Making Transport Sustainable

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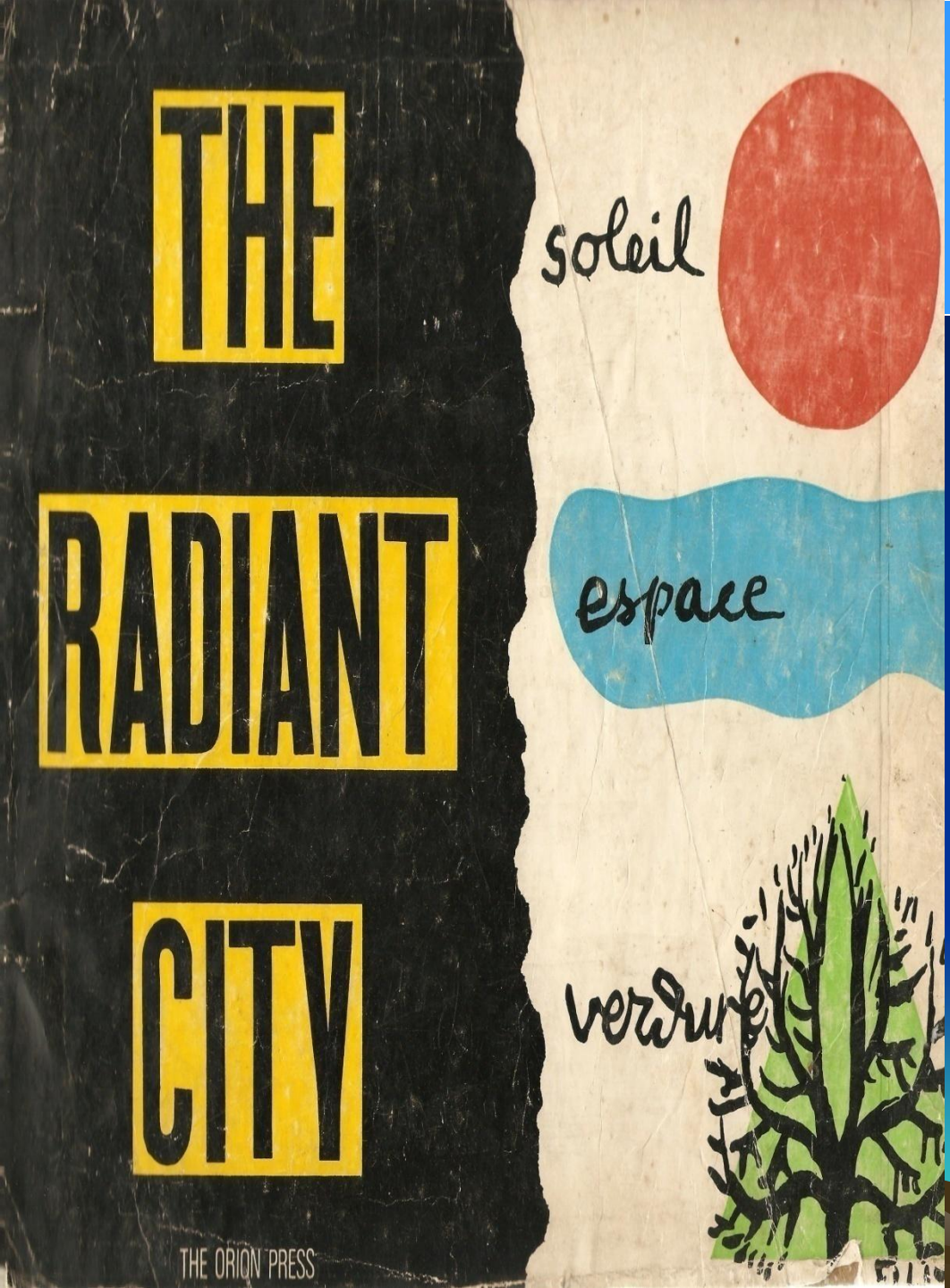
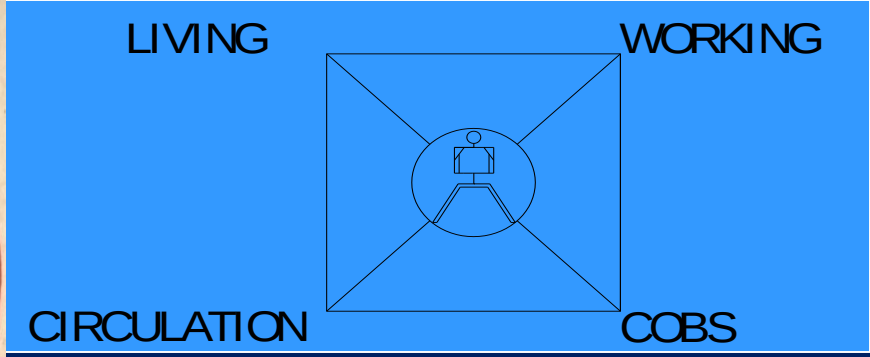




- The Radiant City
  - •An organism capable of housing the works of man of machine-age society.
  - • placed under the masterful government of natural conditions:
    - •Sun
    - •Space
    - •Greenery
  - •And its mission is the service of mankind:
    - •To live
    - •To work
    - •To cultivate body and spirit
    - •To travel about

    (in this order and obeying this hierarchy)

Why People Travel

- Accessibility--Historically Core of societies -- both economically/ socially.
- To reach people, goods, services / opportunities
- Achieving access involved movement,
- --people traveling distances.
- With societies /Cities kept growing/ developing,
- --- movement increased in distance/ speed.
- Faster speeds of movement,
- resulted in more traveling and even longer distances.
- Creating dependency on motorized mobility,
- -- mobility promised independence /new reaches.
- Western societies supported dependency on motorized mobilities
- Changed patterns of land use -- Changed need to cover large distances
- With Infrastructure ready to expand --to accommodate growth in motorized mobility – Expressway, autobahn, Motorway, underpass, flyovers came into existence

Why People Travel

- People travel for:
- doing jobs
- Availing Economic opportunities
- Sourcing food, essential services
- Ensuring Personal Development(going to school, cultural activities)
- For Entertainment (sports, pictures, parks)
- Meeting daily needs of life (living, working)
- Bridging gap between place of working and living
- For Tourism
- Participation in modern life
- essential feature of urban life
- Need to travel is a desired need
- Rapid Technological advances -----promoted easy availability of mechanical vehicles- cars , buses , trains

Importance of Transportation

- Economic growth &transportation positively co-related
- *Transportation leverages* Development – Economic, social, cultural , physical, industrial growth.
- -- bridges gap between demand / supply of goods/ services
- -- links area of production and consumption
- Promotes National /Regional integration
- Promotes Standard of living in undeveloped areas

--- Helps knowledge, learning ,improved trade / culture

- Concentration / decentralization of population
- Promoting Economy and generating employment
- Servicing Better education/healthcare amenities

Importance of Transportation

Transportation– Migration--Helps poor to make better earning-

- **Promotes/controls/enforces- Safety, law , order, disasters**

---Improves balanced development - country/Rural area ---
--Promoting growth of agriculture/supply of agricultural

- **-- marketing agricultural produce in nearby markets,**
- **-- increasing rural employment,**
- **-- promoting rural industries,**
- **-- diversification of agriculture**

Mitigating Disasters/Providing help -MeetingEmergencies

- ***Inadequate transportation-***
- **- adversely impacts economic/ social growth.**
- **-- hampers safe, economical ,speedier/ efficient ---movement of goods/ service**

Transport& Urbanization-

Cities promoting large travel due to:

- **Concentration of large population.**
- **Concentration of large number of activities.**
- **Increasing size of cities.**
- **Increasing travel demand.**
- **Increased travel distance.**
- **Increased use of personal vehicles. .**

Travel demand in cities rising rapidly due to:

- **Increasing income level.**
- **Higher car ownership.**
- **Travel becoming a habit.**
- **-increased distances**
- **Increased travel infrastructure/roads**
- **Easy availability of fast modes of travel**

--Considering multiple impacts of travel – essential to minimize travel to make cities more livable and sustainable

Urbanization-issues

The situation on the ground in our cities is grim

Water supply

Only 105 lpcd supplied, need 140-150

Sewage

Only 30% of sewage is treated

Affordable housing

24% of urban population lives in slums

Public transportation

Public transport share has declined to ~30%

Storm water drains

Storm water drain coverage of only 20%

Private transportation

Peak morning travel time of 1.5-2 hours in large cities

Solid waste

Only 70% of solid waste is collected today

Open space

Only 2.7 m^2 open space per capita compared to 14 m^2 in Beijing

- Transportation-
- issues

TRANSPORTATION SCENARIO IN INDIA

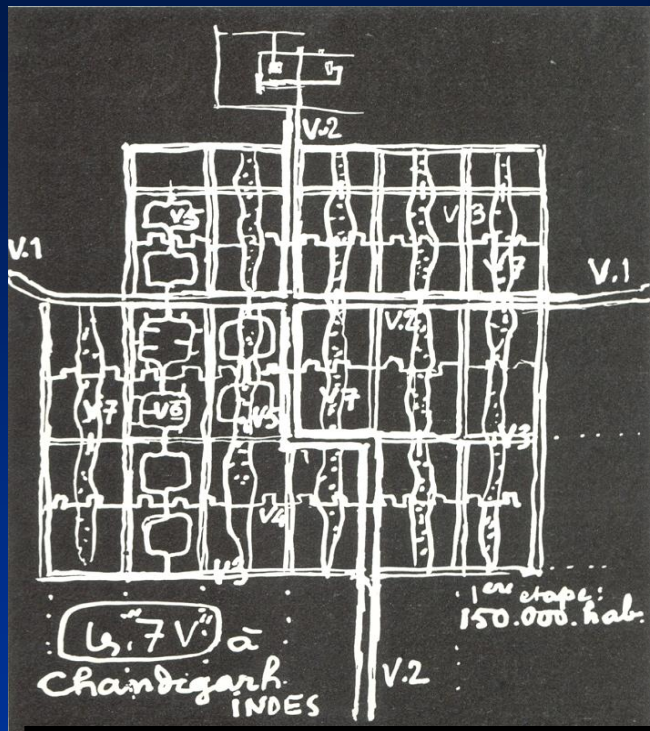
- **Traffic -Travel worst gifts of Urbanization**
- Transportation largely responsible for;
- -Consumption of Energy/ resources- petrol/diesel- mobility/manufacturing
- -- Emission of Greenhouse gasses
- -Global Warming
- Climate change
- noise Pollution --air pollution
- -Smog - Traffic Congestion -Parking
- Adversely Impacting health of people
- Causes Road accidents- main causes of premature death in countries/ cities.
- **Travel becoming risky with**

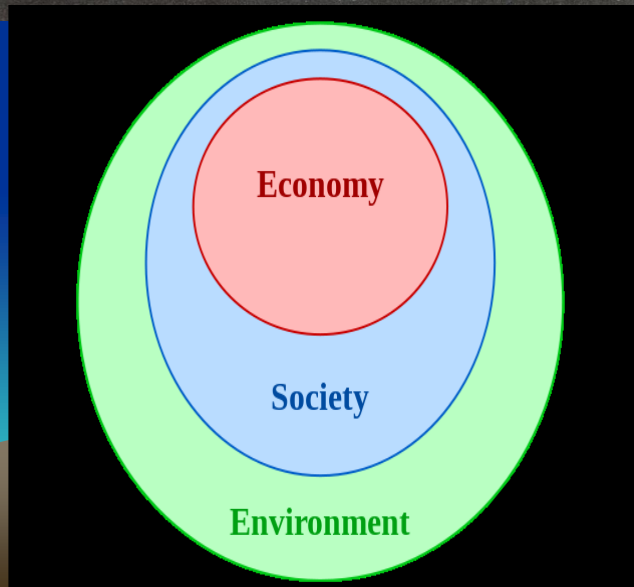
•As per 2019 Report- in India annually

•--4.8 lakh Road accidents--1.51 lakh deaths -

•Every hour **in road accidents**

• - 17 deaths -- 55 accidents





TRANSPORTATION SCENARIO IN INDIA

- Mismatch between vehicle popula**tion / road capacity**

•In last 53 years --,motor vehicle population recorded-- CAGR growth of 10.9%

-- compared to 3.6% in road length with National Highways increasing merely by 2.3%.

08/12/2017 · India--road network-- 6.4 million km--national & state highways and urban & rural roads

-- National highways in India increased from 70,934 km (44,076 mi) in 2010–11 to 132,500 km (82,300 mi) in 2019.

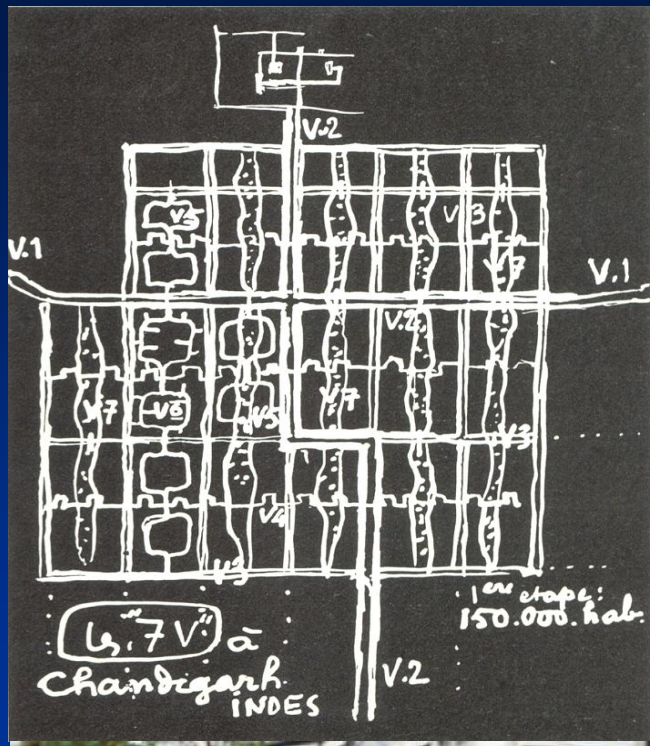
Despite pandemic / lockdown, India constructed 13,298 km of highways in FY21.

--In May 2017, India completed / made operational 28,900 kilometres (18,000 mi) of four- or more-lane highways

•Travel becoming expensive for poor due to elimination of pedestrians / bicycles

•major causalities- cyclists/pedestrians/ pavement dwellers

•Vehicular congestion/traffic jams becoming order of day

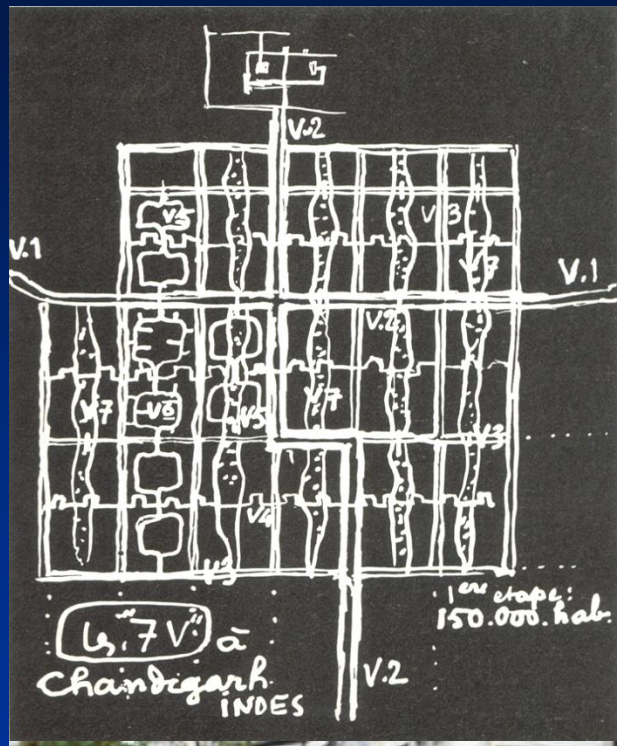


Registered MV in India on 31.03. 2017

- India Produced 26.36 million vehicles in 2019-20
- Total registered vehicles *in India in 2020 stood at 295.8 million* – 21,00,23,289 (YEAR 2017)
- In 2017-- 9 states have more than 100,00,000 registered motor vehicles --. Maharashtra, Tamil Nadu, Uttar Pradesh, Gujarat, Karnataka, Rajasthan and Madhya Pradesh
- Registered motor vehicles in
- --Maharashtra – 30.22 million
- -- Uttar Pradesh – 26.27 million
- -- Tamil Nadu – 26.11 million
- --Gujarat -- -- 22.04 million
- --Karnataka –17.87 million
- -- Rajasthan – 14.90 million
- -- Madhya Pradesh- 13.20 million
- -- Kerala -- 11.3 million
- -- Delhi --maximum number of Vehicles-- 10.26 million(2017) - 12 MILLION IN 2019- Vehicles doubled during last decade

TRANSPORTATION SCENARIO IN INDIA- ISSUES

- Heterogeneous Traffic
- increasing individual vehicle ownership;
- low road capacity;
- poor road geometry;
- large obsolete vehicular population;
- inefficient/ inadequate public transportation;
- low priority for traffic planning; ;
- Low priority to bicycles / pedestrians
- poor traffic management;
- mismatch between vehicle density and road capacity;
- multiplicity of agencies involved
- absence of unified traffic regulatory authority;
- acute problems of parking;
- high rates of accidents etc.



CONFLICT BETWEEN MAN& MACHINE

Inadequate Mass Transportation

Poor Road Conditions

High Degree of Pollution

ACCIDENTS

Options for promoting Sustainable Transportation

Solving Transport Problems

1 Development of Additional Road Capacity

2. Effective Use of Bus Service

3 Traffic Management Measures:

4. Parking Restrictions:

5. Promoting Bicycle:

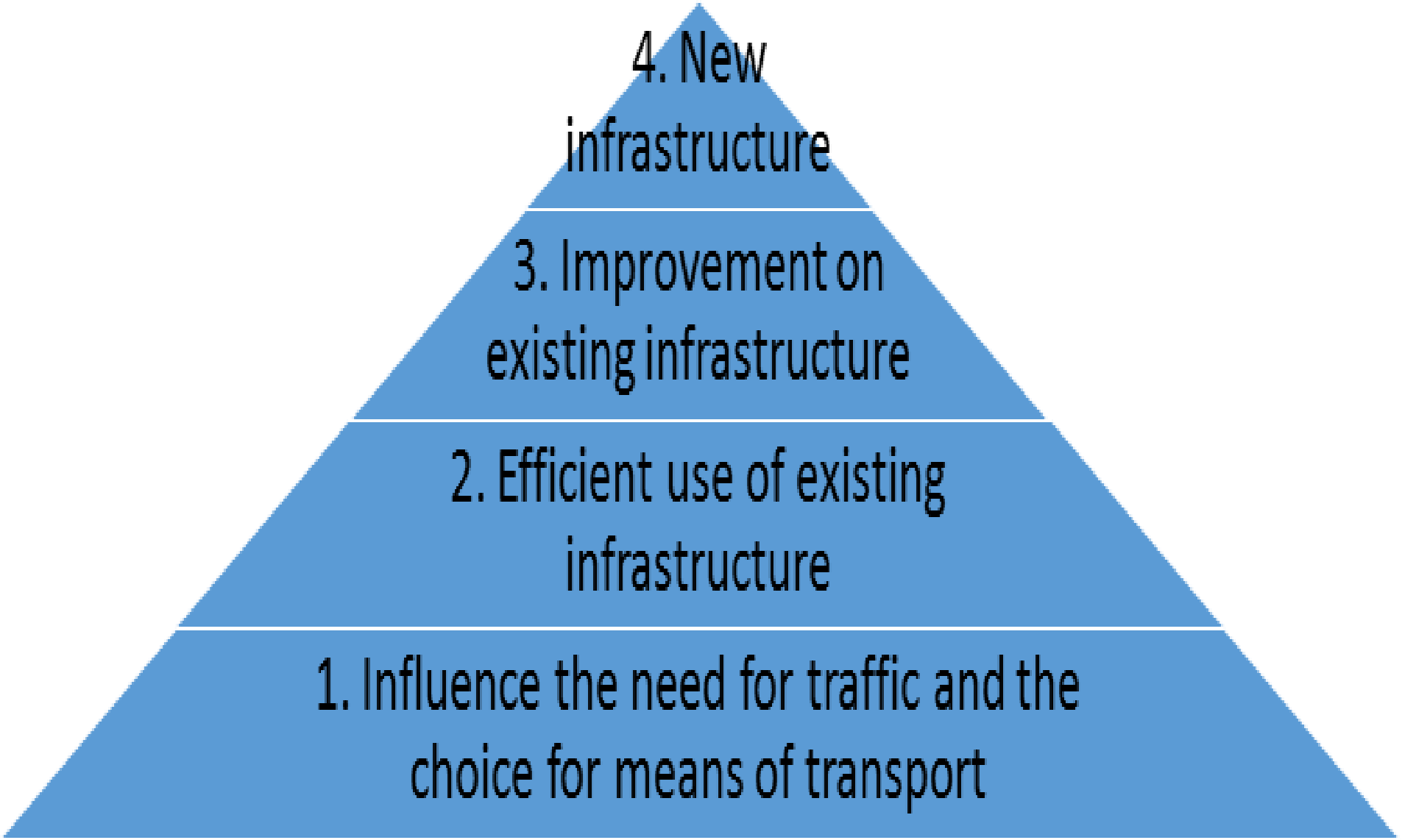
6. Encouraging Walking

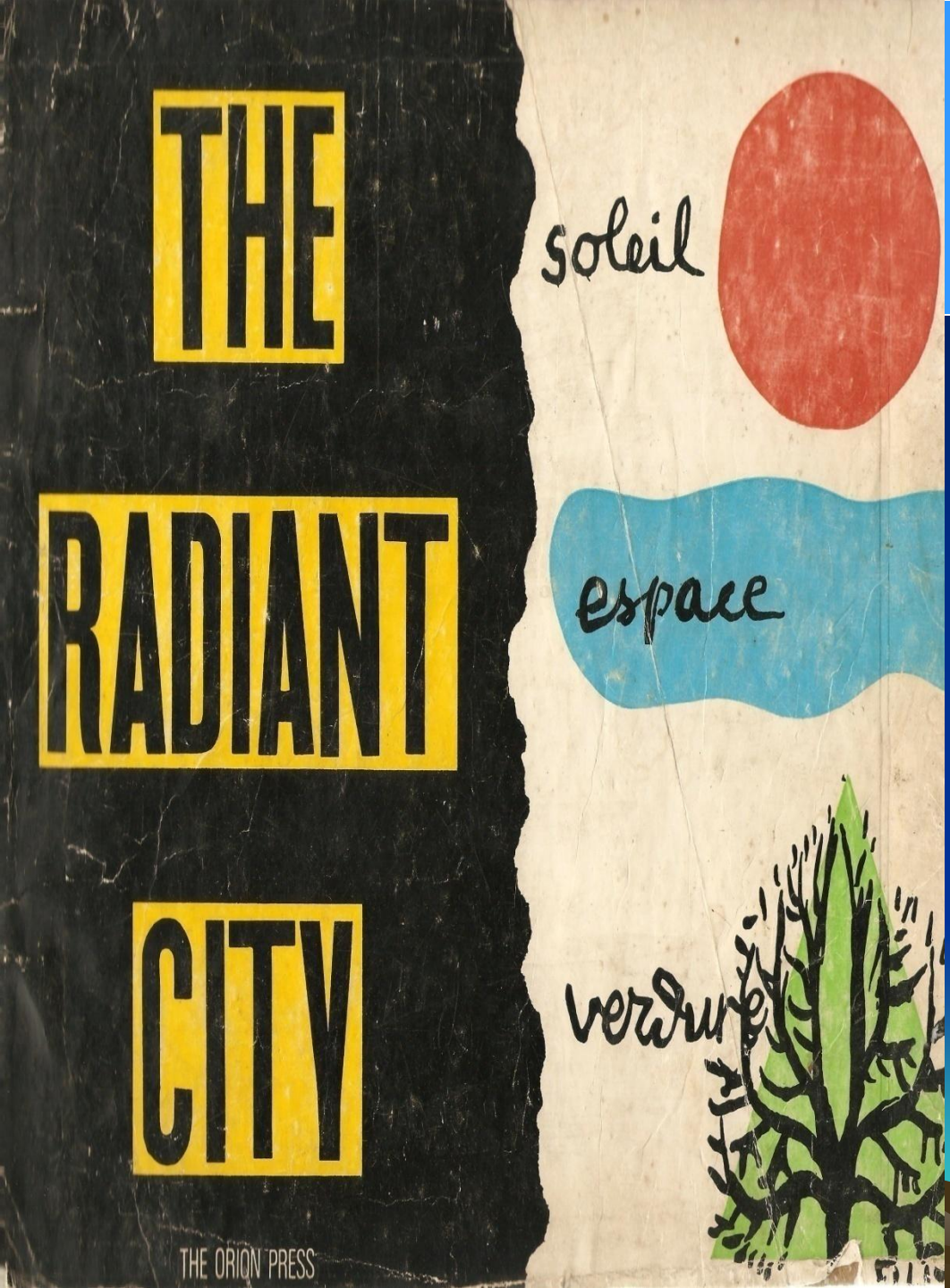
7. Promoting Public Transport

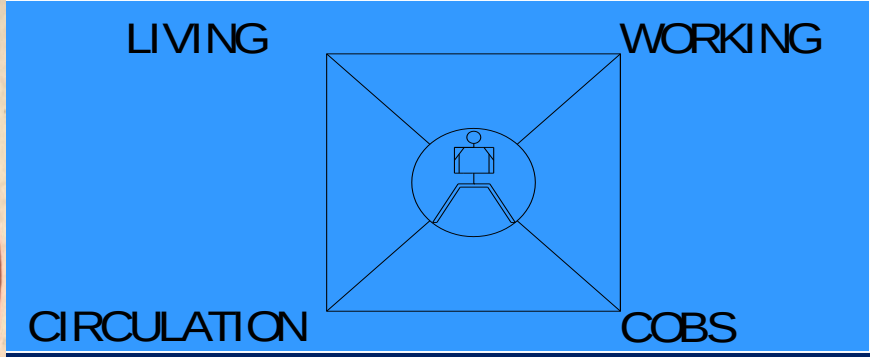
8 Changing behaviour of the road-users

- --other measures for urban transport planning :
- 1. Imposing Restrictions on roads / traffic speeds,
- 2. Regulating traffic access to a link or area,
- 3. Charging for use of roads on a link, or area basis,
- 4. Vehicle restraint schemes,
- 5. Rail rapid transit,
- 6. Transport coordination ; car pooling; ride sharing, using drones, using adaptive signals 7. Public transport improvement, 8 Minimising use of cars

Solving Transportation-Problems







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Sustainable transport

- Refers to transport that is;
- **-- sustainable in terms of**
- **- social,**
- **--environmental and**
- **-- climate impacts.**
- **Sustainability evaluated for transport includes;**
- **--sources of energy;**
- **-- infrastructure used to accommodate transport**
- **-- Operations and**
- **-- logistics**
- **Transportation sustainability largely measured by;**
- **-- transportation system effectiveness and efficiency**
- **-- environmental/ climate impacts of system.**

SUSTAINABLE/SMART TRANSPORTATION

-Redefining approach to Urban Planning.

-Redefining shape & size of cities

-Making cities compact

-Promoting self-contained communities

-Reordering prioritization of modes of travel

•-Making public transport- effective and efficient,

•Equitable allocation of road space.

•Road Pricing

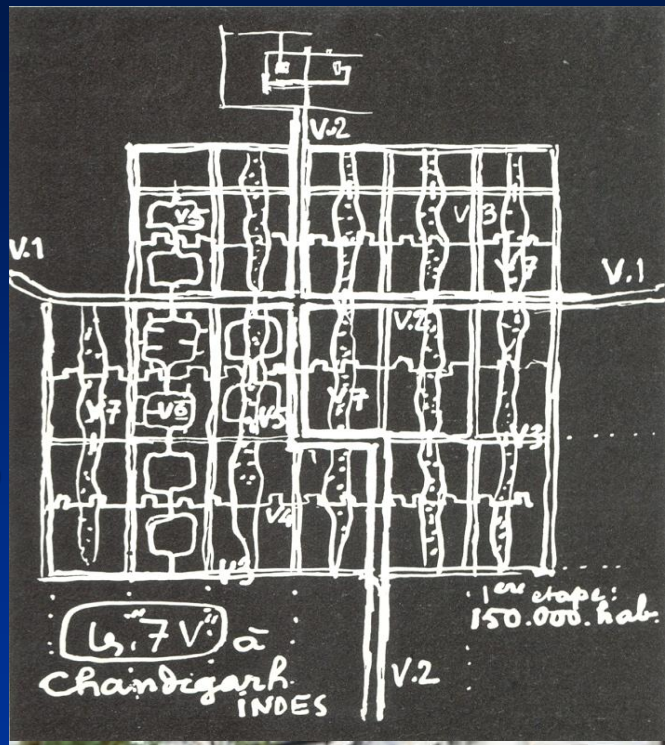
• Promoting intelligent/smart transportation

•Creating public awareness

•Involving communities/ stakeholders

•Deregistration of Old Vehicles

•Establishing effective regulatory/enforcement mechanisms



Principles in Sustainable Transport Planning

- Promoting Accessibility and not mobility
- Planning for people not for vehicles
- Moving people, not cars
- Keeping space for walking and pedalled vehicles
- Reducing travel demand- Re-ordering landuse planning
- Creating shared work centres within residential complexes
- Rationalising planning for
- -- making cities compact – reducing distances
- -Creating self-contained communities
- - Promoting flatted development rather than plotted development
- Promoting multiple use of land
- --responding to climate change
- -- Adopting human scale for planning residential units

8 Principles of transportation to make cities great

8 Principles for Better Streets and Better Cities

- WALK -- Develop neighbourhoods that promote walking
- CYCLE -Prioritize non-motorized transport networks
- CONNECT -Create dense networks of streets and paths
- TRANSIT - Locate development near high-quality public transport
- MIX -- Plan for mixed land use
- DENSIFY -- Optimize density and transit capacity
- COMPACT - Create regions with short commutes
- SHIFT - Rationalise mobility by regulating parking / road use

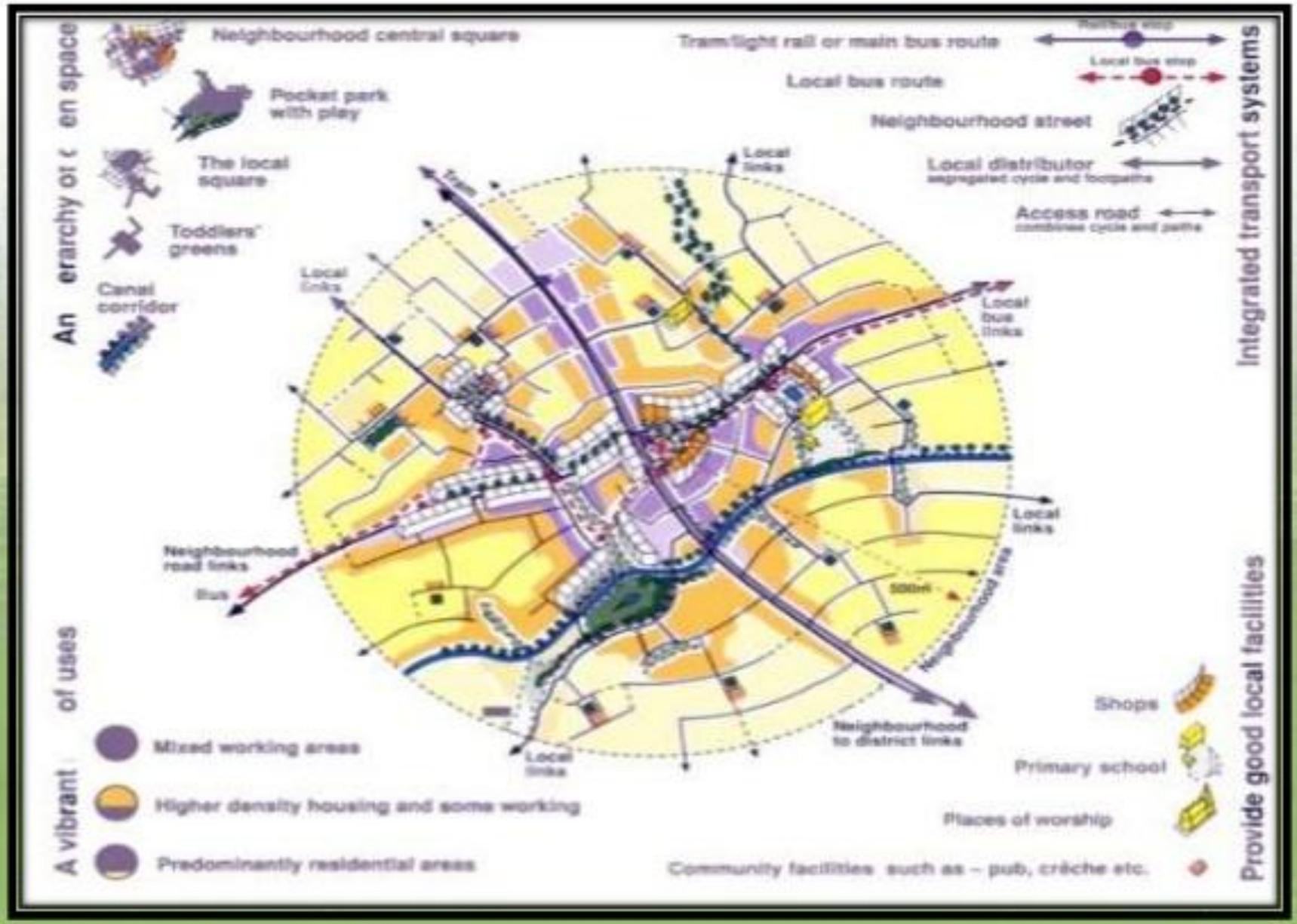
8 Principles of transportation to make cities great

- Making Cities
- Compact

Compact City- advantages

- Compact city– best option to rationalize travel / promote sustainable transport because it-
- Minimizes distance between place of work /living/amenities
- Reduces demand for personalized vehicles
- Reduces Congestion
- Reduces environmental pollution
- --Improves road safety
- --Promotes pedestrianisation & cycling
- --Makes mass transportation effective
- --optimizes land use due to lower area under roads/parking
- -- makes available large open spaces
- -Makes city development cost-effective- less roads/services etc

Compact city model



PLANNING COMPACT CITIES- options

Make cities compact by;

. – promoting High-density development

-- adopting Transit oriented development

-Promoting flatted rather than plotted development

-- Raising Height and

-Rationalizing land uses and Building bye-laws

-Building inside not outside

--- Building vertical not horizontal

--- Building High not low

--- Building mix not pure

---Building dense not shallow

---Building accessibility not mobility

-- Planning for people not for vehicles

COMPACT CITY

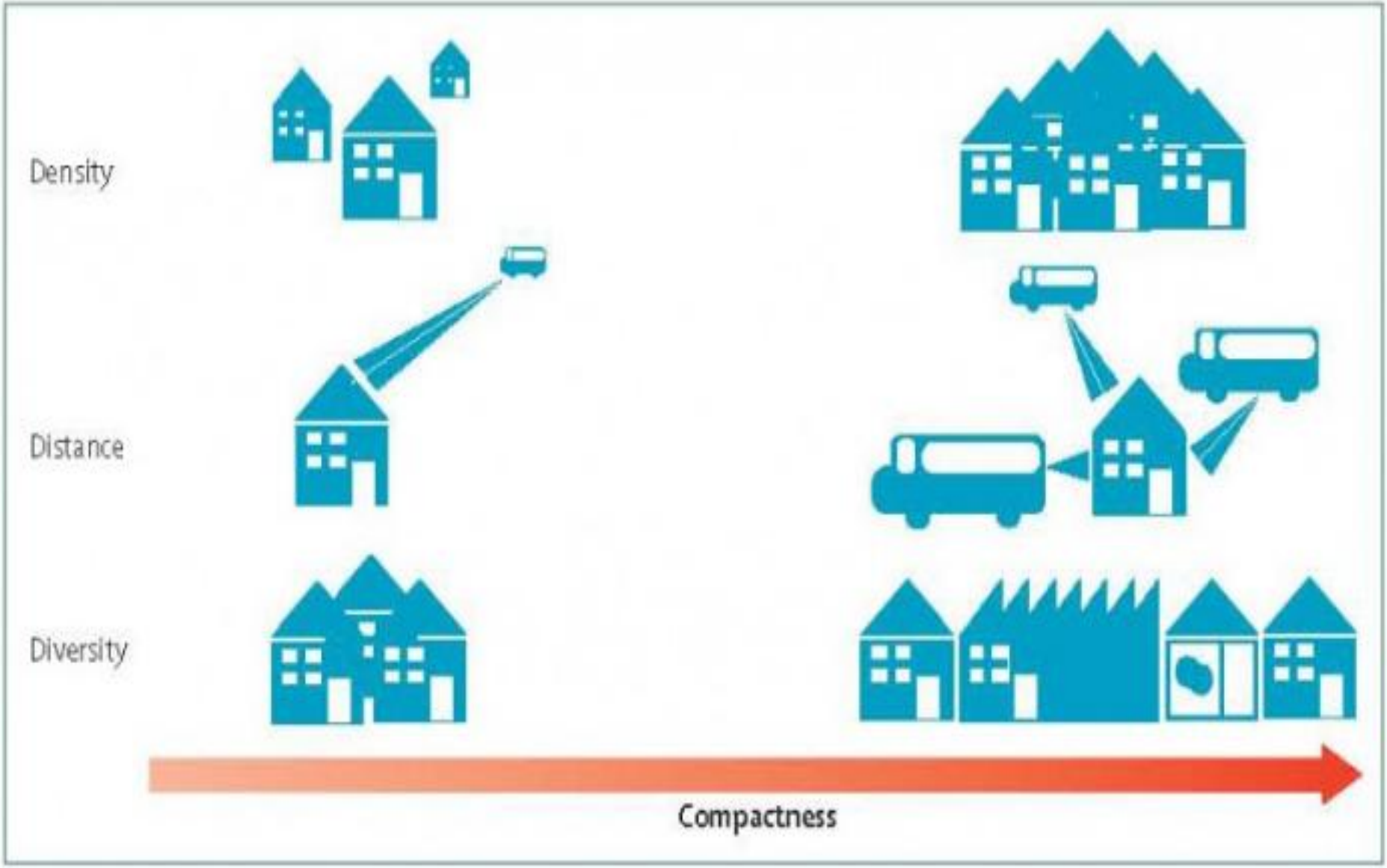
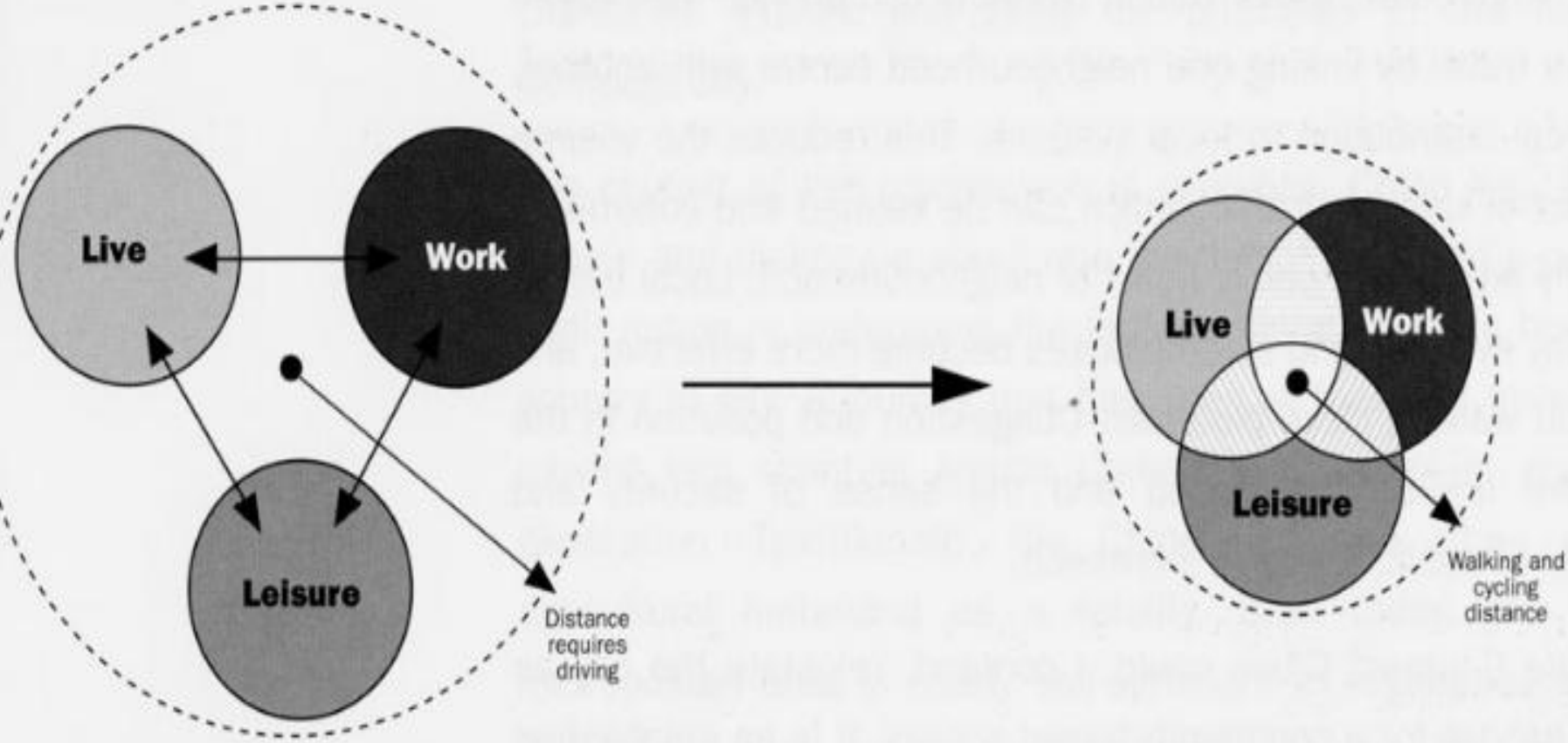


Figure 1: Illustration of the terms density, distance, and diversity as applied in the compact cities model

COMPACT CITY

Compact mixed-use nodes reduce journey requirements and create lively sustainable neighbourhoods



Zoning of activities leads to reliance on the private car.

Compact nodes reduce travel and allow walking and cycling.

Curitiba's BRT corridors run along high-density developed area

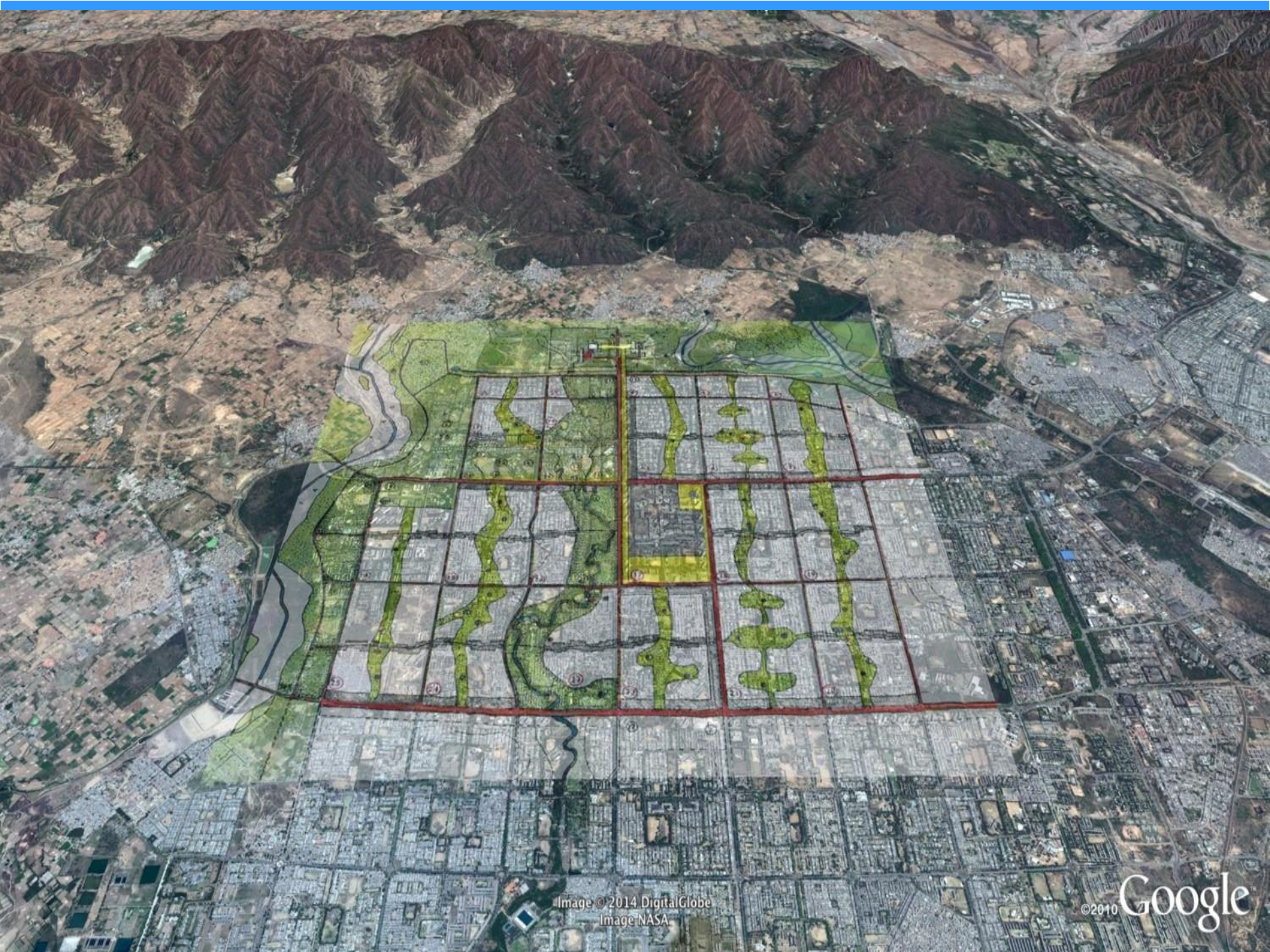


Image © 2014 DigitalGlobe
Image NASA
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CIRCULATION

•An integrated system of seven road types

V1 : fast roads connecting chandigarh to other towns

V2 : arterial roads

V3 :fast vehicular roads

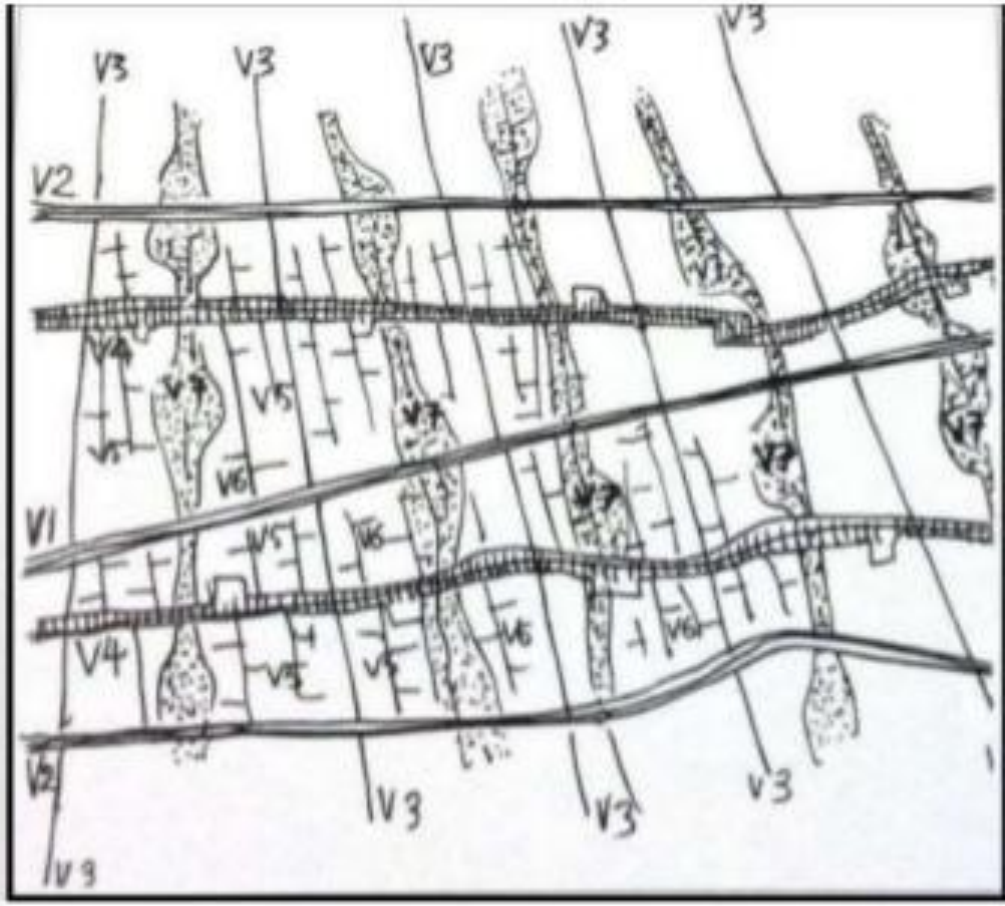
V4 : MEANDERING SHOPPING STREETS

V5 :SECTOR CIRCULATION ROADS

V6 : ACCESS ROADS TO HOUSES

V7 : FOOTPATHS AND CYCLE TRACKS

corbusiers conceptual sketch showing the v-road system



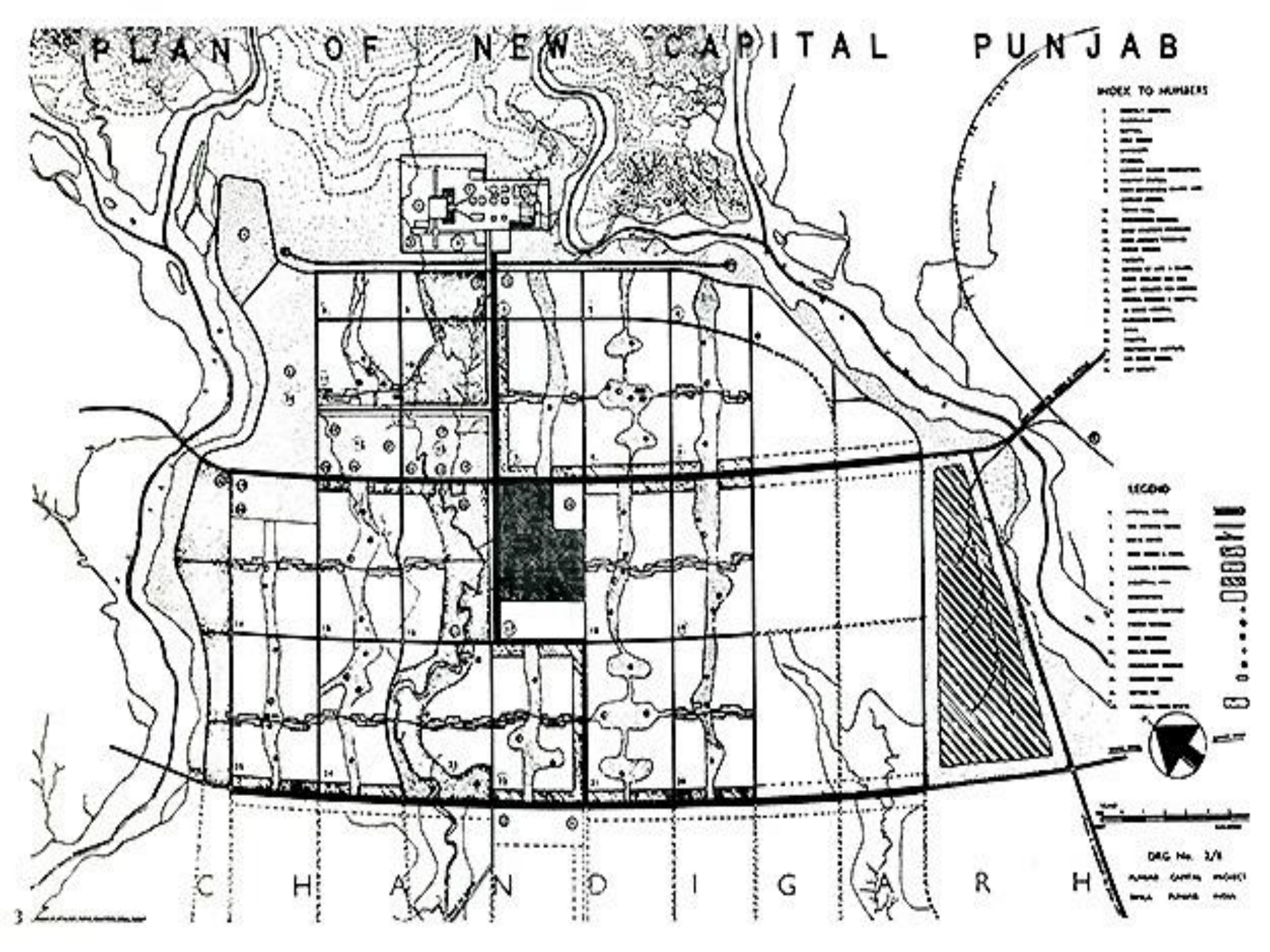
BUSES WILL PLY ONLY ON V1, V2, V3 AND V4 ROADS

•Pathways for cyclists

•Roads intersected at right angles forming a grid

•Hierarchy of movement

•Residential areas segregated from the traffic


PLAN OF NEW CAPITAL PUNJAB
INDEX TO NUMBERS
SECTOR
CHANDIGARH

Layout plan of a Sector

Amazing Future Green Cities of world –Musdar –Abu Dhabi-UAE

- **A city of 50,000population**
- **City of "no cars", no waste**
- Planned to make use of cool sea winds
- Using solar energy on rooftop
- Narrow streets shading houses
- Total recycling of waste/water
- **working/ living area** not farther than200 mts from transportation nodes).
- Electric powered light rail on elevated track to permit easy transport between Musdar and Abu Dhabi.

•for Intra-city travel people use personal rapid transit pods (PRT) run on magnetic tracks using electric power.

•**Aim is to create:**

- Zero Carbon
- Zero Waste
- Zero Car city

..

Sustainable City TIANJIN- Master Plan

1. **Land-use Planning -planned to be compact,** with a **good mix of land uses** and **Transit-Oriented Development (TOD)** principles.

2. Transport Planning -Green transport .--to increase trips via public transport and non-motorised modes of transport --- via bicycles and walking, within Eco-city.

3. **Green and Blue Network Planning---City planned with extensive green (vegetation) and blue (water) networks** to provide quality living /working environment. The green network comprises a green lung at core and eco-corridors emanating from the lung to the other parts of city.
4. Water bodies linked for water circulation to enhance ecology ,provide attractive environment , recreational activities.
5. A wastewater pond rehabilitated /transformed into a clean/beautiful lake.
6. **Master Plan can be summed as**

- Priority for Travel

Green Transportation pyramid

Transport systems are major emitters of greenhouse gases, responsible for 23% of world energy-related GHG emissions in 2004, with about three quarters coming from road vehicles.

Currently 95% of transport energy comes from petroleum. Energy is consumed in the manufacture as well as the use of vehicles, and is embodied in transport infrastructure.

Source: Wikipedia.org

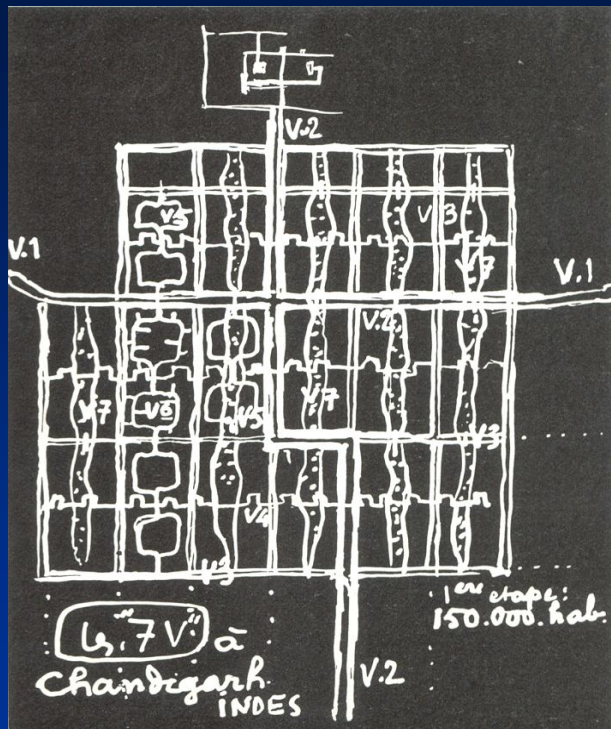
- Go for Cycling

SUSTAINABLE TRANSPORTATION- CYCLING

- Benefits of cycling have long been recognised.
- bicycle is cheap to buy & run
- in urban areas- quickest door-to-door mode
- benign form of transport ;

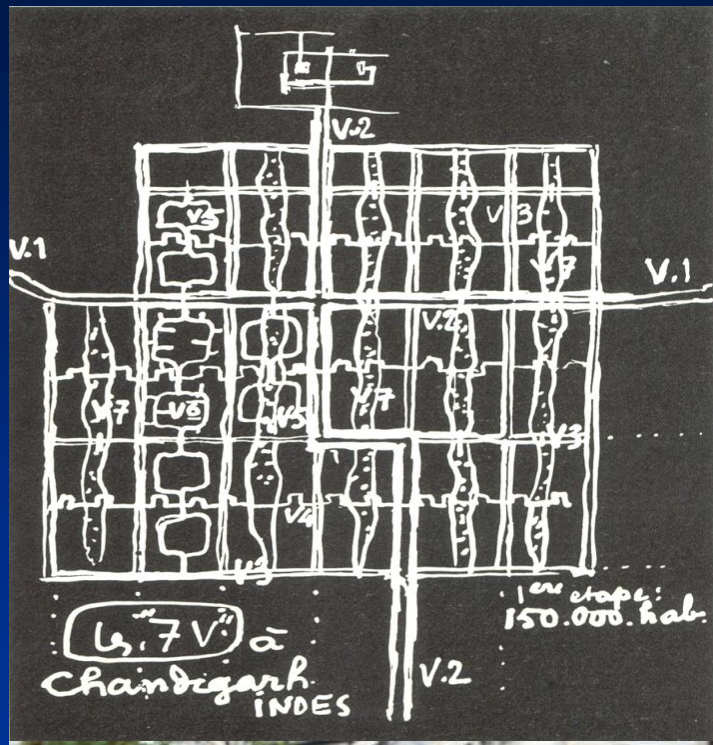
-- noiseless,

- --non-polluting,
- Energy/ space-efficient
- non-threatening to other road users.
- Pro-cycling city promote fitness among cyclists/ health among non-cyclists.
- Cycling providing cheap mobility, for individual /society.



SUSTAINABLE TRANSPORTATION- CYCLING

- **Promoting use of Bicycle as preferred mode of travel for majority of intra- city travel being :**
  - Most inexpensive
  - Most flexible
  - Environmental friendly
  - Minimum air/noise pollution
  - Zero Energy Vehicle
  - Occupying minimum road space
  - Easy Parking /easy maneuverability
  - Reducing congestion
  - Least financial cost to user/society
  - Promoting National Economy
  - Promoting better Human Health
  - Reducing depletion of Non-renewable resources
  - Best option for travelling over short distance.



Bikeway in Lima

- Opt for Public Transport

Public Transport- advantages

- Public transportation -- solution to any city/ nation's:
- economic, energy, and environmental challenges
- Brings better quality of life.
- increasing numbers/ people using public transportation and local communities -- expanding public transit services.
- Every segment of society –
- individuals,
- families,
- communities and
- businesses –
- benefits from public transportation.

National Urban Transport Policy

Public transport scores over other mechanized modes in terms of --space, capacity , cost—pollution; sustainability–

Making public transport - -- best option for urban mobility--State capitals / Metro cities –

- --Start planning for high capacity public transport system
- -- look at proven global technologies

-- prepare comprehensive plans–

-- integrating personal /private modes of travel

-- improve higher ridership

efficient urban transportation networks.

-- **accommodates 20 times passengers** than private cars **on same road space**;

Mass Transport- Energy consumption

In terms of energy consumption-- public transportation better than individual / personal vehicle.

- In England-- As of 2006–2007,
- -- energy cost of London's trains was 15 kWh per 100 p-km, -- 5 times better than a personal car.
- Buses in London-- 32 kWh per 100 p-km, or about 2.5 times of a personal car(75 per 100 p-km)
- in Japan in 1999
- - 68 kWh per 100 p-km for a personal car- 75Kwh UK
- 19 kWh per 100 p-km for a bus,-- 32 Kwh- UK
- --6 kWh per 100 p-km for rail,- 15 Kwh

TRANSPORTATION- SPACE

Equivalent car space (ECS) conversion factors

Created by Kashmira Medhora Dubash, last modified by Chris Kost on Aug 20, 2014

Vehicle	Parking slot dimensions	ECS
Car	5 m x 2 m	1.0
Two wheeler	2 m x 1 m	0.2
Cycle	2 m x 0.5 m	0.1
Autorickshaw	3 m x 1.5-2 m	0.6
Cycle rickshaw	2.5 m x 1 m	0.5
Handcart		
Bus	15m x 2.6 m	3.9
HCV	2.4m x 9m	2.2
LCV	2 m x 5m	1
Mini Bus	2.6m x 8m	1.5

PROMOTING PUBLIC TRANSPORT

ublic transport key to rationalizing urban transportation and making cities Smart -- DELHI, CHICAGO COPENHAGEN (within 400 metres)

Redefining approach to public transportation

Making Public Transport :- more equitable, reliable, affordable, safe, comfortable, sustainable, energy/operationally efficient, cost- effective, eco/ use friendly, large capacity, space efficient

Promoting development along transport network

improving passenger information system

Positioning intelligent transport systems for monitor and control;

affordable ticket pricing; e-ticketing;

using single ticket for all modes of travel

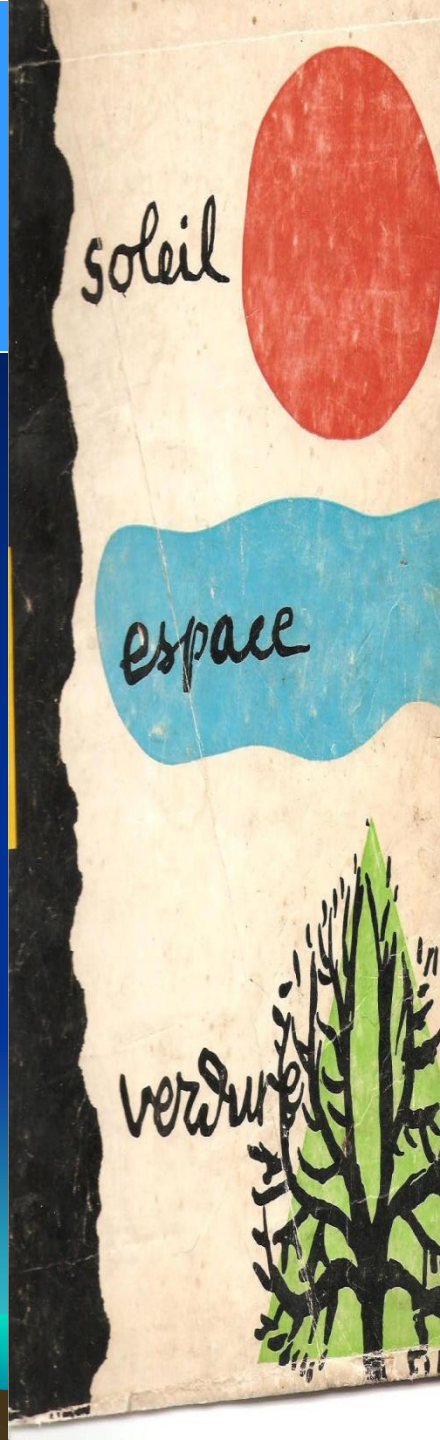
introducing comfortable buses ,

involving Communities,

creating dedicated bus lanes

TRAFFIC-DELHI,AHMEDABAD, ISTANBUL, SINGAPORE

- **City of Singapore** promoted:
- high degree of road efficiency,/ reduced road congestion,--by
- carpooling, Road pricing and public transport
- Generating resources for city infrastructure by *Road Pricing*
- **Delhi, through its *green metro*,** achieved milestone of :
- Transporting 2.8 million people persons
- --on a single day – saving 32 minutes of travel time/person
- Saving annually 10,000 crores in fuel, travel time etc
- --with target of 6 million, when all the four phases operational
- reduced road congestion , air pollution and carbon contents,
- increasing road efficiency ,Making city much cleaner and greener.
- **Ahmadabad's state of art *BRTS*—**
- reinvented and revolutionized the city road traffic
- **Istanbul used** 42 Kms *dedicated road lanes*
- --- for new Bus Rapid Transport System, to promote:
- public transport,
- tackle problem of traffic congestion and air pollution
- most efficient service to 6,20,000 passengers on daily basis.



JANMARG-Ahmedabad

Curitiba’s futuristic ‘tube’ station system for buses--,85% Curitiba uses Bus Rapid Transit -- transporting two million each day-- London subway carries three million-- BRT built in 1974; now 300 cities around world are using


Hotel
2

EQUITABLE ALLOCATION OF ROAD SPACE

SINGAP-ORE MODEL OF ROAD PRICING

Transportation- Options

- Minimize travel- Making cities compact-
- Planning for mixed land-use/ TOD
- Changing people behaviour to Travel
- Changing priority for travel
- Planning for People-- not for vehicles
- Promoting Accessibility-- Not Mobility
- Promoting Cycling
- Promoting Mass Transportation
- Promoting Road Pricing
- Promoting Equitable allocation of road space
- Promoting Electric Vehicles,
- Promote vehicles on Hydrogen fuel

OTHER OPTIONS FOR TRANSPORTATION

- Promoting Intelligent Transportation
- - Promoting Sharing- Bicycle sharing / cars Pooling/car sharing
- Promoting integrated Transit Hubs- for last mile connectivity- Bus system , metro system
- Introducing Geo- spatial enabled efficient transportation system
- Promoting Public transport Surveillance
- Introducing Single fare card system
- Promoting Smart Parking- using sensors, camera,
- - Introducing Smart tolls
- - using Smart Traffic lights
- Promoting Electric Vehicles
- - Using state of art technologies

SMART CITY TECHNOLOGIES

Centralized Control and Management via Web Based Software

- Visual Programming
- 24/7 Location and Speed Information
- Accident Damage Detection
- Route Control

4.5G/3G/GPRS

SERVER

SQL

- Vehicle Tracking and Management
- Reporting

AND SEARCH FOR CREATING SMART/SUSTAINABLE TRANSPORTATION WILL CONTINUE TO POSE GREATEST CHALLENGE TO PROFESSIONALS