SESSION 4:
ENVIRONMENTAL CONCERNS RELATED TO URBAN MOBILITY

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Environmental concerns related with urban mobility

Major environmental problems?

- Climate changes
- Air pollution
- Toxic wastes
- Ozone layer hole
- Habitat destruction
- Water ecosystems collapse

2015 - hottest year ever recorded

Tuvalu – threatened by rising sea levels
Major environmental problems?

- Climate changes
- Fossil fuel combustion
- Air pollution
- Auto-centered mobility
- Toxic wastes
- Refineries
- Ozone layer hole
- Cooling agents
- Habitat destruction
- Oil extraction/Infrastructure
- Water ecosystems collapse
- Maritime transportation

How might we re-frame these problems according to the threats rather than symptoms?
Other transport-related environmental problems

- Noise / vibrations
- Waste from scrapped vehicles & vehicle parts
- Public / natural space occupation
- Barrier effect
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- Natural need for mobility
  - Human Activity
  - Land Occupation
  - Pollution

- Human being
  - Natural Resources
  - Transport System
  - Walking or Vehicles

- Infrastructure
  - Energy

- "Orgware"
  - Software
  - Hardware

- Environment concerns related with urban mobility
Environmental concerns related with urban mobility

- Natural Resources
- Transport System
- Human being

**MORE MOBILITY**

- Human Activity
- Infrastructure
- Vehicles

**MORE CAPACITY**

- “Orgware”
- Software
- Hardware

Unbalance
Environmental concerns related with urban mobility

United Nations definition of Sustainable Development

• Brundtland report (1987):
  “Our common future”

  “Sustainable development is
development that meets the needs
of the present without
compromising the ability of future
generations to meet their own
needs”
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Scheme of sustainable development at the confluence of three constituent parts

- Economic Development
  - Sustain economic growth
  - Maximize profit
  - Expand markets
  - Externalize costs

- Ecologic Development
  - Not exceeding ecosystem’s carrying capacity
  - Ensure resources conservation
  - Reduce and recycle waste

- Social and communitarian Development
  - Increase equity
  - Ensure participation and democratic control
  - Satisfy basic human needs
  - Increase self-confidence of local communities

- Sustainable
  - Equitable
  - Viable
  - Bearable

- Communitarian economic development
- Conservationism

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Definition of Sustainable Mobility by WBCSD

“the ability to meet the needs of society to
move freely, gain access, communicate, trade, and
establish relationships
without sacrificing other essential
human or ecological values
today or in the future”

Definition of Sustainable mobility by OECD/EIA

- **Mobility dimension**
  - The provision of adequate, affordable transport options to satisfy society’s needs for access and mobility and to move goods, also as a means to ensure economic development at reasonable and affordable costs

- **Social dimension**
  - The provision of adequate transport services for all members of society in a manner that does not damage the “social fabric” including safety, health, congestion and equal access to services for different groups of the population
  - By “social fabric” we mean the social buildup of some zone/city/region/country in terms of its class and ethnic composition, employment, education, and values.

- **Environmental dimension**
  - The provision of transport services in a manner that does not degrade the environment or hinder people’s ability to obtain other needed resources or carry out other needed functions with those resources. A key aspect is the reduction of greenhouse gas emissions
Buchanan’s report “Traffic in Towns” (1963)

- The conflict between pedestrians and motor traffic had reached critical dimensions, both in its spatial extent and severity of the incidents and accidents.
- Pedestrians were "naturally" segregated and creating conditions for better road motorized circulation was perceived as a sign of progress.
- In 1960, Colin D. Buchanan was commissioned by the Transport Minister of the United Kingdom to study the development of urban motor traffic and its effect on urban areas.
- Buchanan’s report “Traffic in Towns” (1963) advocated the need to limit access to certain urban areas, to charge parking fees and to finance public transportation.
- It also suggested the existence of a "threshold capacity" for traffic (2000-3000 v / h) above which the urban environment became degraded and decadent, especially with the emergence of urban barriers.
- During the 70s, and contrary to what Buchanan advocated, consistently solutions pointed towards the construction of new infrastructure - high capacity road networks, bridges, highways or parking stations.
Time Budget
what’s left over 24 hours a day?
Basis of Personal Mobility

- Every individual has its own daily activities to meet his personal needs and requirements
  - This is his framework for mobility planning and decision-making
    - It is not very conscious
    - It usually stabilizes at some point until the next event that might impact his daily organization and (possibly) leads to a new stabilized plan
  - Knowing lifestyles from individuals becomes fundamental in order to characterize their daily mobility

- Factors influencing daily mobility planning
  - Perceived wishes and needs
  - Group of activities required to satisfy those wishes and needs
  - Infrastructures, equipment and services of the transport system
  - Restrictions to mobility
  - Inter-personal relationships that affect individuals
  - Available time intervals during a regular day (e.g., non-working hours)
Basis of Personal Mobility

- ~10 hours => Basic physical needs (sleeping, eating, hygiene)
- 8 hours => Work, school, university (for the active and students population)
- ~4 hours => Diversified set of activities:
  - Child care and/or home care
  - Shopping
  - Leisure
  - Resting
  - Other
- There is very short period of time available for mobility (less than ~2 hours).
- People try to minimize time spent traveling (unless during leisure), otherwise they will have to re-distribute their time budget differently and avoid doing other non-obligatory activities.
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Average per-capita travel time budget

(from African villages, 44 city and 20 national surveys)

(Source: Schafer and Victor, 2000)
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Average per-capita travel money budget
(proportion of income dedicated to travel)

<table>
<thead>
<tr>
<th>Travel Money Budget, %</th>
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<tbody>
<tr>
<td>50</td>
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<tr>
<td>45</td>
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<td>10</td>
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<tr>
<td>5</td>
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<td>0</td>
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</tbody>
</table>

Households without a personal car devote only 3±5% of income to traveling

Effect of increasing motorization (stabilization at 550veh/1000inhab)

Japan stabilized at 7%, reflecting the unusual large share of PT.

In mobility there are long term and short term decisions

- Short term decisions include daily activities that can be easily accommodated in day-to-day stabilized trip scheduling (e.g., new sports activity, going to cinema, etc.)

- Long term decisions (those that are structural decisions for the household) include:
  - Home location
  - Employment (school) location
  - Car ownership
  - Transit pass ownership (not so long)

- Not all long term decisions have the same time horizons

- Long term decisions usually have some inertia and are more or less difficult to reverse

- Long term decisions influence travel behavior by restricting the set of options
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Urban Sprawl
major argument to understand the relationship
between transport and land uses
Urban Sprawl: major argument to understand the relationship between transport and land uses

- **Definition**
  - Expansion to the exterior
  - Urbanized areas tend to occupy zones previously used for agriculture
  - The city expands itself in an amorphous way

- **Common and direct consequences**
  - Density decline - inhabitants, jobs and activities
  - Land use segregation – residential areas segregated from other land uses – suburbanization
  - Transport networks that allow high mobility levels making accessibility a harder task
Motives for Urban Sprawl

- Public policies aimed at:
  - Reducing pressure over the city centers
  - Promoting of housing ownership - subsidizing mortgages, mainly through fiscal policies
- Changes in space perception, in place perception and proximity
- Changes in consumption patterns
  - Commoditization of residential environments
  - The American model of detached houses and suburbs as a desirable lifestyle
  - The idea of proximity with nature
- Existence of cheap land in outer zones combined with real estate promoter (housing mass production)
- Increase in income, cheap energy and easier access to motorization
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Interaction between Income, Urban Sprawl, Motorization Levels

Source: Adaptation from the London Research Centre
The paradigm of sustainable mobility

- Technology oriented
  - Technological Innovation – Efficiency Increase
    - More efficient powertrains (electric-drive), new fuels, eco-driving, load factors
    - Absorption of residuals (e.g., catalyzers, noise barriers)
  - Reducing the need to travel – substitution
    - Trip no longer made - Replaced by non travel activity or substituted through technology

- TDM oriented
  - Transport Policy Measures – modal shift
    - Promotion of walk and cycle, Slowing down of urban traffic, Demand management, Investment in public transport, Flexible use of streets
  - Land Use Policy Measures – distance reduction
    - Build sustainable mobility into patterns of urban form and layout
    - Increase densities and concentration – mixed use developments, housing location
    - Public transport oriented developments (TOD)
    - Thresholds for availability of services and facilities

Source: Banister, D., 2008
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Acessibility vs. Mobility by mode

<table>
<thead>
<tr>
<th>Max. Distance (in km up to 35min)</th>
<th>20</th>
<th>8</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist. Between stops (m)</td>
<td>350</td>
<td>600</td>
<td>2000-5000</td>
</tr>
<tr>
<td>Capacity (places/vehicle)</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>4-5</td>
<td>15</td>
<td>25-30</td>
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<tr>
<td></td>
<td>75-80</td>
<td></td>
<td>180 x 3 comp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180 x 5 comp</td>
</tr>
</tbody>
</table>
Travel time per mode according to trip length (in urban environment)

Why walking?

a. “Walking is the first thing an infant wants to do and the last thing an old person wants to give up.

b. Walking is the exercise that does not need a gym. It is the prescription without medicine, the weight control without diet, and the cosmetic that can’t be found in a chemist.

c. It is the tranquilizer without a pill, the therapy without a psychoanalyst, and the holiday that does not cost a penny.

d. What’s more, it does not pollute, consumes few natural resources and is highly efficient.

e. Walking is convenient, it needs no special equipment, is self-regulating and inherently safe.

f. Walking is as natural as breathing.“

John Butcher, Founder Walk21, 1999 (In International charter for walking)
Walking and the environment (I)

Conceptual relations of factors influencing walking

Source: adapted by Paulo Cambra from Handy (2005) and Schmid (2006)
Walking and the environment (II)

**Conceptual framework of the role of perceptions in mediation of physical features of the environment and walking**

Source: Ewing and Handy (2009)
Walkability

“the extent to which characteristics of the built environment and land use may or may not be conductive to residents in the area walking for either leisure, exercise or recreation, to access services, or to travel to work” (Leslie et al. 2007)

or in simpler terms

“the extent to which the built environment is walking friendly” (Abley and Turner 2011)
Pedestrian concerns and needs: the 7 C’s

- **Connected**: The extent to which the pedestrian network links to key trip origins and destinations, as well as the extent of linkages between different routes on the network;

- **Convivial**: The extent to which walking is a pleasant activity, in terms of interaction with people, the built and natural environment, and other road users;

- **Conspicuous**: The extent to which walking routes and public spaces feel safe and inviting for pedestrians, in terms of clear and legible signing and information;

- **Comfortable**: The extent to which walking is accommodated to competences and abilities of all types of pedestrians;

- **Convenient**: The extent to which walking is possible and able to compete with other modes of transport in terms of efficiency (time, money and space).

- **Coexistence**: The extent to which the pedestrian and other transport modes can exist at the same time and place with order and harmoniously.

- **Commitment**: The extent to which there exists engagement, liability and responsibility towards the pedestrian environment, by public authorities.

Source: Paulo Cambra (2012)
The importance of reducing speed

http://www.velocidade.prp.pt/

Source: TRANSITEC.
Urban car driving... (I)

- Angle of vision increases when speed decreases

30 km/h

50 km/h

Circulation space is proportional to speed increase

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- Braking distance increases with speed

30 km/h

- Tempo de reação: 8 m
- Travagem: 5 m
- Total: 13 metros

50 km/h

- Tempo de reação: 14 m
- Travagem: 14 m
- Total: 28 m

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Probability of pedestrian death (%)

- Main argument for 30km/h zones!


Urban car driving... (II)
“Livable Streets”
by Donald Appleyard (1981)

For more information see http://player.vimeo.com/video/16399180
Traffic calming consists of engineering and other measures put in place on roads for the intention of slowing down or reducing motor-vehicle traffic. This is done in order to improve the living conditions for residents living along the road[ dubious – discuss] as well as to improve safety for pedestrians and cyclists.
Traffic speeds of 30 km/h (20 mph) and lower are said to be more desirable on urban roads with mixed traffic.

The Austrian city of Graz, which has achieved steady growth in cycling, has applied 30 km/h limits to 75% of its streets since 1994.

Zones where speeds are set at 30 kph (or 20 mph) are gaining popularity as they are found to be effective at reducing crashes and increasing community cohesion (consistent with the theory of Appleyard).
Share of Cycling over the Total Amount of Trips, mid 1990s

Source: Worldwatch Institute.
Facts about bicycles in urban mobility

Benefits of a Bicycle

- Puts a big fat smile on your face
- Shapes up that goodie
- Zero emissions
- Slows global warming
- Whizzes past traffic jams
- Gives you legs of steel
- No need to pay for gas, parking fees, or auto insurance...hurray!
- It feels like flying
- It carries your goodies home
- Faster and easier than walking
- It's as quiet as a mouse
- The Earth sends a lil extra love to those on bicycles (this is scientifically documented)

www.CICLE.org
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- Roads not very bike-friendly
- More sensitive to bad pavements
- In many cities infrastructure is missing
- Car drivers
  - Might not be used to share space on the street
  - Fear, aggressivity, bad behaviour
- Elevation difference...

Type of cycling infrastructure

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Solving the stairs way problem
Changing the image of cycling

- Good marketing promotion
  - Attractive and positive image of the bicycle-user

- Requirements
  - User point of view
    - Good shift & gear system
    - Light and resistant material
    - Safe and handy place to park
  - System point of view
    - Parking places
    - Coordination with PT for intermodality

Minister of Justice, visiting the Queen, Netherlands
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Environmental concerns related with urban mobility

Responsible: Prof. Rosário Macário
Slides prepared by: Prof. Filipe Moura

END

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2014/2015