

Energy vs Buildings

By 2030, urban dwellers will make up roughly 60 % of the world's population. How will cities look like? What is a role of Architecture? How Important is it? ca. 50 % of World energy consumption is used by occupied space... If transport and industry is added, the number is much bigger. Most of this energy is used for heating (space and water), cooling, lighting... We are witnessing one architectural style that is appearing everywhere. Independent on climate zone or local condition, skyscrapers are emerging on every side of earth. From Dubai to Siberia, we see people living behind a glass, hundreds meters above a ground. Architectural style that strongly depends on energy. With an unlimited source of energy, we could build floating cities and flying cars, but the question is where does the energy come and how much is still there...

Energy vs Society

At 1860 annual production rate have reached 138 million metric tons per year. During the eight centuries of coal mining from 1060 to 1860 the average growth rate in annual coal production was about 2,3 % per year with a doubling period of about 30 years. source > M. King. Hubbert, *Exponential growth as a transient phenomenon in human history*, 1976

Graph shows the growth in the annual consumption of energy per head in England over a period of three centuries. *"The most fundamental defining feature of the industrial revolution was that it made possible exponential economic growth – growth at a speed that implied the doubling of output every half-century or less. This in turn radically transformed living standards. Each generation came to have a confident expectation that they would be substantially better off than their parents or grandparents."* Tony Wrigley

Epoch of Fossil Fuels by M. King. Hubbert

21 century is fossil fuels time. 34 % of used energy is coming from crude oil exploitation. Epoch of fossil-fuel exploitation in human history during the period from 5,000 years ago to 5,000 years in the future (Hubbert, 1974., fig. 10) The age of fossil-fuel exploitation is ephemeral on a millennial time-scale.

Crude oil is most important natural resource of world economy.

Peak Oil is a Moment, when world oil production can not rise anymore.

Energy storage from one Barrel of Oil (159 liter) is equally 12 years of one person work. 40 hrs per day...

We are eating fossil fuels, 1500 liter crude Oil per person per Year is used for food (USA 1995). David Pimentel, Cornell University

"Peak oil means, that you peaked your highest sustainable supply." Matthew Simons

BECAUSE OF PLATEAU TIME, IT IS HARD TO TELL WHEN IS IT GOING TO FALL. HOW HARD A FALLING WILL BE, DEPENDS ON US... Because of huge number of worldwide factors and not backdated data, it is hard to give exactly prog-nose of world "peak" oil.

4 Peaks and Future Scenarios

Mankind can make an objects independent of the energy grid. The architect can draw house to yell loudly "I am Signing Off" !!! Energy is produced every second. We also used it every second. Electricity for our computers, radios, fridges, air conditioning, cooling

and heating facilities, the energy needed to run our cars, for our clothing, appliances, toys and boats. We are in a period of high energy demand and we all want to participate. Energy is produced and it must be spent. There is no way for long-term storage of energy. Has not yet been invented. Nor will it. Energy tends to entropy. Equalization. It depends on the time like we do. Question is what brings us a future?

Population Growth Chessboard Story

If we take a single pair, let's say Adam and Eve, present human population is created after 31,5 doubling times. At 46 doubling times would make a population density high as of one person on 1m² over all earth land areas. Biologist discovered centuries ago that a population of any biological species, plant or animal, if given a favorable environment, will increase exponentially with time. The period required for the population to double is different for different species. For Elephants and Humans doubling period is few decades, but for some bacteria is it as short as 20 minutes. *"It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change"* Charles Darwin-Question is how much of US can sustain one planet earth?

Peak Density 1P/1m²

-46 doubling times would yield a population density high as of one person on 1m² over all earth land areas.-Is there on a Earth such a density?

Population Growth India 1.42

ECOLOGICAL FOOTPRINT 0,9 haG (Global hektar) per person
AIR POLLUTION Fuelwood and biomass burning is the primary reason very high air pollution in rural and urban India. Traffic congestion In cities like Bangalore, around 50% of children suffer from asthma.
SOLID WASTE POLLUTION Trash and garbage is a common sight in urban and rural areas of India. Indian cities alone generate more than 100 million tons of solid waste a year .

GREENHOUSE EMISSIONS India was the third largest emit-ter of carbon dioxide in 2009 at 1.65 Gt per year, after China (6.9 Gt per year) and the United States (5.2 Gt per year).

In 1971 there were around half a billion Indians (554 000 000 exactly according UN Statistics). Nowadays there are about 1.2 billions Indians and so they make over 15 percent of the world's population. According to UN stats and annualy growth per cent age, there will be in 2030 about 1.42 Billions Indians and about 50 % of them will be living in cities. We can say that in a future every 6th inhabit-ant of the world will be Indian. Also we can say that indian way of life is affecting us all. India is a significant consumer of energy resources. In 2009, India was the fourth largest oil consumer in the world, after the United States, China, and Japan. With growth of population India demands on energy will continuously rise. But will be there enough energy for all? Michael Simmons sad, that if citizens of India and China will be living like Americans now, our non - renew-able energy resources will be out in couple of years. How is population growth affecting Indian cities?

FOOD

In 2007, India was using 61 % of total land area for agriculture. Population of India at 2007 was 1.11 Billion people. How will India feed growing population? 1.2 Billions

WATER POLLUTION

Today no river in India is clean to drink. Open defecation is widespread even in urban areas of India. According to World Health Organization 2005 report, sewage discharged from cities and towns is the predominant cause of water pollution in India. In most of cities of India there is no sewage treatment facilities.

The untreated water is used for drinking, bathing, and washing. The Mithi River, which flows through the city of Mumbai, is heavily polluted. Flooding during monsoons worsens India's water pollution problem, as it washes and moves all sorts of solid garbage and contaminated soils into its rivers and wetlands. None of the 35 Indian cities with a population of more than one million distribute water for more than a few hours per day.

SANITATION

Of the 2.5 Billion people in the world that defecate openly, some 665 million live in India. 31% Of all India Population had access to improved sanitation. The lack of adequate sanitation and safe water has significant negative health impacts including diarrhoea. The World Health Organisation estimated that around 700,000 Indians die each year from diarrhoea. In urban areas, 96% had access to an improved water source and 54% to improved sanitation.

FRESH WATER

India will face water supply shortages by 2025. India has 20 percent of the Earth's population, but only four per cent of its water. Fresh water use per head per day in India is 25 liter. Austria 145 liter and USA 295 liter of fresh Water. *source > Energie Atlas*

India Annual Average Rainfall Map

Mumbai sits on a seismically active zone. The area is classified as a Seismic Zone III region, which means an earthquake of up to magnitude 6.5 on the Richter-scale may be expected

Solar Radiation India

Solar thermal technologies have a special relevance in India due to the high temperatures and the number of clear, blue-sky days: Average radiation is 4.5 - 6 kWh/m²/day (radiation on a given surface in kilowatt-hours per square meter per day) with an average of 280 clear days. The equivalent energy potential is about 6,000 million GWh (gigawatt hours) of energy per year. India itself has a different zones. Mumbai is in hot and wet zone, with average annually solar radiation 5.90 kWh/m²/a.

India Southwest Summer Monsoon

The southwestern summer monsoons occur from June through September. The Thar Desert and adjoining areas of the northern and central Indian subcontinent heats up considerably during the hot summers, which causes a low pressure area over the northern and central Indian subcontinent. To fill this void, the moisture-laden winds from the Indian Ocean rush in to the subcontinent. These winds, rich in moisture, are drawn towards the Himalayas, creating winds blowing storm clouds towards the subcontinent. The Himalayas act like a high wall, blocking the winds from passing into Central Asia, thus forcing them to rise. With the gain in altitude of the clouds, the temperature drops

and precipitation occurs. Some areas of the subcontinent receive up to 10,000 mm (390 in) of rain annually.

India Climatic Zone Map

Mountain climate
Humid Subtropical
Tropical wet and dry
Tropical wet
Semi-arid
Arid

Letter from Suketu Mehta

Word of Author!

Couple months ago I recived a letter from a guy called Suketu Mehta. First I tought it is a spam, so I automatically wanted to delete it. Like But from some reason I open it. The letter goes like this>

Dear Arhitect,

My name is Suketu Mehta and I am 29 years old. At moment I live in 13 Compound, one of 10 Nagars (neiberghood) of Dharavi, one of the biggest slums in Asia. Acording to this list from Mike Davis, Dharavi is proudly holding sixteenth place in the world. But the population of Dharavi can no longer be counted, only assumed trough satellite images. So that makes me Slumer, but I more preffered term Squeezer. We are really squeezing here. If you're still reading my letter, I will try to explain you my situation.

Figure 1

16 Largest Megaslums (2005) *

1. <i>Nezal Chalcol Izta</i> (Mexico City)	4.0
2. <i>Libertador</i> (Caracas)	2.2
3. <i>El Surl Ciudad Bolivar</i> (Bogota)	2.0
4. <i>San Juan de Lurigancho</i> (Lima)	1.5
5. <i>Cono Sur</i> (Lima)	1.5
6. <i>Ajgunle</i> (Lagos)	1.5
7. <i>Sadr City</i> (Baghdad)	1.5
8. <i>Soweto</i> (Gauteng)	1.5
9. <i>Gaza</i> (Palestine)	1.3
10. <i>Orangi Township</i> (Karachi)	1.2
11. <i>Cape Flats</i> (Cape Town)	1.2
12. <i>Pikine</i> (Dakar)	1.2
13. <i>Imbaba</i> (Cairo)	1.0
14. <i>Ezbet El-Haggana</i> (Cairo)	1.0

15. *Cazenga* (Luanda) 0.8
16. *Dharavi* (Mumbai) 0.8

Village Story

So I am born in this village. Shani Shingnapur. It is a village in state of Maharashtra in west India. Maharashtra which means – Great Land. My village is famous for one interesting fact that no house here has a door. Not even a type of locks or keys. Villagers here believe strongly in power of their god Shani. It is a Hindu god of the planet Saturn. That is all nice and sweet but I left my village couple years ago because of one simple reason. I could not find a job. I mean you could work for some 300 rupees a month, on a field. It is a misery, not enough for decent food on the table, not to mention some perspective of future.

The primary occupation of the people living in the Indian villages is agriculture. My village, as every other in India, is comprised of settlements which are strictly caste-based. There are four castes in India, Brahmin (Priests), Kshatriyas (warriors and rulers), Vaisyas (skilled traders, merchants and minor officials), Sudras (Unskilled workers). There is also a fifth caste none as Dalits (Harijans), Untouchables – do all the lower – order work, subordinate to all. This is the lowest caste, and unfortunately me myself belong to the Dalits. I say unfortunately because the upper castes, namely Thakurs of the Kshatriya (warriors) and Brahmins (priest) caste, they hold ownership of land, orchards and ponds. They are also educated and dominated in Indian villages as in Indian whole Society. None of us, Scheduled Caste (SC), owns any piece of that land. During a harvesting time, Kshatriyas compete with each other to have their crops harvested as early as possible, and the entire harvesting is done by SC. They beat us sometimes and rape our women.

*harvesting story humanright.asia

Village formation

Take a closer look at my village. The layout of a village is, as everything else, based on caste system. Brahmins settlement is strategically located at the main entrance in a village on every side. Close to them is school. Area bordering with Brahmins is occupied by Kshatriyas followed by agricultural fields. We, Dalits and others from working - class find our places around these fields, on periphery of village, and with no access to public wells.

Funeral

I am Hindu also, and in our tradition is to cremate our dead near the bank of a river. But, since SC lives mostly in edge of poverty, or better to say, already crossed the edge of poverty, and with no access to village commons, no graveyard, sometimes we are forced to leave mortal remains in the river.

Economy

The economy of our villages is completely based on agricultural produce. In time of great Indian leader M.K.Gandhi villages were also economically leaders. Central to Gandhi philosophy was the principle of "swadeshi", which means local in self – sufficiency. Core of India, self-sufficient villages, manufacturing mainly for use, not selling or disturbing.

Gandhi said once upon a time, "The true India is to be found not in its few cities, but in its seven hundred thousand villages. If the villages perish, India will perish too." Gandhi was killed on a 30. January 1948 from hindu nationalist, Brahman called Godse. How my closed friend Kiran Nagarkar sad once :” The only good thing was, that the killer was not a Muslim. Hard to imagine, what kind of bloodbath, the citz and the country would have otherwise drowned.”

One wish > “Go west”

After Gandhi, impoverishment of villages, influenced mainly trough mechanization of agriculture, leads to lack of jobs and deruralization. Also, American pioneering spirit “Go West” , still works in India. People from all parts of country, march to Megacities , as Mumbai, Delhi, Kolkata, searching for Luck. For us Maharastrians, Mumbai is a Golden City, wich never sleeps. He is known as Eldorado Indien , dated from independency. There is a jobs...

How to leave village

There are more options to leave a village. First one is very simple, pack your things and catch a train. Second you have maybe some cousine alredy settled in a city. Third is not so legall and involves becaming a member of gang. Some friends of my as part of D-Company gang went to city before 6 months, and they are coming back now, with good clothes, driving a epencive cars and taking a girls in a beer-bars. They are member of one of so many gang in Mumbai.

I choosed second option and called my cousin.

So I moved. I left my mother and my father, and two sisters in hope to find some money for their weeding.

Bombay

How my friend Kiran Nagarkar (wrighter) once said, Bombay is the richest, most brutal, most beautiful, baddest city in India. He is India`s most populated city and also is the financial and commercial capital of the country as it generates 6.16 % of the total GDP. You can find in Bombay more as 250 diet clinic, but also you can find a 10 millions people without trink-water connection. In Graz lives 3600 people on square kilometre, in some slums of Bombay you can find a more than 400 000. According to protocol of WHO (World health organisation) , air pollution in Bombay is so high, as you consume daily two packages of cigarettes. Bombay is a modern Babylon, a mirriored mosaic of whole India. On streets people talks to each other on some crazy mix of Hindu, English, Gujarati,

Marathi and Urdu. There is also so called Bombay-rotwelsh, slang of gangster, in which word *kaam* means same for sex, work and dead. If you are going to Bombay, you are going to City, but if you are going out of Bombay, to Europa or Dubai, you are going *upar goan*, in to the village. If you know Bombay, rest of the world is a village.

History of Bombay

* Greater Mumbai District Gazetteer 1986, Geology

* "Mumbai: History of a City". British Library. Retrieved 11 September 2012

<http://www.bl.uk/learning/histcitizen/trading/bombay/history.html>

From Stone Age to Portuguese

British archaeologist Todd found in northern Mumbai Pleistocene sediments which indicates habitation on these region since Stone Age. According to the Greek geographer Ptolomy in AD 150 it was called Heptanesia – the cluster of seven Islands, now known as places of Mumbai : Colaba, Old Woman's Island (Little Colaba), Isle of Bombay, Mazagaon, Worli, Parel, Mahim. These Island were separated by swamps and grewed together into a single landmass through out engineering project by the Hornby Vellard in 1784. It took 60 years to complete it.

Thousands years ago, Islands of Mumbai were part of Mgadhan empire. After they were ruled by the Silhara family until the middle of the 13th century. King Raja Bhimdev, founded his kingdom in the Maharashtra region in the late 13th century after Silhara Dynasty and established his capital in "Mahikawati" (now it is a Mahim).

Islamic Period

The Muslims ruled Islands from 1348 to 1391. Sultan Kutb-ud-din, Mubarak Shah I, who ruled in this period, demolished temples and he becomes a demon : Mumba Rakshasa. Mosque Haji Ali Dargah in Mahim dates from period of this Sultan.

Poruguese Period:

Hindu named islands with many names Manbai, Mambai, Mambe, Mumbadevi, Bumbai. City gets his name in 1508 from portuguese explorer and dealer Francisco de Almeida. He sailed with his ship into the deep natural harbour of the island and pleasantly impressed with position, he called it *Bom Bahia* (Good Bay). In 1534, the Portuguese ruled over the islands and established a trading center. Main trading products at that time were silk, muslin, chintz, rice, cotton and tobacco.

The Englishman in Bombay

Bombay was a present to British Empire. King Charles II of England married in May 1662 Catherine of Braganza, whose family offered a Portuguese territory of Bombay as dowry.

Charles rented Bombay to East India Company for just 10 pounds of gold a year. Under a governor, Gerald Aungier, of the East India Company from 1672 to 1675, city gets his freedom of religion and of movement, a huge step away from Portuguese feudal and religious policies. From that period Bombay bloomed as a free port. Company supported G. Aungier to build a new City of Bombay – they sent him a plan for rebuilt London after the Great Fire of 1666. People started to buy a land and build their houses. Company self build a castle and forts around it (with 1,500 soldiers for protection), a church, a hospital and a mint for making coins. By year 1675, the population was around 60,000. There are records from that period, which describes unhealthy climate for the English : “two monsoons” are average age of the man, and every twenty children survives infant days. The British spoiled the Portuguese name “Bom Baia” to “Bombay”

Cotton time

American Civil War was a pure luck for Bombay. The Americans stopped completely supply of cotton to England, and Bombay stepped into cotton trade. In first half of 20th century, almost all cotton production in India was made between Ahmedabad and Bombay. Opening the Suez Canal in 1869, reduced the travelling time to the Empire in half, Bombay became the gateway to India, and people from all over India and the world came : Portuguese, Mughal, British, Gujarati, Parsi, Marathi, Sindhi, Punjabi, Bihari, American. Bombay was a secure place, with plenty of jobs, people with all sort of skills came to start a new life in this gateway ; to money, to jobs, dreams. Cotton from Gujarat, was shipped through Bombay port to England, came back manufactured into cloth prior and sold again in Indian market.

Growth of City

Hornby Vellard in 1784

By 1845 , Hornby Vellard land reclamation project took his end, and the seven island that previously made Bombay , turned now into one large island. The Bombay was connected to Salsette by a mound at Sion, Colaba and little Colaba conjoin to Bombay, mound connecting Mahim and bandra followed and so on.

In 1853, the first Indian railway opened, connecting Bombay’s Victoria Terminus and Thane. Vitoria Terminus station (name changed through Shiv-Sena-partei into Chhatrapati Shivaji Terminus) was one of the gloriest stations in the world then. There is a story that concept of Dabbawalas (food carriers) originated during this period. Namely, British working on railway, didn’t like local food, set up services of dabbawalas to carry lunch from their home straight to the workplace. Through out work of company, for keeping control, company created a number of government buildings. Railways, Town Hall, Elphinstone college, commercials banks, newspapers.

City of Bombay has continued to grow. In 1864 there were 816,562 living there.

Post-Independence Period

In 1947, the British left their Empire under the Gateway of India, domed arch of yellow basalt surrounded by four turrets. At this period economy was mostly directed by Indians, mostly by the Parsis and Gujarati, so these transfer of the government occurred in Bombay in good conditions. Food industry, pharmacy, medicine discovery of offshore oil ; growth of the port, were new industrial productions and accelerator of City fast development.

SLUMS in Mumbai

In Greater Mumbai 1,959 slum settlements have been identified with a total population of 6.25 million, which forms 54 per cent of the total population of the city (Census of India, 2001).

Dharavi is not a largest slum of Asia. Not anymore. Also in Mumbai there are now some slums that can compare with Dharavi. There is 2000 Slums in Mumbai. Like a cancer or more like cure they are spreading through city.

Networks of slums is connecting different cities parts.

Slum is not a place, slum are people.

That is mosaic of whole India and India mirrored her in slums. Rate of non working is minimal. Not more than 10 %. There is job for everybody. Women, Children, Men. Recycling is the most common. Mumbai would choke himself in waste, if there were no Dharavi.

Streets are narrow and rare. Houses are from metal, brick, wood, nylon, and sometimes from concrete. Houses are made very fast. One slum was cleaned 2 times in day, but he appears again and again in same day. Architecture of slum is temporary, human scale and made from local materials. Built it from whatever you find. Dharavi makes 600 billions \$. They do not know what to do with Dharavi. To clean it (Redevelopment projects) or to build something between (Upgrade projects.)

Slums in Mumbai have always existed. Even back in the time when the fort was developed, the native villages have always been close to slums. They never underwent any planning, infrastructure construction or implementation of facilities such as water, sewage and drainage. Slums have risen dramatically since 1950. Most of this is due to the fact that Mumbai's tripled since India's independence in 1947.

Today slum dwellers make up 60% of Mumbai's population, that is approximately 7 million people.

History of Dharavi

Until the late 19th century, this area of Mumbai was mangrove swamp inhabited by Koli fishermen. When the swamp filled in (with coconut leaves, rotten fish, and human waste), the Kolis were deprived of their fishing grounds—they would soon shift to bootlegging liquor— but room became available for others. The Kumbhars came from

Gujarat to establish a potters' colony. Tamils arrived from the south and opened tanneries. Thousands traveled from Uttar Pradesh to work in the booming textile industry. The result is the most diverse of slums, arguably the most diverse neighborhood in Mumbai, India's most diverse city.

480 People is coming every day to Mumbai

One part of these 480 People, will go to the Dharavi.

Is there any empty place left?

How they are going to live?Where?On what space?

What will they drink? Electricity? Sewage drainage? Defecation?

Most of them without a place to stay!

So the Slums are growing further, under the same

condition. At same time air and water pollution is

growing, lack of open and green space is increasing, energy demand is growing , number of untreated waste also and a simple question is still unanswered :

WHERE TO, WITH ALL THIS PEOPLE?

Lack of Water

Water is short supply, and had to be collected from distribution points.

It is not unusual that this distribution points for water collection broke, leading to flooding, what causes than infection and diseases.

"Throughout the slum filthy chicken and mutton stalls dispose bloody viscera into open drains thick with untreated human and industrial waste - cholera, typhoid and malaria are common. Taps run dry most of the time and tankers bring in potable water once in a fortnight."

Dan McDougall ,Journalist, Dharavi Out of the rubbish, for Observer

There are some open water flowing systems and they are highly polluted.

Also Mihti river , bordering Dharavi is highly polluted.

There is a water distribution trough Dharavi that feeds a Mumbai with fresh water. Illegally water supply is provided from local Goons , mostly during night

The Ancient Ingenuity of water harvesting. During a monsoon time, it is a common rain water harvesting in rural zones.

Women and children daily spend a lot of time and have to make several trips to collect water.

Lack of Sanitation

Sanitation in slums is very poor as 73 per cent of slums depend on community toilets provided by the government, 28 per cent defecate in the open, 0.7 per cent slums have pay to use toilets managed by NGOs and only 1 per cent of slums have individual toilets.

Others have mixed provisions or use toilets in other slums or mobile toilets. Inadequate numbers of toilets lead to long waiting times. Overuse and poor maintenance makes them unhygienic especially in areas where the user group is undefined.

Inadequate water supply and the absence of electricity connections further limits the use of public toilets.

Women and small children face great difficulties due to inadequate and poorly maintained toilets. This is in spite of the fact that 59 per cent of toilet blocks were constructed after 1995.

A survey of toilet facilities in Dharavi in 1997 revealed that there was one toilet for every 1488 people. However, 80 per cent of these mainly public toilets were unusable because of blockages, filth and disrepair. While some homes have their own facilities, these are few and far between

Lavatory blocks do exist but ration is approx. 1 lavatory to 1500 people, so washing the body is done outside of homes.

Of the 2.5 Billion people in the world that defecate openly, some 665 million live in India. Lavatory blocks do exist but ration is approx. 1 lavatory to 1500 people, so washing the body is done outside of homes.

Lack of Space

Most of homes in Dharavi are around 125 square feet (11. 6 m²).

Lavatory blocks do exist but ration is aprox. 1 lavatory to 1500 people, so washing the body is done outside of homes.

The main uses Living and Working are connected close to each other - often in the same street or in the same building. There are no extra ways leading from homes to workplaces

The buildings are mostly two stories. The ground floor area is used for various industrial and manufacturing uses. Because of this use is provided with greater story height.

The density of the area with a floor space index (FSI) of about 2.0 to 2.5 is relatively high. *"The building and entirely built area appears to human needs and pleasing proportions."* Georg Jahnsen

"Once you get accustomed to sharing 300 square feet (28 square meters) of floor with 15 humans and an uncounted number of mice, a strange sense of relaxation sets in—ah, at last a moment to think straight."

Mark Jacobson, *National Geographic* , *Mumbai's Shadow City*

Dharavi Slum or Recycler

Dharavi is becoming the green lung stopping Mumbai choking to death on its own waste. All along Apna St hundreds of barefoot street children, human recycling machines, scurry back and forward, hauling bundles of waste - plastic, cardboard or glass - retrieved from Mumbai's vast municipal dumps.

"From every alley comes the sounds of hammering, drilling and soldering. In every shack, dark figures sit waist-deep in piles of car batteries, computer parts, fluorescent lights, ballpoint pens, plastic bags, paper and cardboard boxes and wire hangers, sorting each item for recycling. Workshops reveal everything from aluminium smelters recycling drink cans to perspiring bare-chested men stirring huge vats of waste soap retrieved from rubbish tips and local hotels."

Walking through Dharavi, home to an estimated 15,000 single-room factories, it becomes difficult to conceive of anything that is not made or recycled here.

5000 one - room factories with 800 \$

A chaotic system of wires carry electricity to slum residents.

70 % of E. is stolen from main power lines.

Labour worker get paid about 30 Rupies (1.80 \$) for 12-14 working hours.

Most of them do not have a own place, they share with other workers floor of the room where they work.

The average household in Dharavi now earns between 3,000 and 15,000 rupees a month (£40-£200), well above agricultural wage levels.

Human Recycling Machines

Recyclers send collectors to purchase waste materials from “suppliers”. *Suppliers* are offices, malls, homes, and industrial sites throughout the city. Collectors sift through City and collect 8.5 million metric tons of garbage and trash everyday for recycling and repurposing

Transport the waste material from the supplier to the Dharavi. Transportation expenses are borne by the recyclers and represent the largest component of costs in many cases. The smaller operations are completely dependent on the rail system. Dharavi’s central location reduces travel times and expenses during the collection phase.

Sorting Sorting is done by hands by assembly line workers

Reprocessed and used for new products Example Plastic :With 80 % of all Mumbais plastic waste, Dharavi is center of Mumbais recycling industry. Plastic is sorted by colour, than ground up in to small pieces and dyed. It is than melted and moulded in to plastic sheets ready to be sold on.

COLLECTORS

Everyday a thousands of people are spreading trough different parts of Mumbai, collecting a waste and bringing him back to Dharavis recycling industries. Dharavi is so becoming some kind of the green lung stopping Mumbai choking to death on its own waste. Slum dwellers use their imagination and work hard to make something out of the day-to-day objects otherleave behind, its recycling industry employs over 250,000 people. Because of its position in a same hearth of Mumbai, Dharavis COLLECTORS can cover large part of City.

“In a city that wastes nothing, everything has a market as long as you are willing to pay something for it. Junk is a word that does not exist. If it has a use it will be used to its maximum.”

Climate Mumbai

Seasons

Climate of Mumbai is fluctuating one as it is a coastal area and the weather is highly influenced by the presence of Arabian Sea. Generally May is the hottest month of the year and the average temperature remains between 32C- 40C. January is the coldest month in Mumbai and the average temperature remains about 18C. The distance to the sea lends a humid effect to the weather in Mumbai throughout the year.

Summers season in Mumbai is from April to Mid June followed by monsoon from Mid June to Mid September. The rain in Mumbai is extremely heavy and the annual rainfall of

Mumbai is around 200cm. Winter in Mumbai lasts from November to February and during this season the weather of Mumbai is really pleasant. During the winters the temperature varies in between 15-25 C.

Mumbai Weather

Mumbai weather can be categorized into four seasons of summer, winter, monsoon and the withdrawal season. December to February is the winter season, March to May is summer, June to September experiences Monsoon climate while October to December is the withdrawal season.

The annual rainfall of Mumbai is around 2,200 mm. Mumbai weather experiences the maximum rainfall in the month of July, which results in flood. The rainfall continues till the third week of September. By October the humidity starts decreasing. As November arrives, Mumbai goes through literally hot days and warm nights. During December time the nights are very cold and the temperature may turn to 13C at night.

WATER SUPPLY

Mumbai depended on wells and ponds/lakes for its water supply. The water Supply kept rising with newer Schemes, trying to meet the demand for the growing population. The reasons of constant water shortages are distribution losses, pilferage, wasteful use etc. which causes about 40%-60 loss of water. Tulsi, Vihar, Powai lakes supply the southern region of Mumbai, while the other lakes supply the suburbs. Rain Water Harvesting & Ground Water use, were earlier the main sources of water supply and it was collected in tanks. People measured the height of water level in tanks and accordingly decide how much to draw from it to make it last over the year. Such tanks were placed over the Mumbai area. For Example one is still there Banganga Tank. Tank was built in the 1127 AD. Restoring, building new tanks will help in achieving growing water demand, also with rainwater harvesting the groundwater table will rise, water quality will improve, salinity in water will reduce, cracks in building will be minimised, etc. Though capturing rainwater from the rooftops, terraces, in the tanks will also help solving Mumbai's monsoon floods problem.

Wind Rose Dharavi

WINTER SEASON

During winter season the prevailing wind direction during day and night time were found to be from westsouth west with a calm percentage of 14%

POST MONSOON During post monsoon season the prevailing wind direction during day and night time were found to be from east and north east with a calm percentage of 19%.

SUMMER SEASON The prominent directions during summer season are west North West and North West with a calm percentage of 26%

MINIMUM SPEED FOR WINDTURBINE

The latest models supposedly can start at about 5 miles (8 km) per hour wind speed, but most start at around 8 miles (12 km) per hour, though it is debatable whether a really useful amount of energy can be generated at these low speeds. The turbines also need a very large electrical 'kick-start' from the National Grid to get them into action, but as the first wind turbine starts generating power, that power is available to other wind turbines. A wind farm will have the later starting wind turbines starting with the energy from the earlier wind turbines. Large amount of power is also required to brake them when the wind speed hits around 50-55 miles per hour, which is their upper safety limit.

WIND TURBINE

Vertical-axis wind turbines (VAWTs) In a VAWT, the shaft is mounted on a vertical axis, perpendicular to the ground. VAWTs are always aligned with the wind, unlike their horizontal-axis counterparts, so there's no adjustment necessary when the wind direction changes; but a VAWT can't start moving all by itself – it needs a boost from its electrical system to get started. Instead of a tower, it typically uses guy wires for support, so the rotor elevation is lower.

It has shown that, typically, wind turbine require an average "least windy month" windspeed of about 2.5m/s to begin to be economically competitive, (eg. Fraenkel). Fig. 125 rather crudely indicates the world's windspeed distribution pattern. This is considerably simplified and a much more detailed treatment of this topic is available from the World Meteorological Organization. It can be seen that much of the world, with the exception of the centres of the major land-masses, and the equatorial forested regions, is suitable for deploying wind-pumps.

Art of vertical Rolling

Ashoka Chakra is a depiction of the Buddhist Dharmachakra, placed in a center of National flag of India. represents Indian need for horizontal rolling. Gandhi first proposed a flag to the Indian National Congress in 1921. The original design presented to Gandhi included two colours, red for the Hindus, and green for the Muslims. In the centre was a traditional spinning wheel, symbolising Gandhi's goal of making Indians self-reliant by fabricating their own clothing. The desiAgn was then modified to include a white stripe in the centre for other religious communities, and provide a background for the spinning wheel.

“Again, the wheel denotes motion. There is death in stagnation. There is life in movement. India should no more resist change, it must move and go forward. The wheel represents the dynamism of a peaceful change” Sarvepalli Radhakrishnan, India's first Vice President

Wind

by Proff. Cody Brian

-With increase of height above the ground, wind speeds also increase, this helps in integrating natural ventilation in high rise building structure
-it continues the direction of flow when passing an obstacle.

Berhard Sommer

Introduction Lectures

Wings - Facade System

As second layer, terrace vegetation, produce water vapor , increasing humidity, third layer, facade skin, serves as dehumidicator of outside air (now cleaned) , trough it`s non porosity. Textile skin, catches evaporated water on its surface and collect it on ground for later use.

Wings - Facade System

IT IS FACADE THAT FOLLOWS SUN AS ATTRACTORS , MESUARING DISTANCE OR FOR DEFINED SUNPATH, IT REACTS AND OPEN AND CLOSED ITSELF. FASSADE IS A SIN AND COS FUNCTION , IMPLEMENTED ON RANDOM SURFACE.
THIS STUDIE IS MADE BY IGOR MITRIC FOR MASTER THESIS
PROJECT ON INSTITUT FOR BUILDINGS AND ENERGIE.

Sun

Fire provide us with HEAT, LIGHT and ENERGY.

Our FIRE is SUN.

The Sun is everything.

Sun is food that we eat, sun is oxygen that we breathe, sun is fuel that we use. Also the water that we drink is produced trough atmospheric destilation process. It is a heat that came from sun, that purifes our drinking water. Our bodies are warmed trough sun. Our buildings also. If we design with sun it can be our friend. But if we design against it, it will be enemy. We need to understand sun and its relation to the earth in order to build our enviroment properly. Sun is FIRE, one of four elements wich makes our life. My location is at hot and wet climate zone, wich is highly influenced trough sun. Sun is always there. In winter, summer, spring or fall. Always!!!

In order to play with fire, we need to understand it.

Orbit

The Earth loops around the Sun, once a year in a slightly elliptical orbit (it is a shape of an oval), at average distance of 149.5 million kilometers.

Earth Axis

Earth rotates about its own axis once each day, wich we encounter as rising and setting of the sun. That means that one half of globe (wich is oriented away from sun) is in darknes, and the other half is in sunlit. Earth complete its orbit every $365 \frac{1}{4}$ days. The earth`s orbit is out of round by aproximatly 3 percent. That`s means that distance between Sun and Earth change itself , what causes a variation of about 7 percent in a intesity of solar radiation on a earth surface over a six-months period.

But this is not a reason for a earth`s seasons.

Tilt

The Earth axis is tilted for $23^{\circ}27'$ from the plane of its solar orbit , wich is a reason why (for the Northern Hemisphere) the sun appears lower in the sky in the winter and higher in the summer. In fact, the earth is closest to the sun in winter.

Tilt is reason for earth`s seasons.

Altitude

If we imagine, or draw imaginable horizon plane of earth on our location, angle between these plane and height of sun for desired day is called altitude. If we take winter and summer altitude for 21.december and 21. june, their difference will be 47° .

If we implement these angle on our project, it is a possible in pre design stage to see what parts of building will be infected during a year from direct solar radiation.

Shading

In Mumbai, or anywhere at about 19° North latitude , the sun is at a 47° altitude at noon of winter solstice, day of lowest sun position.

Also at a 94° altitude at noon of summer solstice, a day with highest sun position in year.

Rest of the year sun changes his angles between these to angles in domen of 47° .

For these area is very important thermal priority complete shading of facade from direct solar radiation, all year long.

*not in case of darkly painted stack with thermal mass , see Earthship Vol 1. How to build your own

Better formulate is > No solar gain is wanted in a hot & humid climate

Two options for natural shading

Option 1

Example for this aproach is Sunbelt Menagement Building, San Diego, Schneider + Schumacher, Cody Brian. But at that project is taken in account Summer atlitude of 60°, wich means letting winter sun in a building for heating. But in my case, of completly shading, we would need to make angles higher than 45°, what could lead us in construction problems.

Option 2

...after his trips to Algeria, Argentina and Brazil he had the final answer to the actual problem: an external sun screen to control solar radiation, or 'brise-soleil' was added outside the glass layer. This concept, a passive measure unlike the other two, would become an integral part of Le Corbu's architecture until the end of his career.

* * * * * s o u r c e

Brise- Soleil 2012

Form follows Energy, interaction with Sunpath

Sun moves trough the sky in 3-dimesional Arc, following both, azimuth and altitude changes, taking a specific path for each day. If we want to design properly our brise-soleil, natural shading system, we need to follow this path of sun. My ground floors are changing slitly, and they have more less eliptical form, so it is welcome to follow different sun altitudes for different period of day, to get exact necceseary amount of "Overhang".

For that I use winter & summer solstice, as max. values. Also, I use just sun altitudes in specific period of day for each of days>

10:00, 11:00, 12:00, 13:00,14:00,15:00

Grasshopper3d Script

For getting exact form, I need it to wright a small scrpit using excelent Plug In for Rhino 3D, open source soft. Grasshopper 3D. Script is working as next ;

We work with two surfaces>

Surface a : floor above wich serves as shading and Surface b : floor bellow, on wich form will be drawn. First is to find a center point of surface a. From this center point, we draw a sun vector (for Lat. + 19.04) for specific period of time. I will start with 21. June, 10 Hr in morning. Hours before 10 I will not take in a countww, because their angle is to low

(see table on previous page) , which would impact function of form in such a level, that it would have little or no useful area below.

After drawing a sun vector through center point, we need to find intersection point between projected normal from S_v and edges of our Surface a. This intersection point (A) will be our sun vector drawing point. Next step is to find an intersection between Sun vector S_v and floor below. This point is first point for our Ground Floor Curve. After implementing script on next hours for June and December, 10, 11, 12, 13, 14, 15, 16, we can draw our outline curve for ground floor.

Then I have send this file to EcoTect to test my script. EcoTect is showing that my floor is shaded about 82 % during a whole year.

Solar Access Calculation, 21. June

Then I have send my 3D file to EcoTect for testing my script. With EcoTect we can analyse solar radiation on our surface during a solstices or even during a whole year. EcoTect graph is showing that my floor is shaded approx. 82 % during a whole year.

Solar Access Calculation, 21. December

These two charts are showing us monthly incident solar radiation and monthly percentage shading for our form. Conclusion is that object is naturally shaded about 82 % over whole year. Mostly is not shaded before 10 and after 16, when the sun radiation is not so high, but again there is enough of it, to radiate heat on our facade in early morning and late afternoon. These of course can be solve with AC or some other cooling solutions, but my purpose is to get shading naturally much as possible. So there is need for another facade element to protect our building for these 18 % percentage during a year

Facade II

The simplest layer two is two plant a plants. They protect a facade and cooles a air for couple of degrees. It is also possible to grow edible plants as fruits and nuts. It means that some percentage of necessary food can be produced on Noah's Arc. For that we need height and dirty areas such are terraces. This sky gardens can provide us with food, oxygen and second shading layer.

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