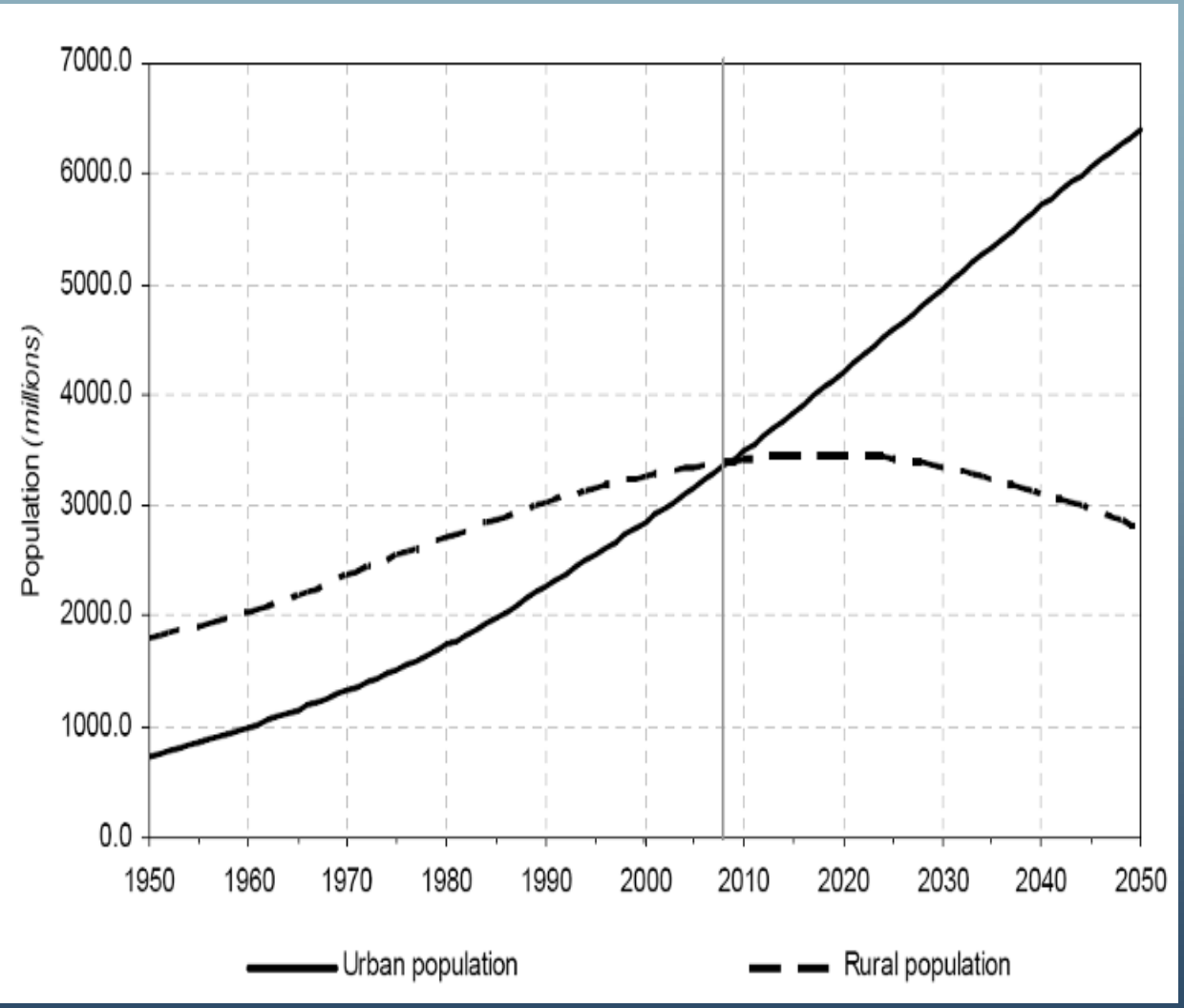
IAAS-PIK
Global Sustainability
Potsdam 9 July 2013

"Climate change, energy shortage and population growth: Challenges to sustainable planning"

Pierre LACONTE

An urban world



World

2008	2050
50 %	70 %

Europe

2008	2050
75 %	*82 %*

Source: United Nations Department of Economic and Social Affairs/Population Division 5. World Urbanization Prospects The 2007 Revision.

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Megacities - Whatever the precise definition, megacities are the future

60 million additional urban inhabitants per year

- From currently **25** megacities to more than **100** within the next **30 years**
- **In next 20 years:**

China: 30 new cities with >1 million inhabitants

Indian: 26 new cities with >1 million inhabitants

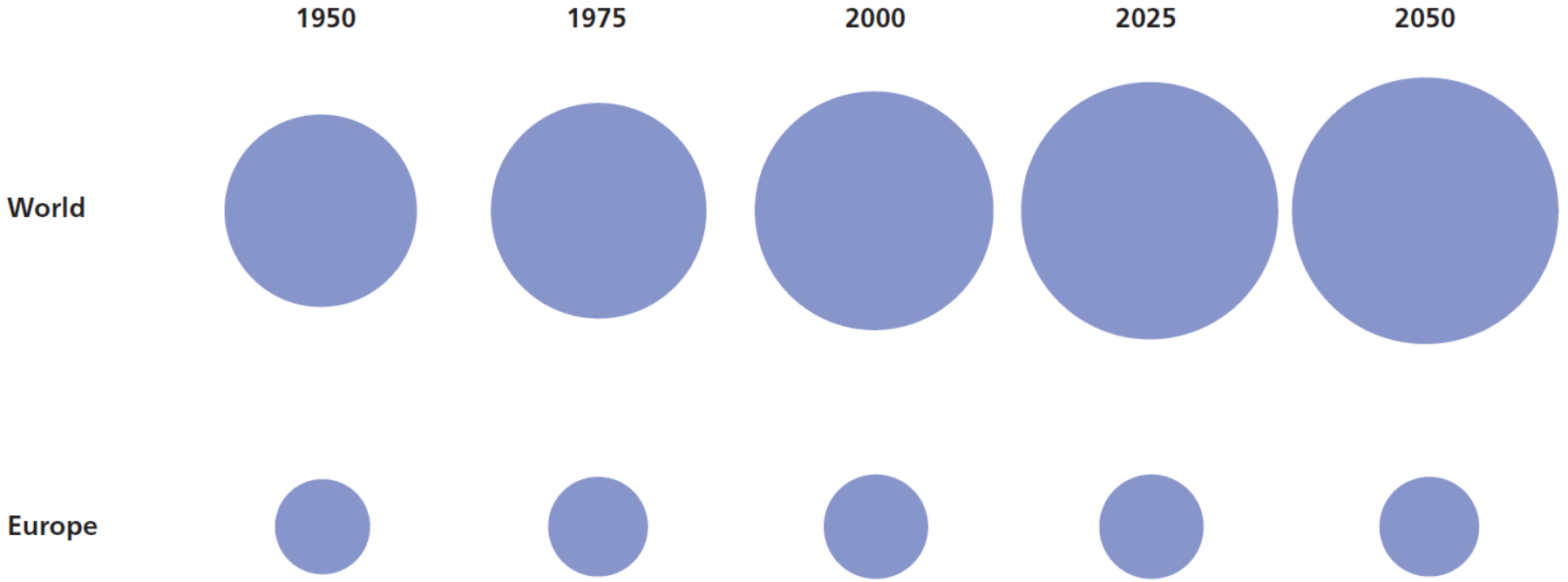
Increasing income discrepancy: a planet of slums?

Many mega cities in the world are located by the coast: *Tokyo, Mumbai, Sáo Paulo, New York City, Shanghai, Lagos, Los Angeles, Calcutta, India, Buenos Aires, etc.*

(source UN - 2011)

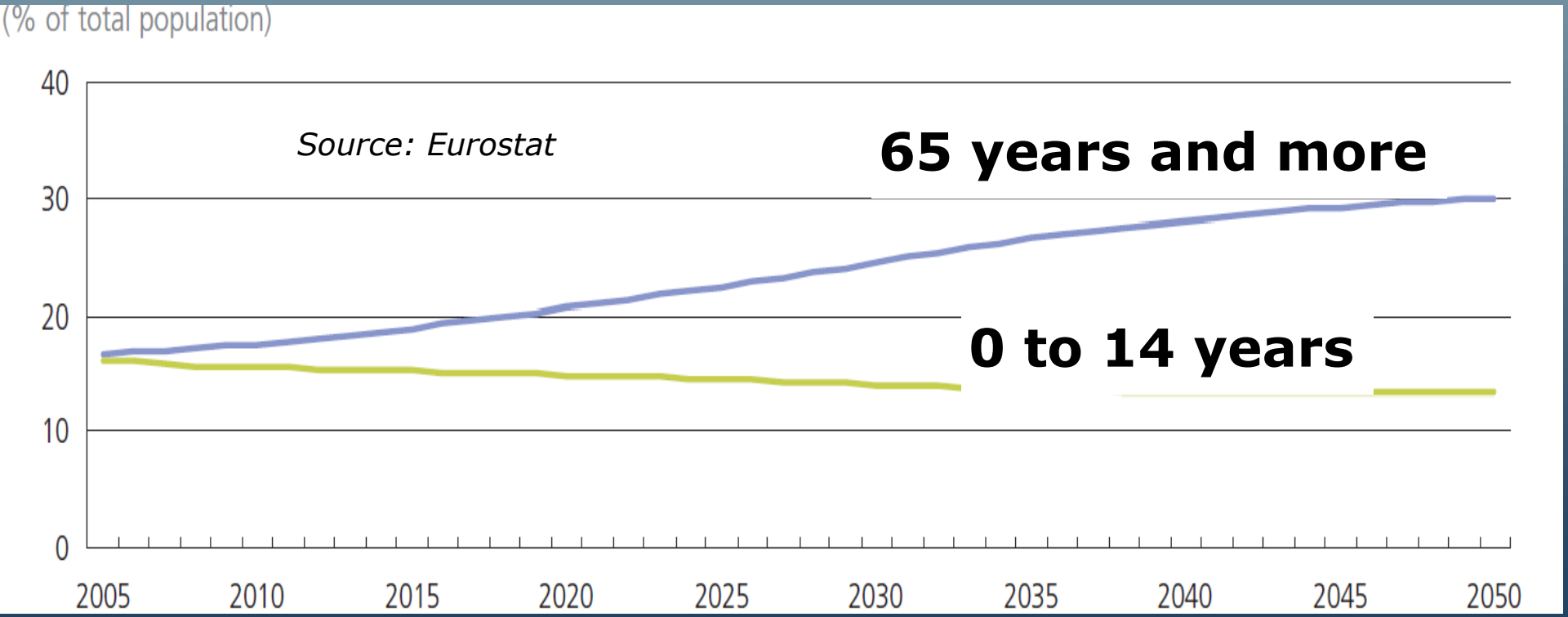
But fall in EU population by 2050
down to 5% of the world population

and shrinking industrial cities



An ageing society (two persons of working age for each person aged 65 or more)

Population projections, EU-27



Gloablisation: planetary overconsumption

1956: first containership

2013: close to 20 trillion $ trade (source The Economist 18/05/2013)

Climate change

- World greenhouse gas emission cuts are not enough to stop average global temperatures rising by more than 2°C
- The decade 2000–2009 was the warmest on record; the temperature in Europe has risen more than the global average
- Reluctance of decision makers to invest in adaptation

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Urban metabolism

Cities as living organisms

Environment

Energy and matter

Urban **system**

waste and emisssions

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Input

Society / Economy

Output

Local extraction, production and space
• minerals, biomass, water, space, etc.

Imports
raw materials, fossil fuels, products, etc.

Indirect flows associated with imports

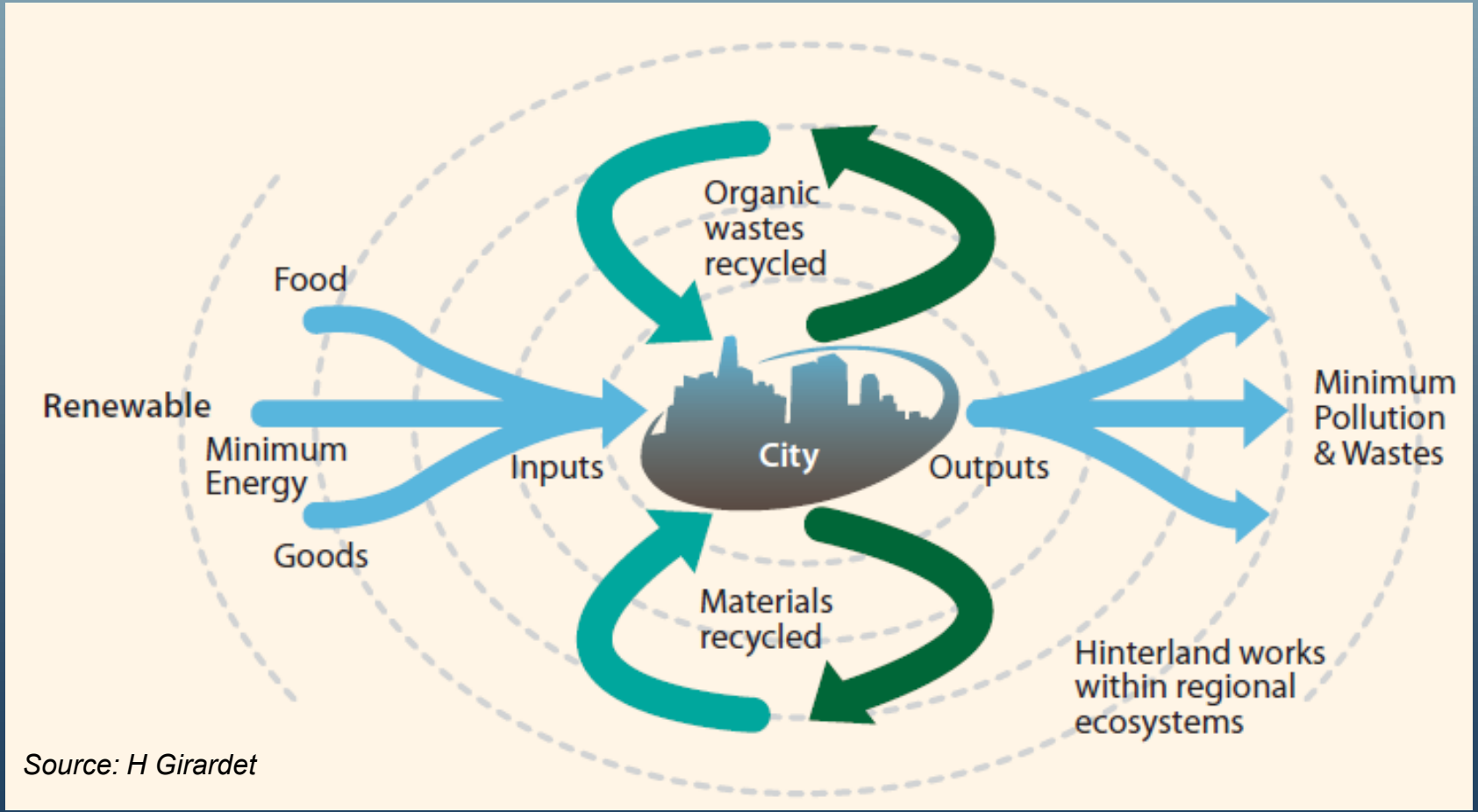
To nature:
• Emissions to air
• Emissions to water,
• waste landfilled
• dissipation flows

Exports
waste, emissions, etc.

Indirect flows associated with exports

The metabolism of cities: from linear to circular

- **The open-loop approach is unsustainable in an urbanising and limited world**
  - Linear metabolism = cities consume resources and create waste and pollution at high rate
  - Circular metabolism = cities reduce consumption and pollution, recycle and maximise renewables



Source: H Girardet

Kalundborg Eco-industrial Park

- At the center of the exchange network is the Asnæs Power Station, a 1500MW coal-fired power plant, which has material and energy links with the community and several other companies.
- Surplus heat from this power plant is used to heat 3500 local homes in addition to a nearby fish farm, whose sludge is then sold as a fertilizer.
- Steam from the power plant is sold to Novo Nordisk, a pharmaceutical and enzyme manufacturer, in addition to Statoil power plant.
- This reuse of heat reduces the amount thermal pollution discharged to a nearby fjord.
- Additionally, a by-product from the power plant's sulphur dioxide scrubber contains gypsum, which is sold to a wallboard manufacturer.
- Almost all of the manufacturer's gypsum needs are met this way, which reduces the amount of open-pit mining needed.
- Furthermore, fly ash and clinker from the power plant is used for road building and cement production.

Waste as a valuable resource

- It is possible to reduce waste by
  - reducing the quantity of waste produced
  - and recycling instead of burning.

  Price incentives are needed

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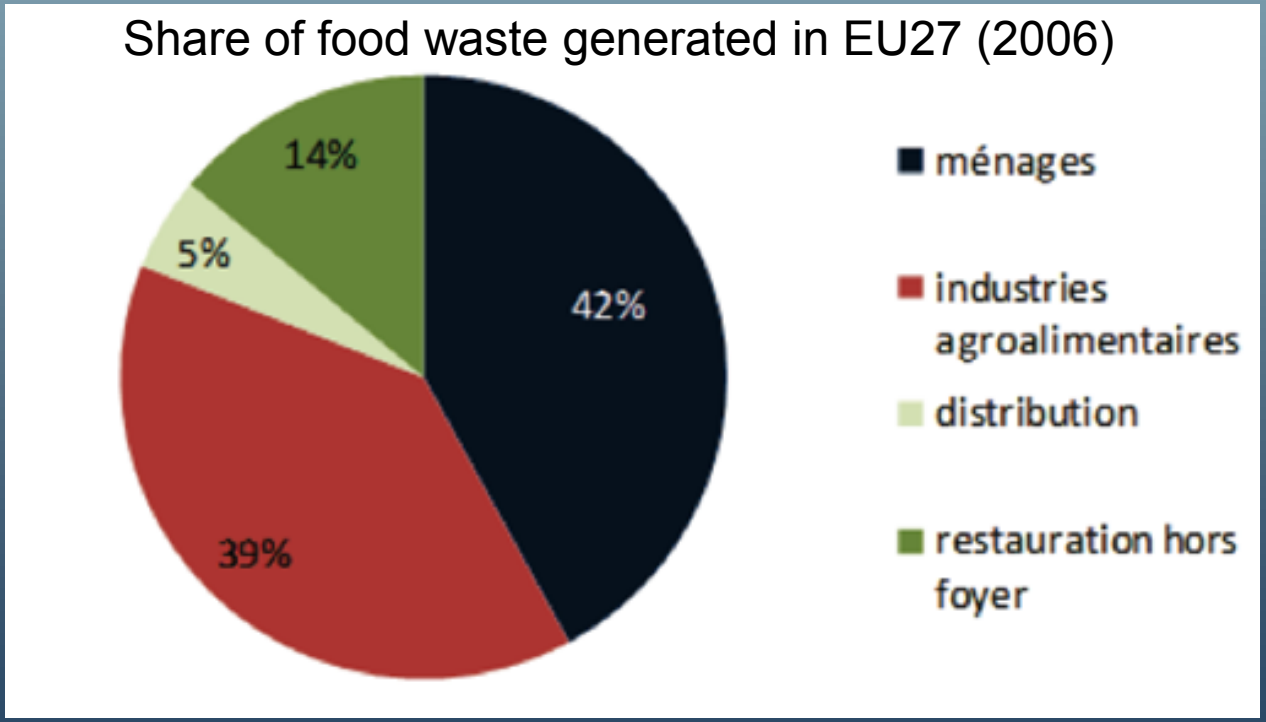
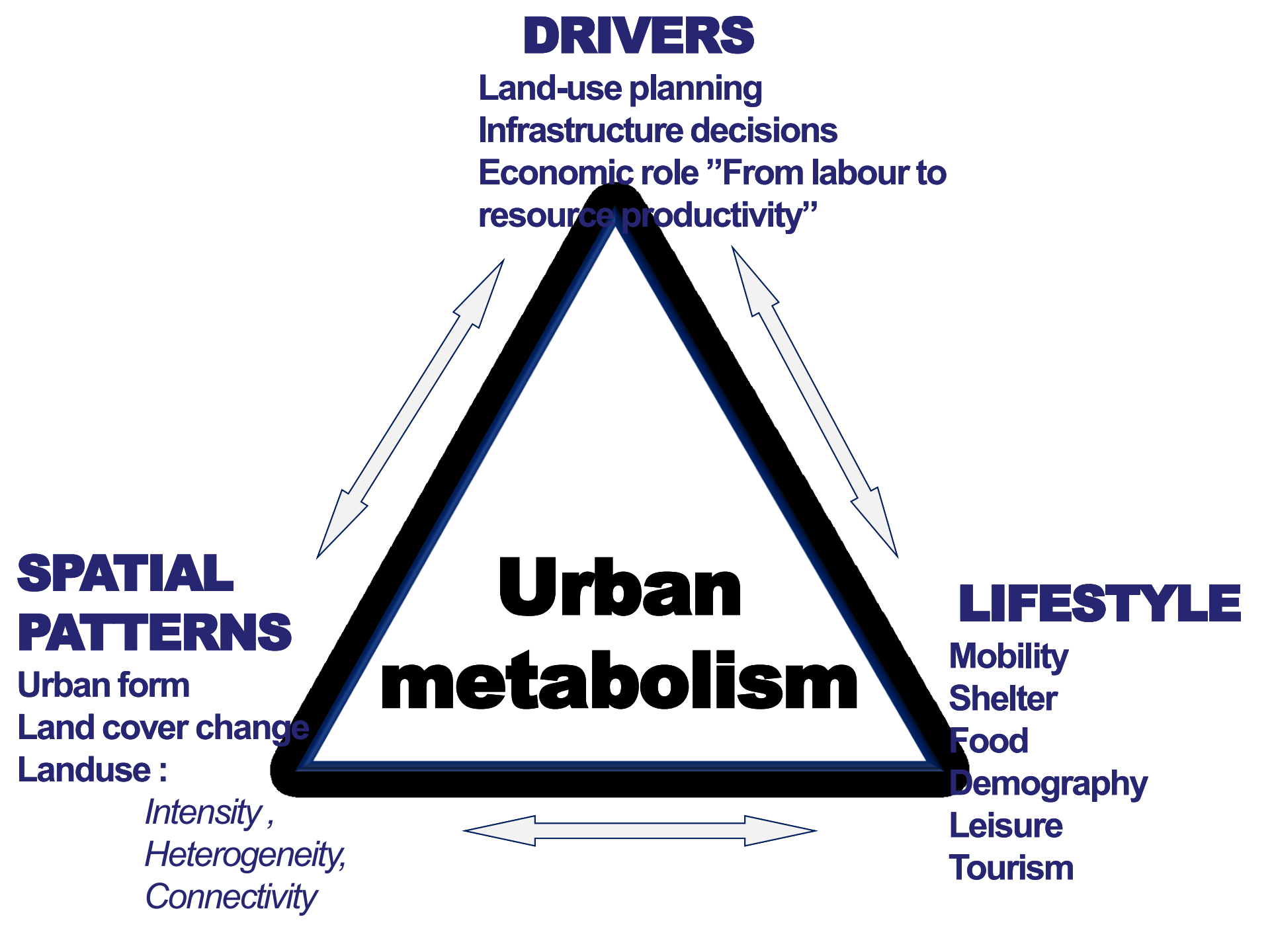
Waste of food

- 181 kg of food waste/inhabitant/year (3x more than needed) (Eurostat - 2006)
- For ensuring world food safety in 2050, the FAO considers the agriculture production needs to increase in 70% *(jelle Bruinsma, 2009)*



Source: Eurostat - Bio Intelligence Service 2010


DRIVERS
Land-use planning
Infrastructure decisions
Economic role ”From labour to resource productivity”
SPATIAL PATTERNS
Urban form
Land cover change
Landuse :
Intensity ,
Heterogeneity,
Connectivity
Urban metabolism
LIFESTYLE
Mobility
Shelter
Food
Demography
Leisure
Tourism

Households that cause low environmental pressures tend

(A larger-scale Swiss study - Girod and de Haan, 2009).

- to live in **urban areas**
- to use **public transport** rather than private cars
- to use **renewable energy for heating**
- to live in **apartments** rather than single family houses
- to **eat less m**eat and more organic food

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Rebound effects

Technological gains are often outweighed by consumption growth

- **Direct rebound-effect**: an increase in efficiency lowers the cost of consumption which can then lead to a rise of the consumption of the same product – loose cargo to containers packed/sealed at the production place
- **Indirect rebound effect**: reduction in the costs of consumption increases the real income of households which can trigger a rise in the consumption of other goods and services – decoupling income from energy use

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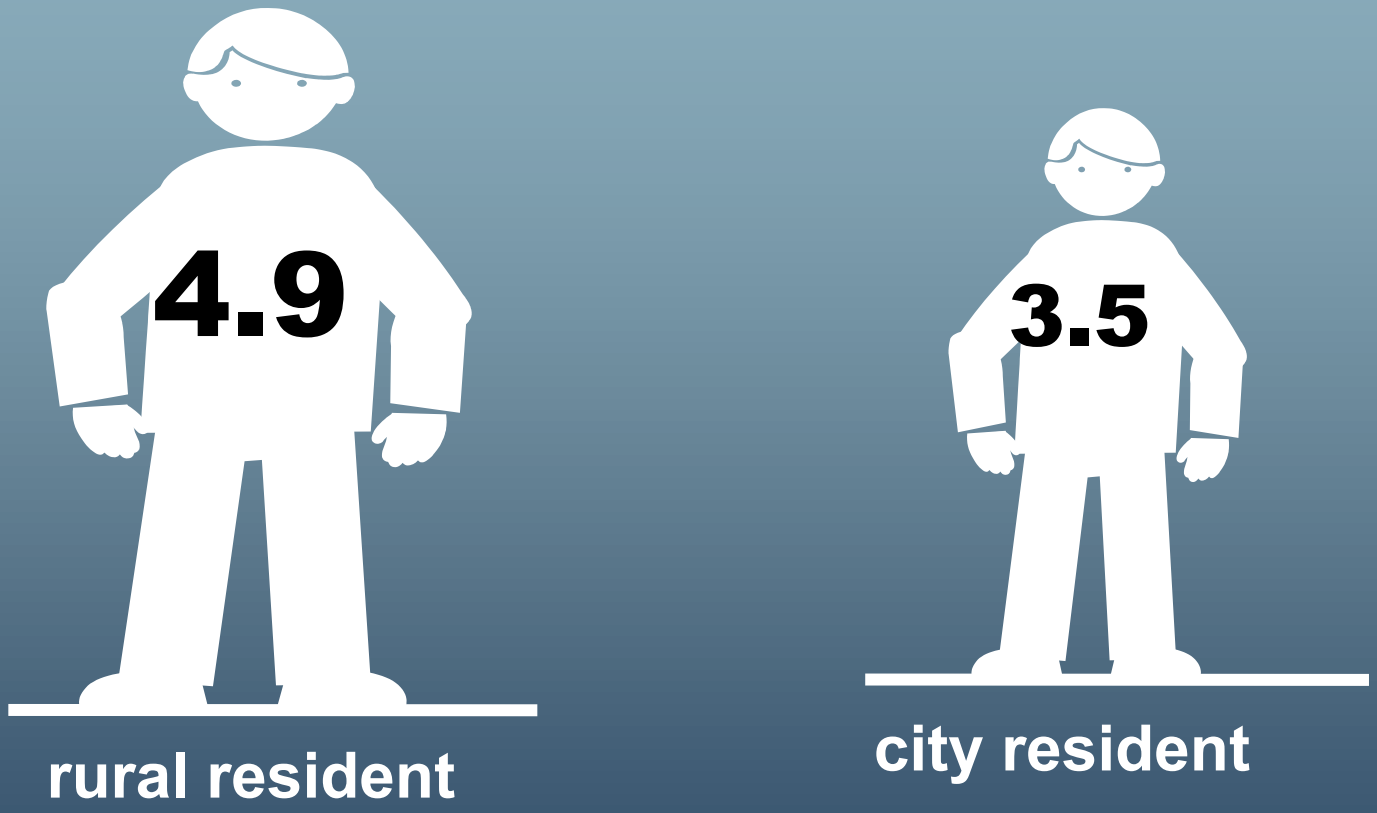
Cities are more efficient



Tonnes of oil equivalent / year in Europe

Source: IEA, 2008

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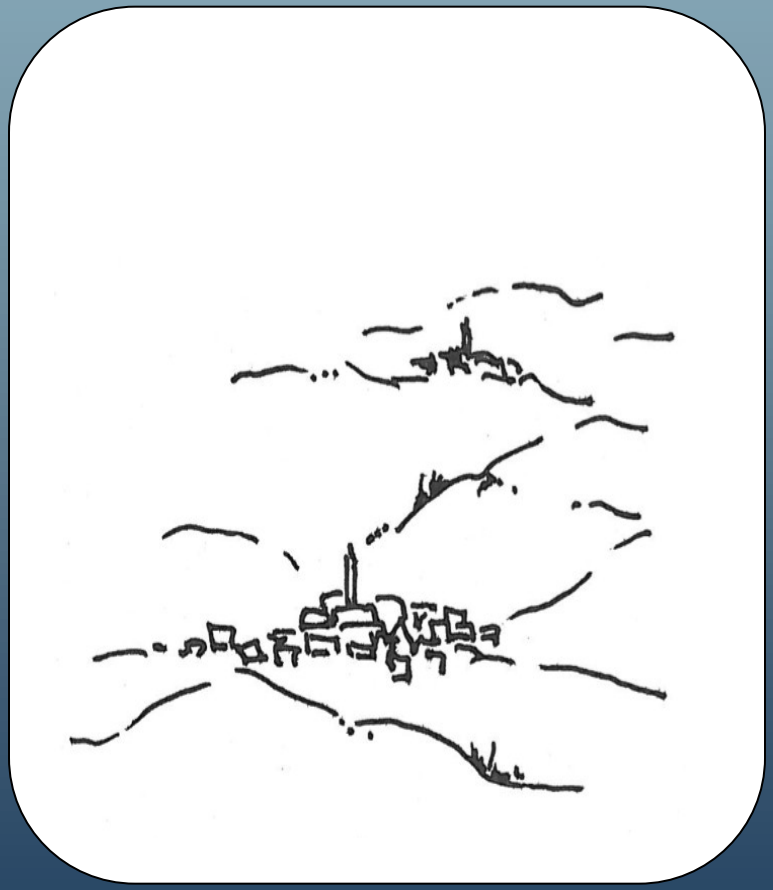
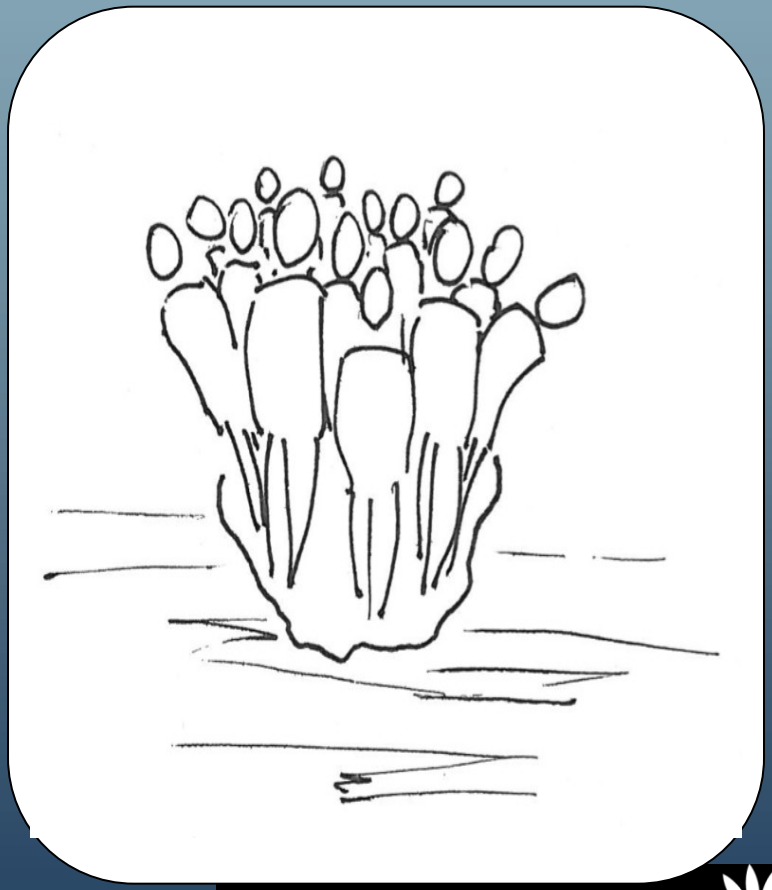
Cities in Europe ...

4% area



75% people



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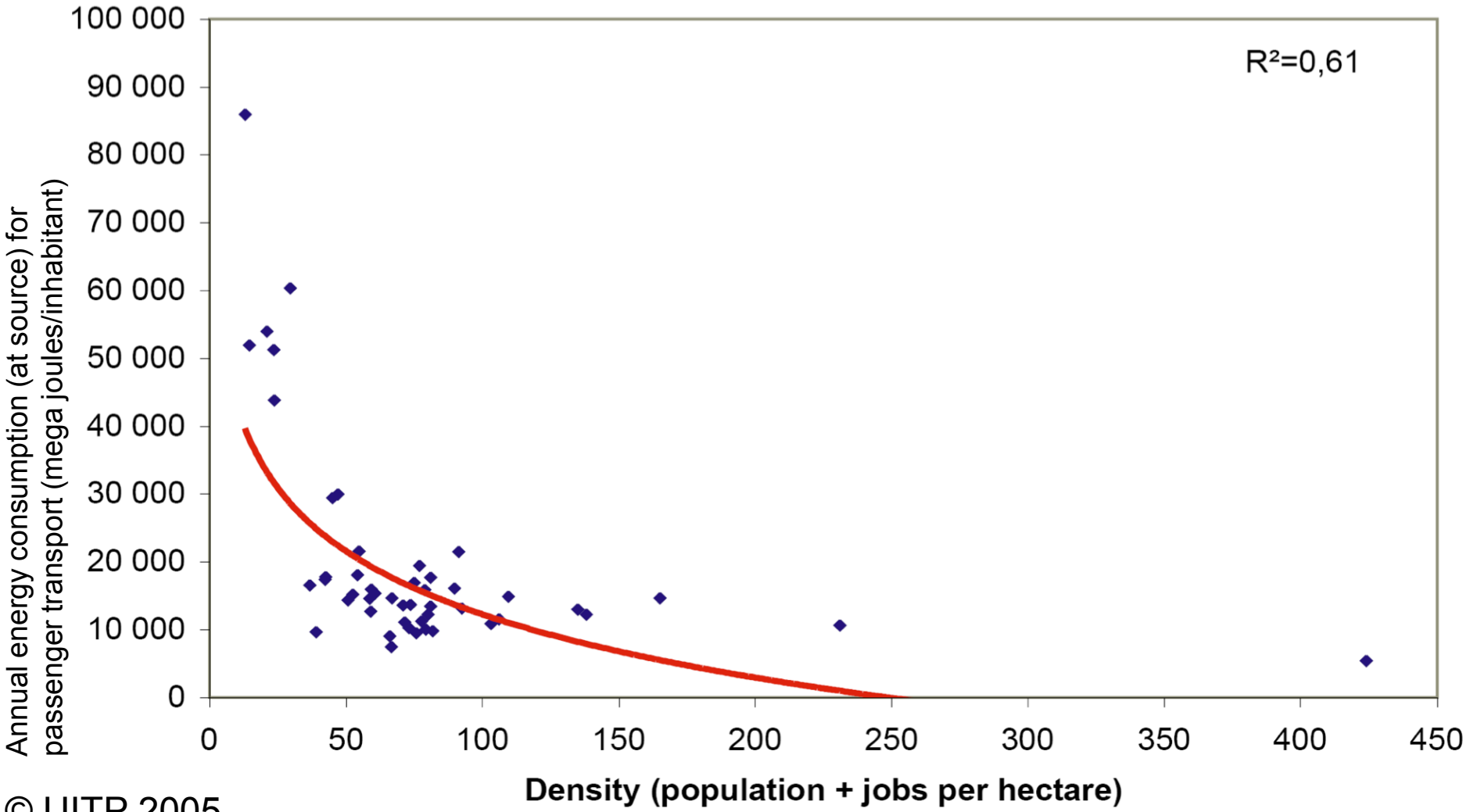
Energy consumption

Passenger transport versus density



Cars in cities generate

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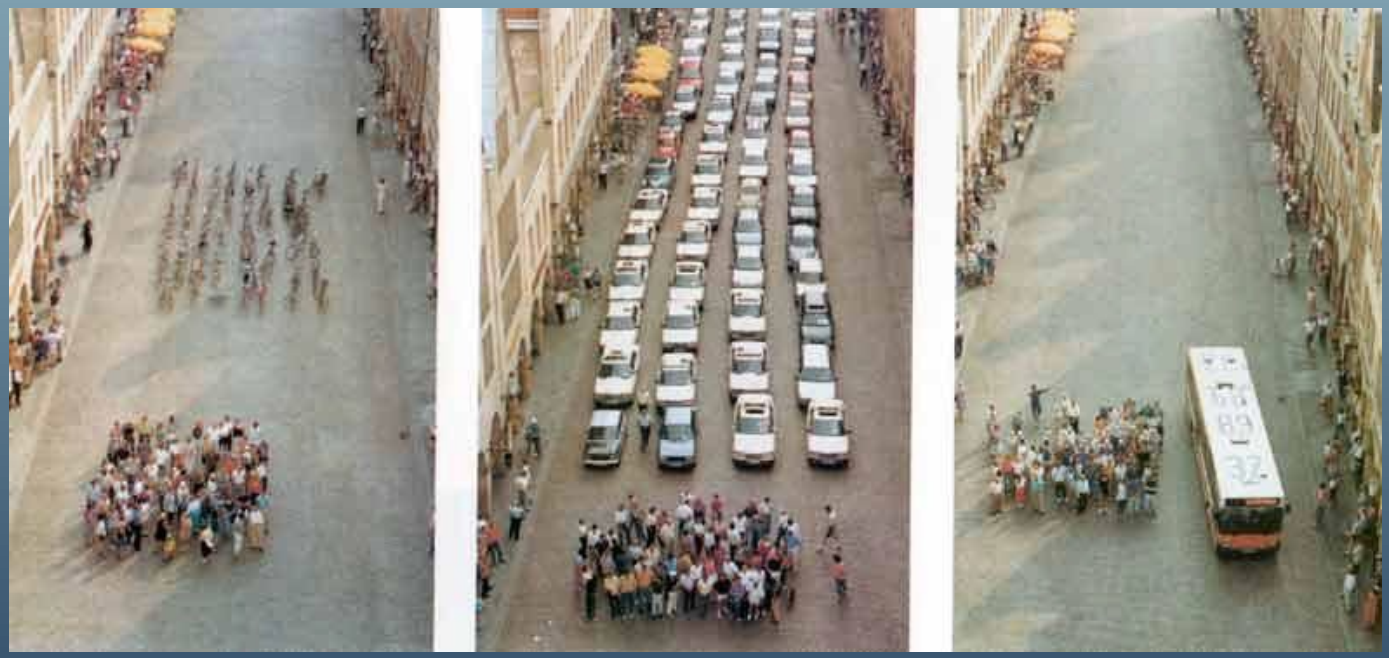
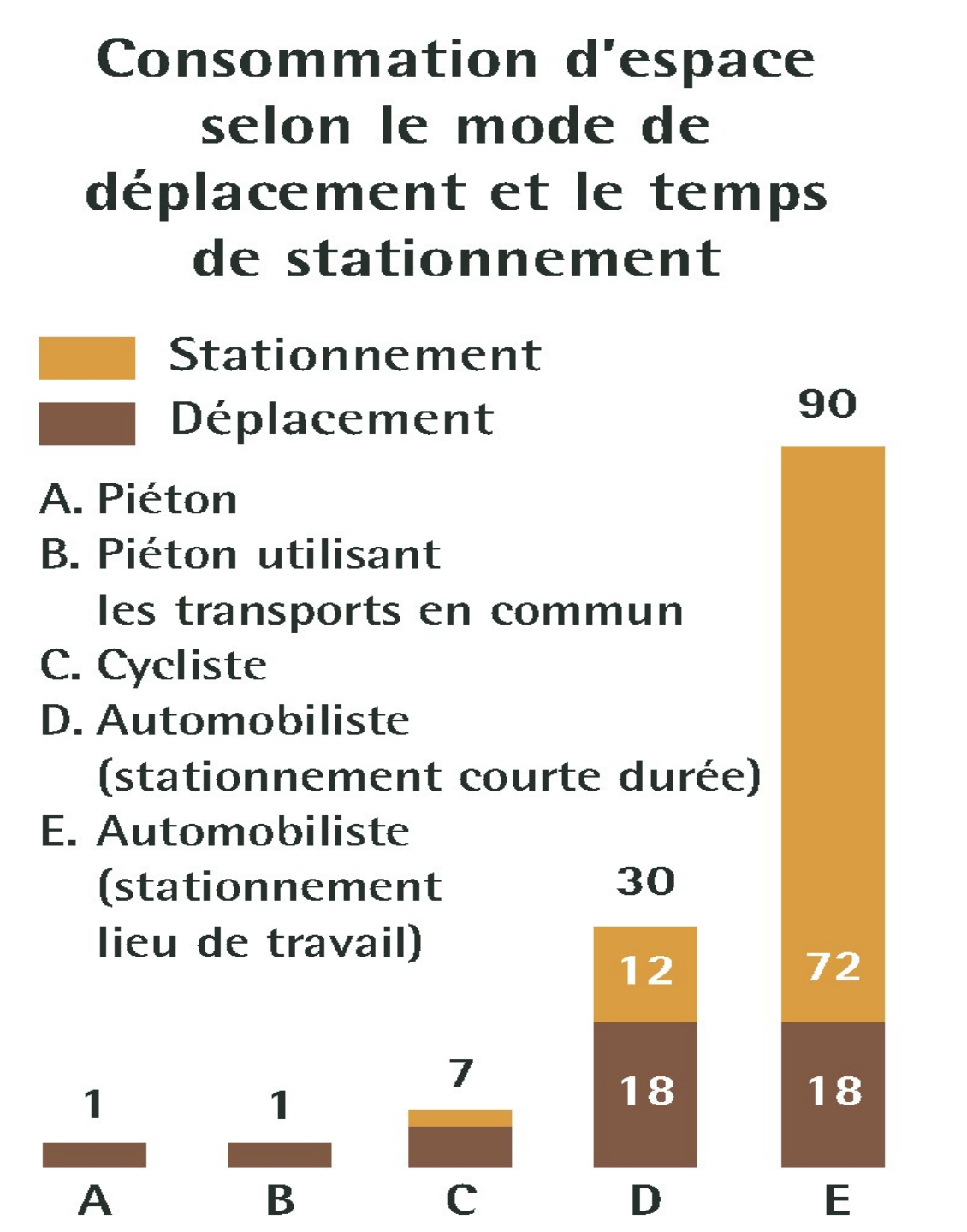
- Pollution and noise
- High level of energy consumption
- Health problem
- Stress
- Injuries and fatalities
- Waste of space in cities

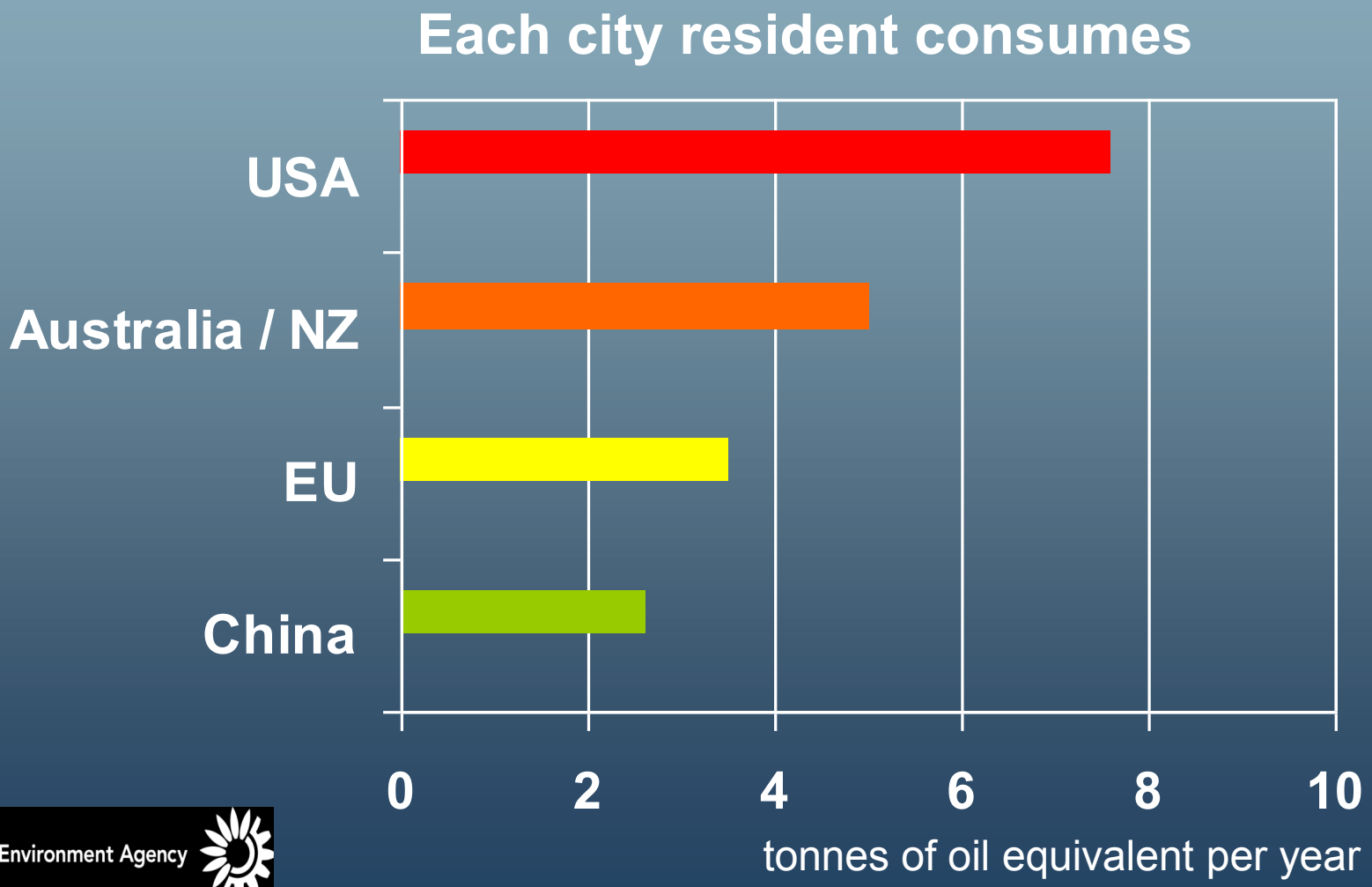


Amount of space required to transport the same number of passengers by car, bus or bicycle

Planning for pedestrians.
The pedestrian option was taken to save land and advance transport infrastructure investment. The diagram shows the multiplier of land consumption generated by automobile transport and related parking.



European compactness is more efficient…



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Source: IEA, 2008

The dispersed and fragmented city: is it still a city?

How to live in a city built for cars but not for people?

- The urban functions are dispersed
- Mobility increases
- Users of city are not necessarily city residents

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The urbanity: the « Agora » function of cities and gardens

- **Cities and gardens are the places that ease social interactions**

A city is a place

to work, to study, to live daily life, to do sport, to go to theater, to do shopping, to stroll, to walk, to spend time in green open spaces, to benefit of all urban services, to meet others people, etc.

Peri-urban areas

- *Neither urban nor rural*
- *Less services and social interaction*
- *A daily life based on mobility*
- *Car-dependance*
- *Cost of transport*
- *Isolated population, etc.*

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What is a compact city?

A use of space in a in a more sustainable way

Dense and proximate development patterns	Urban areas linked by public transport systems	Accessibility to local services and job
• *Shorter intra-urban distances* • *Urban land is intensively used* • *Distinct border between urban and rural*	• *Public transport facilitate mobility* • *More efficient public service delivery* • *More effective use of urban land*	• *Residents have access to local services on foot or by using public transport* • *Mixed land use*

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We can’t erase the past

In Europe, the structure of the "low-energy" city and resources efficient city is already partially built

(Source: "La ville post-carbone : les formes urbaines et la transition énergétique", Jean-Pierre TRAISNEL 2011)

The buildings, the pavement, the streets (etc.) will be the same but the uses of the city will change

No Masdar city in Europe

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Urban form and design
sets the frame
Nature
makes the difference

The performance of buildings depends on a number of factors such as the performance of the installed heating system and building envelope, climatic conditions, behaviour characteristics (e.g. typical indoor temperatures) and social conditions (e.g. fuel availability).

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Greening the compact city

- Rivers as an urban recreational Landscape
- Squares are the living rooms of the city
- A park for everyone within walking distance
- Playgrounds for children
- Green wherever possible (1 million trees Bloomberg programme in New York)

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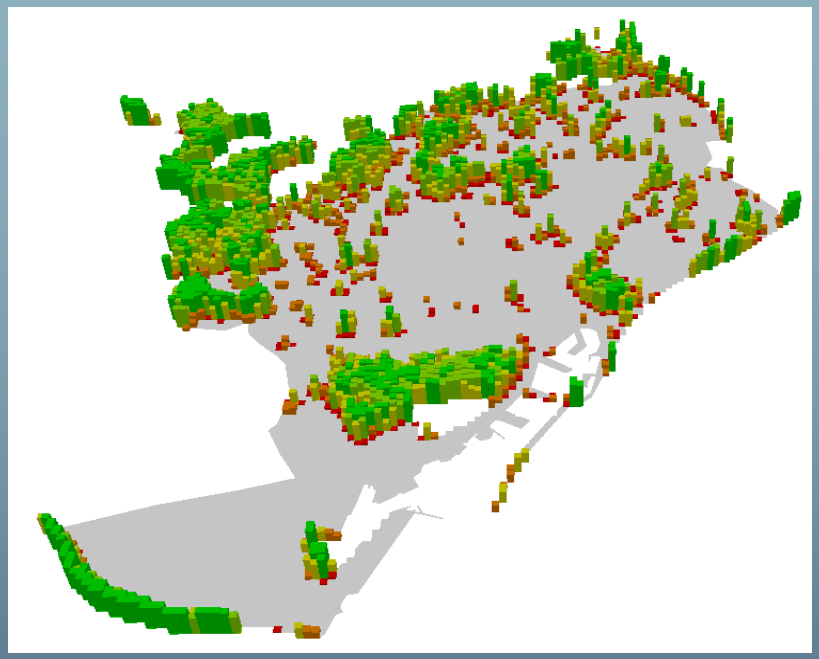
Green infrastructure



Ecosystem-services are key criteria for strategic decision-making

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Information and communication technologies as an opportunity

- information about all modes of transport (anytime, anynwhere) and costs of location (MVV Calculator)
- saving of trips with tele-working and video-conferencing
- regulation of temperature and lighting of buildings
- etc.

Challenges facing decision-makers in societies marked by mass individualism (the me-me-me culture doesn't trigger intergeneration solidarity)

- Sustainable transport
- Building energy efficiency
- Waste management
- Water and wastewater
- Urban ecosystem mgt
- Quality of life, health

ROOM FOR « OBLIQUITY » APPROACHES (John Kay)

3 EXAMPLES:

- Singapore, Zurich, Louvain-la-Neuve

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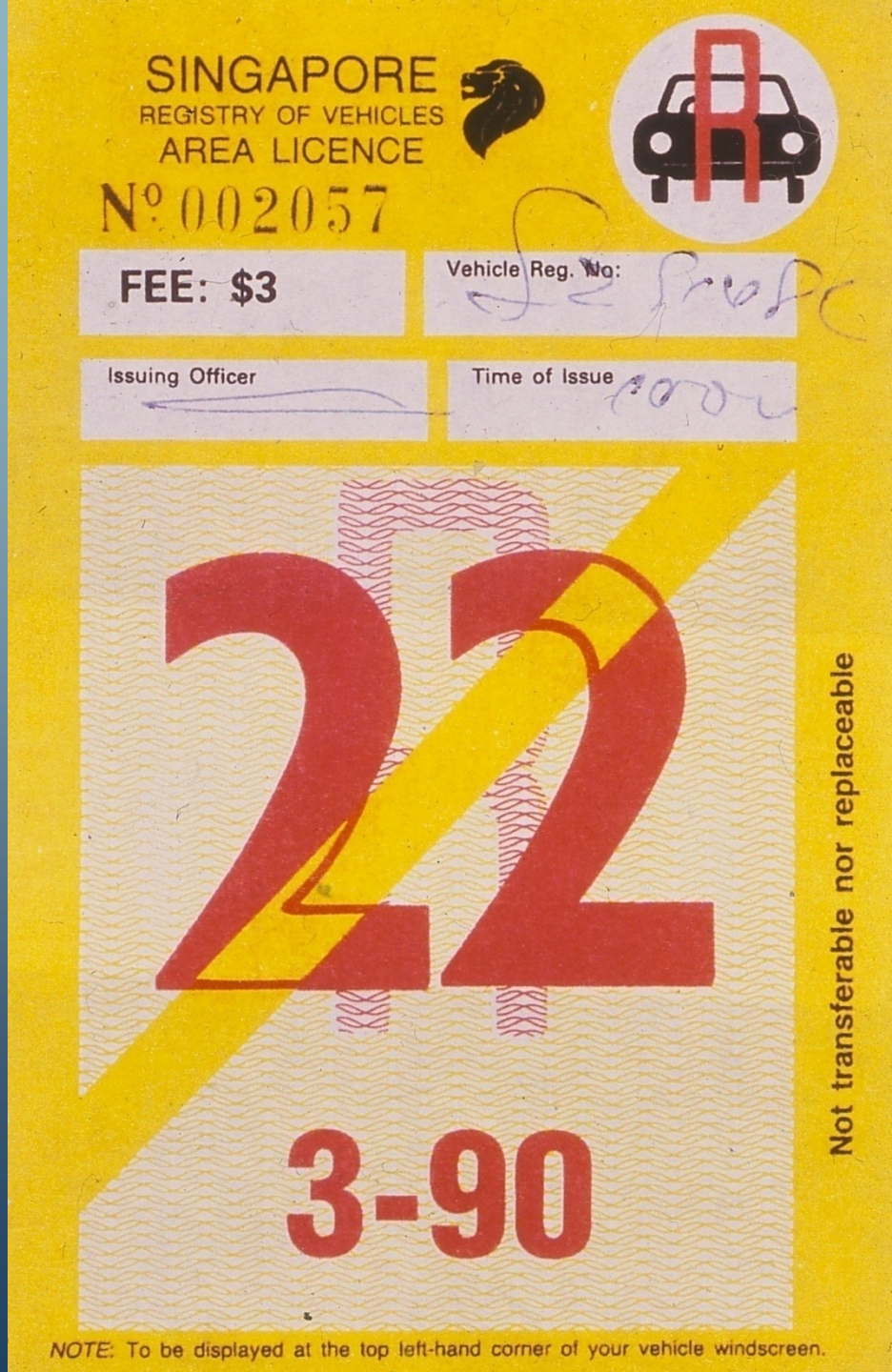
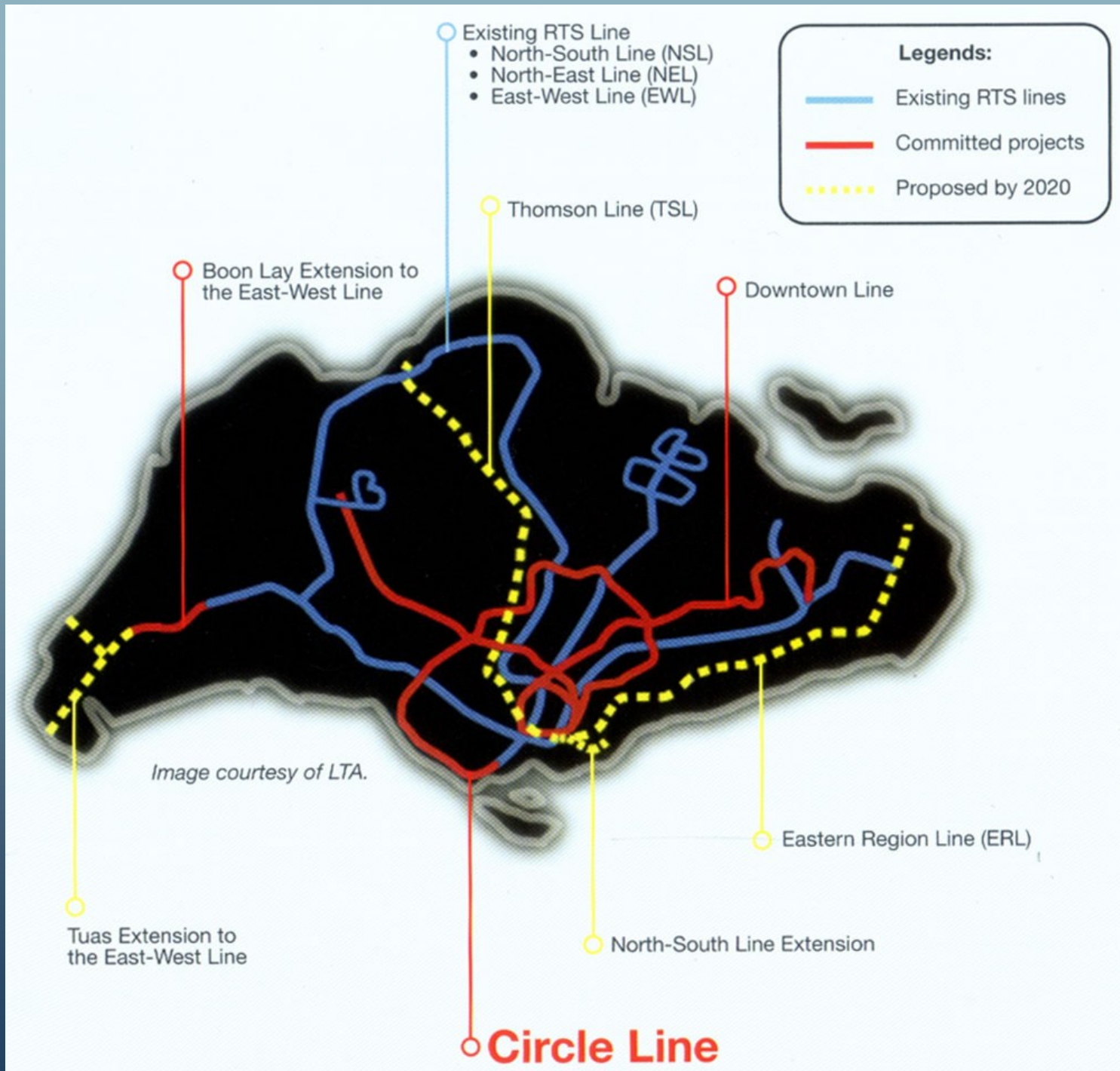
- From 1975 Singapore has endeavoured to save scarce land and natural resources through market mechanisms such as auctioning of new car plates (taken over in Shanghai) & pricing of road access to the city, for solo drivers (no fee if 3 passengers). This was easily accepted as it gave drivers the choice to pay for solo driving or accepting 3 passengers.



In 1998 the system was replaced by Electronic Road Pricing, achieved through pre-paid cards debited as used (no invoice-related privacy problem).

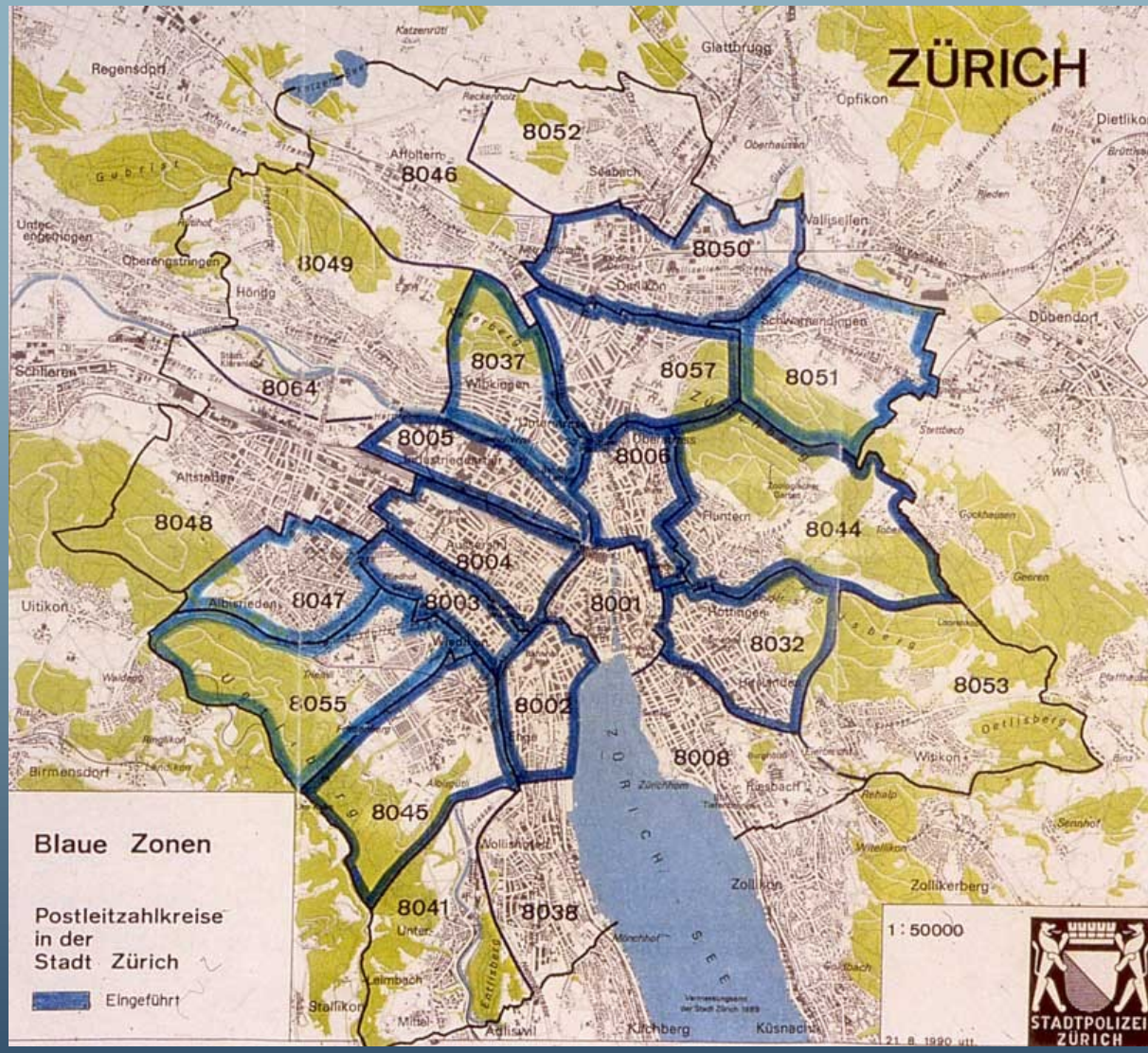
- Level of charges can change at any moment, according to the level of congestion (easily accepted as it is not an additional tax). From 2011, the ERP will be operated from satellite at any point of road congestion (gantries no longer needed).

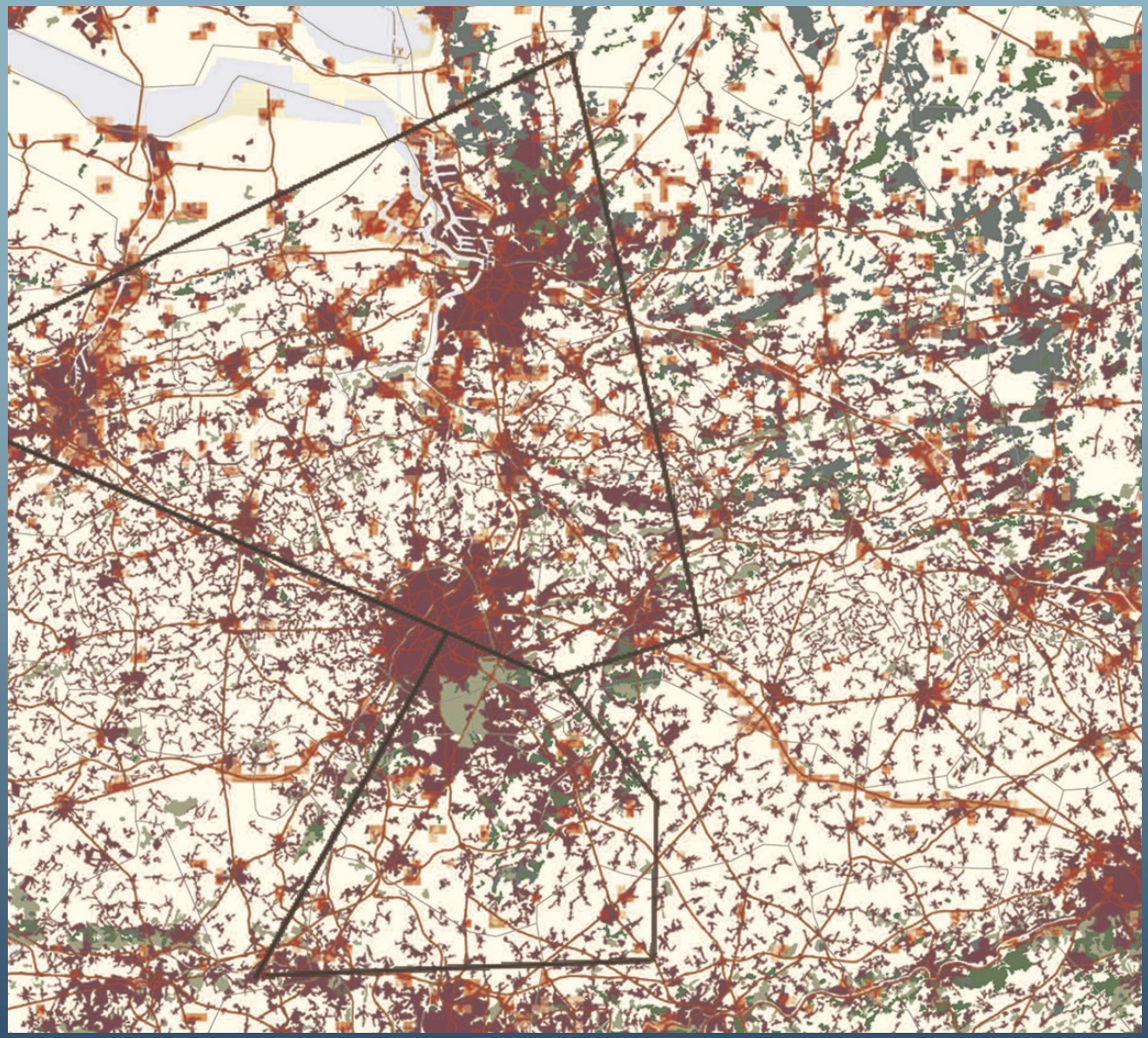

Existing RTS Line
• North-South Line (NSL)
• North-East Line (NEL)
• East-West Line (EWL)
Legends:
Existing RTS lines
Committed projects
Proposed by 2020
Thomson Line (TSL)
Boon Lay Extension to the East-West Line
Downtown Line
Image courtesy of LTA.
Eastern Region Line (ERL)
Tuas Extension to the East-West Line
North-South Line Extension
Circle Line

Zurich traffic management:

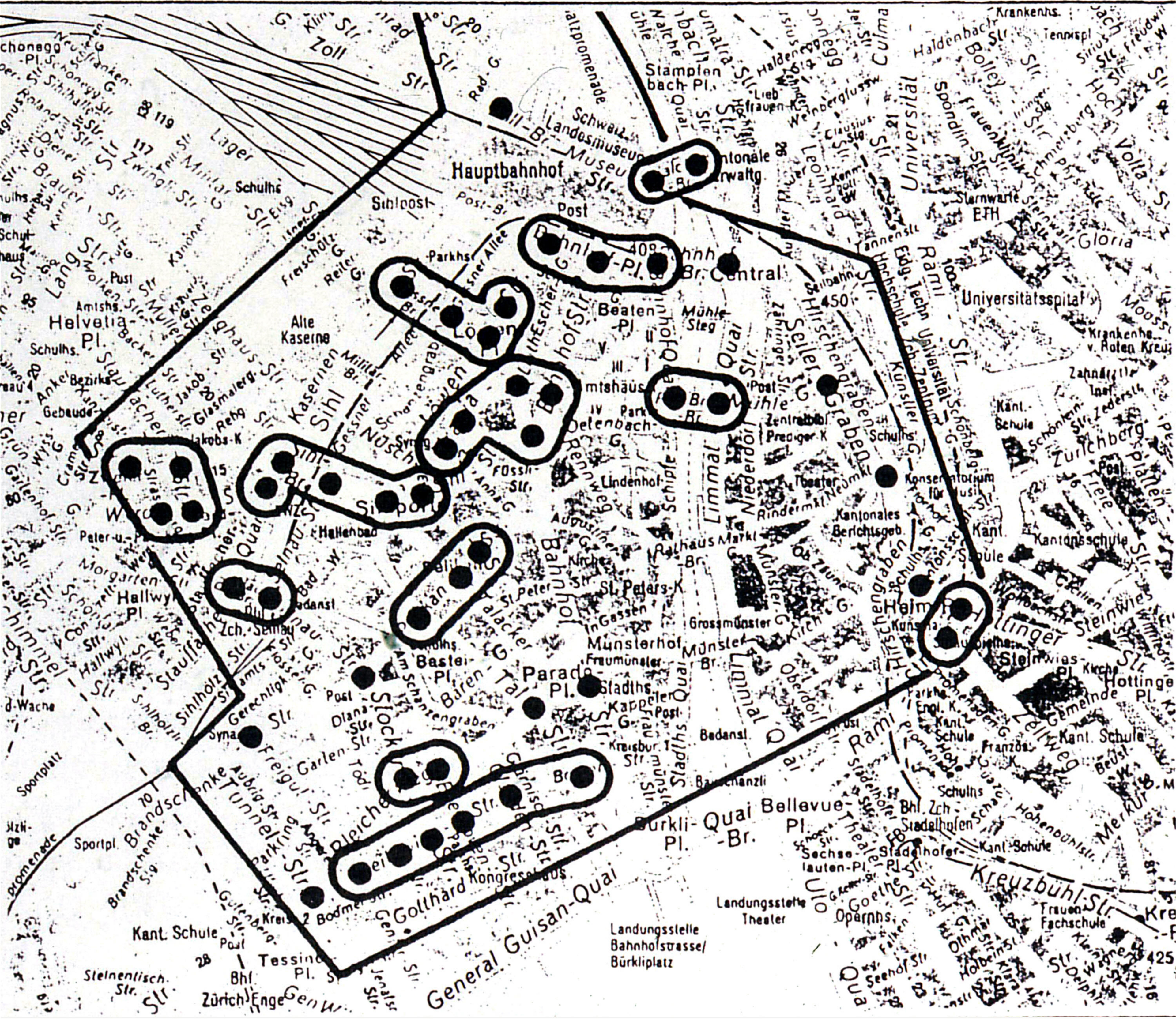
In Zurich, trams and buses enjoy absolute priority on street. When approaching a traffic light the sensor (shown on the lower left) ensures they have a green light at any time of the day. The reliability of timetables makes public transport the City's fastest mode of transport. Modal split is around 80% in favour of public transport.

Zurich parking management: Unrestricted on-street parking is exclusively reserved for Zurich-registered residents, while automobile commuters entering the city from other municipalities are subject to limits on their parking time. This parking measure has entailed a large-scale return of inhabitants to the city, has benefitted the public car parks and has been politically rewarding for the city fathers, while suburban rail travel has been made easier.



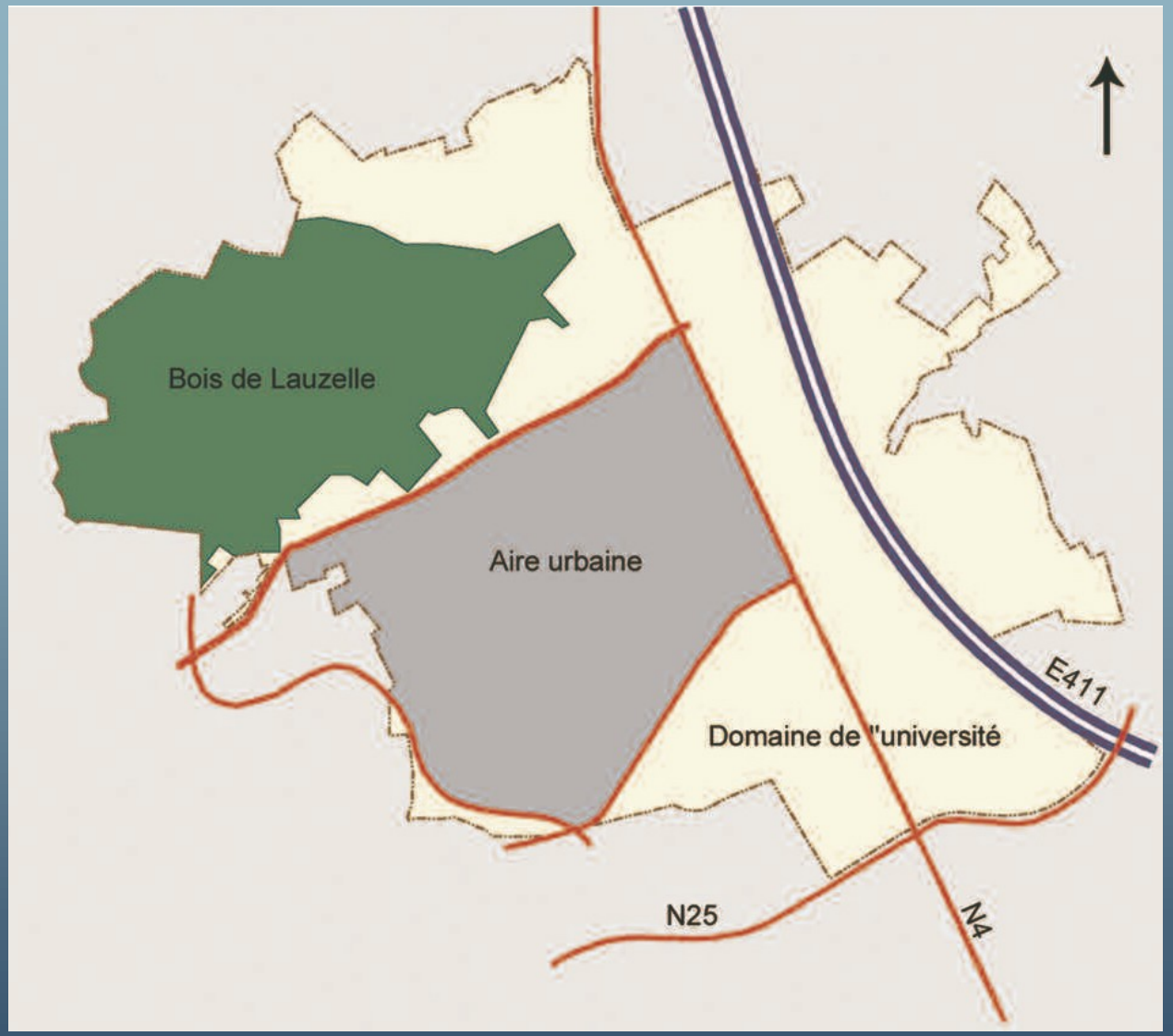


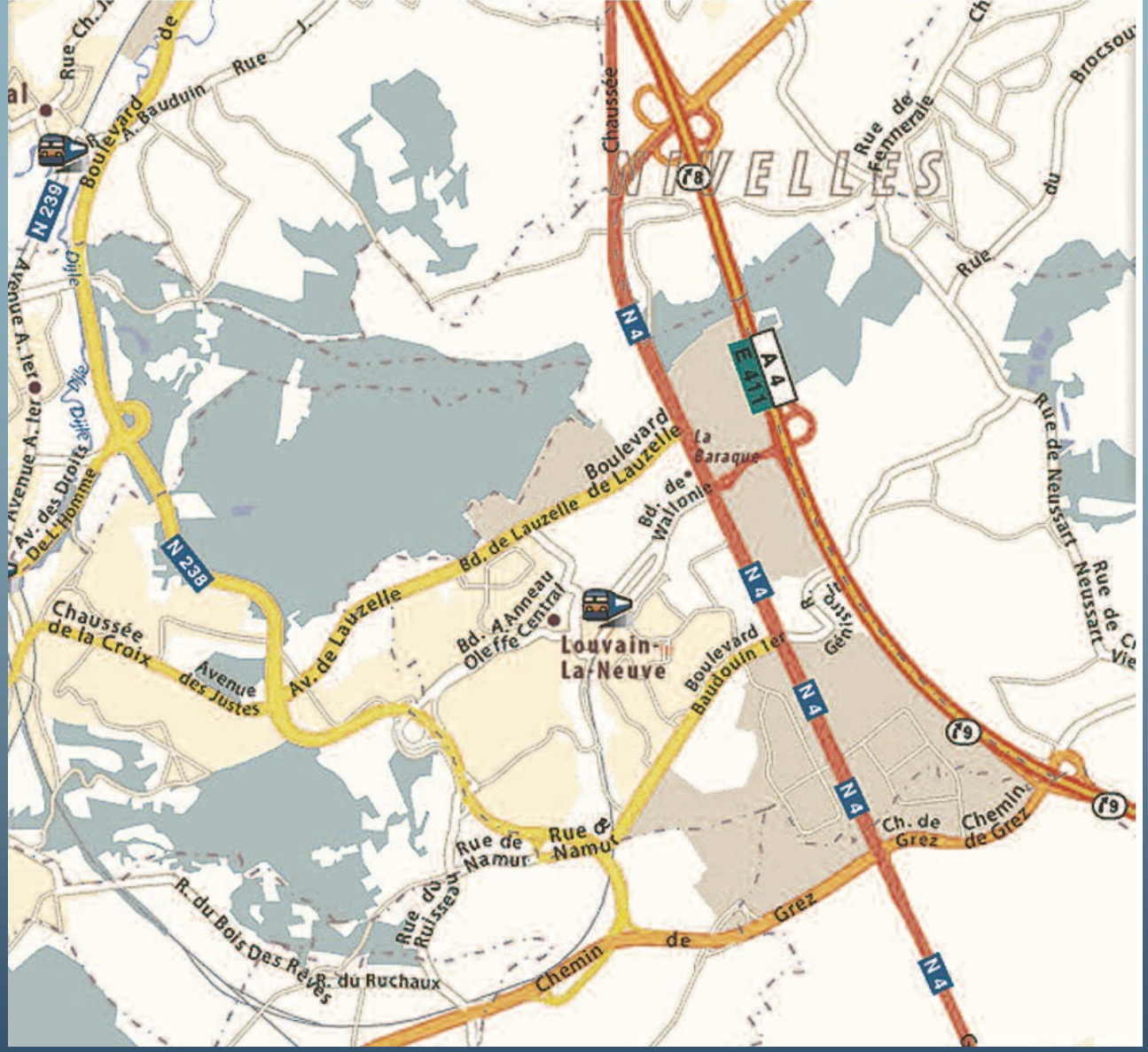
Map showing the metropolitan pattern of Central Belgium. The cities of Antwerp, Ghent Bruges and Louvain, North of Brussels, loosely suggest a diamond (losange). The cities of Charleroi, Nivelles, Ottignies and Wavre, South of Brussels loosely suggest a triangle All of them are commuting distance from each other (maximum 60 km).



Hauptbahnhof
Landesmuseum
Sihlpost
Post
Bahnhof-Pl.
Br. Central
Universitätsspital
Sternwarte ETH
Gloria
Helvetia-Pl.
Alte Kaserne
Kasernen Str.
Sihl
Beaten Pl.
Mühle Steg
Limmat Quai
Niederdorf
Lindenhof
Rennweg
Bahnhof Str.
Augustiner G.
Rathaus
Markt
St. Peters-K
Grossmünster
Münsterhof
Fraumünster
Parade-Pl.
Stadths.
Kappeler G.
Bastei-Pl.
Bären-G.
Tal Str.
Am Schanzengraben
Bleicher Weg
Tödi Str.
Gotthard Str.
Kongresshaus
General Guisan-Quai
Bürkli-Quai
Bürkli-Pl.
Bellevue-Pl.
Quai-Br.
Sechseläuten-Pl.
Opernhs.
Utoquai
Rämi Str.
Hirschengraben
Seiler Graben
Konservatorium für Musik
Kantonales Berichtsgeb.
Theater
Kant. Schule
Kantonsschule
Heimplatz
Steinwies Str.
Zürichberg
Hottingen
Kreuzbühl Str.
Stadelhofen
Stadelhofer Str.
Hallwyl Pl.
Stauffacher Str.
Hallenbad
Sihlporte
Löwen Str.
Uraniabr.
Zch. Selnau
Sihlhölzli
Brandschenke Str.
Tunnel Str.
Tessiner Pl.
Bhf. Zürich Enge
Kant. Schule
Landungsstelle Bahnhofstrasse/Bürkliplatz
Landungsstelle Theater
Sportpl.
Zoll Str.
Lager Str.
Lang Str.
Hohl Str.

The university bought ca 1000 ha of agricultural and forest land in a rural area close to Brussels Namur road (N4): the central part was set aside for urban development; forest land in the North was preserved. The overall master plan and architectural coordination was entrusted to the Groupe Urbanisme-architecture (R. Lemaire, J-P. Blondel and P. Laconte).

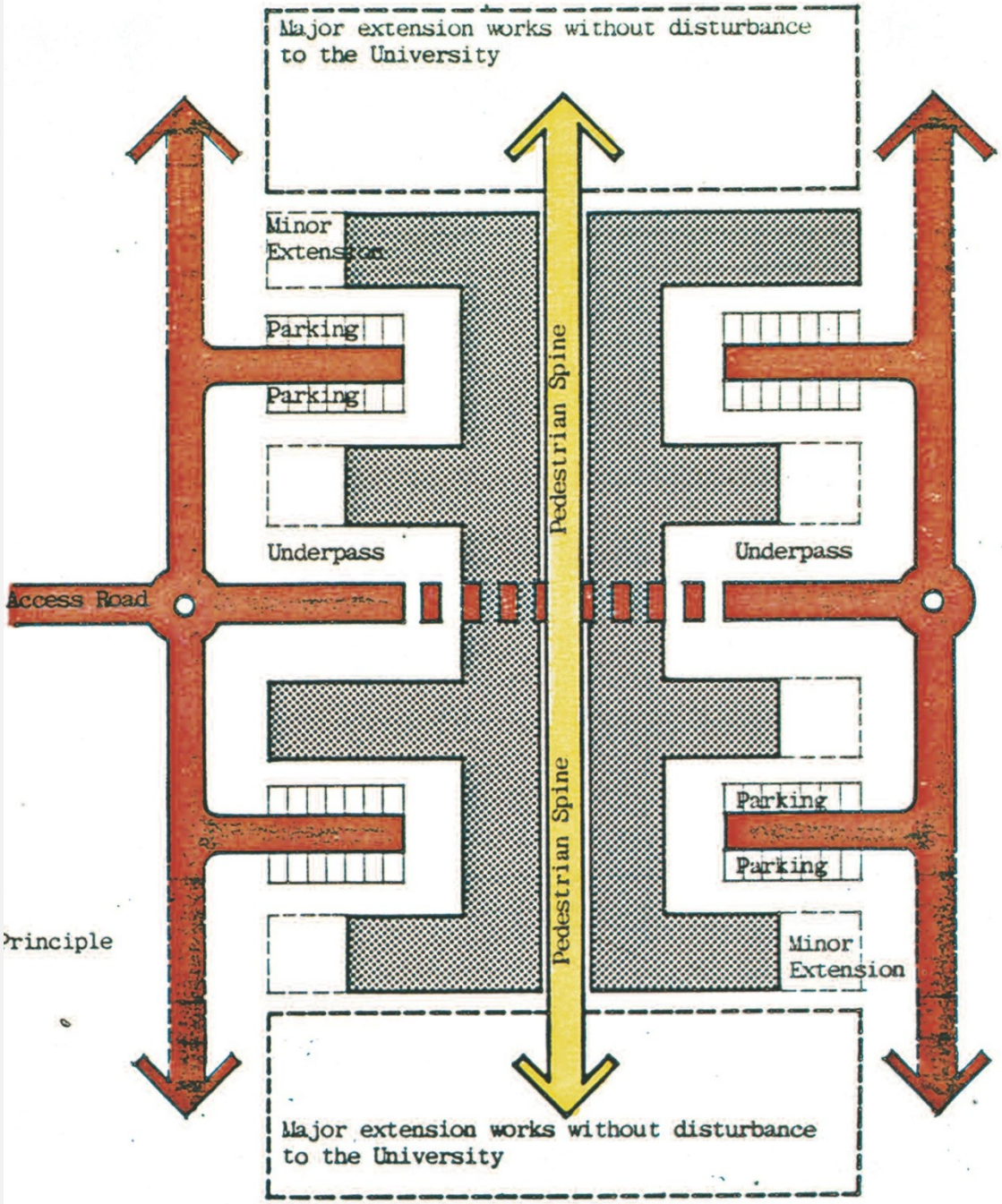




The first phase of the linear development started in 1972, from the existing road (N4). From 1976 an underground railway station was brought into service. The street and road network was developed by phases, as justified by the planned development of urban activities.

Planning for uncertainty.

A linear pedestrian central spine – in this case the University of Lancaster - allows a step by step mixed urban development, automobile access to buildings and parking being placed outside of the spine, with occasional underpasses.



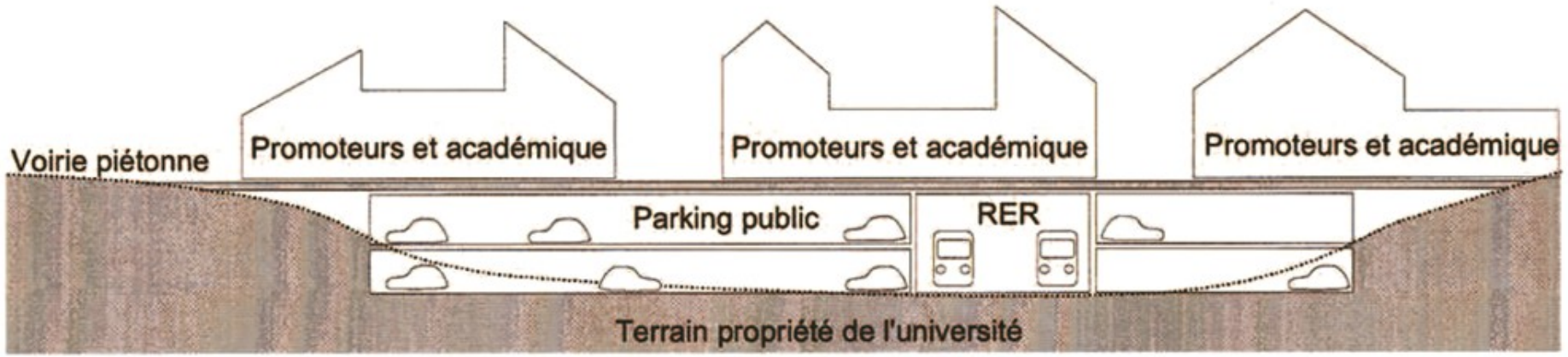
The centre of the first phase was the Science Library, a huge concrete building seen as the cathedral of a university town with its plaza (parvis), above an automobile underpass. It is a social gathering place with university buildings, shops and restaurants (arch. A. Jacqmain).

Some trees are planted along the main pedestrian spine. Design vocabulary includes brick and concrete (arch. G. Epstein).

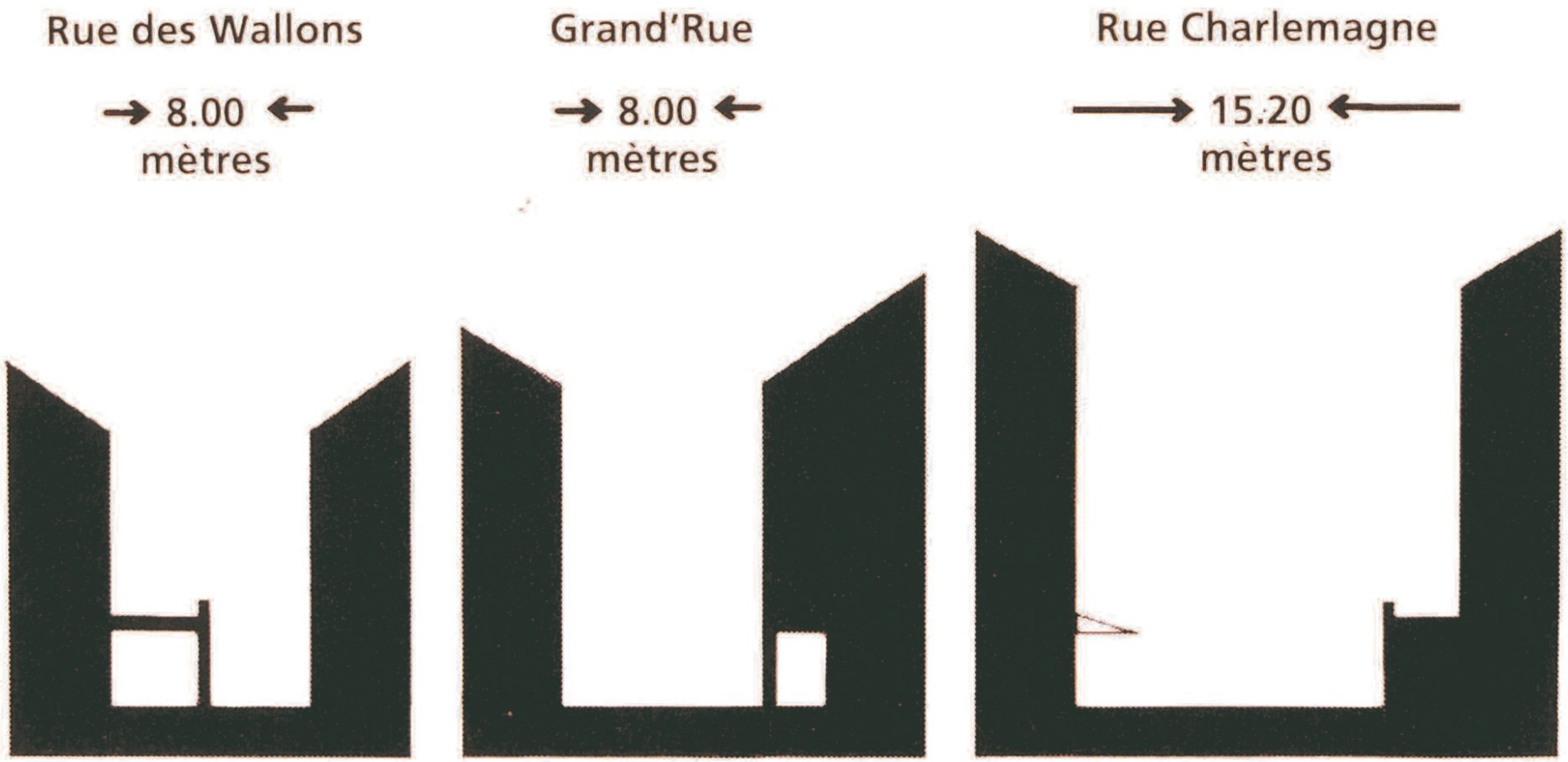
Parking. All parking spaces are planted with different tree species in order to attract different kinds of birds. They have become an ornithological reserve.

The new station (1976). It is entirely underground, in view of being covered at a later stage.

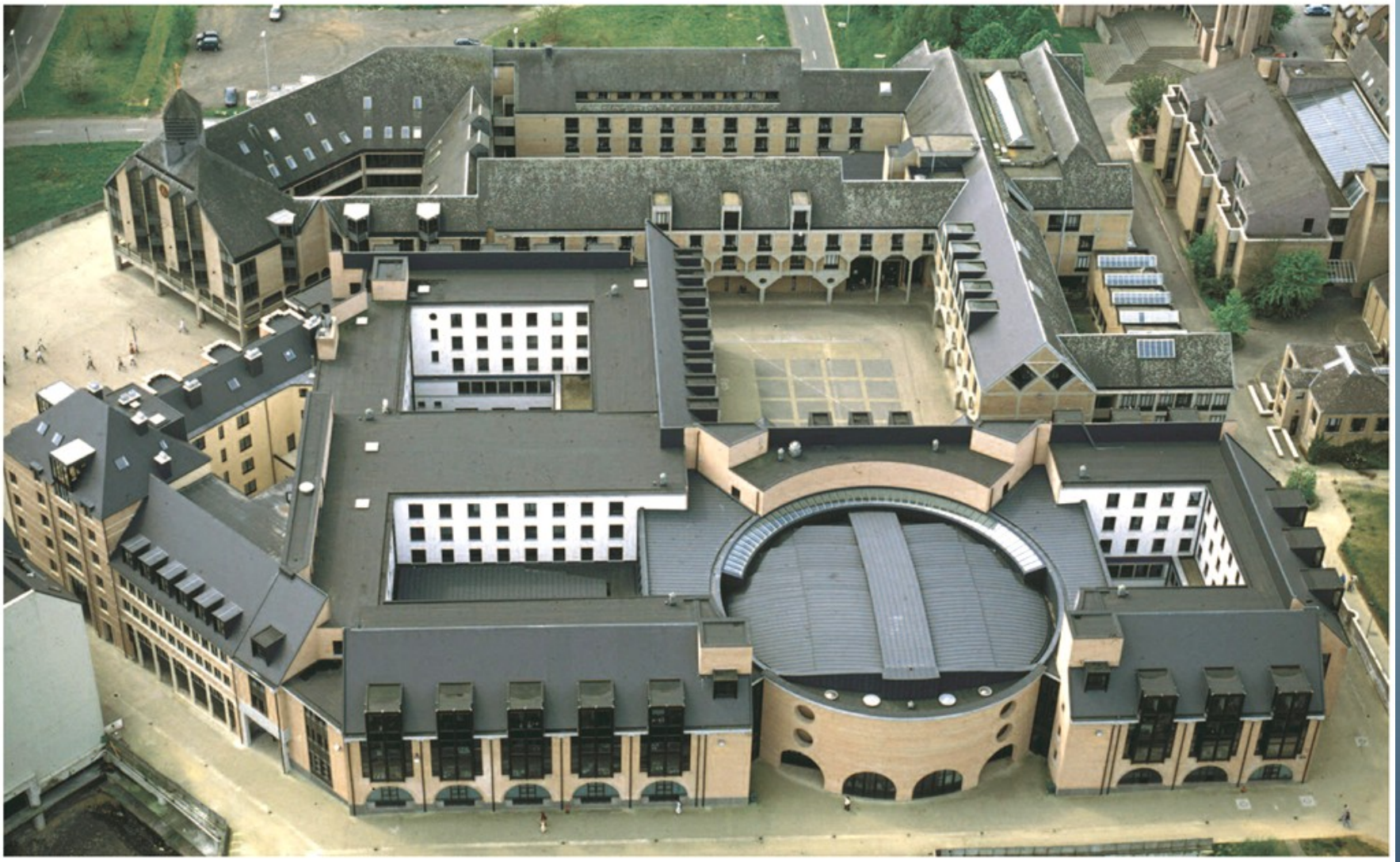
The Station. The arcaded entrance of the station (arch. Y. Lepere) on the pedestrian spine is the place where the slab starts.



The functioning of the slab. The diagram shows how the underground remains property of the university while the infrastructure and buildings are leased (leases of up to 99 years) to public and private investors.

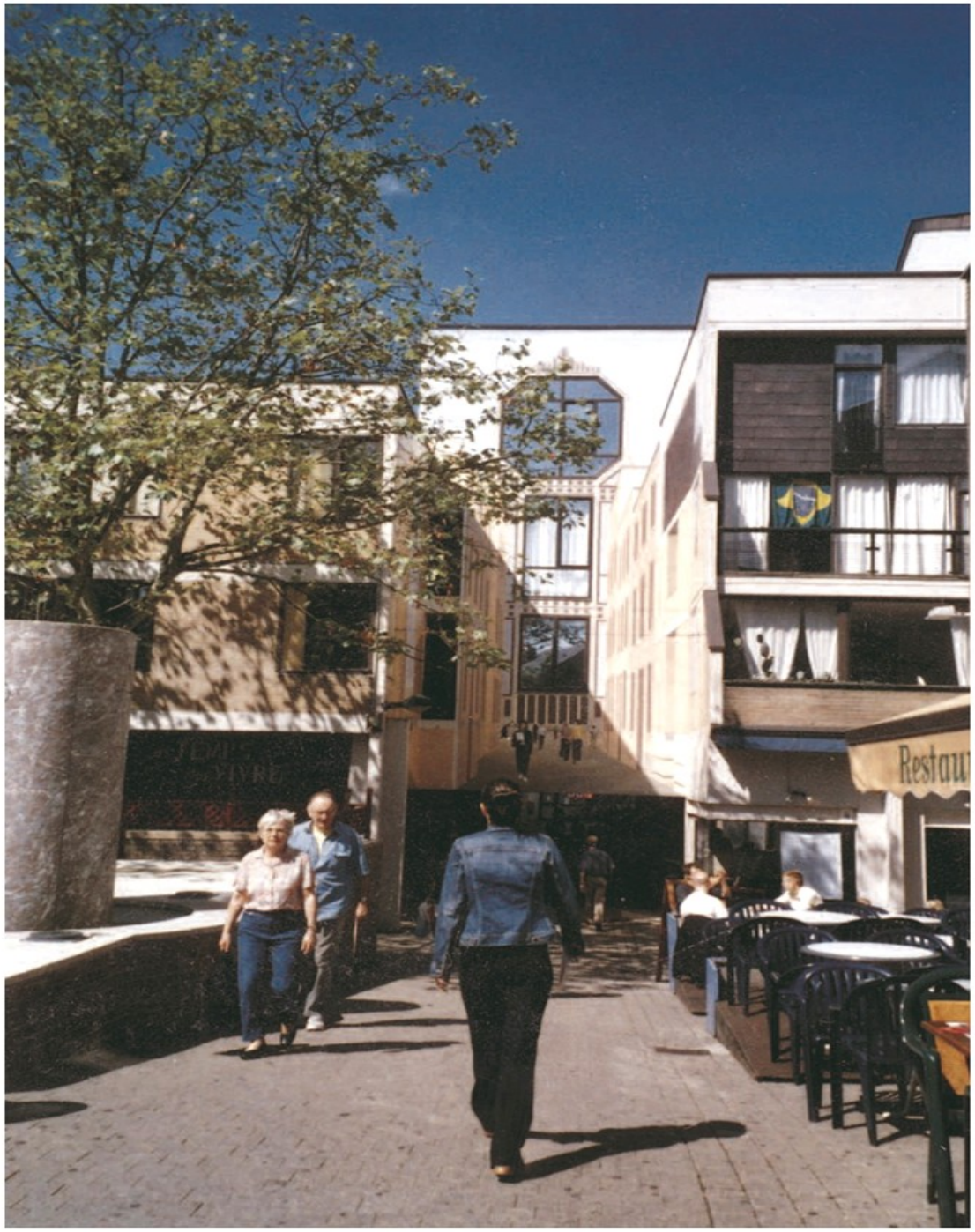


Streets are narrow and generally canopied to save space and reduce infrastructure costs, as well as to protect pedestrians from rain and sun. Plots are whenever possible kept small to allow architectural diversity and to open access to small contractors.



High-density low-rise buildings with interlocking courts and piazzas replicate the university colleges of traditional university towns (arch. E. Verhaegen).

The slab hosts numerous small public spaces planted with trees and sidewalk cafés.



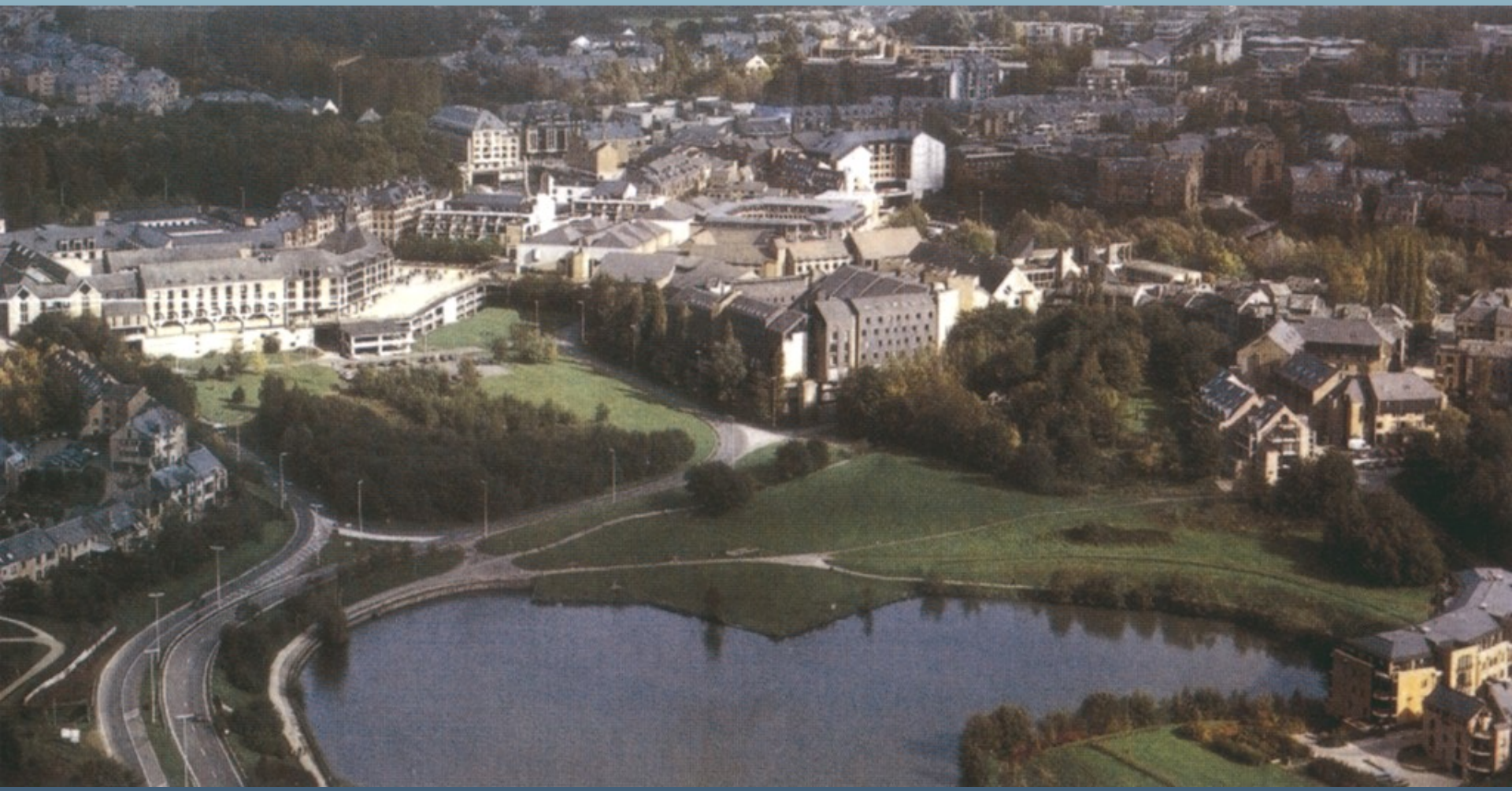
Cafés and restaurants are occupying pedestrian spaces while automobile access uses the underground parking.

“L’Esplanade”.

In 2005 a large shopping centre was opened, next to the station, together with a new residential street, on the slab. It was an immediate success (8 million visitors per year) and is to be extended above the rail tracks.

All storm water is collected to an artificial lake that serves as reservoir and amenity.

A pre-monitoring of entering water and oxygen provision allow to check the fishing water quality of the lake.



An aerial view of the city taken in 2003 shows the overall high-density low-rise development and the potential for further extensions close to the lake.

3 posters by Hundertwasser illustrate the planning spirit of a sustainable city: high-density compactness, transport corridors served by public transport and amenities making the city enjoyable.


USE PUBLIC TRANSPORT
SAVE THE CITY

UITP

ENJOY YOUR CITY
USE PUBLIC TRANSPORT

International Union (Association) of Public Transport

Union Internationale des Transports Publics

MOBILITY FOR ALL

Internationaler Verband für Öffentliches Verkehrswesen