hearing loss in humans. It affects both health and behaviour of a person by causing hypertension, anxiety, sleep disturbances and headaches.



SMELL



The faculty or power of perceiving odours or scents by means of the organs in the nose. To perceive odours or scents surrounding on all sides.

Norms/ Standards

1 Olf is the strength of the smell produced by a healthy adult working a sedentary job, in a climate controlled environment, with the hygienic equivalent of 0.7 baths per day, and a skin surface area of 1.8 square meters. Smell Intensity can also be expressed in parts per million of butanol. The smell intensity is usually stated according to a predetermined rating system. Widely used scale for this is the following:

- 1-Barely perceptible
- 2-Slight
- 3-Moderate
- 4-Strong
- 5-Very strong or by description of the smell like: Pungent, Food smell, Fish smell etc.

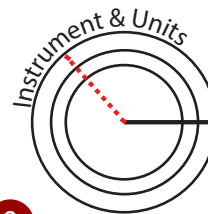
Significance

Strong, unpleasant or offensive smell can interfere with a person's enjoyment of life especially if they are frequent and / or persistent. Major factors relevant to perceived odour nuisance are:

- Degree of Offensiveness
 - Duration of exposure to odour
 - Frequency of odour occurrence
 - Tolerance and expectation of the receptor
- Though foul odour may not cause direct damage to

health, toxic stimulants of odour may cause ill health or respiratory symptoms. Secondary effects, in some, may be nausea, insomnia and discomfort. Very strong odour can result in nasal irritation; trigger symptoms in individuals with breathing problems or asthma. On the economic front, loss of property value near odour causing operations/ industries and odorous environment is partly a consequence of offensive smell.

Methodology



Primary Survey

Human Perception



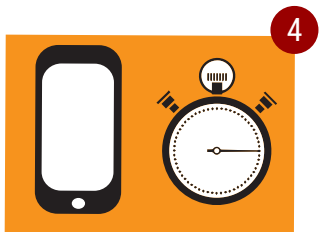
1 Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



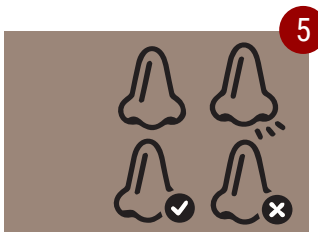
2 Mention your name in the space provided and note down the time.



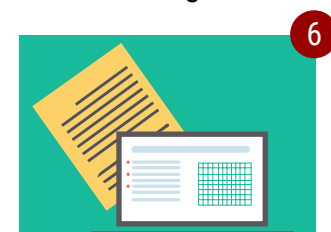
3 Identify and mark your location on the map in the field sheet from where you are going to take the readings.



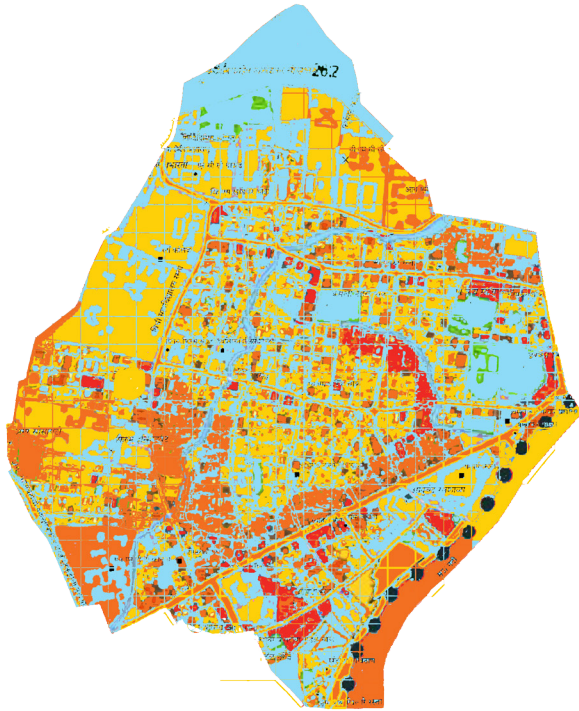
4 Use the calibrated application from your mobile phone or the instrument required to collect the readings.



5 Note down the time. Identify the smells in the area. Mark all the appropriate options based on the list provided



6 Fill up the field sheet with the data and the readings collected.



Map 3. : Heat map generated for smell in a ward.



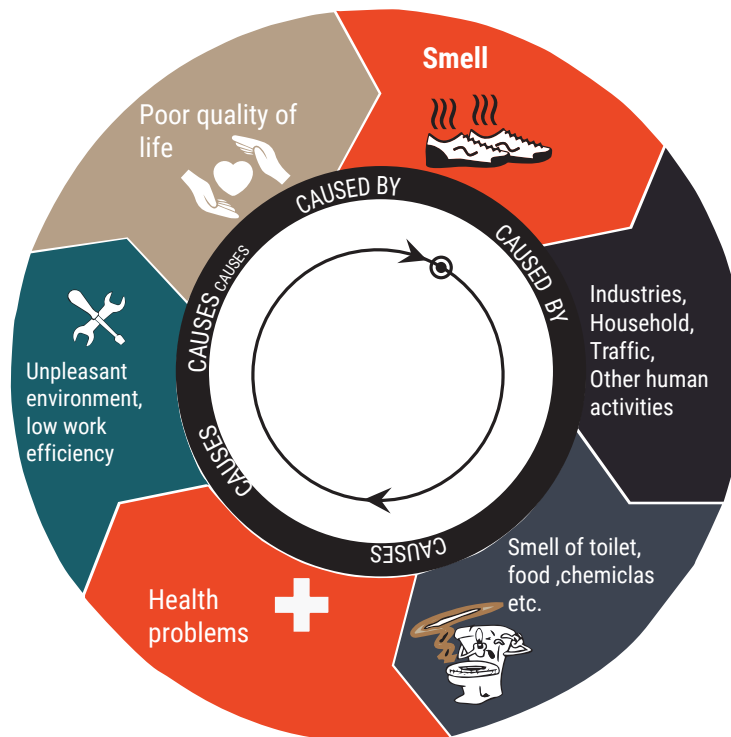
Results

Smells in an area have a part in deciding our physical comfort level. Fragrances (in moderation) generally contribute towards increasing the comfort level while foul odours work exactly the opposite way like garbage, sewage etc. negate. Identifying the smells in an area can give pointers if any activities need to be prohibited or

shifted downwind to increase the comfort of residents and in turn improve their quality of life. The purpose of the study is to identify smell related words on geo-referenced map of individual ward maps. The next stage is to create a structure for a large and apparently unrelated dataset of smell words through a system of classification.

Stresses

Unpleasant odours can arise from specific industrial processes, adversely affecting workers and even residents. The most common sources of odour arise from sewage treatment plants, animal rendering factories, chemicals etc in the neighbourhood. Unpleasant smell can affect one's mood, can lead to frustration, and non-productivity.



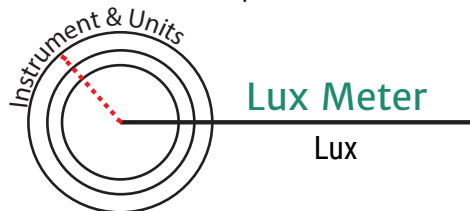
AMBIENT LIGHT



The light surrounding the environment or a subject. The term usually refers to sources of light that are already available naturally (e.g. the sun, moon, lightning) or artificial light already in use (e.g. street lighting).

Norms/ Standards

- i) Less than 100 lux is insufficient daylight
- ii) Between 100 lux and 2000 lux is useful daylight
- iii) More than 2000 lux is too much daylight and can result in visual and thermal discomfort.



Significance

Visual resources are an important component of the quality of life of any geographic area. As users experience a place, their primary sensory interaction with that place is visual in nature, and a wide variety of shapes/ space colors, and textures, composed by topography, structures, roadways, and vegetation, forms the views of the city.

Visual discomfort is experienced when the ambient

light is well below and above the comfortable light level. Excessive/Reflective light is common in urban areas, where it leads to visual discomfort and annoyance for residents, pedestrians and can create hazards for motorists.

Ambient light therefore becomes an important factor to be addressed in policy making to achieve visual comfort and thus good quality of life.

Methodology



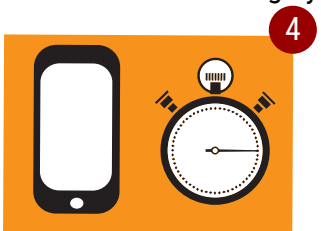
1 Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



2 Mention your name in the space provided and note down the time.



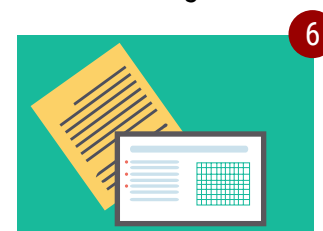
3 Identify and mark your location on the map in the field sheet from where you are going to take the readings.



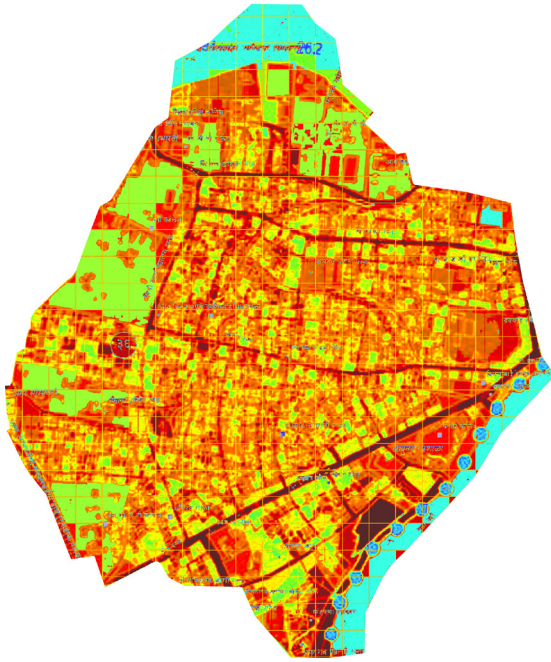
4 Use the calibrated application from your mobile phone or the instrument required to collect the readings.



5 Note down the time. Take the readings in all the 4 directions. Stand in place and hold the phone such that it is away from your own shadow. Note down the readings on the sheet provided. Follow the same procedure for all the other samples.



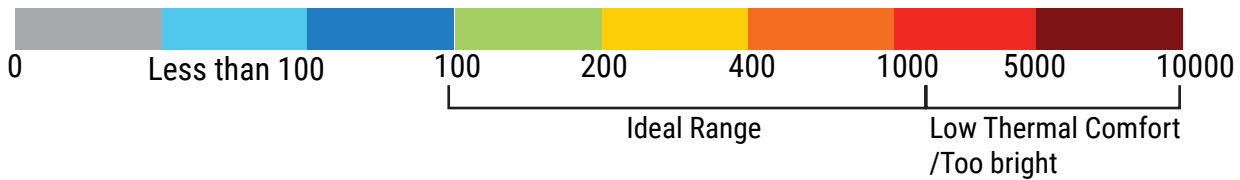
6 Fill up the field sheet with the data and the readings collected.



Results

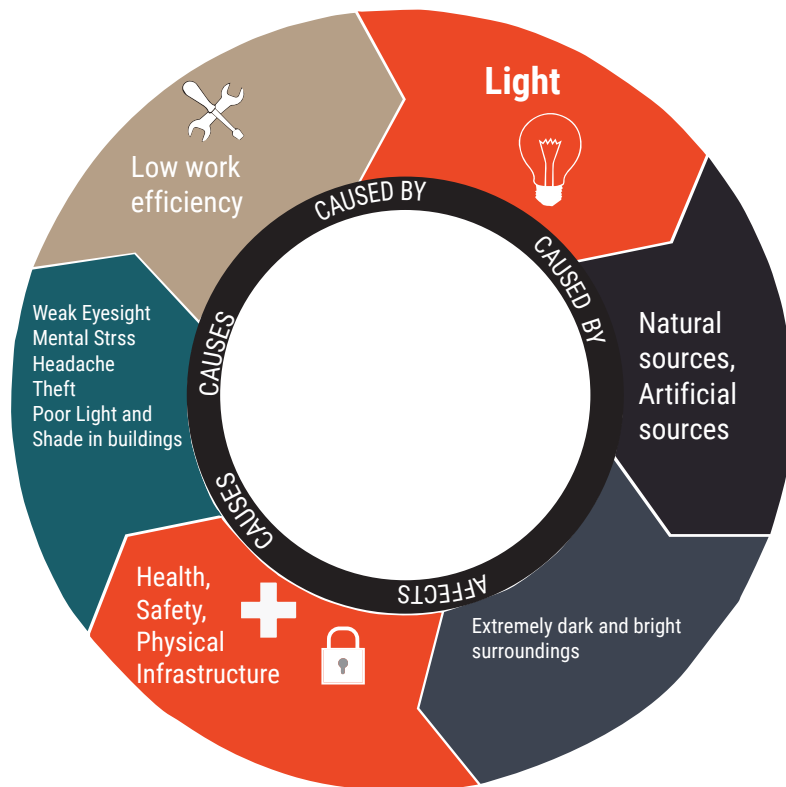
- i) The survey for ambient light will help identify the urban places with:
- a) Insufficient and excessive light levels
 - b) Reason for the lighting levels (insufficient or excessive) such as distance between buildings, building facades and sparse tree cover
 - c) Discomfort and hazards for residents, pedestrians and motorists

Map 3. : Heat map generated for ambient light in a ward.



Stresses

Light pollution is the alteration of light levels in the outdoor environment (natural) due to man-made sources of light. Indoor light pollution is such alteration of light levels in the indoor environment due to sources of light, which compromises human health. Excessive light leads to discomfort and adverse health effects. Over-illumination causes headache, fatigue, stress, anxiety and eyesight imparities. Glare from the vehicles is declared as a public health hazard leading to unsafe driving conditions.

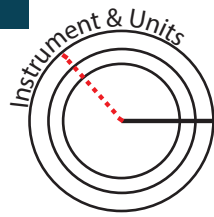


AESTHETICS



A branch of philosophy dealing with the nature of beauty, art, and taste and with the creation and appreciation of beauty.
A pleasing appearance or effect.

A beautiful environment decreases your stress levels.



Primary Survey

Human Perception

Sub-Indicator List

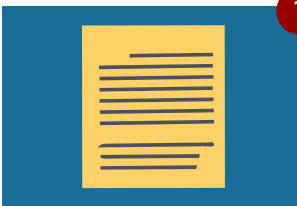
1. Street Scape
2. Building Facade
3. Landscape
4. Cleanliness
5. Organized/Unorganized

Significance

Only when there is an acceptable ambient environment, can an individual feel good about being a part of a city or a neighbourhood. Having a beautiful, well ordered, clean and pleasing environment creates a sense of civility and enables individuals and communities to be more productive

and positive. It creates a sense of security and pride and this in turn improves livability. Planning a beautiful ambient environment not only improves the “feeling” or “experience” of existing in a place but ensures cleanliness and order. Land values skyrocket in such highly desirable locations.

Methodology



1

Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



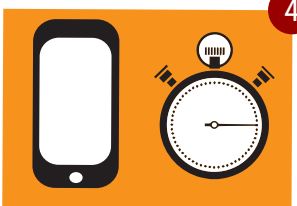
2

Mention your name in the space provided and note down the time.



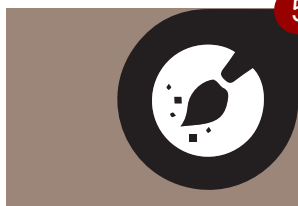
3

Identify and mark your location on the map in the field sheet from where you are going to take the readings.



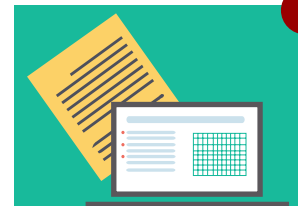
4

Use the calibrated application from your mobile phone or the instrument required to collect the readings.



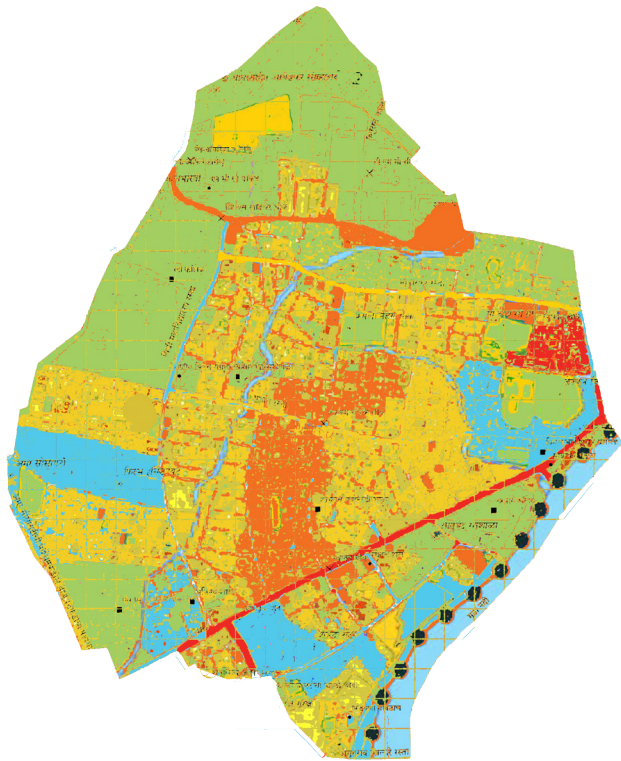
5

Note down the time. Observe the surroundings in all 4 directions. Rate the surroundings in the table provided in the sheet.



6

Fill up the field sheet with the data and the readings collected.



Map 3. : Heat map generated for aesthetics in a ward.



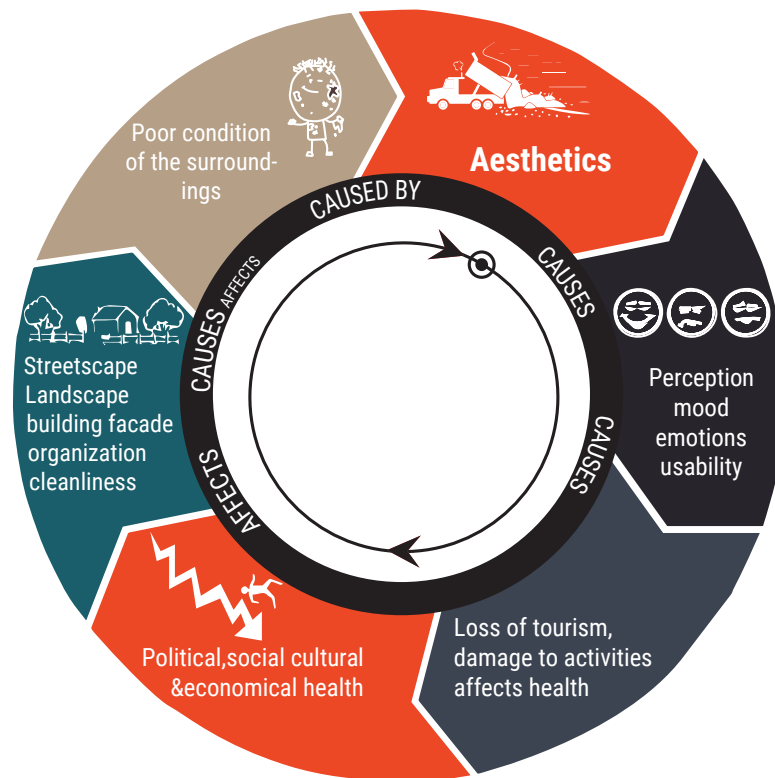
Results

Visually pleasing vistas are a welcome sight in any neighborhood. In addition to the facade design and condition, lighting plays important role in deciding the aesthetic value of a vista. Very dark or over bright vistas, like areas with a glare from a building's glass facade make residents uncomfortable, thus

are undesirable. Aesthetics of an area need to be studied to:
 i) To elicit if the place is visually appealing and harmonious to the people
 ii) To understand the major reasons for the place not/being visually appealing and harmonious or vice versa.

Stresses

Bad aesthetics or visual pollution disturbs the visual areas of people by creating negative changes in natural environment. Billboards, common storage of trash, space debris, hanging cables, buildings and automobiles are forms of visual pollution. Such pollution is caused due to administrative negligence, excessive advertising and cluttered surroundings. Poorly planned buildings and transportation systems also create visual pollution. Effects of pollution include distraction, eye fatigue, changes in one's behaviour, loss of identity to a place etc. which in turn affects the user readability and condition of the surroundings.



“IT’S TIME TO COME TOGETHER”

: CROWDSOURCING A CITIZEN RESPONSE TO QUANTIFIED CITIES MOVEMENT (QCM)

Today, in our times, human participation has been considered a key to develop communities. And new urban planning, instead of theoretical and cognitive issues, is more likely leading to practical planning, implementations and participation.

The precondition for any intervention to be successful is for the beneficiaries to have ownership of that intervention (because they are the ultimate users). Pune data and the Quantified Cities Movement are being created by CDSA to improve decentralized governance by building transparency and accountability by facilitating citizens’ participation.

The pattern of development of Pune has been decidedly mercenary and unplanned, with the only criteria being accessibility to existing and upcoming IT hubs. As things stand now, Central Pune has lost its previous quality and ambience in residential zones.

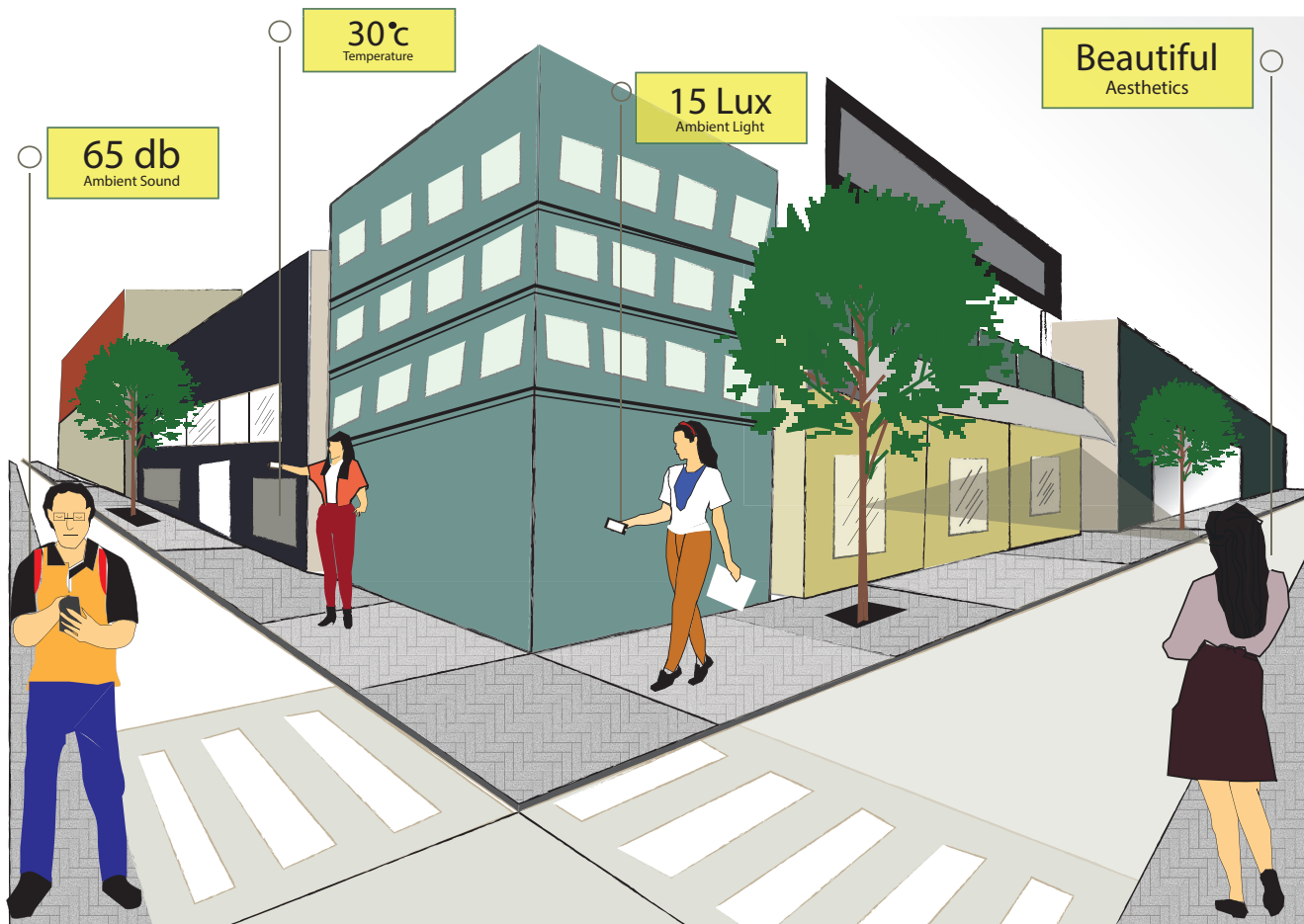
It is true that the PMC and other government departments are responsible for different aspects of the cities governance; the recent growth is overwhelming even for the best of governance. As Pune-kars we can complain, but is that all that we can do? We live in the city, we add to the traffic, we generate waste, we pollute water, in other words, we add to this crisis. The question to ponder over is, Should we just be a part of the problem, or can we be a part of the solution to make this a better, a more livable city?

Every one of us can make a difference! What starts with a ‘can do’ attitude can go a long way. Shed the attitude of only keeping your house clean. Take responsibility for your neighborhood and the whole city.

Empower yourself! Do you know where your local ward office is located? Do you know your ward counselor, do you know the concerned engineers in your ward, the health officer etc... Reach out and talk to them on issues in your ward. Be aware of their responsibilities, understand their constraints and see how you can work together. These can have a big impact. Each of these might sound trivial, but if all of us are involved, our collective action can make a lot of difference.

While there is much you can do as an individual, your power is enhanced as part of a group. Become a part of Quantified City Movement (QCM); be responsible for good changes in the city. Coordinated action by a community can work wonders.

While certain facts about our fast growing city are gloomy, the future of Pune will depend on the actions of its residents. Many cities around the globe have turned around splendidly, and given the educated cosmopolitan populace Pune hosts; there is no reason why our city cannot justifiably regain the title of “Queen of Deccan” instead of the pejorative but sadly title of “Unplanned & Sporadic city”.



Streetscape



The visual elements of a street, including the road, adjoining buildings, sidewalks, street furniture, trees and open spaces, etc. that combine to form the street's character.

Building Facade



A facade is generally one exterior side of a building, usually, but not always, the front.

Landscape



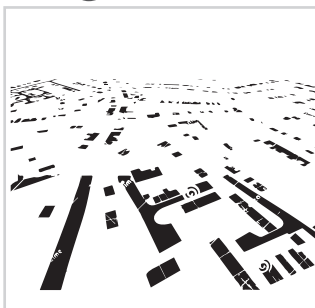
It can refer to the visible features of an area of land, or to an example of the genre of painting that depicts such an area of land. Landscape, in both senses, includes the physical elements of landforms such as (ice-capped) mountains, hills and water bodies such as rivers, lakes, ponds and the sea, living elements of land cover including indigenous vegetation, human elements including different forms of land use, buildings and structures, and transitory elements such as lighting and weather condition

Cleanliness



Cleanliness means that there is no dirt, no dust, no stains, and no bad smells. The purposes of cleanliness is health, beauty, absence of offensive odour and to avoid the spreading of dirt and contaminants to oneself and others

Organized / Unorganized



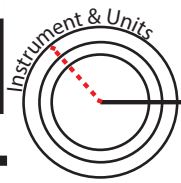
In case of a city, it is overall arrangement of vehicular & pedestrian way, built mass, signage, street shops, commercial activity, trees (landscape), and act in a systematic way, especially on a large scale.



T RAFFIC



The movement (as of vehicles or pedestrians) through an area or along a route. Can also be termed as congestion of vehicles stuck in traffic.



Primary Survey

Human Perception

Sub-Indicator List

1. Vehicle counts
2. Vehicle average speeds
3. Direction of vehicular movement
4. Origin/Destination analysis
5. Passenger volume
6. Modal breakup
7. Public transport analysis (time, comfort, cost, route rationalization)
8. Floating population analysis
9. Accident statistics (number of accidents, danger zones, types of vehicles involved, outcomes {deaths, injuries, damages} and major causes)

Significance

The study and regulation of traffic in a given area is of great importance. Levels of traffic or an index of traffic can indicate a good or bad quality of life for a given place. The situation of many of the indicators (mentioned) above can be exacerbated due to high traffic. Traffic and congestion contribute immensely to bad air quality, noise

pollution, increase in ambient temperature, negative smells and an overall negative livable environment. Through proper regulation and planning the ill effects of traffic can be mitigated and the positive effects enhanced.

Norms/ Standards

Any proposed site plan or subdivision plan which is expected to generate over one hundred (100) directional trips during the peak hour of the traffic generator or the

peak hour on the adjacent streets, or over seven hundred fifty (750) trips in an average day.

Methodology



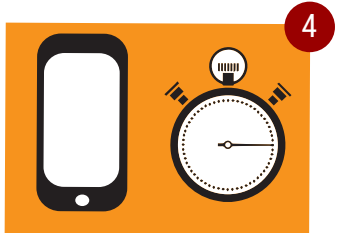
1. Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



2. Mention your name in the space provided and note down the time.



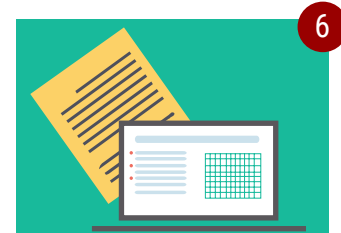
3. Identify and mark your location on the map in the field sheet from where you are going to take the readings.



4. Use the calibrated application from your mobile phone or the instrument required to collect the readings.



5. Collect the statistical data showing traffic



6. Fill up the field sheet with the data and the readings collected.

Outcome



Map 3. : Map generated for traffic in a ward.

RESULTS

Primarily five kinds of traffic analyses to be done overall in order to understand the traffic scenario

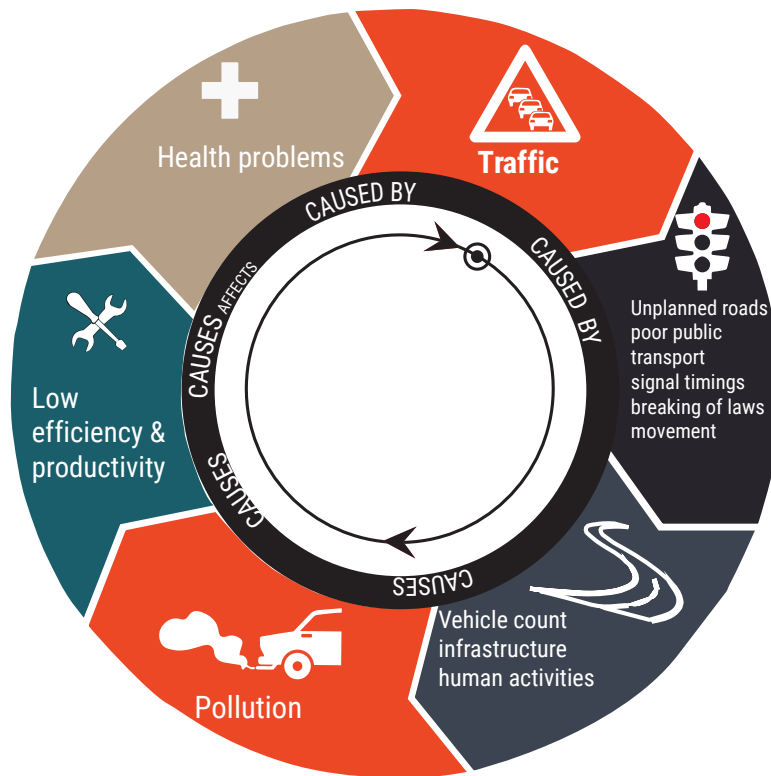
1. Traffic count: For vehicular as well as pedestrian movement would be taken on a field sheet.
2. Speed and Delay studies
3. Floating population analysis
4. Accident Statistics (number of accidents, danger zones, types of vehicles involved, and outcomes {deaths, injuries, damages} and major

- causes)
5. Direction of vehicular movement (Number and direction of vehicles in a time interval on a road)
6. Destination Survey (trip time, destination of vehicles and trip start and end)
7. Passenger Volume (To calculate flow of people and make amends for public transportation accordingly)
8. Modal Split (type of vehicles in a road section, pedestrian trips)



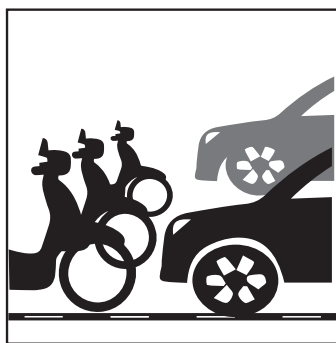
Stresses

Traffic congestion occurs due to increasing in use of vehicles on road and is characterized by slower speeds, longer trip times and increased queueing. Road work and weather effects also add up to congestion. Adverse traffic affects the productivity of a person and also causes delays. There is a high wastage of fuel which in turn causes air pollution. Wear and tear of vehicles, road rage and reduced health of motorists are other effects of traffic. Blocked traffic may interfere with the passage of emergency vehicles. It also causes spill-over of vehicles on alternate routes which have reduced capacity to carry more number of vehicles. It increases the chances of collisions.



Vehicle Counts /Traffic Volume

1



Number of vehicles that pass a given road cross section in a given interval of time.

Measurement

Formula: No. of vehicles/time interval

Unit: PCU (Passenger Car Unit)

Methodology: Manual Method (survey)

Significance

- i) To appreciate traffic characteristics in terms of size composition and variation -directional and temporal
- ii) To appreciate the spatial distribution of traffic
- iii) To establish the level of service on the road network

Results

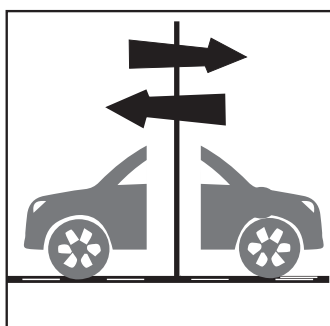
The vehicle count/Traffic volume will help in analysing:

- i) Traffic characteristics of the study area
- ii) Traffic volume
- iii) Spatial distribution of traffic

No.	Vehicle Type	Passenger Car Unit
1.	Motor Cycle or Scooter (2-Wheeled)	0.50
2.	Passenger Car, Pick-up van, Auto rickshaw	1.00
3.	Agricultural Tractor, Light Commercial Vehicle	1.50
4.	Truck or Bus	3.00
5.	Truck-trailer, Agricultural Tractor-trailer	4.50
6.	Bicycle	0.50
7.	Cycle Rickshaw (Pedel)	2.00
8.	Hand Cart	3.00
9.	Horse-drawn Vehicle	4.00
10.	Bullock Cart	8.00

Direction of Vehicular Movement

2



The directions in which the movements of vehicles occur in a given time interval.

Measurement

Methodology: Manual Method (survey)

Significance

- i) To assess the temporal and spatial distribution of traffic volume.
- ii) To carry out a review of all the routes operating in that area and to suggest modifications in existing routes as well as new route plans for the city.

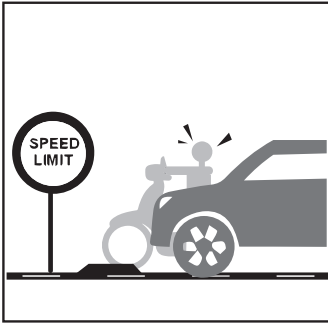
Results

- i) The analysis of direction of vehicular movement helps in Route Rationalization i.e. to distribute heavy traffic density.
- ii) The study analyses the changes in the movement patterns of the passengers in the city.

- iii) It analyses the gaps in Route Planning which are not serving the existing demand patterns.
- iv) It facilitates the identification of the mismatch in the passenger demand and allocation of public transport routes.

Speed and Delay Studies

3



Vehicle average speeds/ speed and delay studies involves assessing the running speed along the road network. Running speed is the average time of movement taken to cover a distance.

Measurement

Formula: $Speed = \frac{Distance}{Time}$

Unit: Km / hr.

Methodology: Manual Method (survey)

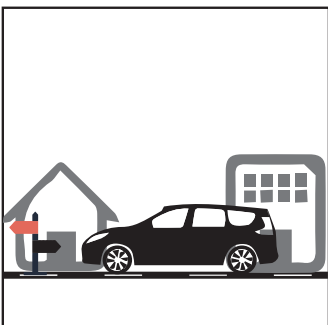
Significance Results

To elicit the journey and running speed along the road network.

- i) To identify the bottleneck
- ii) To quantify delays and identify the factors causing delay.

Household Origin-Destination Survey

4



The origin-destination survey is to identify where and when trips begin and end.

Measurement

Household interview using a questionnaire.

Significance

Origin-Destination survey provides data and analysis which is important for forecasting travel demand.

- i) To elicit socio-economic characteristics of the household.
- ii) To elicit the travel characteristics of the

- household (total trips, purpose of the trips, trip length, mode of travel, etc).
- iii) To elicit opinion regarding general transportation problems of the city and the probable areas of improvement.

Results

- i) Trip origin and destination helps in calculating floating population for an area.
- ii) To analyze the Modal split.
- iii) To elicit the preferred mode of travel and the reasons for the same.
- iv) To understand the socio-economic profile of the study area and hence the paying capacity of people for transportation.

Passenger Volume

5



Number of passengers (in vehicles or pedestrian) that pass a given road cross section during a time interval.

Significance Results

Passenger volume provides us a threshold for planning of public transportation and overall planning policy.

Passenger volume gives us the number of people using a particular route and mode of transport.

Measurement

Formulae:

i) Passenger volume for Particular transport = Number of vehicles (particular transport mode) per hour X Average occupancy of that transport mode

ii) Total Passenger volume = \sum Passenger volume for particular transport mode (Passenger volume is of a given road cross section)

Unit: Passengers per hour

Methodology: Data is analyzed from Traffic volume study

Modal Split

6



Modal split represents a method used to determine the potential number of trips by mode or in other words, the share of different modes of transport and pedestrian trips in the total transport needs.

Significance Results

In order to develop and deploy new transport strategies and services such as Park & Ride systems, carpool/car-share plans, individual public transport services, congestion charging policy, demand responsive services etc. the data collected from modal split represents the basic input data.

i) To assess the number of people using different modes of transport.
ii) To compare the modal split of public transportation with recommended norms.

Measurement

Formulae:

Modal split= % of passengers using particular mode of transport

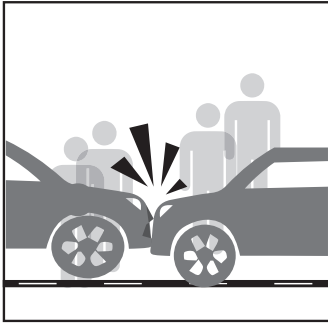
Unit: Percentage

Methodology: Data is analysed from Origin-Destination survey

City Size	Recommended Public Transport modal Split
Below 1 Million	30%
Around 1 Million	30%
1.5 Million	min. 40%
3.0 Million	min. 50%
6.0 Million	min. 70%
9.0 Million	min. 75% (85%with mass transit system)

Accident statistics

7



Accident can be defined as collision between two or more vehicles or a vehicle and a pedestrian resulting in injury and property damage.

Measurement

- i) Secondary data collection from Local Police Station
- ii) Observation based survey(Manual)

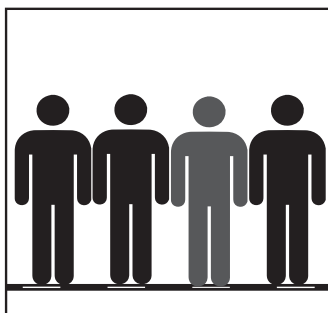
Significance Results

To identify the planning and management measures for improvement of traffic safety.

- i) To assess the trends of accidents in the study area
- ii) To assess the temporal and spatial variation of accidents.
- iii) To help identify accident prone areas
- iv) To identify the major causes of accidents.

Floating Population Analysis

8



Floating population is defined as the population which is not the permanent resident of an area but passes through the area or visits an area for a certain time period.

Measurement

Data is analyzed based on Origin-Destination survey

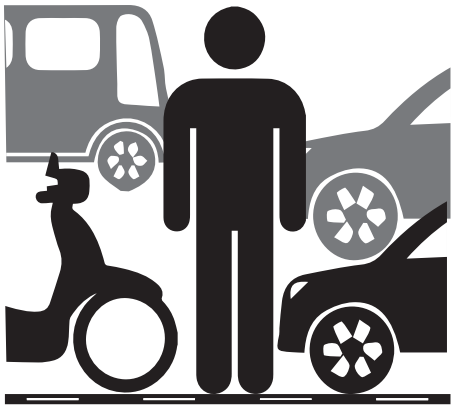
Significance Results

The main function of transportation system is to help people and goods circulate from one place to another. Therefore the cognizance of floating population becomes very significant for planning new traffic and transportation strategies.

- i) The quantity of floating population
- ii) It highlights the pull and push forces that affect the population of a given area.

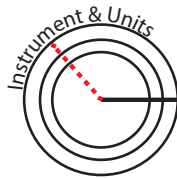


WALKABILITY



The extent to which the built environment is friendly to the presence of people living, shopping, visiting, enjoying or spending time and especially walking in an area.

A residential area shall be ideally planned in such a way that children, the specially challenged and the elderly can move from one place to the other easily. It makes getting around easier for everyone and also avoids usage of automobiles for short trips.



Measuring Tape

Meters

Norms/ Standards

Footpath shall have a minimum width of 1.5m excluding unusable spaces around trees or other obstructions like building corners etc.

- Increase width by 1 m for business and shopping areas
- Minimum 3.5 m for footpaths adjoining shops
- Minimum 4.5 m for long shopping areas

Pedestrian Count per Hour

In one direction	In both directions	Minimum Footpath Width (in M)
1200	800	1.5
2400	1600	2
3600	2400	2.5
4800	3200	3
6000	4000	4

Significance

Walking as a mode of transport for humans, is easy to promote, when the walkways are planned and made in such a way so as the children and the elderly can use them easily, it becomes easily usable for the whole population.

Walkable areas experience reduced automobile traffic and therefore reduced congestion and air pollution. When combined with public transport, these beneficial effects can spread over large areas.

Methodology



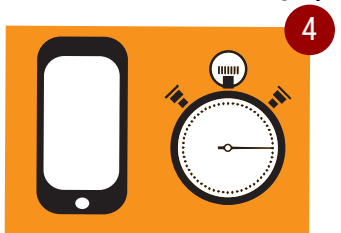
1. Make sure you have all the apparatus ready for carrying out the survey. Please use the field sheet provided. Read all the instructions thoroughly.



2. Mention your name in the space provided and note down the time.



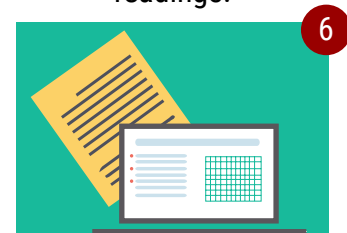
3. Identify and mark your location on the map in the field sheet from where you are going to take the readings.



4. Use the calibrated application from your mobile phone or the instrument required to collect the readings.



5. Mark the presence or absence of footpaths and any obstacles using appropriate symbols as you walk along the road. Obstacles- Trees, electric poles, streetlights, distribution boxes, vendors or shop extensions, Pits, Garbage bins, benches



6. Fill up the field sheet with the data and the readings collected.

Outcome



Map 3. : Map generated for footpaths in a ward.

RESULTS

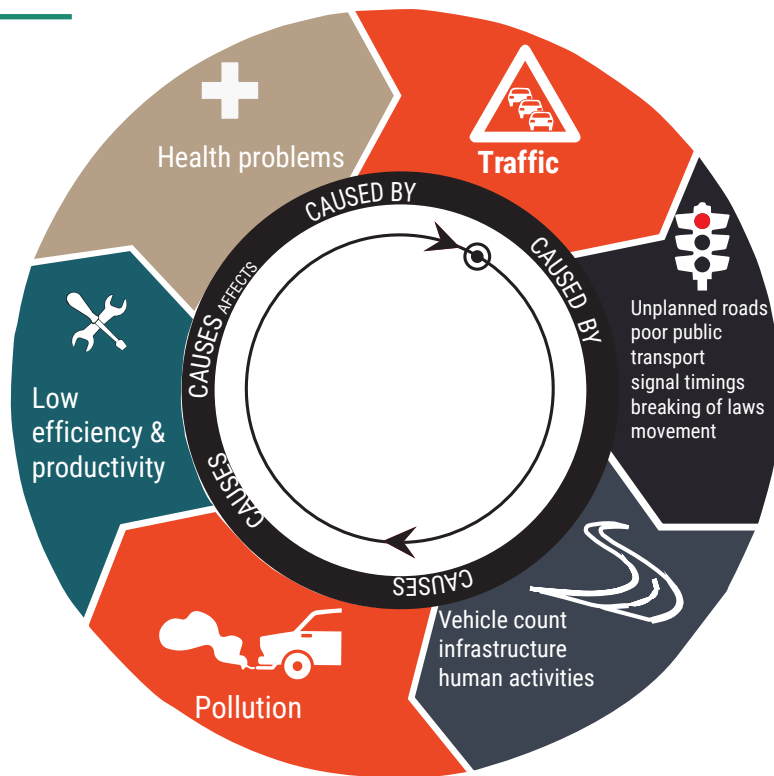
The walkability survey will help identify

- Pavement quality and material
- The roads with and without footpath
- Quality of footpaths
- Usability of footpaths
- Potential improvements to the existing footpaths
- Points of vulnerability for pedestrians



Stresses

Walkability determines the ease of access to and moving around the neighbourhood, for various reasons like commute to and from work, to and from amenities, facilities, and services, children walking to and from school, playground etc. More walkable a neighbourhood, more likely are the people to walk and more the environmental and social benefits as seen above.

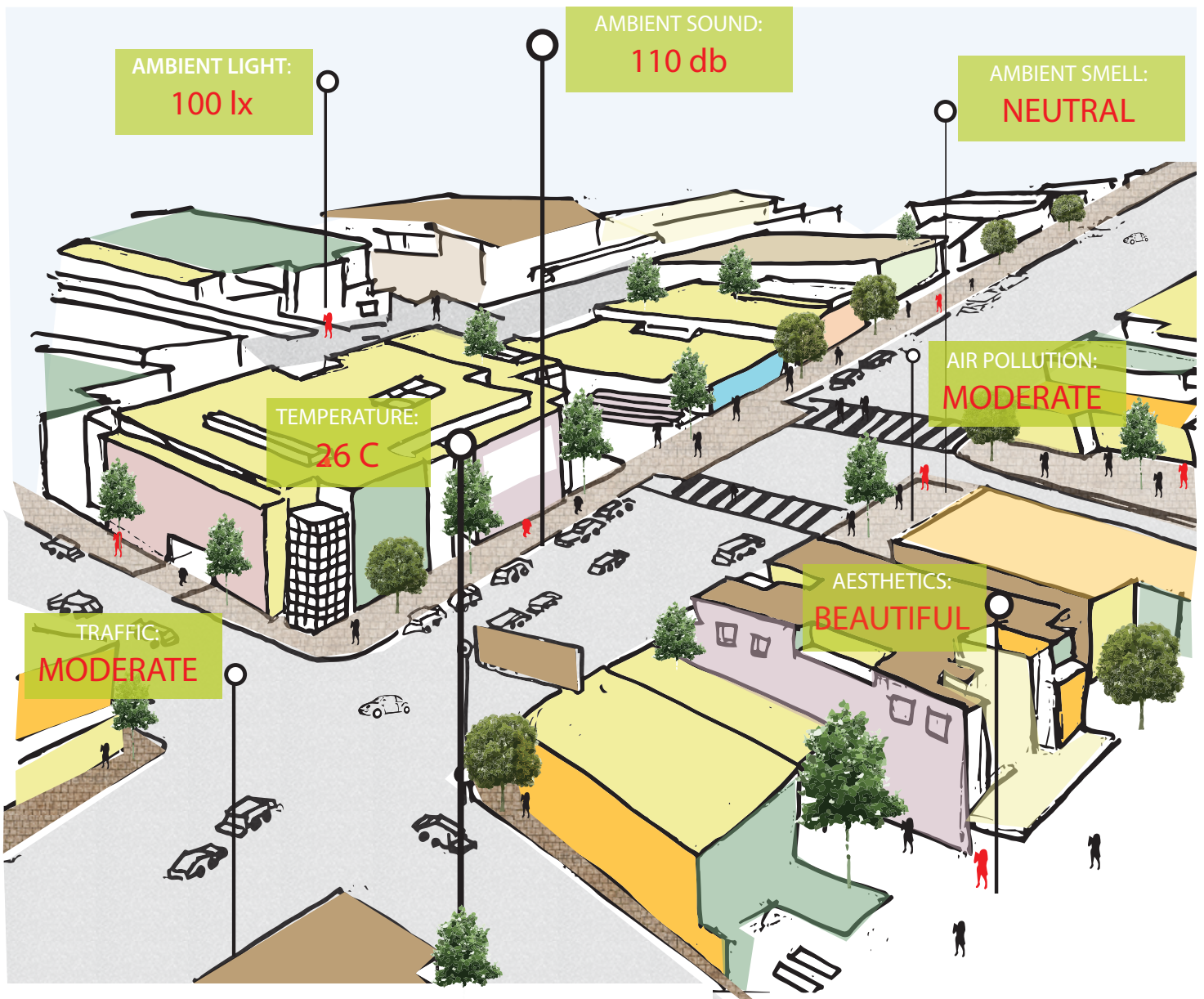


LETS KNOW

Data on ambient environment should be collected on field surveys for the data to be represented, sampling would have to be done. The samples shall be taken uniformly over the study area. This can be done easily by overlaying a grid on the map. One data point can be taken at the center of every grid. The size of the grid depends on the characteristics of the indicator and their nature to vary over a distance. For example, Temperature and humidity would change every 100 meters or so, but air pollution would fairly remain constant over longer distances.

The data on various indicators namely air pollution, temperature & humidity, ambient light, ambient sound, aesthetics, smell and traffic can be collected in a field survey using various tools and instruments. Air pollution can be measured using gas measuring equipments, similarly thermometer, hygrometer, lux meter and decibel meter can be used for the collection of respective data. For aesthetics and smells perception of the surveyor is the test. For traffic survey there are tools like origin-destination survey, vehicle count etc. which have a standardised format. We have discussed these methods and tools earlier in the manual.

“Your future is created by what you do today and **NOT** tomorrow”



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