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Dipartimento di Ingegneria Civile e Ambientale

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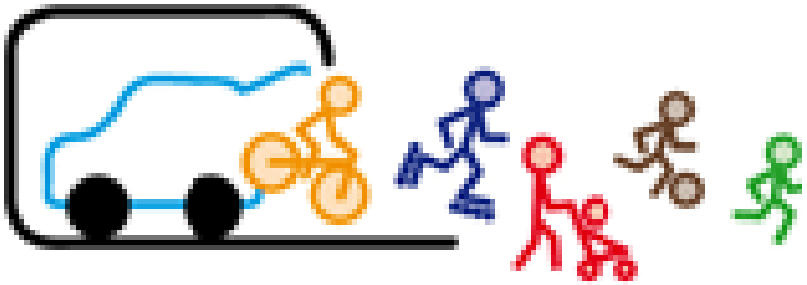


Piani d'azione per la diffusione della mobilità sostenibile in Europa

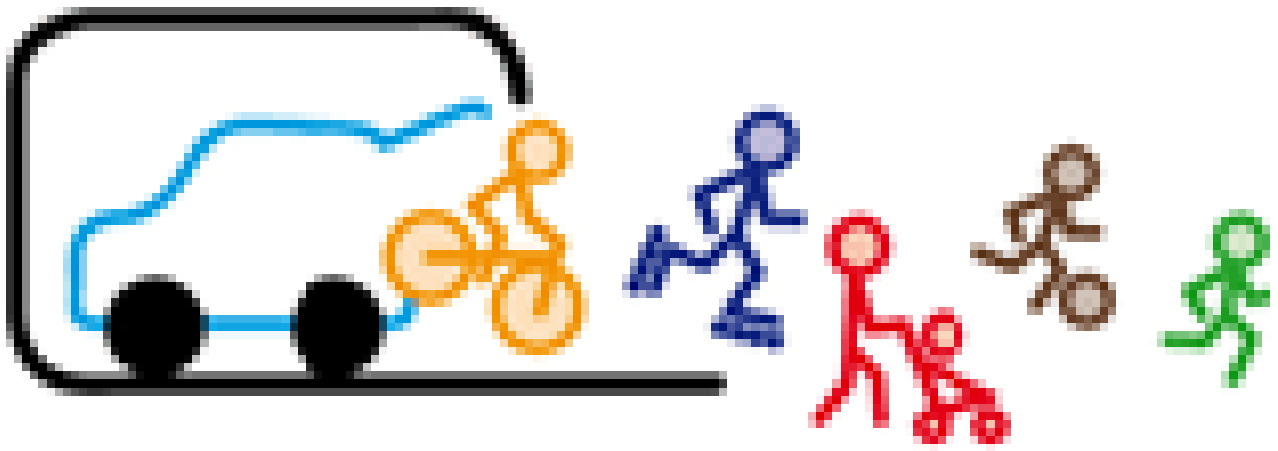
Modulo Europeo Jean Monnet "New skills for new challenges: sharing and boosting knowledge on European Policies" A.A. 2011-2012.

Unità Tematica 2 – Ingegneria

Catania, 11 febbraio 2012

Contenuto della presentazione

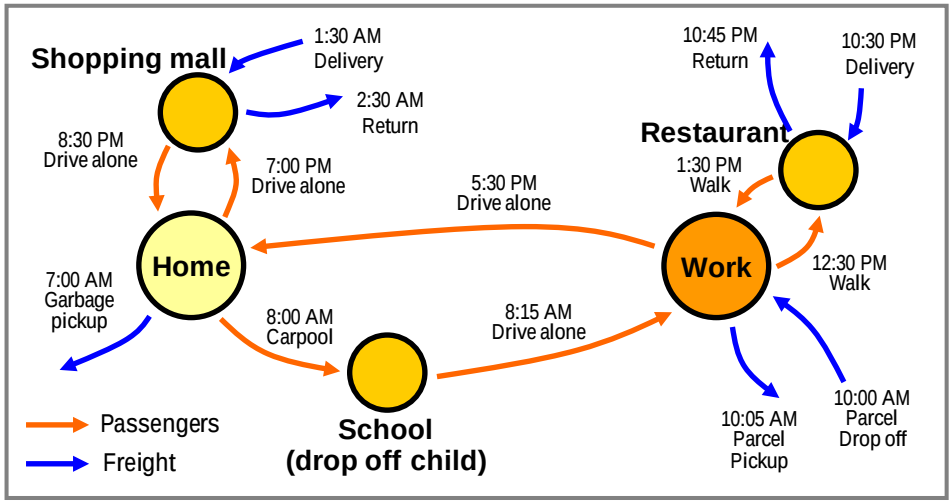
- Evoluzione del concetto di mobilità sostenibile
- Dati e impatti della mobilità in Europa
- Strategie e strumenti per la MS
- Esempi di azioni per la MS
- Piani di azione per la MS
- Il monitoraggio del piano

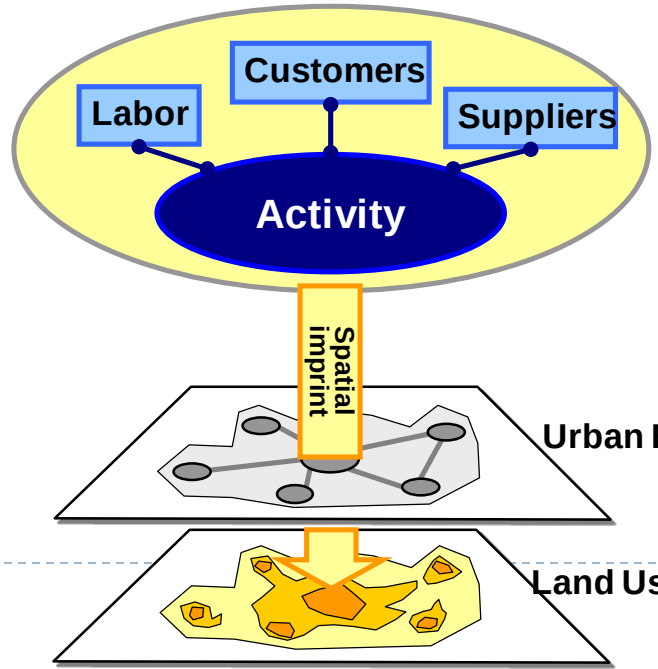


Evoluzione del concetto di mobilità sostenibile

Definizione di mobilità

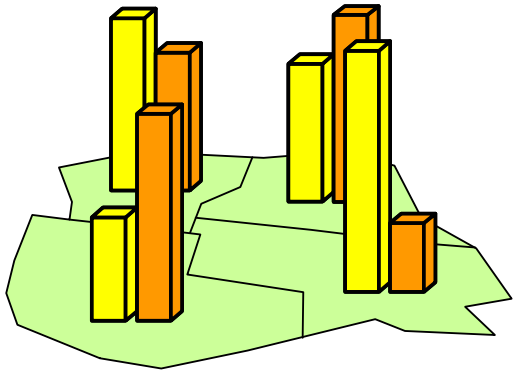
- La **mobilità** delle persone è l'estrinsecazione dei rapporti di relazione che sono alla base di una comunità organizzata, espressa ai massimi livelli all'interno delle aree più densamente urbanizzate.
- La **mobilità** è il cambiamento di posizione delle persone e delle cose nello spazio per l'esigenza degli individui di consumare beni e servizi in luoghi diversi da quelli in cui si trovano.



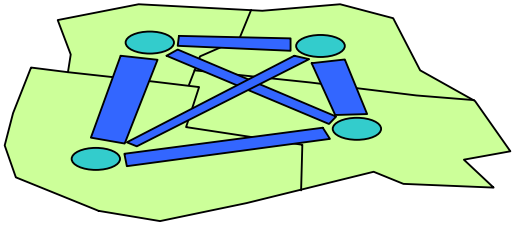


Land Use, Transport and Mobility

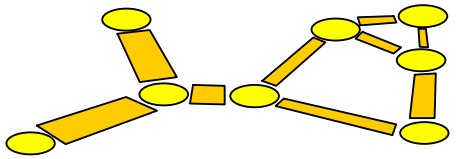
- **L'ambiente territoriale**, attraverso la sua forma fisica e la sua organizzazione funzionale, rappresenta la **causa** del nascere della domanda di mobilità, mentre i **trasporti** sono lo **strumento** che le consente di concretizzarsi.
- I **flussi di traffico** sulle reti di trasporto generano gli impatti sul sistema dei trasporti, sull'ambiente e sul territorio



Land Use



Spatial Interactions



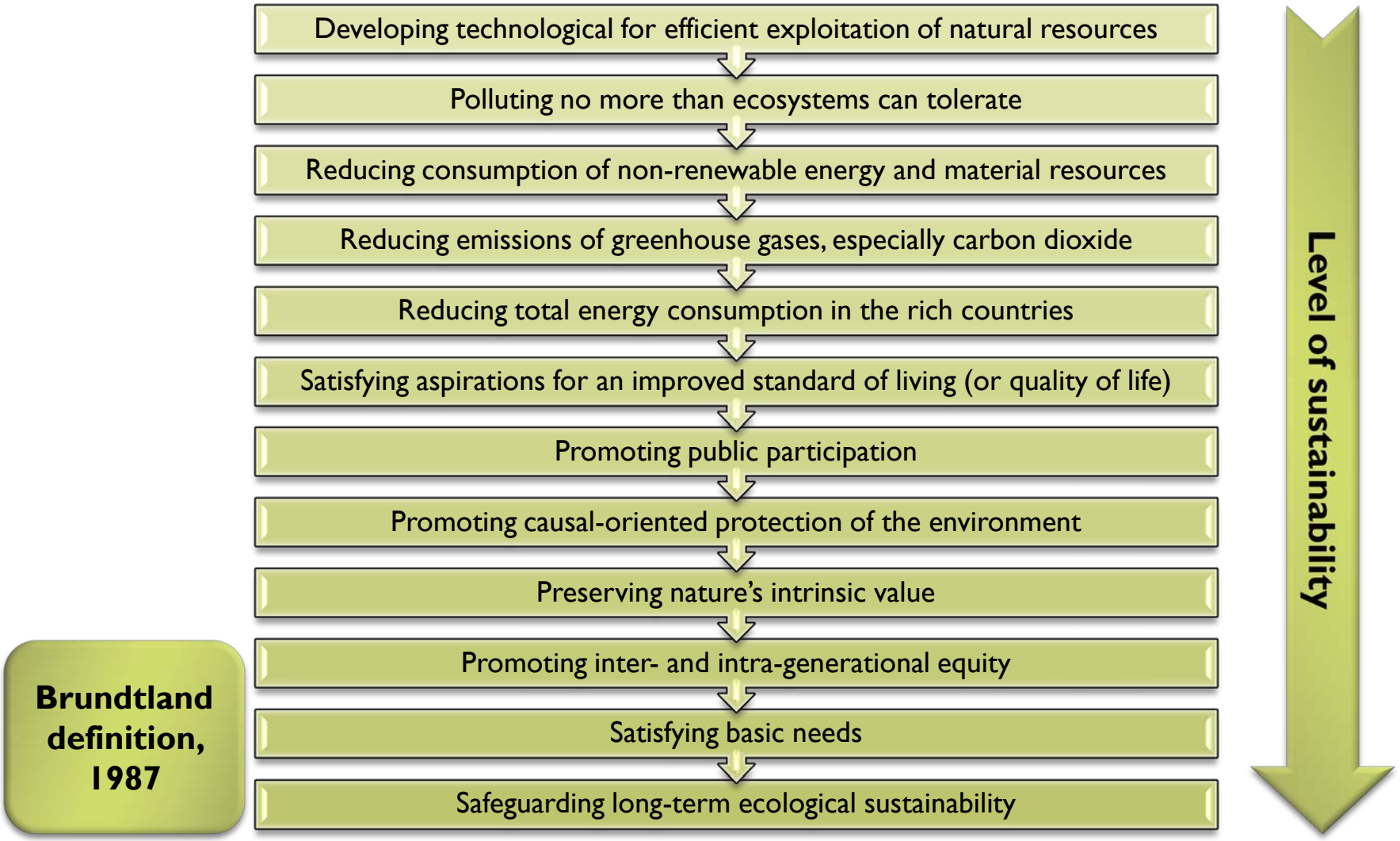
Transportation Network

Sustainable development (Brundtland, 1987)

'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'

From *Our common future*, the final report of the UN Commission on Environment and Development, chaired by Gro Harlem Brundtland

Sustainable development variable levels of sustainability

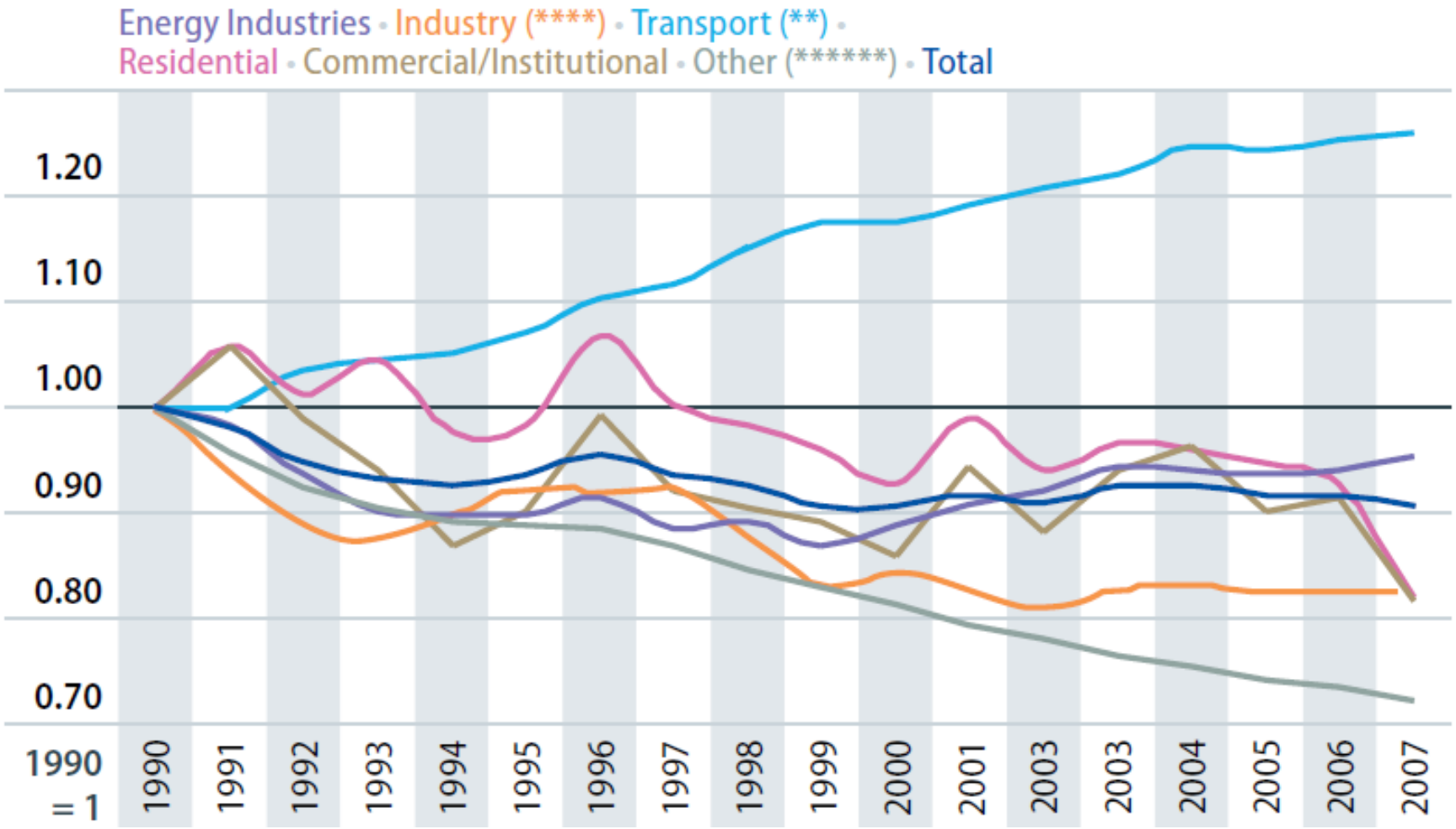


Transport is part of the sustainable development

- United Nation Conference (Rio de Janeiro, 1992), put transport at the forefront of the sustainability debate

- Climate change and clean energy
- **Sustainable transport**
- Sustainable consumption & production
- Conservation and management of natural resources
- Public Health

Trend of GHG emissions by sector



EU Energy and Transport in Figures
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Sustainable mobility, an evolving concept

- CEC , 1992
  - First appearance of the term “sustainable mobility”
  - Strict environmental standards for all modes of transport
  - Reduction in transport volume

Sustainable mobility, an evolving concept

- OCSE, Paris Conference1996
  - does not endanger public health or ecosystems
  - meets needs for access
  - use renewable resources below their rates of regeneration,
  - use non-renewable resources below the rates of development of renewable substitutes”

Ecologist vision on what SM should not to do

Sustainable mobility, an evolving concept

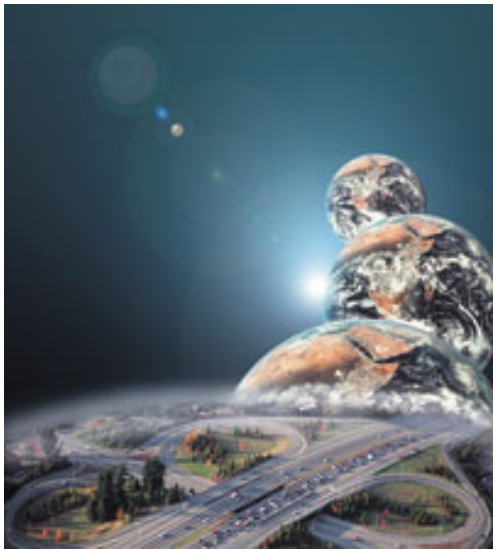
- CEC 1993
  - Disappearing the need for fundamental changes in transport patterns and reductions in transport volume
  - Reducing traffic intensity (congestion and pollution) rather than transport volume
- CEC (1998, 2001)
  - improving efficiency and competitiveness, liberalizing market access, ensuring fair and efficient pricing and improving external effectiveness

Sustainable mobility, an evolving concept (EU, 2001)

Allows the basic access and development **needs of individuals**, companies and societies to be met **safely** and in a manner consistent with **human and ecosystem health**, and promises **equity** within and between successive generations

Is **affordable**, operates fairly and efficiently, offers **choice of transport mode,** and supports a **competitive economy**, as well as **balanced regional development**

Limits **emissions** and **waste** within the planet's ability to absorb them, uses **renewable resources** at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimizing the impact on land and the generation of noise.

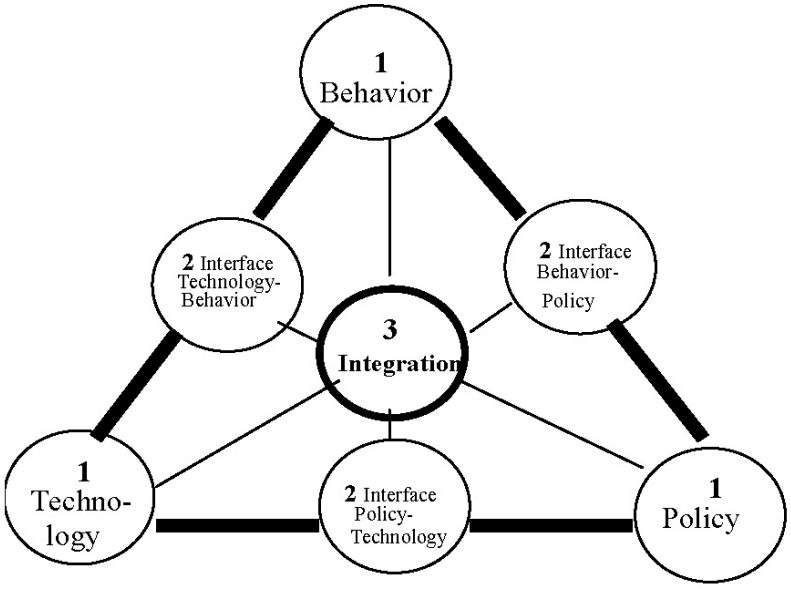


More extensive and economic vision on what is a desirable SM

Definition adopted by The Council of Transport Ministers of the European Union in April of 2001.

Sustainable mobility, an evolving concept
Social impacts

- Social Change and Sustainable Transport Conference, Un. of California, Berkley, 2002
  - Solutions must be found in the intersections of the three categories
- Car dependence is a social problem (Gorham, 2002; Newmann and Kenworthy, 1999)
  - Urban form and land use
  - Psychological dependence

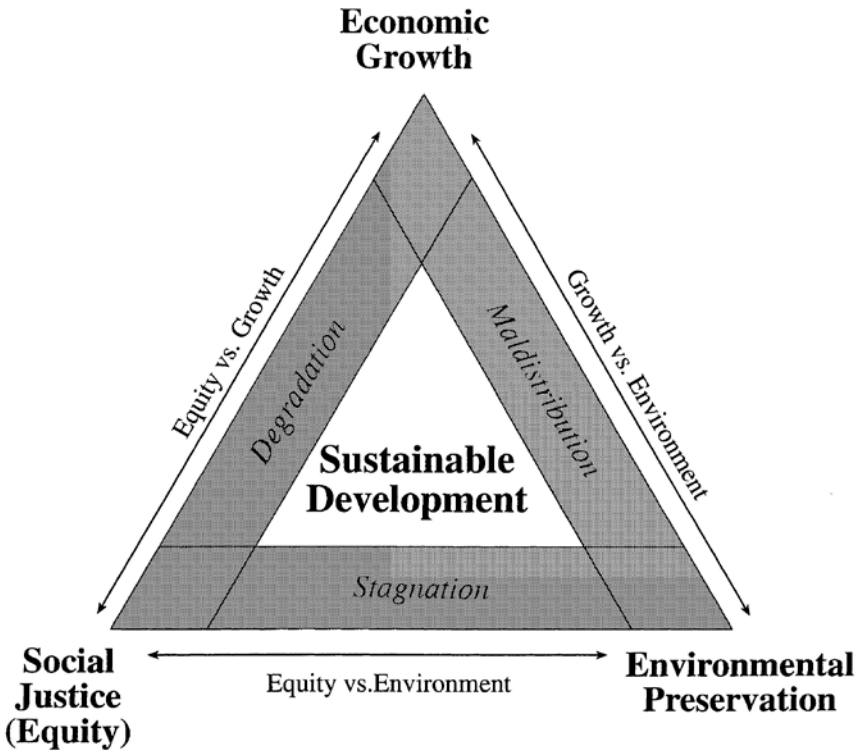


Sustainable mobility, an evolving concept
Social – psycholgical issues (Gatersleben and Uzzel, 2002)

- factors influencing people's willingness to change their transport pattern
  - how much they feel that their personal car use contributes to transport problems (**responsibility and awareness**).
  - how much they feel that changes in their travel behavior will help to solve such problems (**self-efficacy**).
  - how much they believe others are willing to help solve such problems (**trust and cooperative feeling**)
- planning measures should be accompanied by communication strategies or soft strategies increasing
  - knowledge of the costs and benefits of different travel modes
  - feelings of responsibility for the problems
  - mutual trust
  - control over the solutions

Sustainable mobility, an evolving concept
Equity impacts (Feitelson, 2002)

- Equity analyses
  - comparing populations exposed to transport-generated environmental problems to unexposed populations
  - **distributional implications** of policies advanced to address transport-generated environmental problems
  - transport's impact on environmental equity concerning land use, urban form and activity patterns

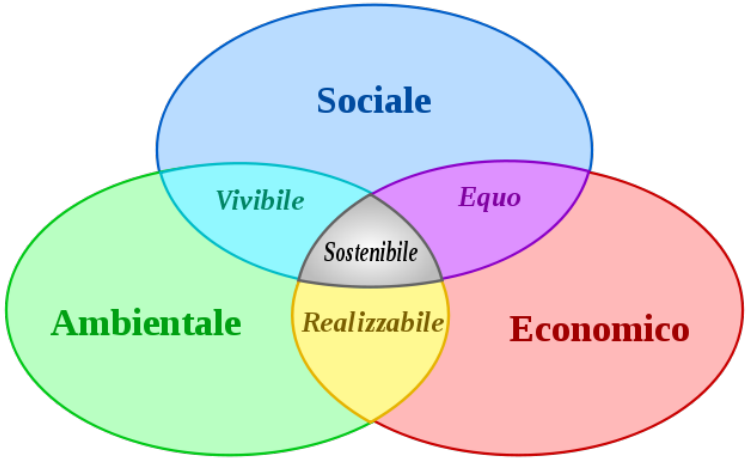


Sustainable Urban Transport Plans (CE 2007)

The EU asks for implementing

Sustainable Urban Transport Plans

to ensure that our transport systems meet society's economic, social and environmental needs whilst minimizing their undesirable impacts on the **economy, society and the environment**



CE, 2007, Sustainable Urban Transport Plans - Preparatory Document in relation to the follow-up of the Thematic Strategy on the Urban Environment

Environmental aspects of mobility

- atmospheric pollution
- contribution of transport to global warming
- noise pollution
- land take
- impacts on flora and fauna
- the effects of waste disposal

Economic aspects of mobility

Economic efficiency relates to the transport system (infrastructure building and service providing) as a whole when **costs of the users and of society** at large are considered.

Economic development relates to the consequences of transport policy on the economy of the areas affected

(include the revival of **economic activity**, the increase of **employment levels**, the attraction of new investments or the **expansion of existing industries**)

Social aspects of mobility

Positive issues

- employment
- regional development
- access to all sorts of services, leisure activities and job opportunities.

Negative issues

- greater car dependency is increasing the **social exclusion** of people dependent on public transport
- liberalization of transport services could harm employment and **working conditions**
- changes in transport prices aimed at efficiency and environmental protection could reduce **social equity** by excessively penalizing low-income groups
- **Road deaths** and damages

Green Paper on urban mobility (CE, 2007)

- How can **sustainable modes** of transport be promoted?
- How can the use of **clean transport** technologies be encouraged?
- What services and systems can be developed to **better inform** European travellers?
- Is there a need for a European charter on **passenger rights** in public transport?
- What can be done to improve passenger **safety and security**?

Evolving concepts and approaches to SM

	1992			2011
Impacts	environment	society	economy	equity
Focus	reducing transport volume and consumptions	transport intensity (local pollution)	congestion, competitiveness	accessibility, safety, quality of life
Disciplines	environemental enginnering transport geography transport economy	sociology	political science	social psychology
Approaches	EIA, quantitative modelling, regression analysis	scenario building and scenario analysis	case studies, qualitative modelling	institutional analysis
Questions	Is transport sustainable?	When is transport sustainable?	How to achieve sustainable mobility?	Why do we fail to achieve SM?

Adapted from Holden, 2007. Achieving Sustainable Mobility. Asgate e-book

Sustainability in the laws and in professional transport planning in Italy

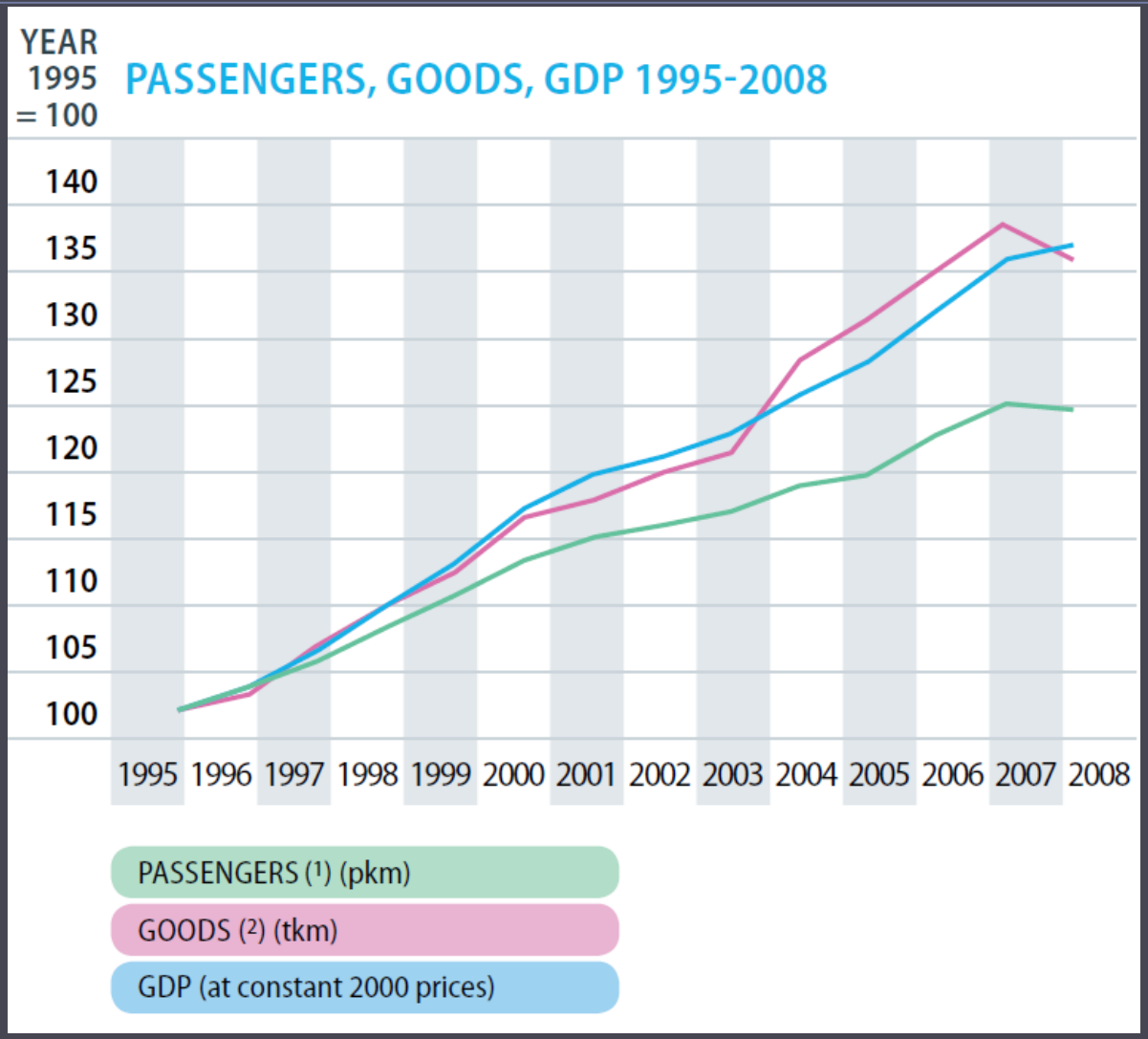
- Sustainability is not part of the Urban Traffic Plans (**PUT**) in Italy, the only compulsory plan, without strategic vision (two years of life)
- A lot of different sector, sometime conflicting, planning tools (safety, cycling, parking, etc.)
- Sustainability is partially included in the goals of Urban Mobility Plans (**PUM**): satisfying mobility needs while reducing social and environmental transport costs
- A lot of laws funding **partial SM actions** (car sharing, electric cycling, etc.)
- Introduction of the **Mobility Management** (TDM in Europe) DM 1998.
- Sustainability can be partially introduced in transport planning through the Strategic Environmental Assessment (**VAS**) procedure (L.152/96)

Alcuni numeri sulla mobilità in Europa

Il settore dei trasporti in Europa

- Il settore dei trasporti rappresenta
  - il 7% circa del PIL europeo
  - il 5% dei posti di lavoro nell'UE
  - Il 13% della spesa familiare
  - Il 10-15% del costo di un prodotto
- È un' industria importante, che apporta un contributo fondamentale al funzionamento dell'intera economia europea.
- La mobilità è anche un diritto fondamentale dei cittadini.

Transport Growth EU-27



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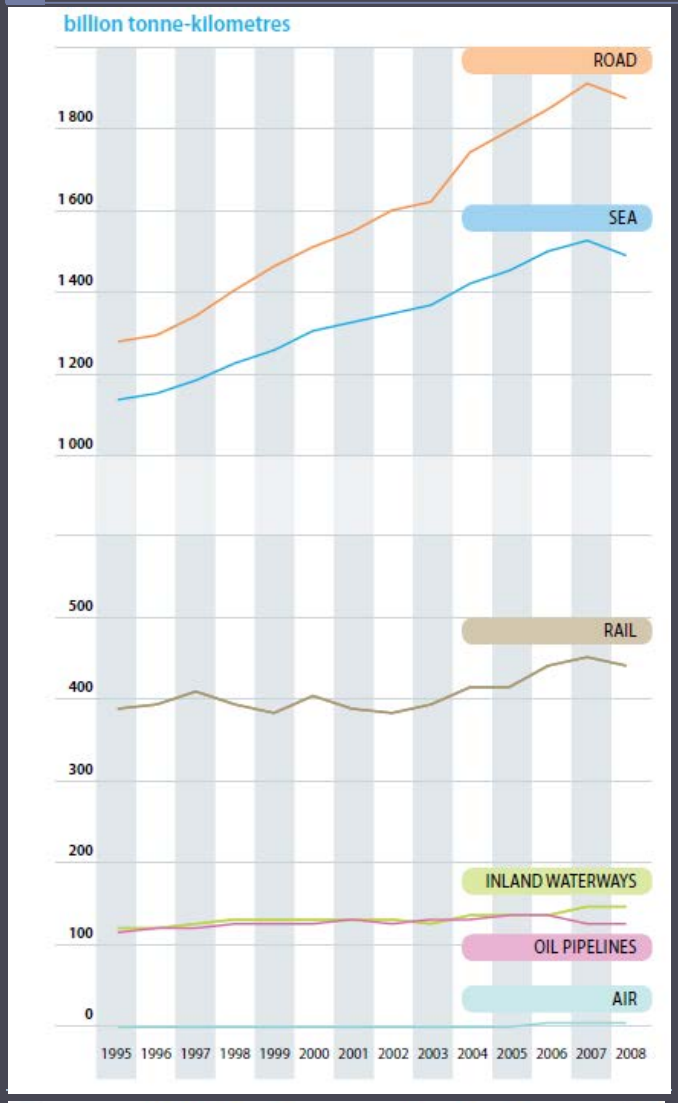
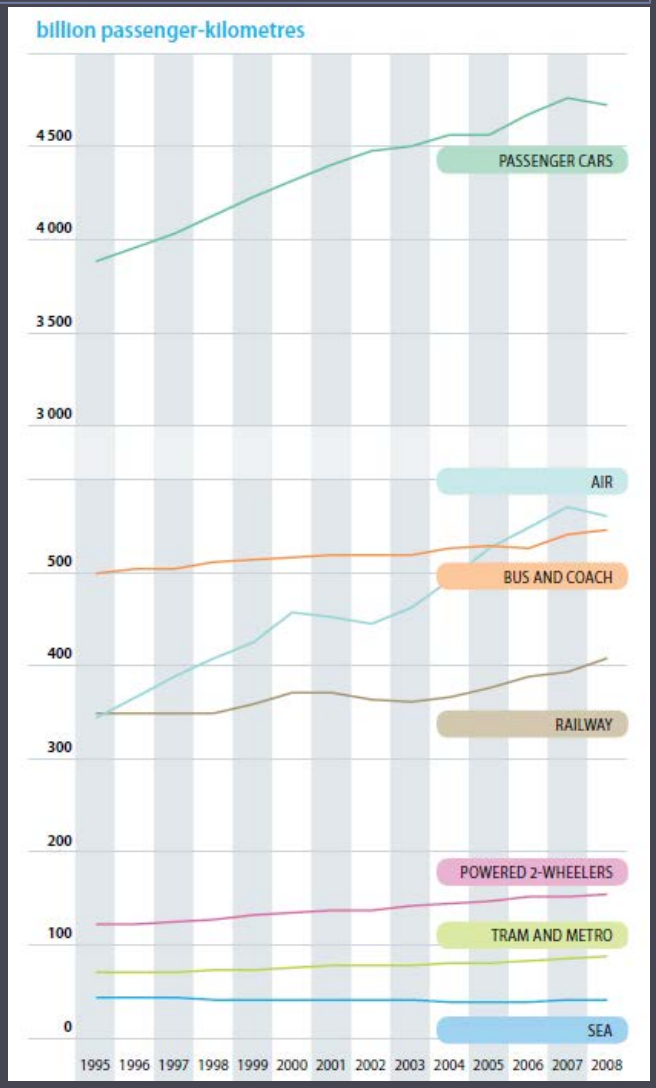
Trasporto merci e passeggeri per modo di trasporto



EU-27 Performance by Mode for Freight Transport – 1995-2008



EU-27 Performance by Mode for Passenger Transport – 1995-2008

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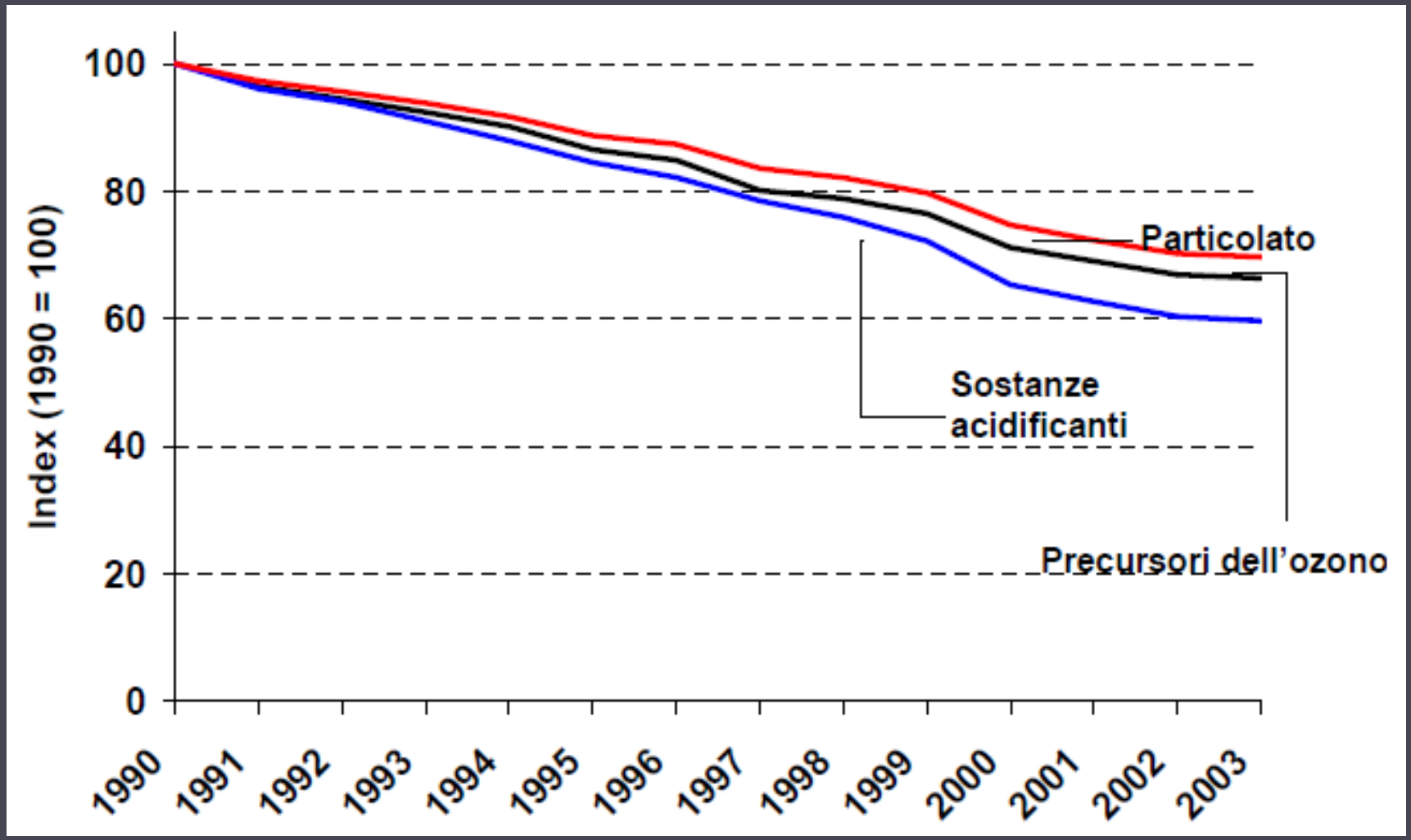
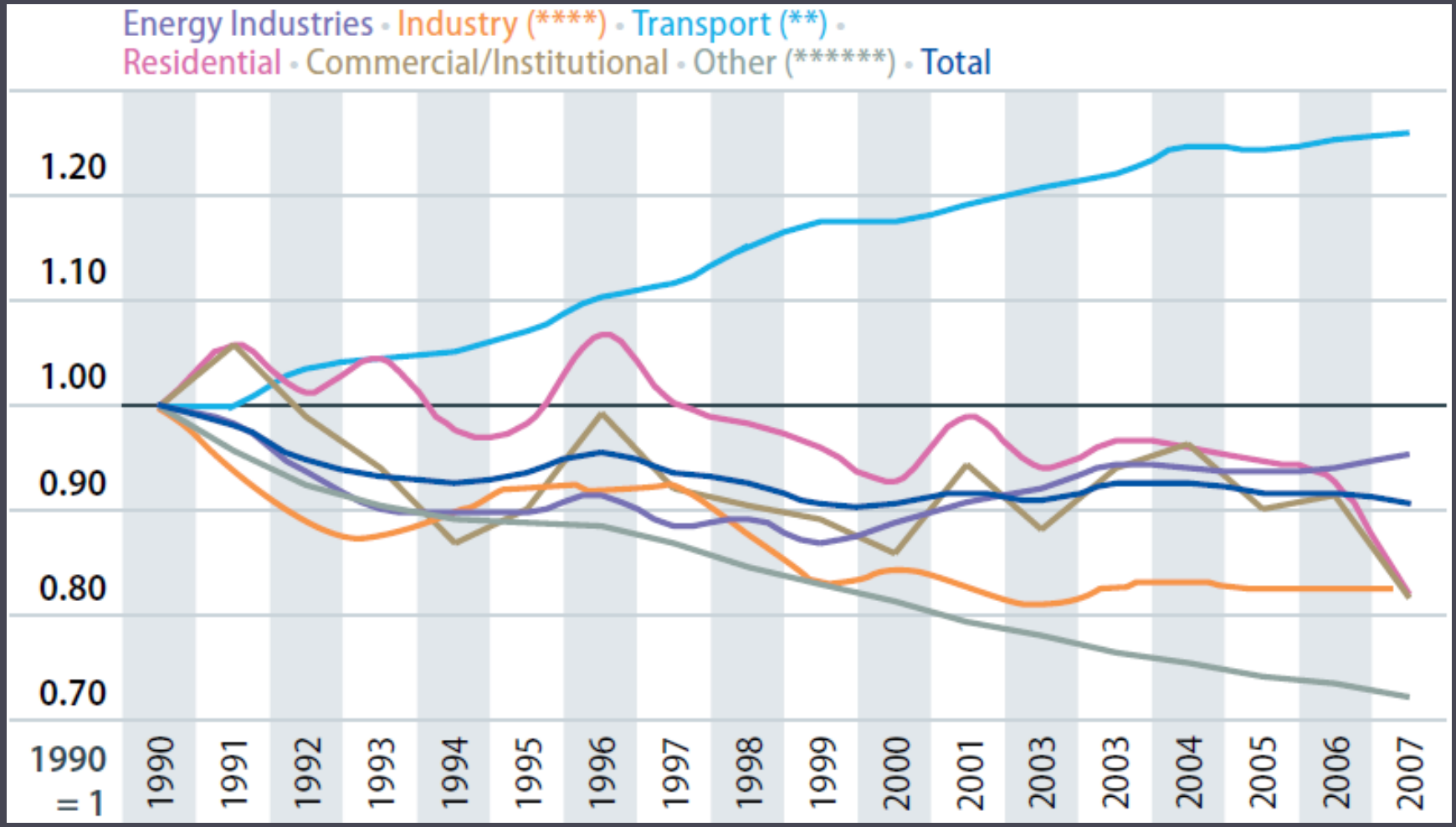
Principali impatti

Trend emissioni atmosferiche prodotte dai trasporti



Trend di emissione di GHG per settore



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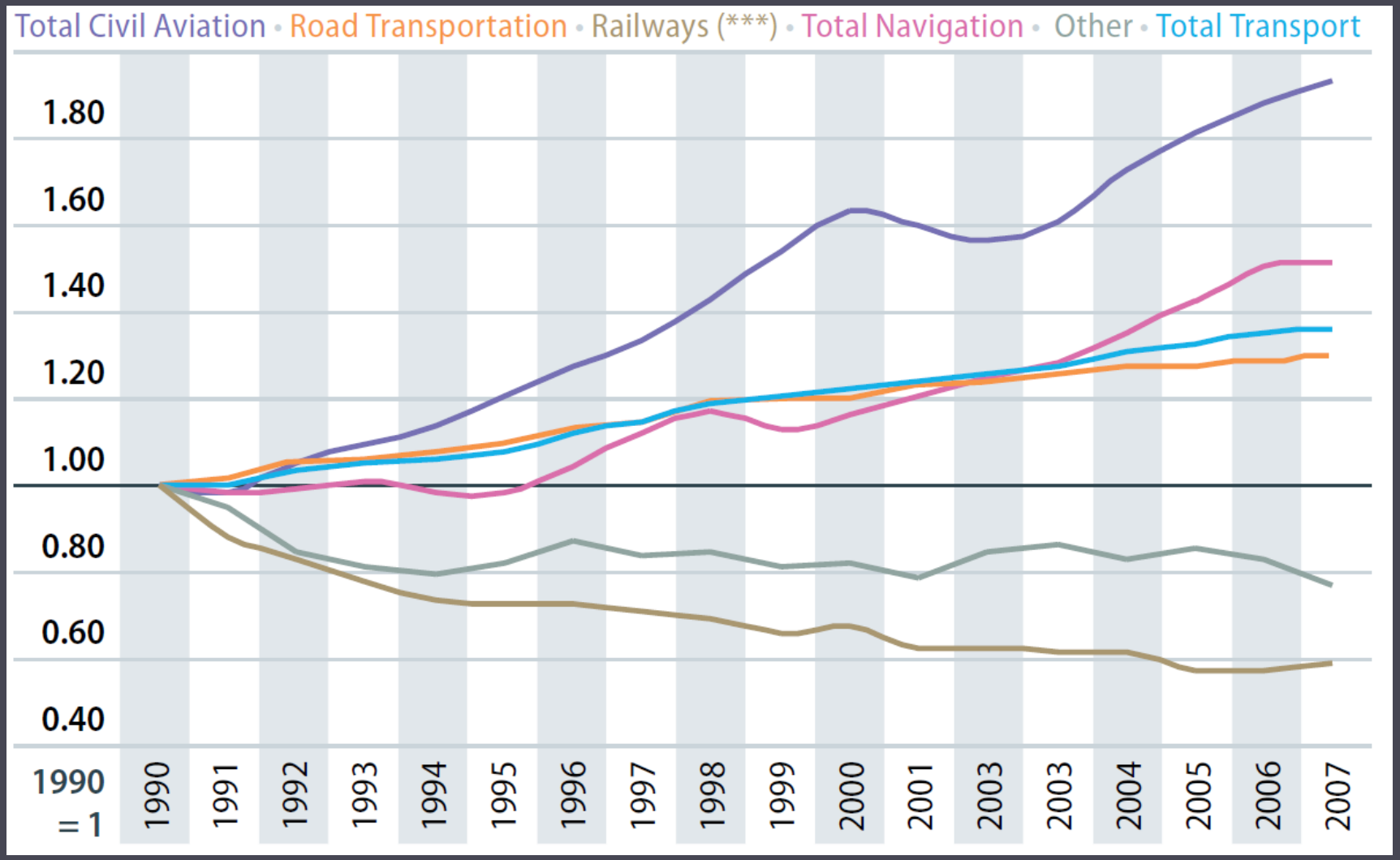
Trend di emissione GHG per modo di trasporto



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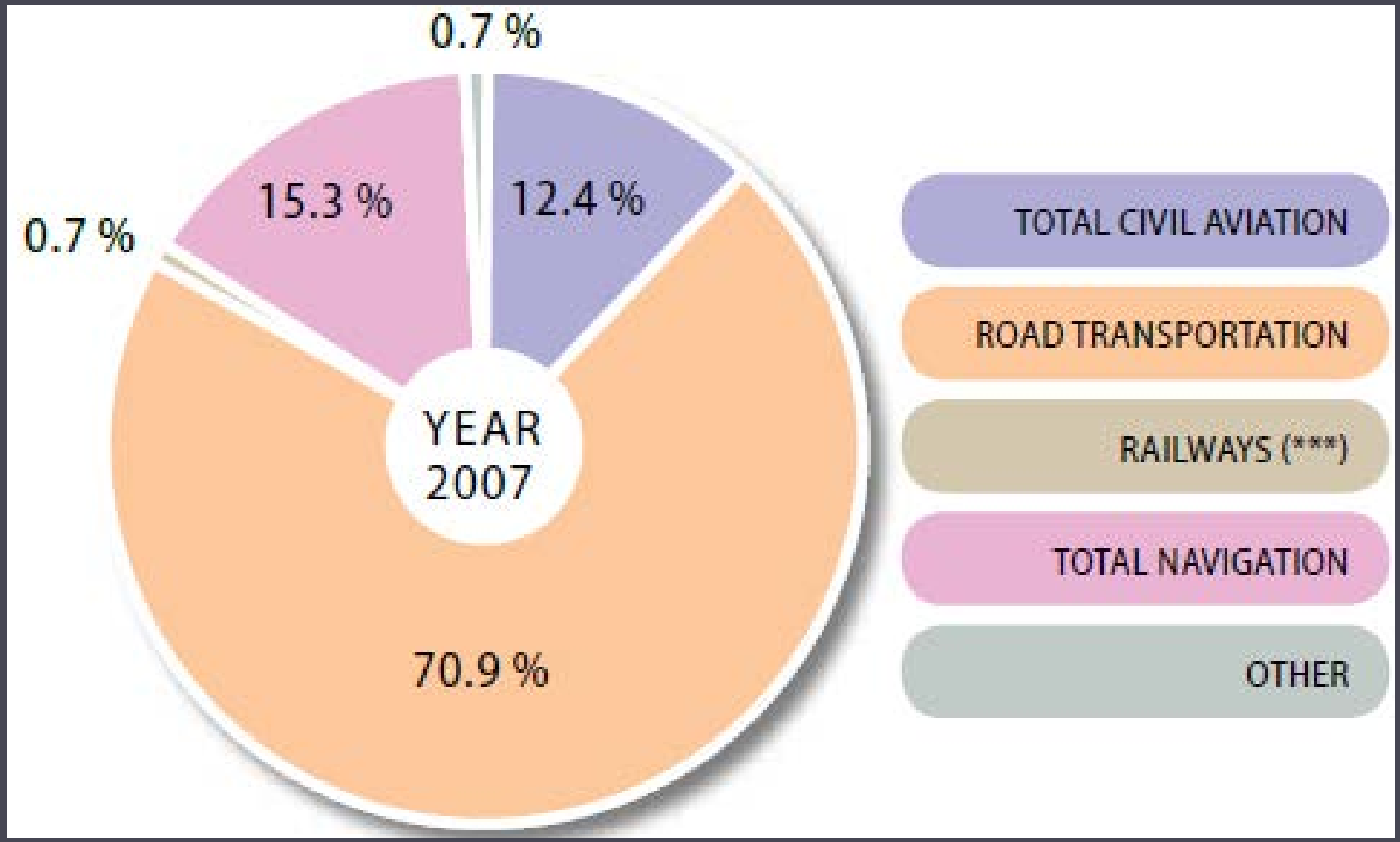
Emissione di GHG per modo di trasporto



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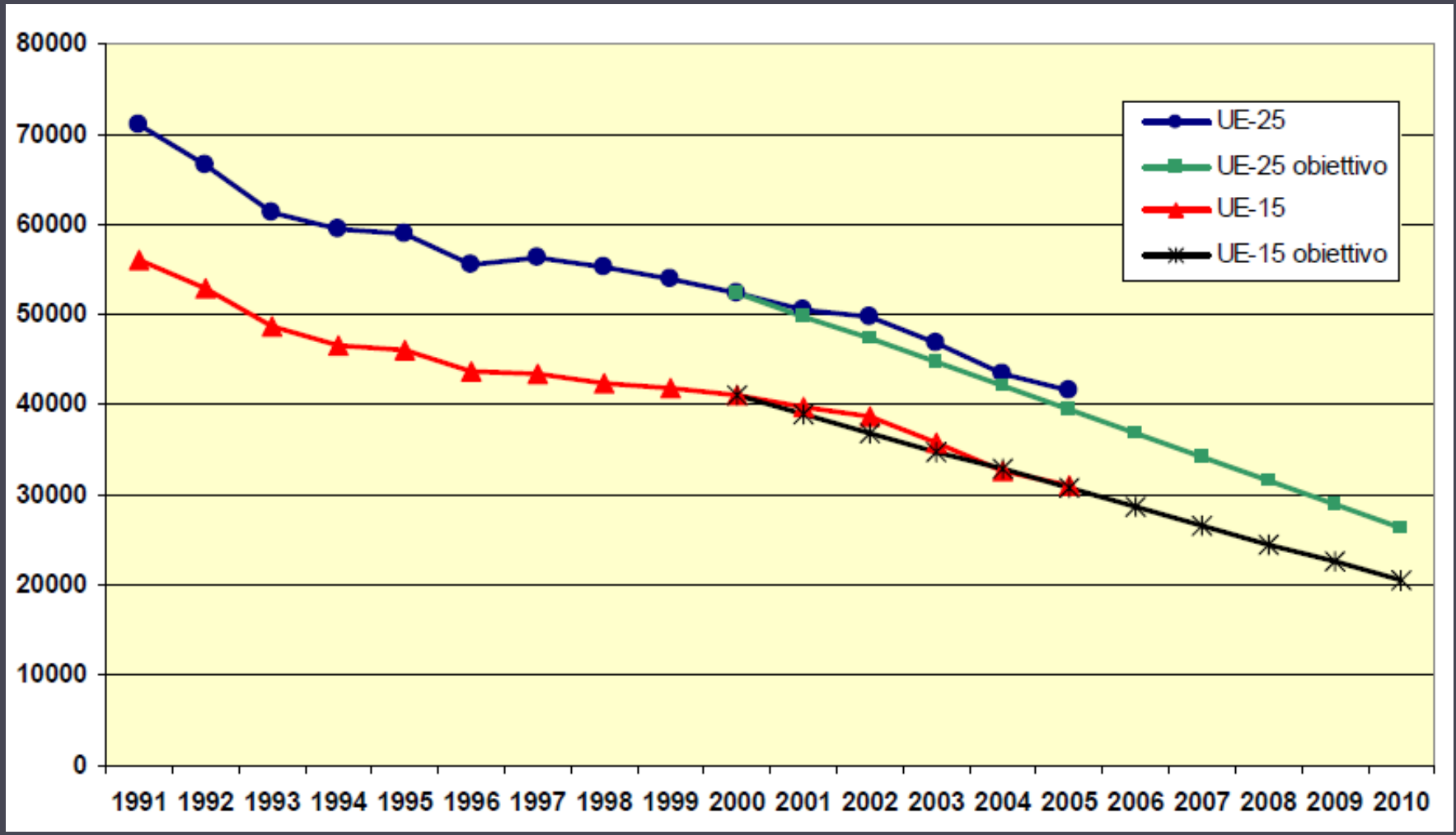
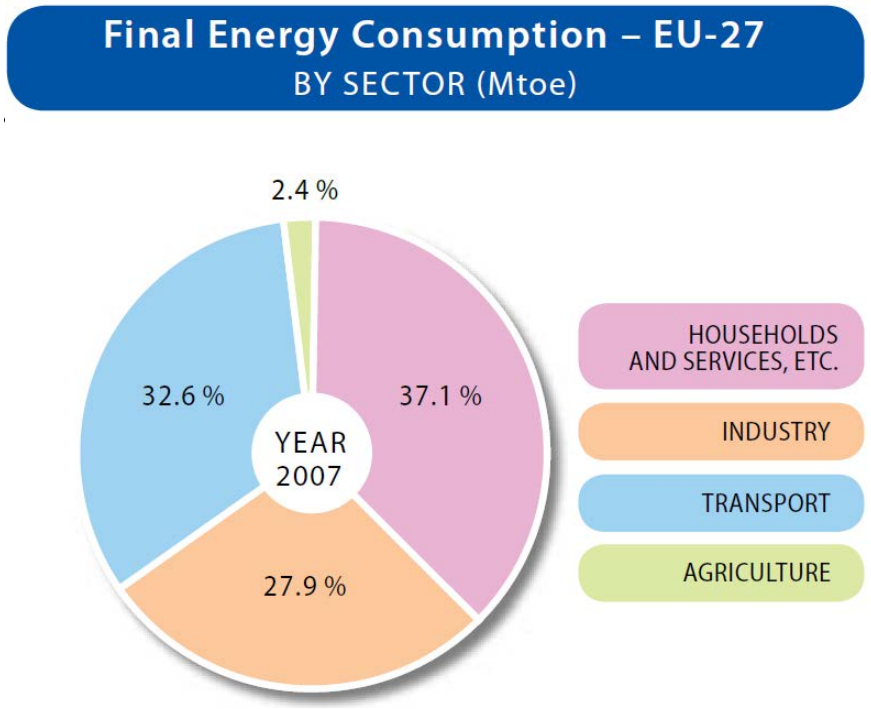
Vittime della strada



Trasporti ed energia in Europa

- I trasporti consumano il 70% circa del consumo globale di petrolio nell'UE
- Il trasporto stradale e quello aereo consumano rispettivamente il 60% e il 9% di tutto il petrolio



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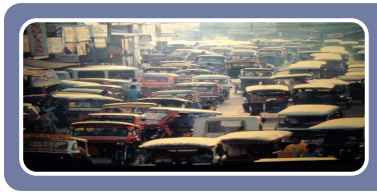
Impatti dei trasporti

Costo ambientale 1.1% del PIL



Congestione 1.0 % del PIL

Gas Serra 25% del totale (+34% rispetto al 1990)

Incidenti 40.000 vittime per anno

70% del consumo di petrolio

La politica dei trasporti urbani in Europa

Urban transports

Problemi

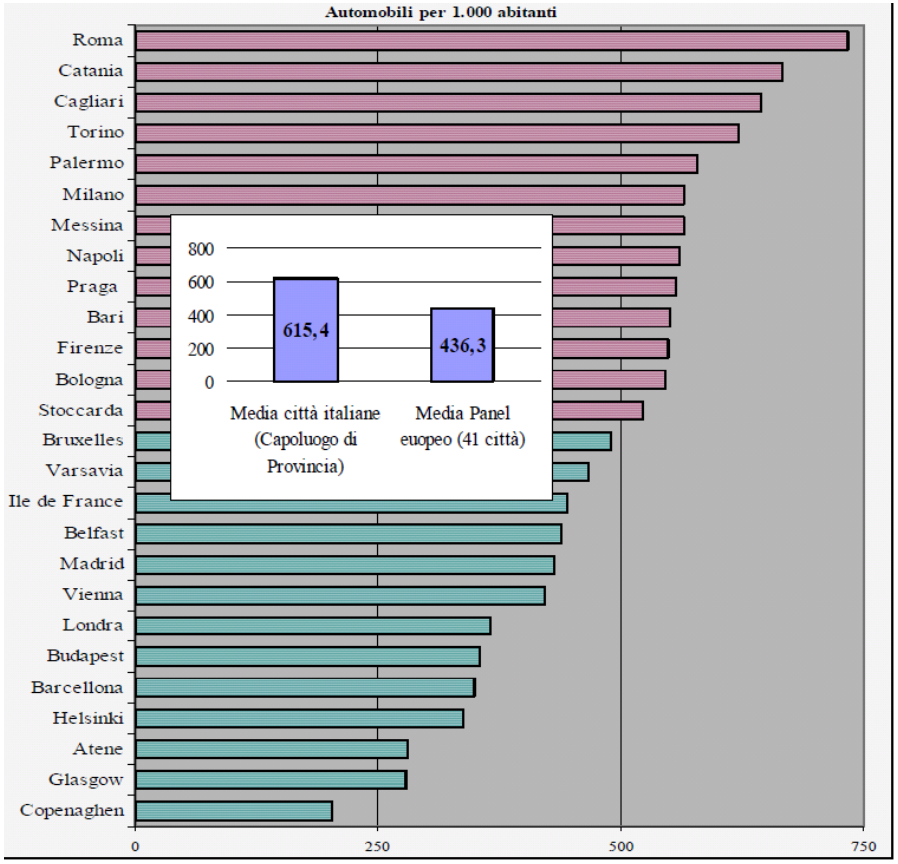
- L'80% degli europei vive in un'area urbana.
- 40% delle emissioni di CO2 generate dal trasporto stradale e fino al 70% delle altre sostanze inquinanti prodotte dai trasporti.
- Una vittima su tre perde la vita in città.

Obiettivi

- Potenziare la mobilità riducendo al tempo stesso la congestione, gli incidenti e l'inquinamento, cioè **promuovere una mobilità sostenibile**

Key figures on urban mobility trends – Current situation

- Passenger cars are responsible for 75% of passenger kilometers travelled
- **Car ownership** per household is increasing (+ 38% in average between 1990 and 2004)
- 50% of car trips are **less than 5km**, 30% are less than 3km
- Less than 5% by **bicycle**
- Less than 10% by **public transport**
- Walking and cycling are decreasing
- **Car occupancy** remains close to one.
- **Urban freight** is typically between 20% and 25% of road space use (space used x hours)



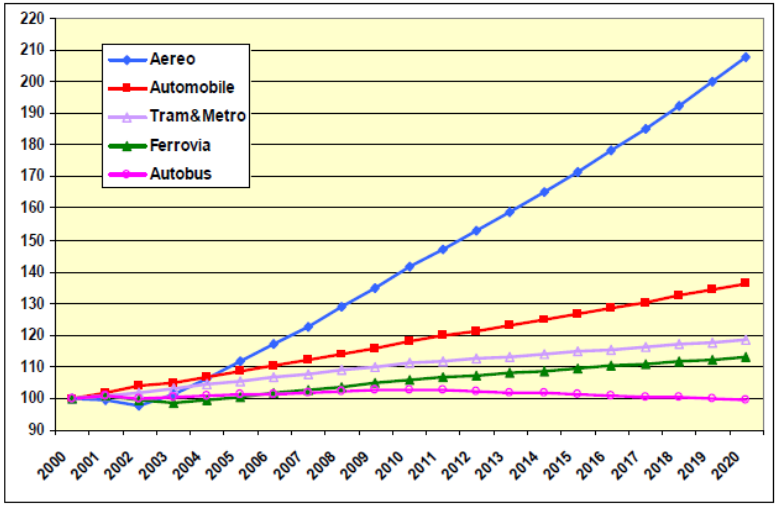
onte: elaborazione Isfort su dati Istat e Urban Transport Benchmarking Initative 2006

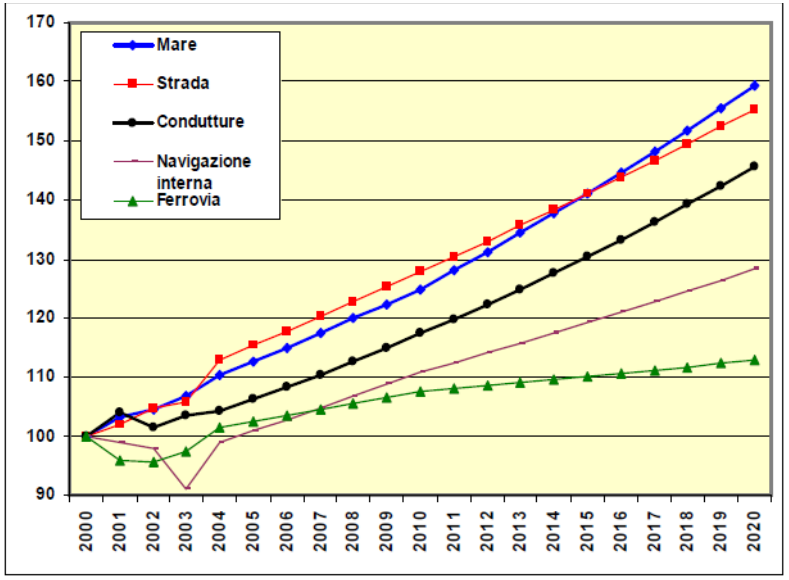
CE, 2007, Sustainable Urban Transport Plans - Preparatory Document in relation to the follow-up of the Thematic Strategy on the Urban Environment

Key figures on urban mobility trends – outlook 2000-2030

Passenger transport (pxkm) is expected to grow by 42% (road traffic would then count for 85% and car traffic for 75% in 2030)

Freight transport (t-km) are expected to grow by 63% (road traffic would count for 45%)





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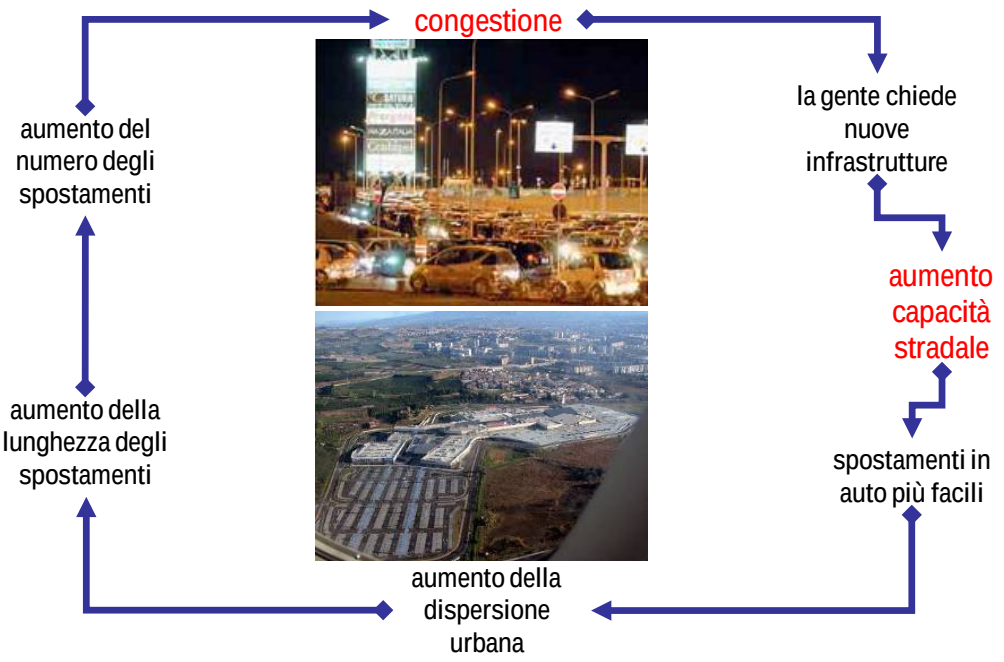
Sprawl and car dependency

Sprawling as urban development model

Usual, easy and cheap response: to increase and expand road capacity

In return more urban sprawl hence more difficulties to connect urban expansions to public transport and an increase in car ownership.

Result: growth in peripheral and radial car traffic.



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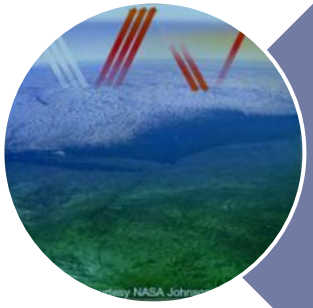
Climate Change



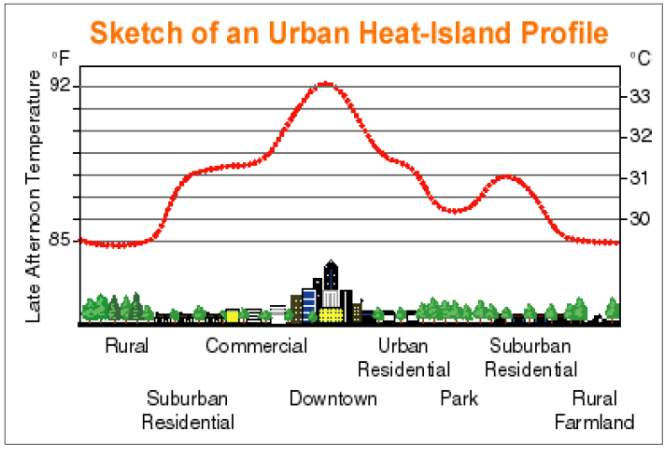
Over the past 100 years, the global average temperature has risen by about 0.6°C and the European average temperature by **0.95°C**.

EU policies aim to limit the future global average temperature increase to **2°C** above pre-industrial levels in order to limit the damage.

CE, 2007, Sustainable Urban Transport Plans - Preparatory Document in relation to the follow-up of the Thematic Strategy on the Urban Environment

Climate Change

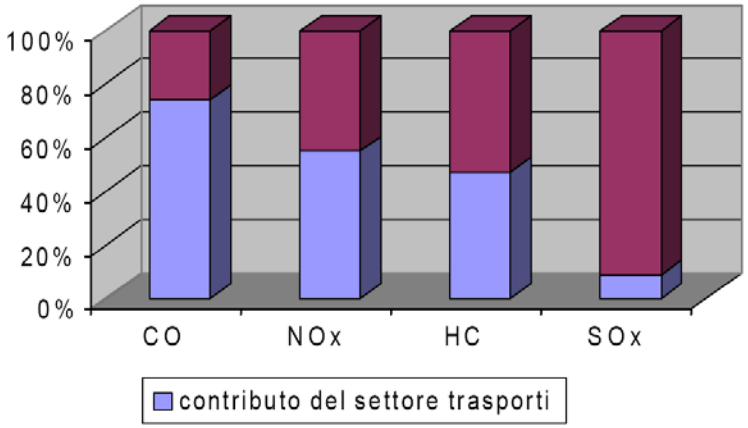
- If current trends continue, **CO2** emissions from transport will be some **75% higher** in 2030 than in 1990.
- **Urban road traffic** contributes to at least **40% of transport related CO2** emissions and approximately 10% of overall CO2 emissions in the EU.



Climate change

Urban air pollution

- Road traffic contribute to high levels of PMxx, NOx, benzene and poly-aromatic hydrocarbons (PAH).
- In 2000, exposure to particulate matter, was estimated to reduce average statistical life expectancy by approximately nine months in the EU-25, equal to **348.000 premature mortalities per annum**.



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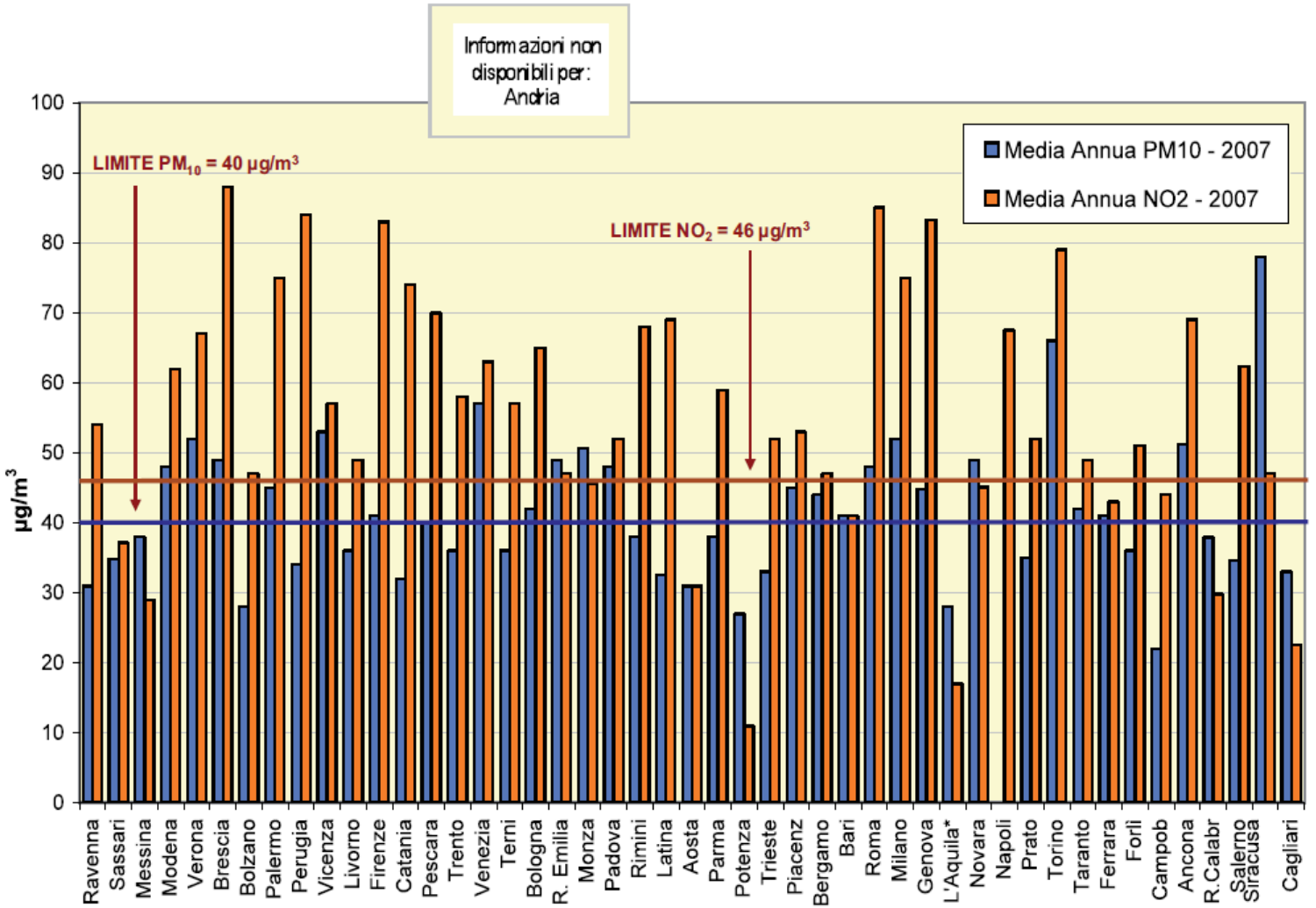
Air pollution in Italy



Road safety in urban areas

- **40.000 victims** per year in Europe, 6000 in Italy
- Two thirds of overall road accidents and **one third of overall road deaths** occur in agglomerations.
- Powered two-wheelers, pedestrians and cyclists are frequently victims (in the range of 14-25 age most affected group).
- **Third death cause** by the 2020 according to World Health Organization

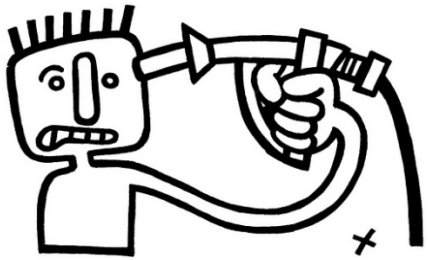
CE, 2007, Sustainable Urban Transport Plans - Preparatory Document in relation to the follow-up of the Thematic Strategy on the Urban Environment

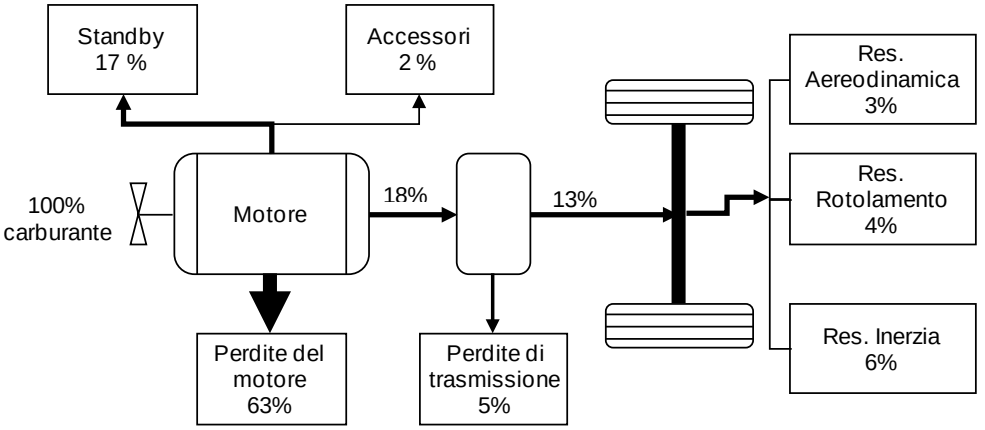
Traffic noise

- Urban traffic noise levels usually exceed the guidelines set by the World Health Organization for the protection of health.
- **20% of the Union's population** suffer from noise levels that scientists and health experts consider to be **unacceptable**
- An additional 40% of people are living in so-called "grey areas" where noise levels are such as to cause serious annoyance during the daytime.

Transport energy consumption: high dependency on fossil fuels

- Transport accounts for 30% of overall EU energy consumption.
- A half of all road transport fuel is combusted in urban areas.
- Some 98% of the transport related energy market depends on oil, the largest part of which (75%) is due to road transport.





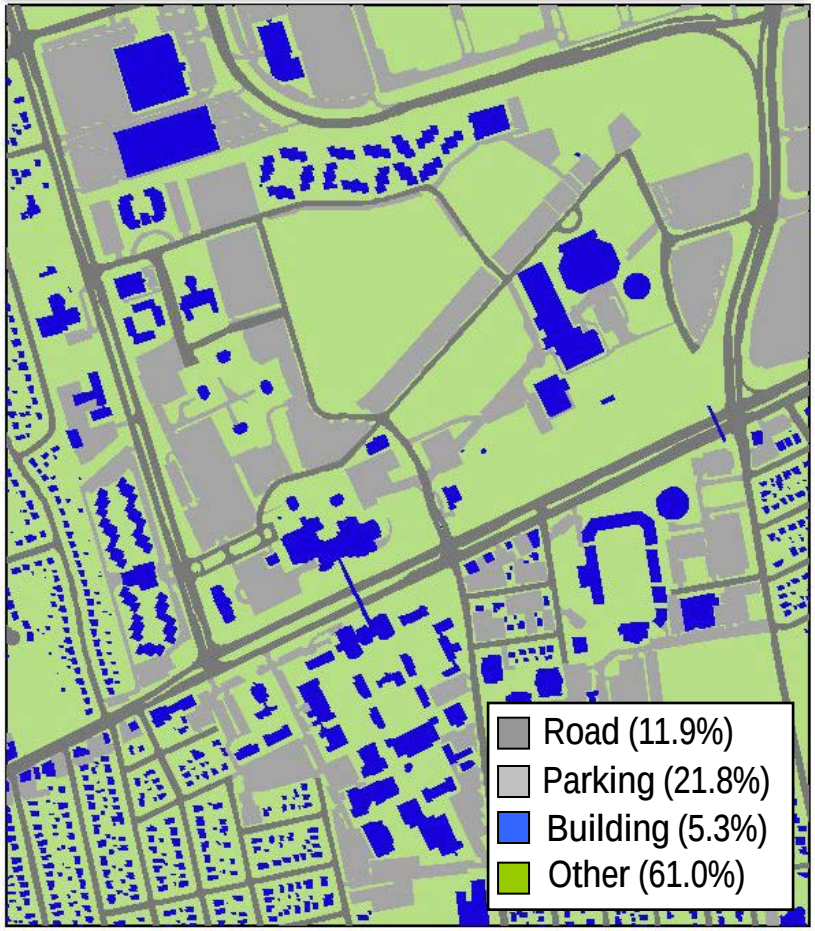
Meno del 2% dell'energia consumata diventa trasporto utile

Congestion

Land use occupation of road infrastructure

- 1/3 dello spazio urbano è occupato da strade e parcheggi

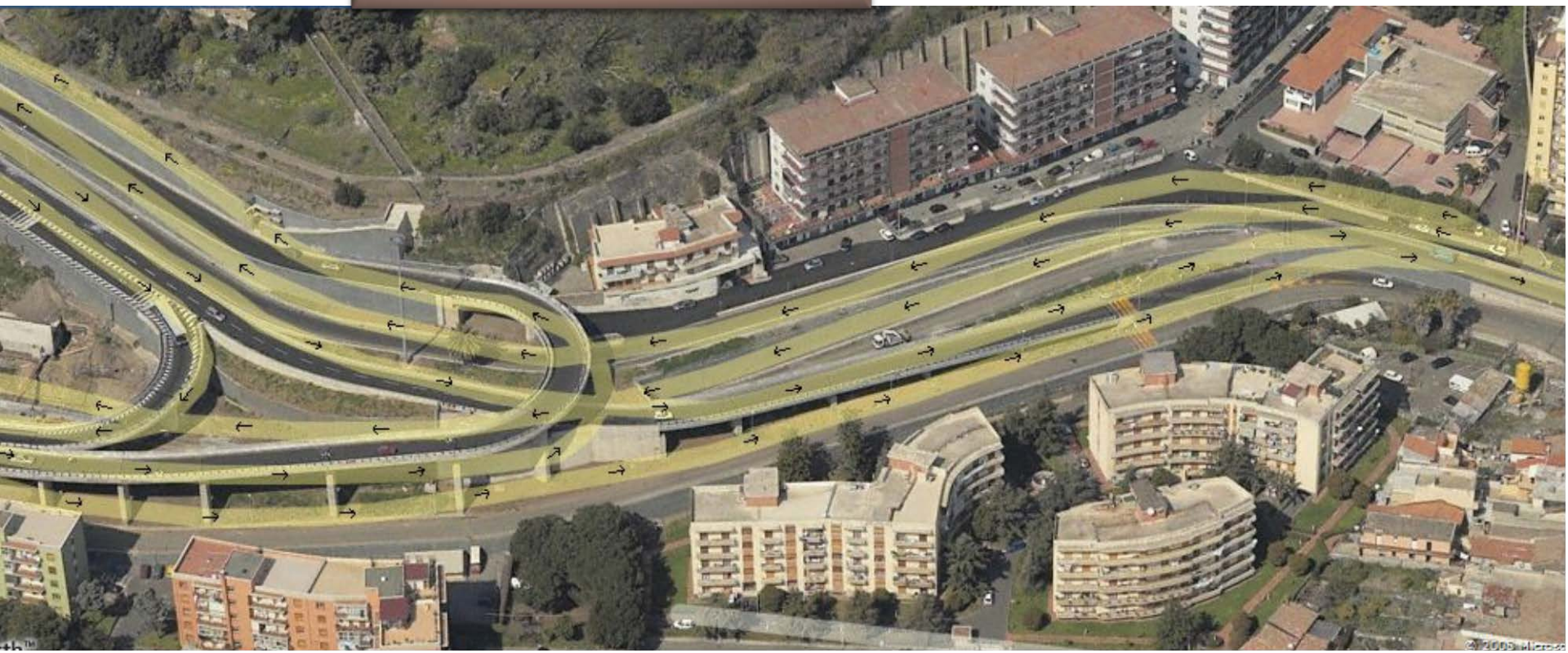
Urban Spatial Structure, Hempstead, Long Island, New York



Land use occupation of road vehicles

Social segregation

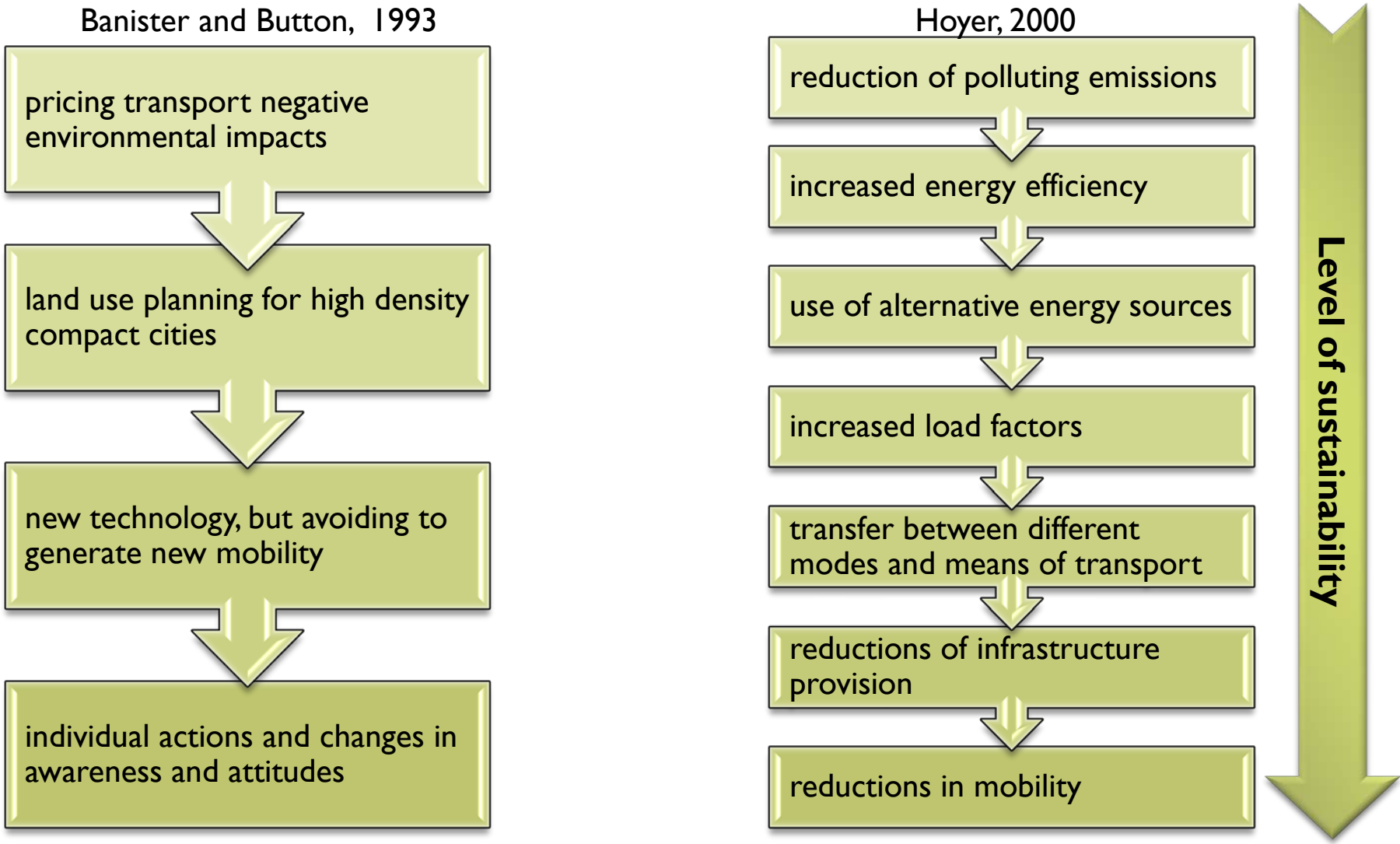
Catania, via Due Obelischi



Social degradation

Strategie e strumenti per la mobilità sostenibile

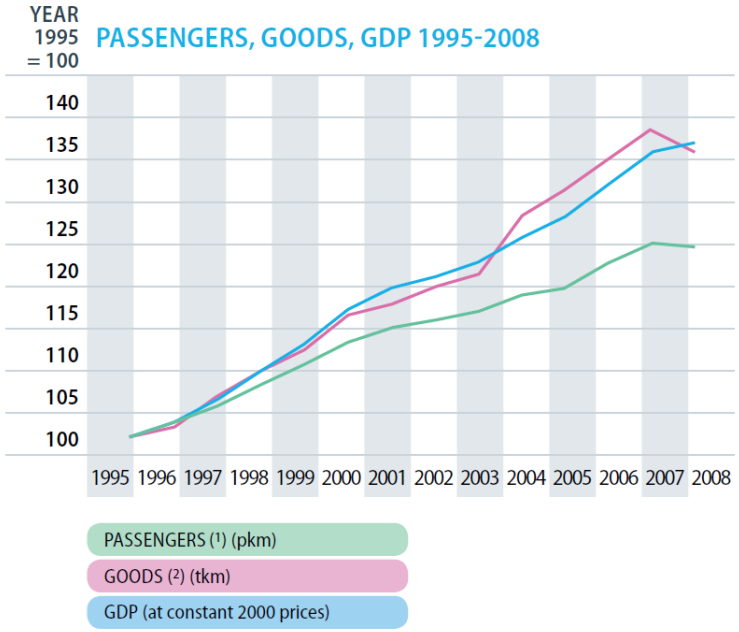
measures and strategies to promote SM, Hoyer (2000)



measures and strategies to promote SM Sustainable Urban Transport Plans (CE 2007)

Operational objectives and targets

- **Decoupling economic growth** and the demand for transport with the aim of reducing environmental impacts.
- Achieving sustainable levels of transport **energy use** and reducing transport **greenhouse gas emissions**.
- Reducing **pollutant emissions** from transport to levels that minimize effects on human health and/or the environment.
- Achieving a balanced shift towards **environment friendly transport modes** to bring about a sustainable transport and mobility system.
- Reducing transport **noise** both at source and through mitigation measures to ensure overall exposure levels minimise impacts on health.
- Halving **road transport deaths** by 2010 compared to 2000.

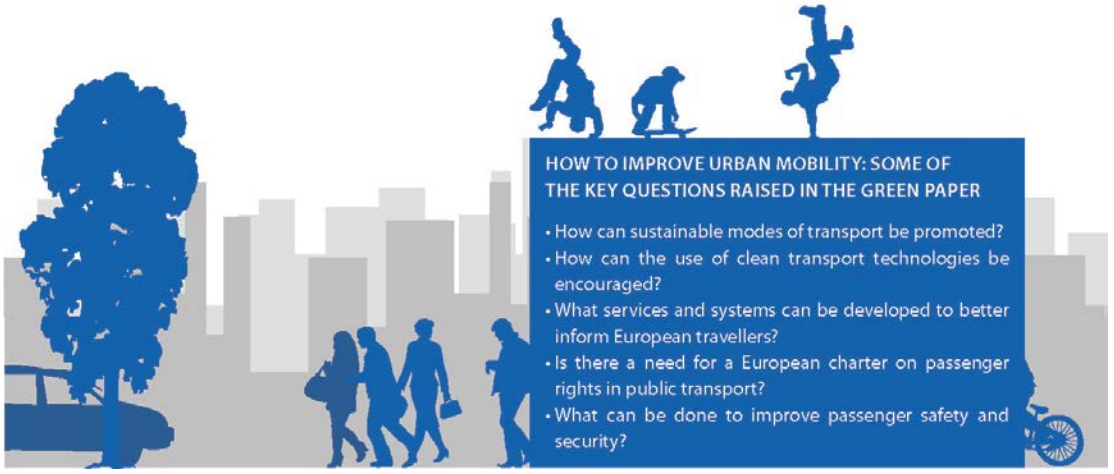


CE, 2007, Sustainable Urban Transport Plans - Preparatory Document in relation to the follow-up of the Thematic Strategy on the Urban Environment

measures and strategies to promote SM Action Plan on Urban Mobility (CE, 2009)

twenty measures to encourage and help local, regional and national authorities in achieving their goals for sustainable urban mobility

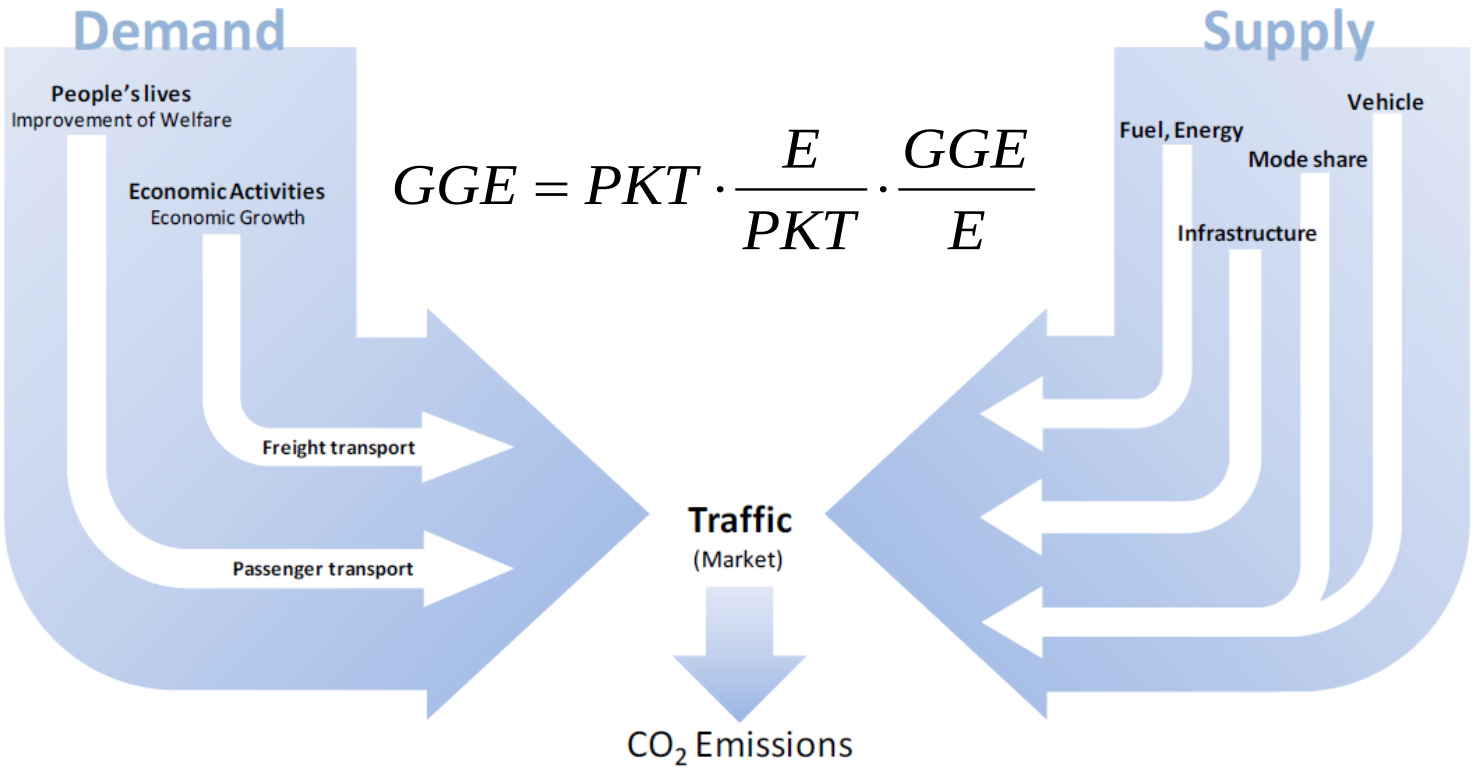
- Improved information
- Passenger rights
- Better planning
- Greener transport
- Sharing experiences
- Funding



Strategic lines of SM (Banister, 2005)

- Reduce the need to travel.
- Reduce the absolute levels of car use and road freight in urban areas.
- Promote more energy-efficient modes of travel for both passengers and freight.
- Reduce noise and vehicle emissions at source.
- Encourage a more efficient and environmentally sensitive use of the vehicle stock.
- Improve safety of pedestrians and all road users.
- Improve the attractiveness of cities for residents, workers, shoppers and visitors.

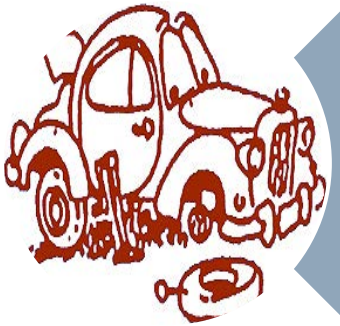
Need for a new transport planning approach



$$GGE = PKT \cdot \frac{E}{PKT} \cdot \frac{GGE}{E}$$

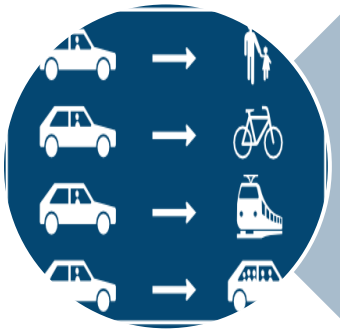
CO_2 Emissions = Activity (passenger, freight) — AVOID × Mode Share — SHIFT × Efficiency (tank to wheel, traffic efficiency) × Fuel carbon content (well/field to tank) — IMPROVE

Common and basic strategies to SM



to reduce the need to travel and trip lengths

AVOID



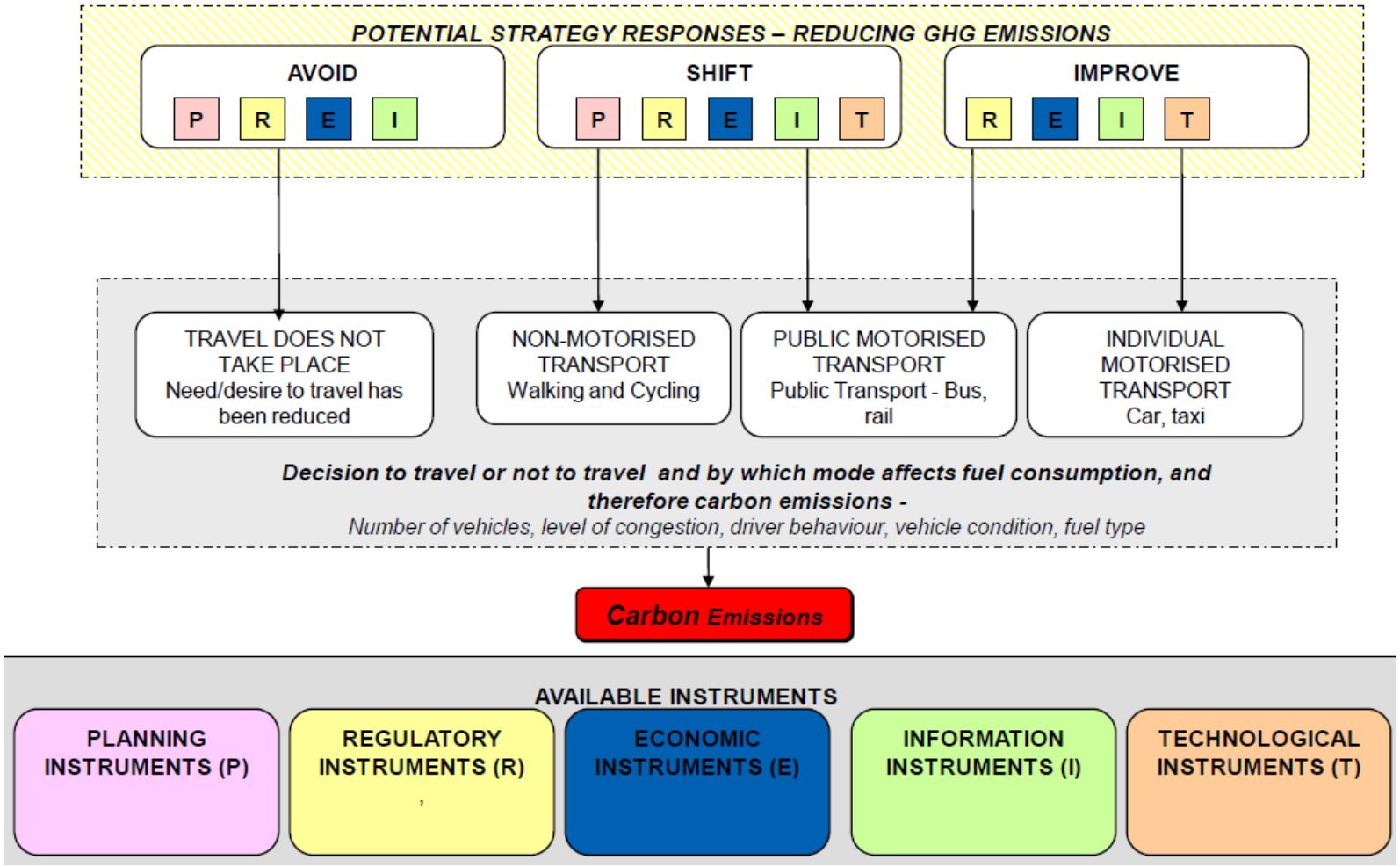
to encourage modal shift

SHIFT

to encourage greater efficiency in the transport system.

IMPROVE

Strategies and Tools for SM



Links between Urban Transport and Climate Change
Armin Wagner, Energy and Transport, GTZ Eschborn
www.gtz.de/climateandtransport, www.sutp.org

Toolbox of instruments

PLANNING INSTRUMENTS
e.g. land use planning, planning of public transport, planning of non-motorised modes

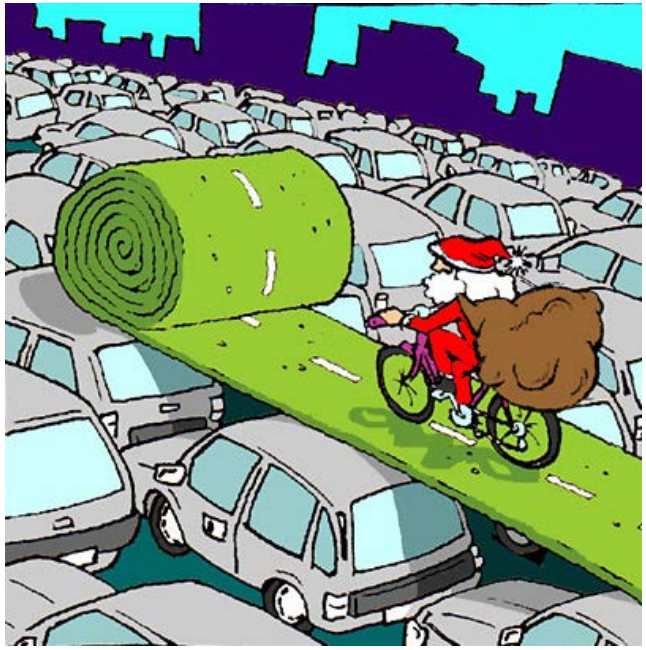
REGULATORY INSTRUMENTS
e.g. emissions standards, speed limits, parking regulation, physical restrictions

ECONOMIC INSTRUMENTS
e.g. fuel taxes, vehicle taxation, road pricing, subsidies, parking fees

INFORMATION INSTRUMENTS
e.g. public awareness campaigns, traffic information systems, public transport information systems

TECHNOLOGICAL INSTRUMENTS
e.g. fuel improvement, cleaner engines

Links between Urban Transport and Climate Change
Armin Wagner, Energy and Transport, GTZ Eschborn
www.gtz.de/climateandtransport, www.sutp.org



Strumenti per la mobilità sostenibile

Strumenti di Pianificazione

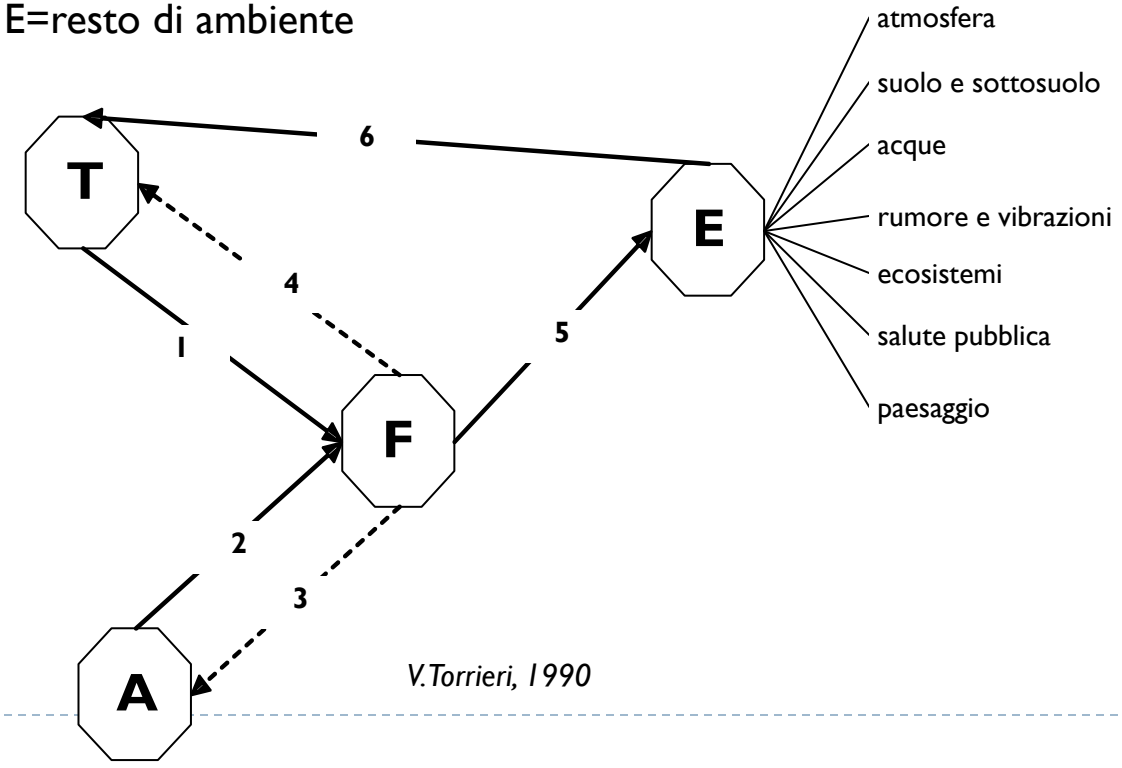
Uso del territorio e trasporti

Azioni per la mobilità sostenibile

Interazione Trasporti – Territorio - Ambiente

Componenti

- T= sistema di progetto (trasporti)
- A=sistema attività economiche
- F=flussi di traffico
- E=resto di ambiente



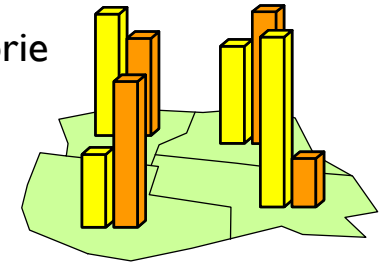
V.Torrieri, 1990

Relazioni

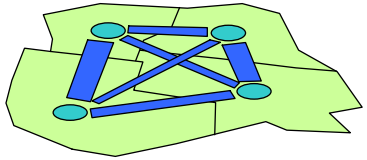
1. opportunità di trasporto
2. domanda di trasporto
3. accessibilità (relaz. a lungo termine)
4. efficienza interna (relaz. a breve termine)

cessione scorie

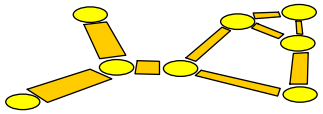
risorse



Land Use



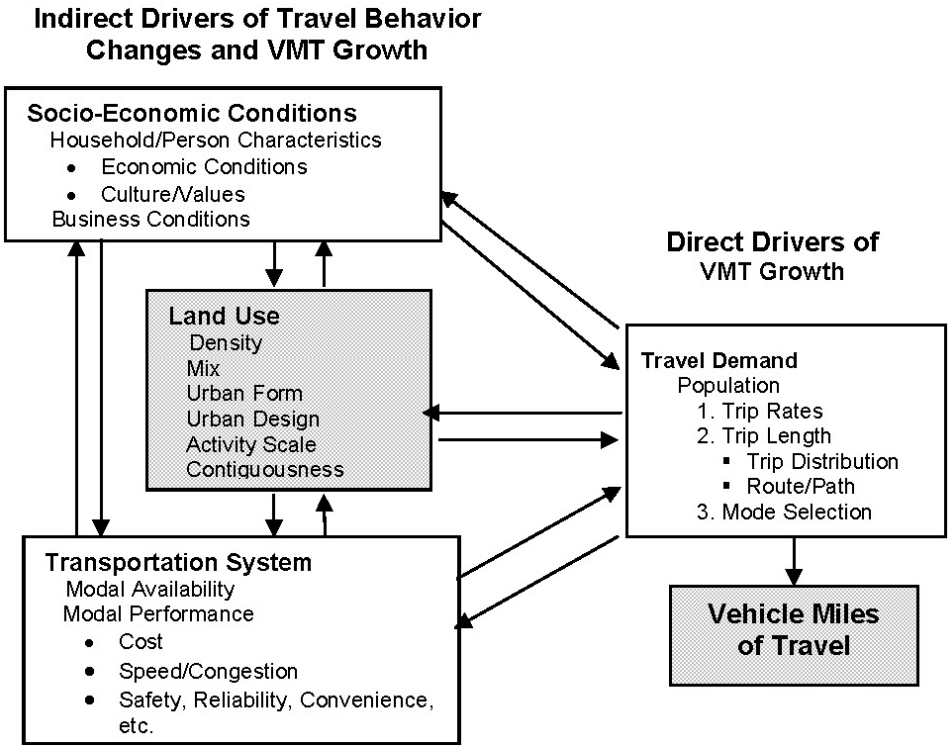
Spatial Interactions



Transportation Network

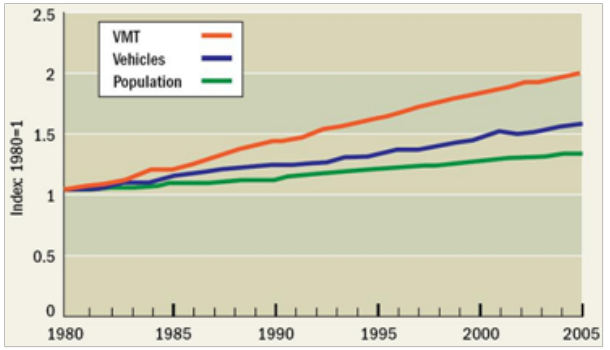
Land use and transport planning

- **Transport planners** need to forecast how future travel demand is affected by land use and similarly they have to be able to estimate how new transport investments modify land use. It is basically a predictive task.
- Conversely, the point of view of the **urban planners** should be prescriptive: how to address changes in land use in order to get better performing transportation systems and how to change the latter in order to produce desired changes in land use.
- Hopefully these two processes could evolve in an holistic approach within a unique role of planner able to cope with the complex interaction between the transport system and land use.

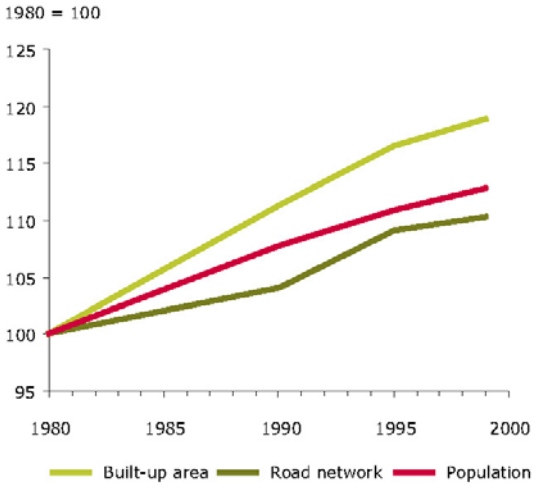


Land use and transport planning

- **Urban sprawl** is the physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas
- In the USA vehicle-distance travelled has grown three times faster than population and twice as fast as the number of vehicle registrations
- in the period 1995-2006 Europe has experienced an annual rate of population growth of 0.28% and a road transport related GHG emission growth rate of 1.53%



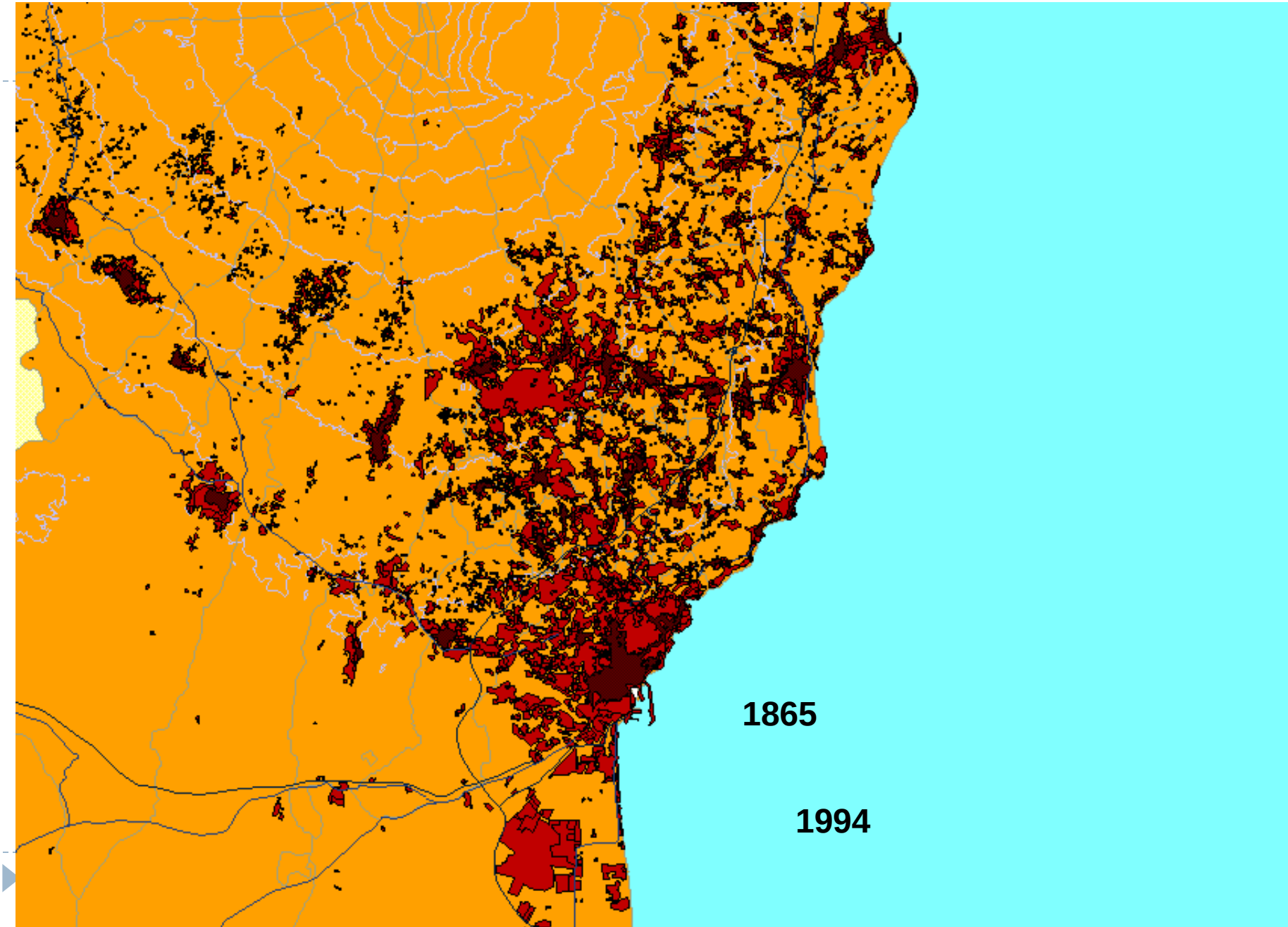
Built-up area, road network and population increases, selected EEA countries



Note: Countries covered are: Belgium, Czech Republic, Denmark, France, Germany, Latvia, Lithuania, the Netherlands, Poland, Slovakia and Spain.

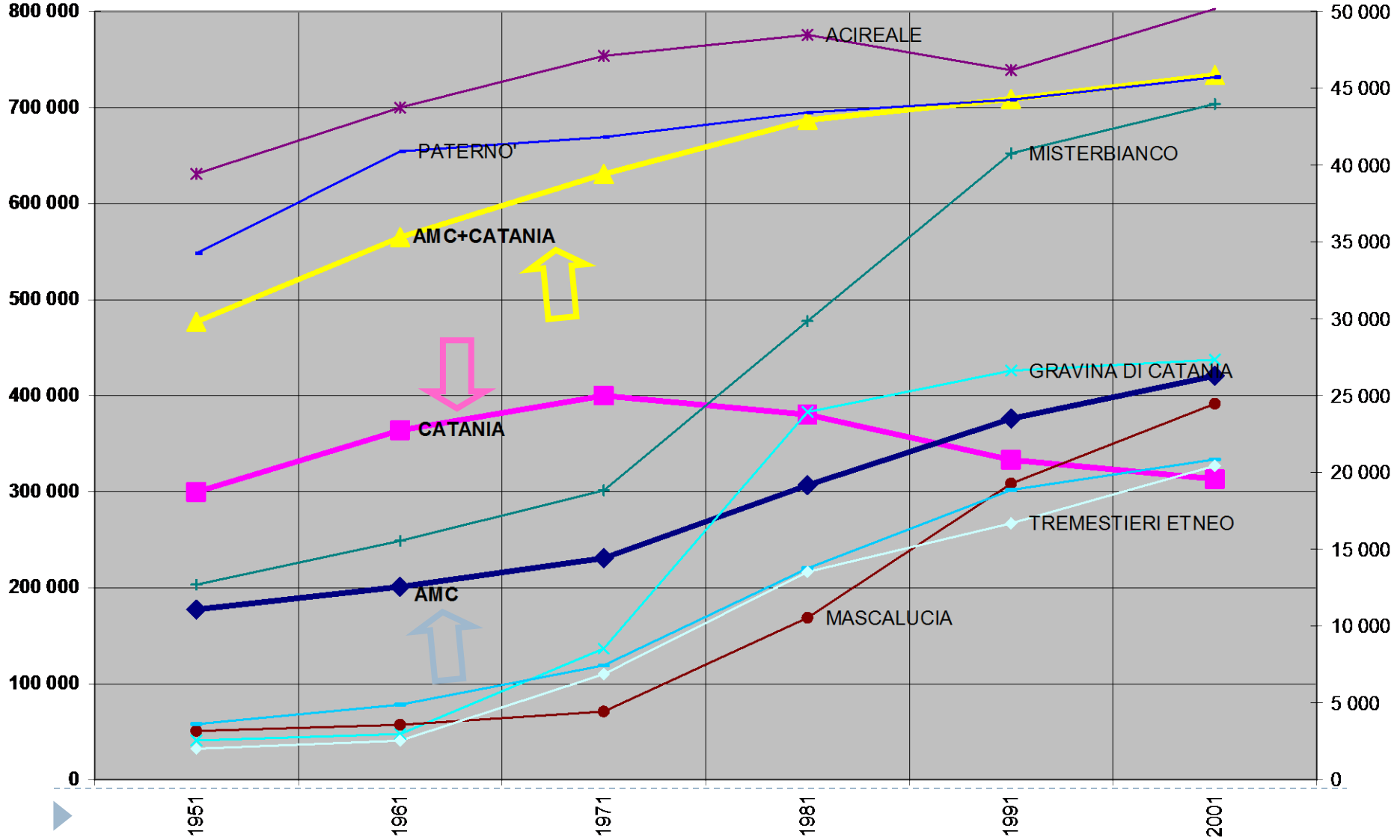
Source: EEA, 2002.

Land use change - Urbanization in Catania

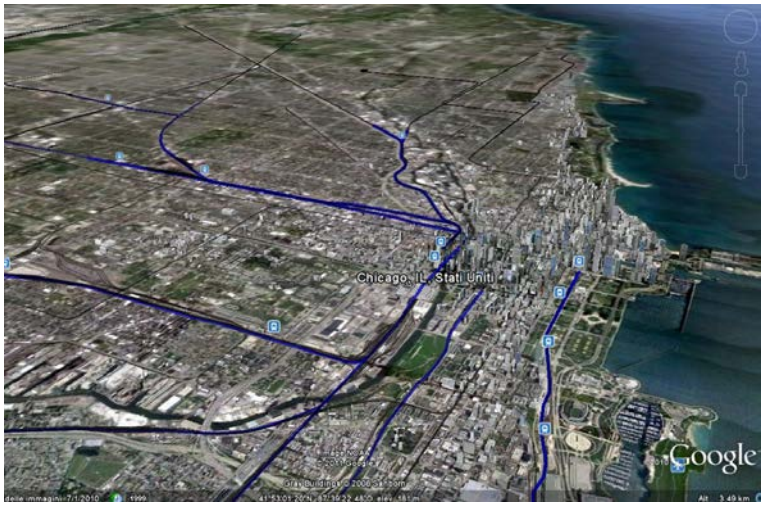


Metropolitan Area of Catania

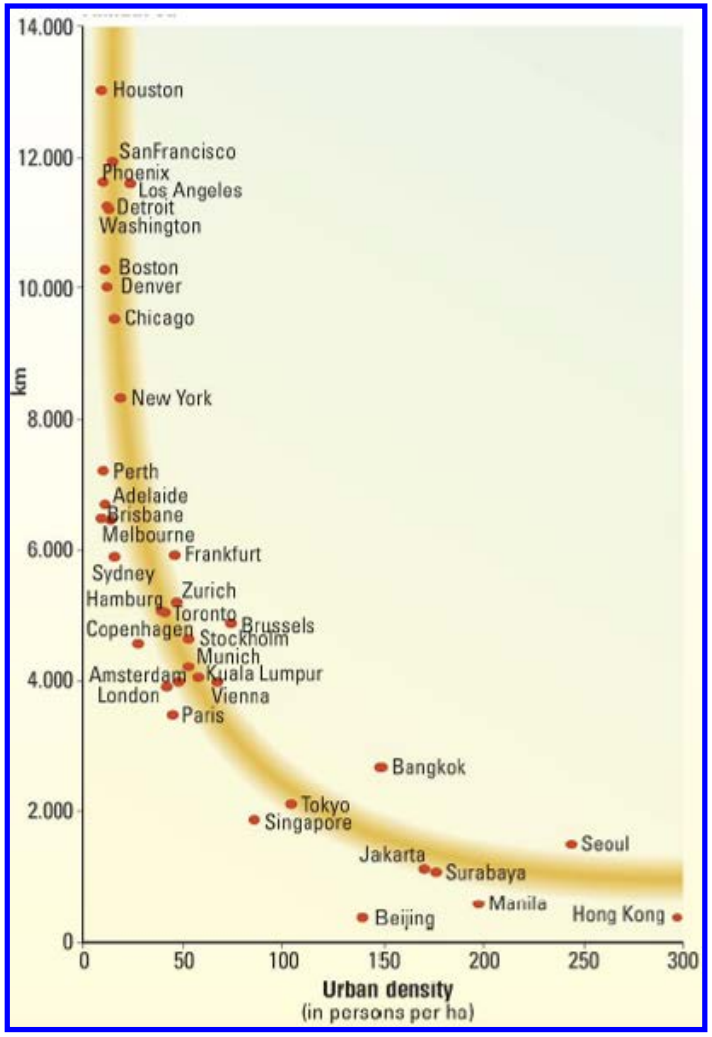
Demographic trend in the Metropolitan Area



Land use and transport planning

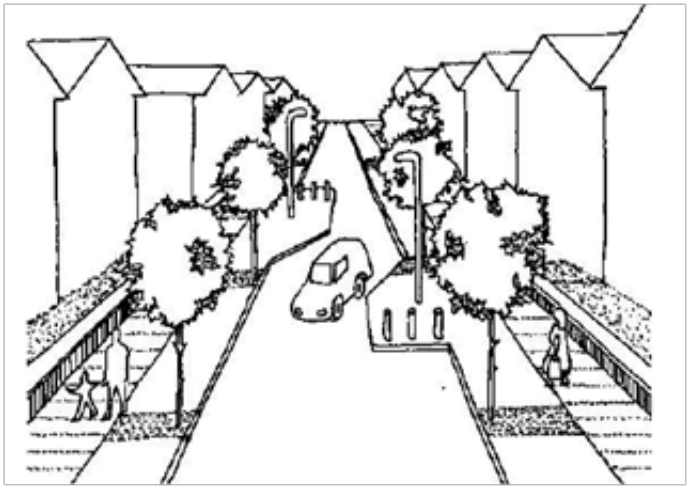


Densità e km percorsi

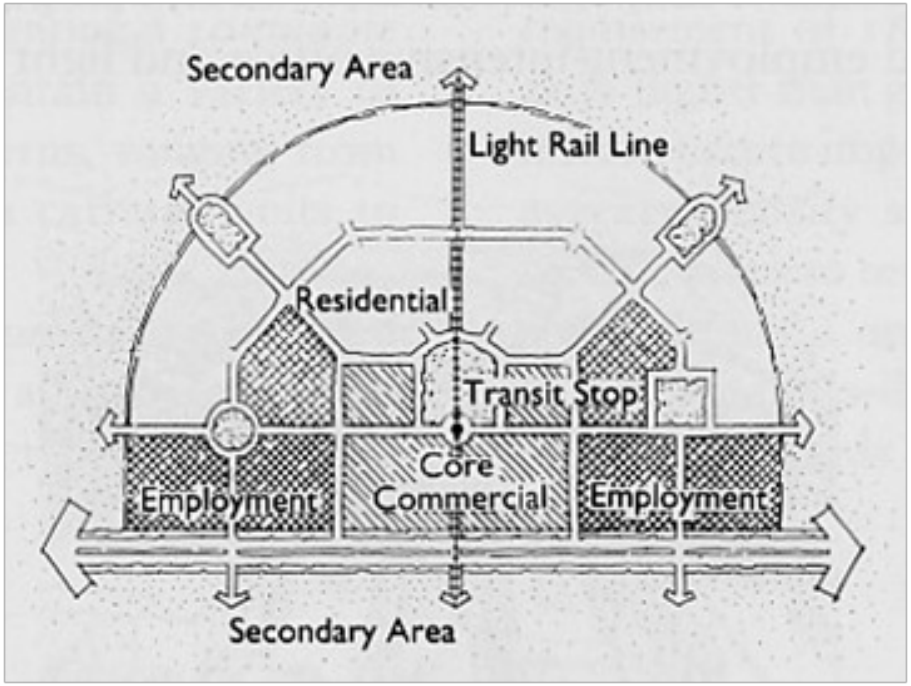


Smart growth

- Mixing land use
- Compact building design
- Walkable communities
- Variety of transport options



Transit Oriented Development



Urban TOD (Calthorpe, 1993)

Transit Oriented Development

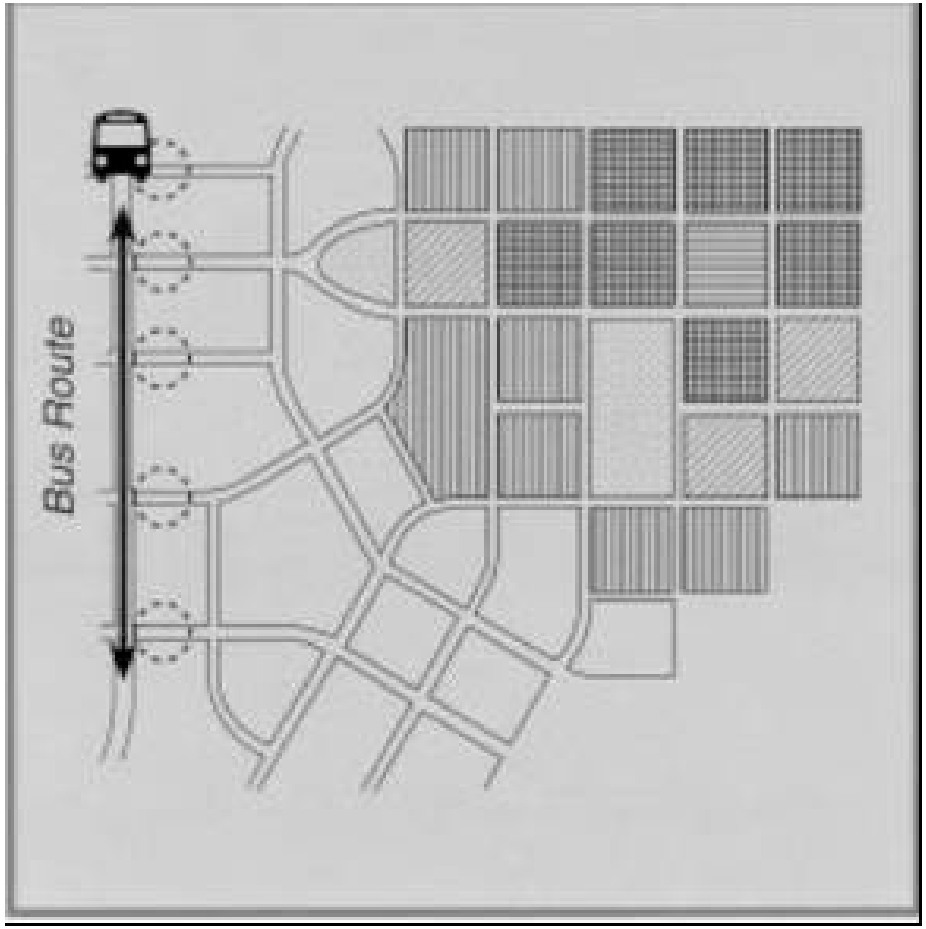
An example of TOD: Railway Station of Zuidas in Amsterdam


M
M
M
M
M
Lower Density Zoning
Lower Density Zoning

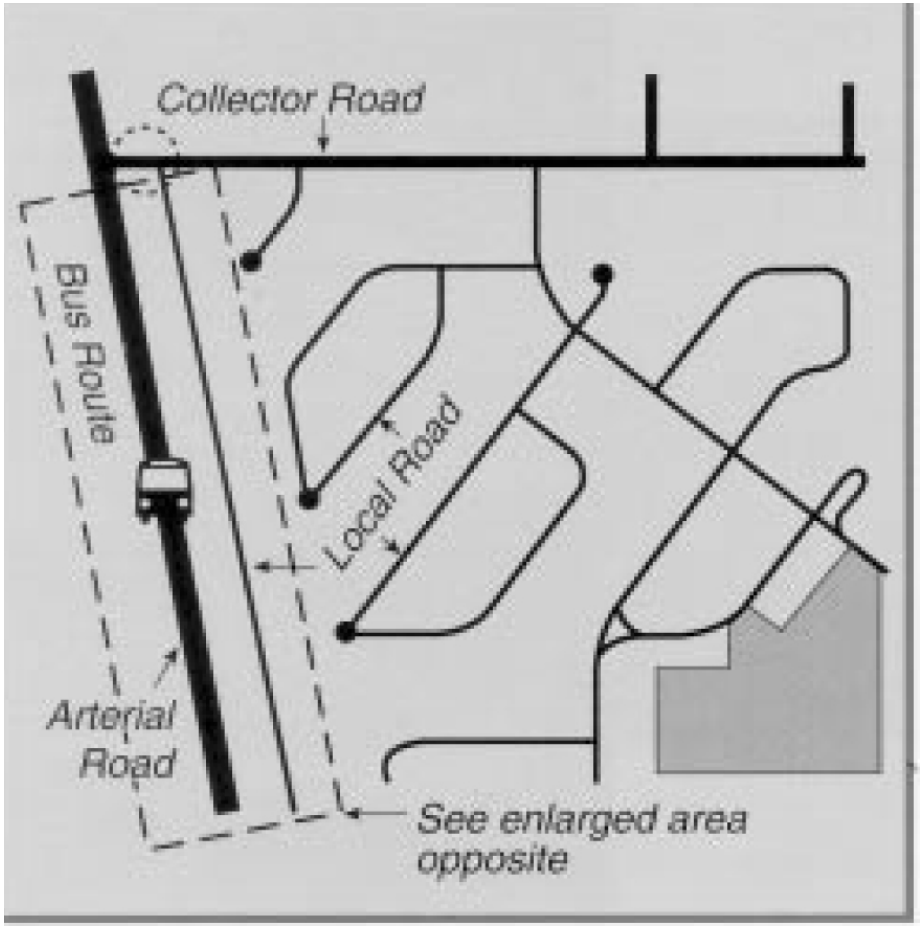
TOD in Vallingby (Sweden)

TOD in Vauban (Freiburg, Germany)

Pedestrian friendly patterns enhance the TOD

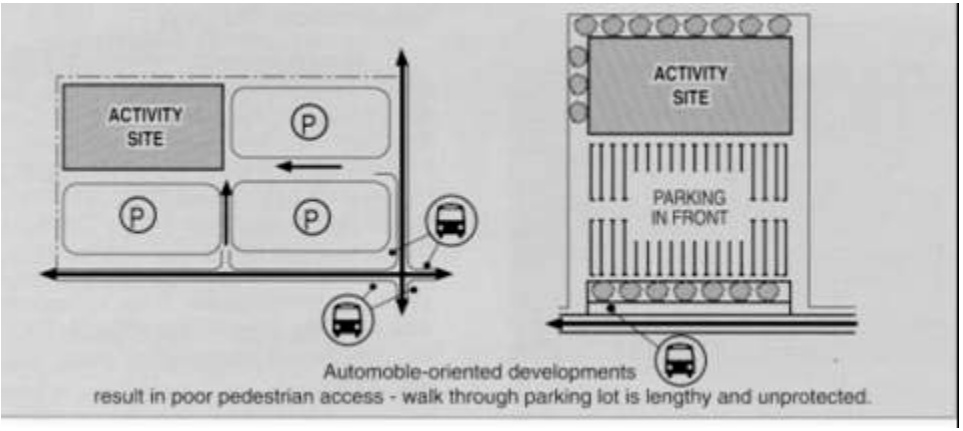


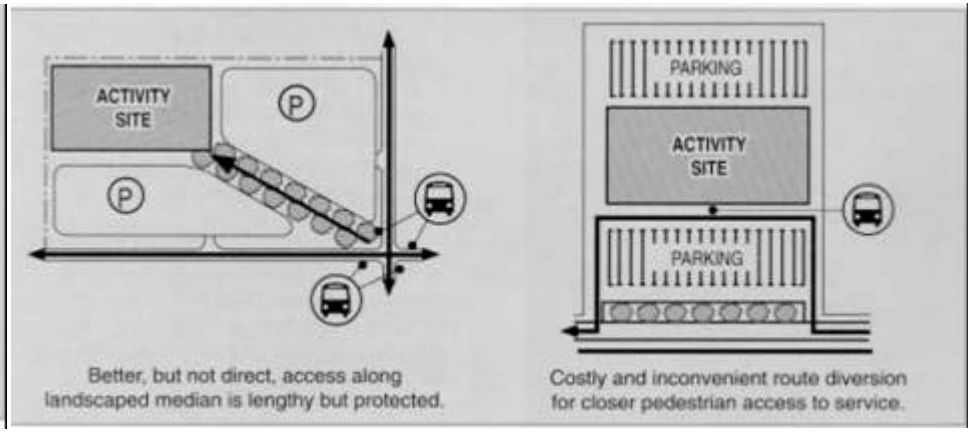
Good for transit access



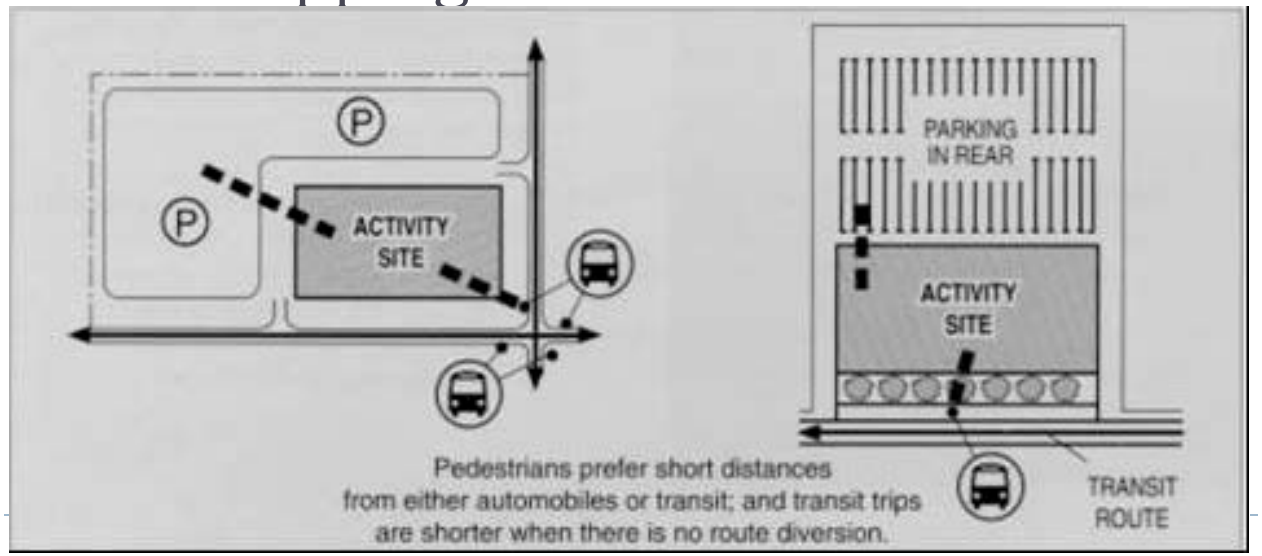
Good for traffic crossing avoiding

Pedestrian friendly patterns enhance the TOD





Layout of a shopping centre



Strumenti di Pianificazione
Trasporto Pubblico

Azioni per la mobilità sostenibile

Public Transport Planning

Progetto della rete di linee
(numero di linee e sequenza dei percorsi di ogni linea)

Determinazione delle frequenze di ogni linea
(Pianificazione del servizio)

Costruzione del quadro orario
(Programma di esercizio - Schedulazione delle corse)

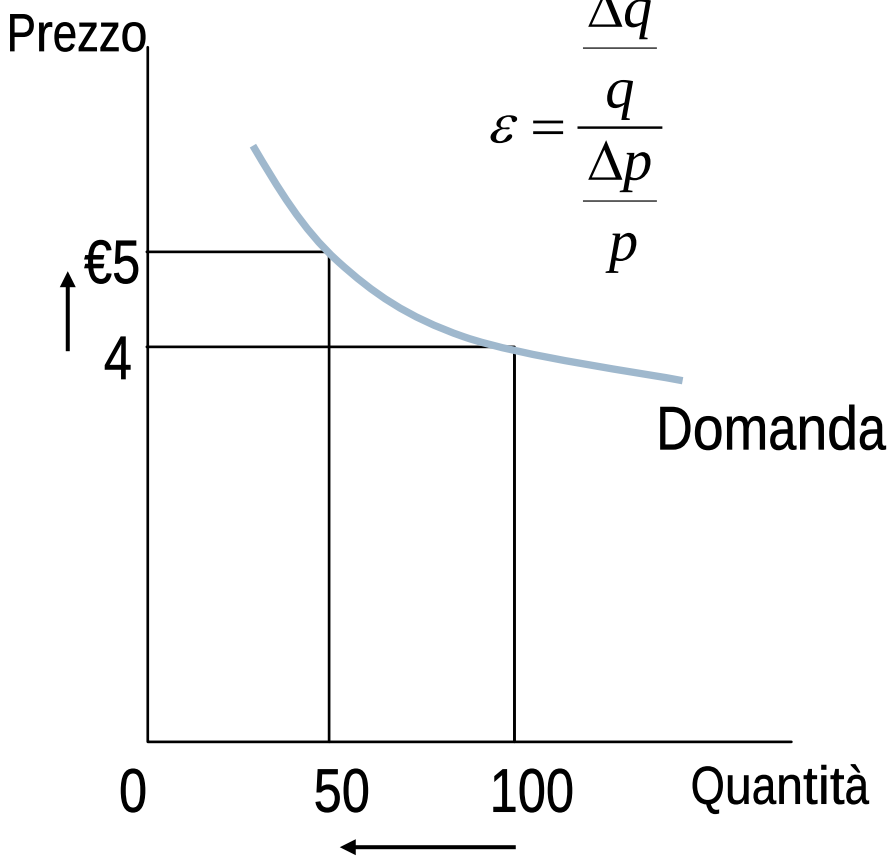
Schedulazione dei veicoli
(Assegnazione dei veicoli alle corse, cioè costruzione dei turni macchina o Vehicle Scheduling)

Schedulazione degli autisti
(Assegnazione dei conducenti ai veicoli, cioè costruzione dei turni uomo o Crew Scheduling)

Concetto di elasticità

$$\varepsilon = \frac{\text{variazione \% della quantità}}{\text{variazione \% del prezzo}}$$

$$\varepsilon = \frac{\frac{\Delta q}{q}}{\frac{\Delta p}{p}}$$

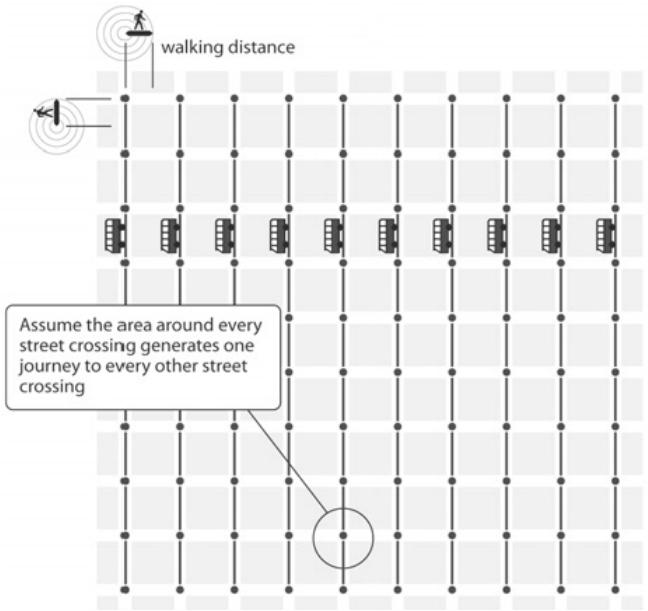


$$\varepsilon = \left| \frac{\frac{-50}{100}}{\frac{1}{4}} \right| = \left| \frac{-50\ \%}{25\ \%} \right| = 2$$

$$\varepsilon = \left| \frac{\frac{-50}{\left(\frac{100 + 50}{2}\right)}}{\frac{1}{\left(\frac{4 + 5}{2}\right)}} \right| = \left| \frac{-66.6\%}{22.2\%} \right| = 3$$

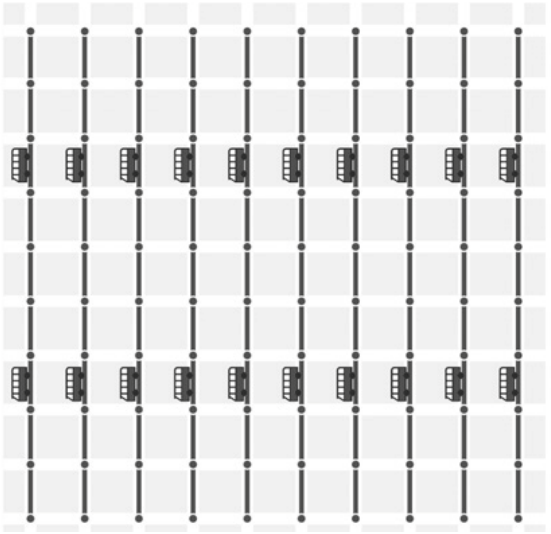
Frequenza del trasporto pubblico

"Squaresville" con dieci linee di bus in direzione nord-sud



•ogni intersezione genera uno spostamento al giorno verso ogni altra intersezione, (9900 spost.).
•La potenzialità delle dieci linee bus è 900 (10%)
•Con uno shift modale di 1/3 degli spost. su bus sono 300 (3%)

"Squaresville" con dieci linee di bus in direzione nord-sud e frequenza raddoppiata su tutte le linee

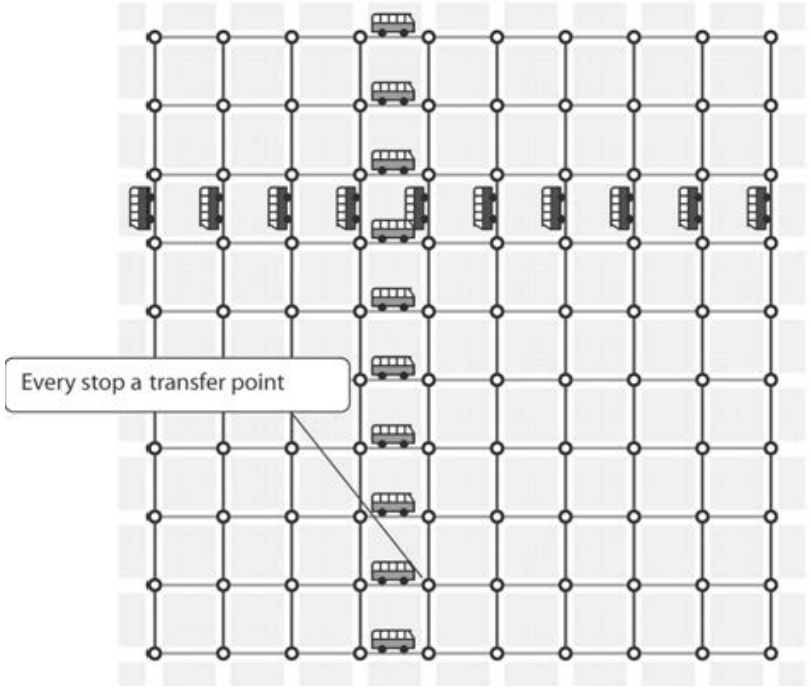


•raddoppiando la frequenza delle linee abbiamo un aumento di 450 spostamenti
•ripartizione modale del 4.5%
•costi di esercizio +100%
•ricavi da traffico +50%

Frequenza del trasporto pubblico

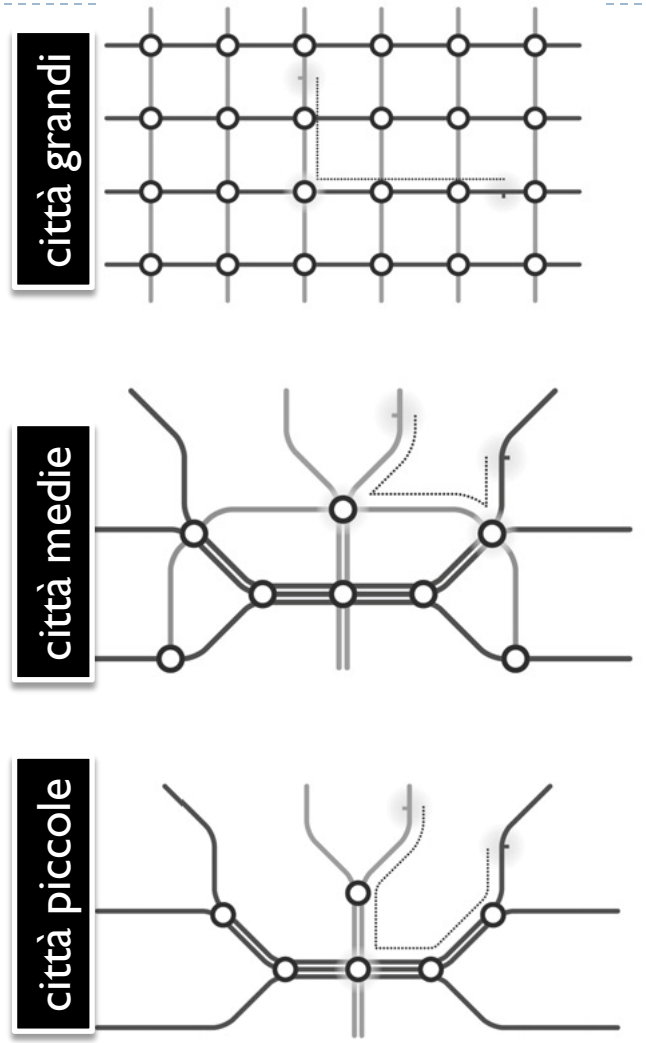
- La rete acquista la capacità di servire tutti i 9900 spostamenti, di cui 1800 direttamente e 8100 con un solo trasbordo.
- Se ipotizziamo che la quota di spostamenti su mezzo pubblico con trasbordo si dimezza (1/6) rispetto a quella con collegamenti diretto, la domanda complessivamente servita diventa (1800/3+8100/6) pari a 1950 e la ripartizione modale passa dal 3% al 20%.
- Questo caso teorico fornisce un'elasticità della domanda alla frequenza di 5.5, invece che di 0.5

Squaresville" con venti linee di bus in direzione nord-sud ed est-ovest

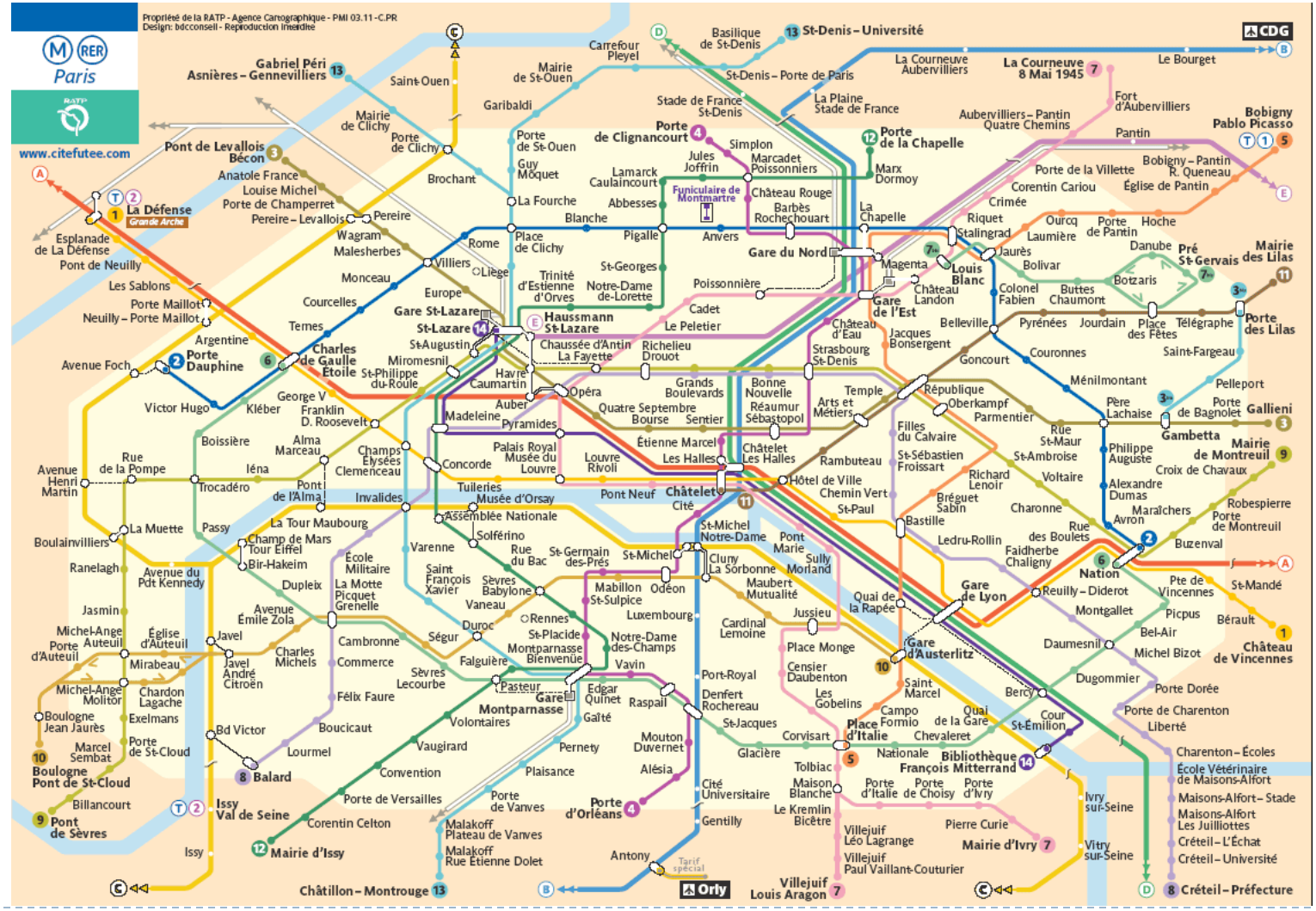


Progetto della rete di trasporto pubblico

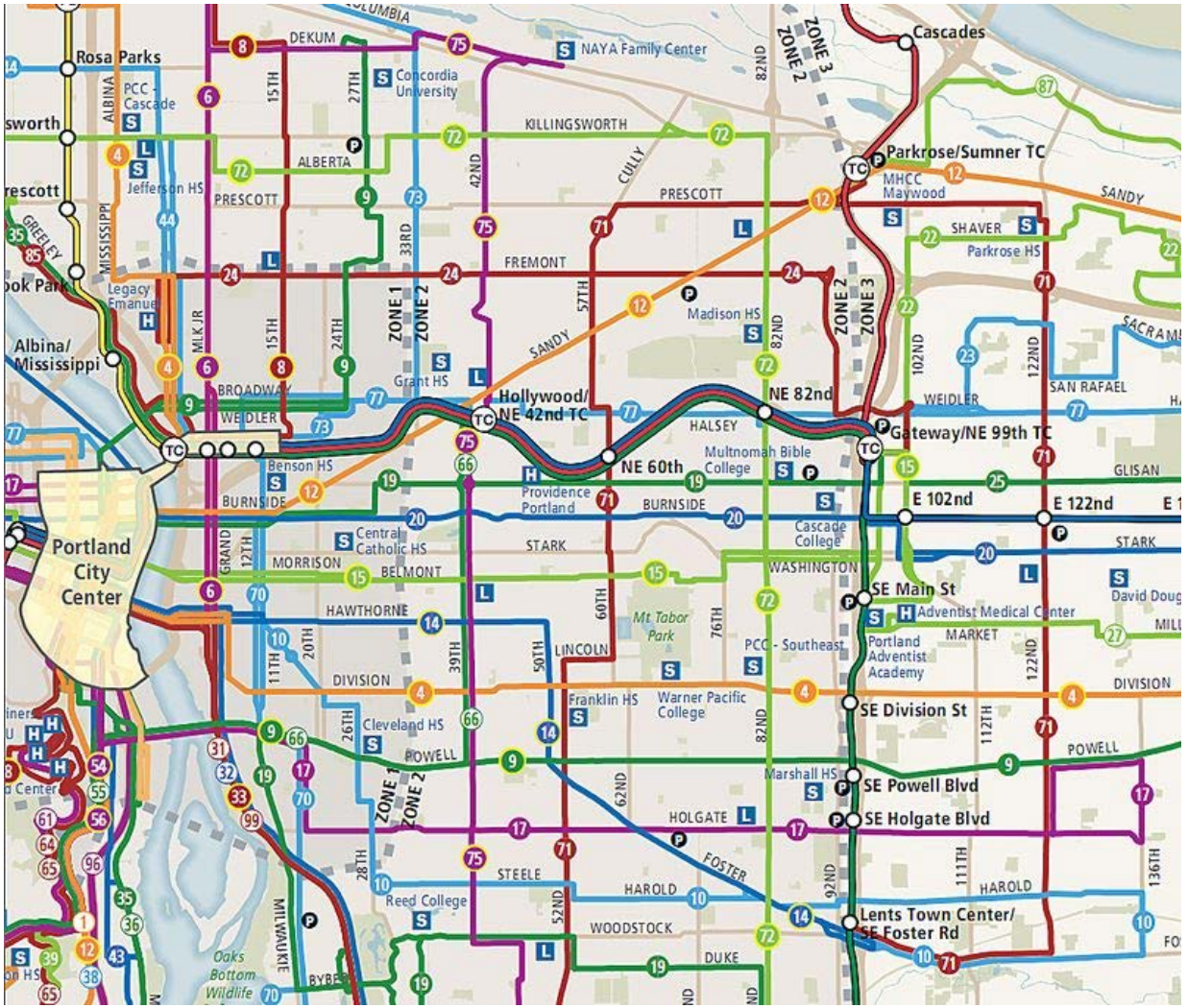
- Modello di "Squaresville" con una rete a griglia di linee ad alta frequenza che consente qualunque spostamento con un solo trasbordo, adatto a città molto grandi
- Per città medie(100.000-300-000 ab.) Due linee circolari con buona frequenza favoriscono gli spostamenti trasversali, seppure con più di un trasbordo. I nodi di interscambio principali devono essere molto curati.
- Per città più piccole (<100.000 ab.), l'offerta è concentrata su un servizio tipo "pendolo" che attraversa il centro della città (vedi Figura 29) o con servizi radiali con trasbordo al centro.

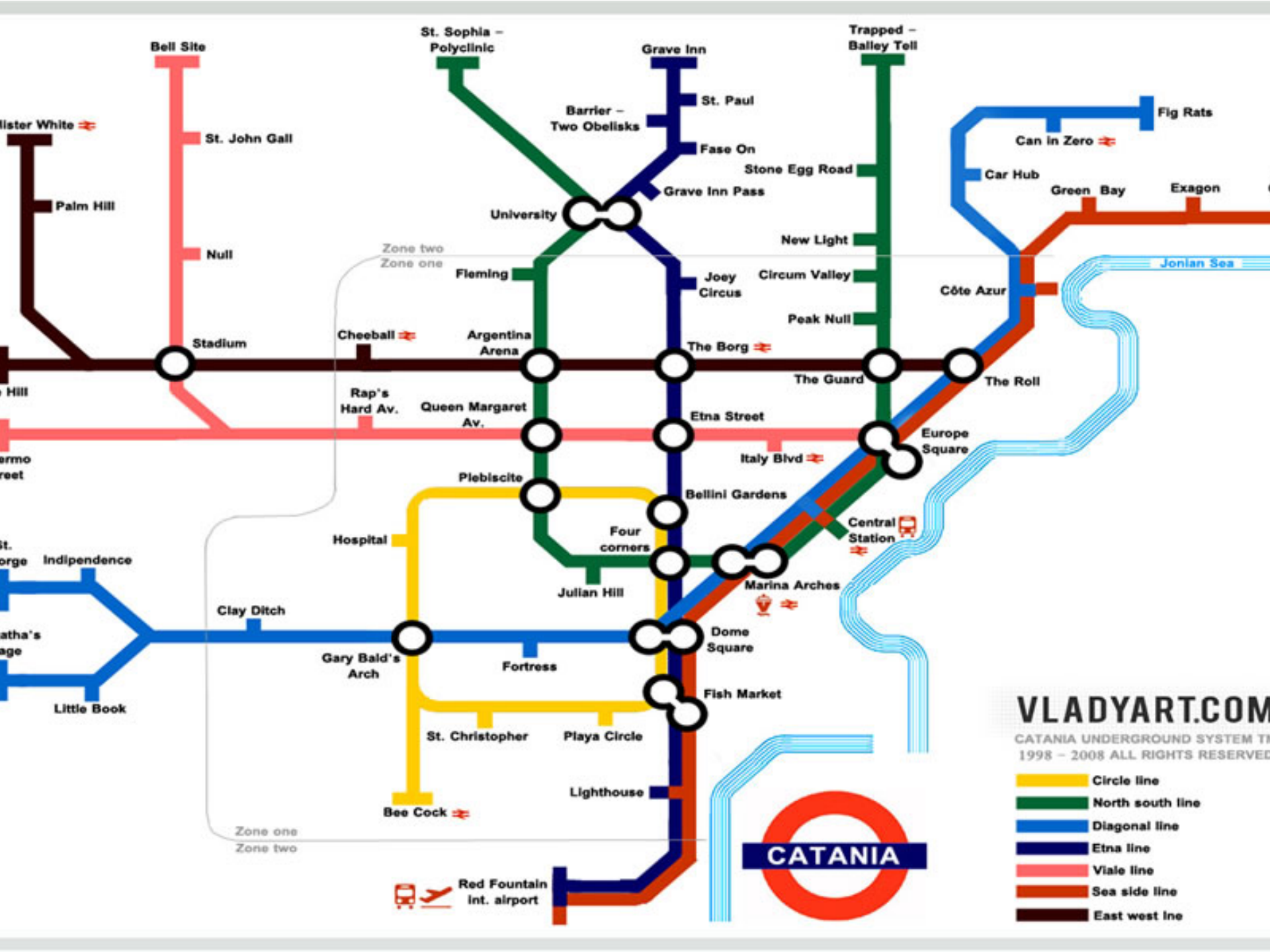


Esempi di reti a griglia

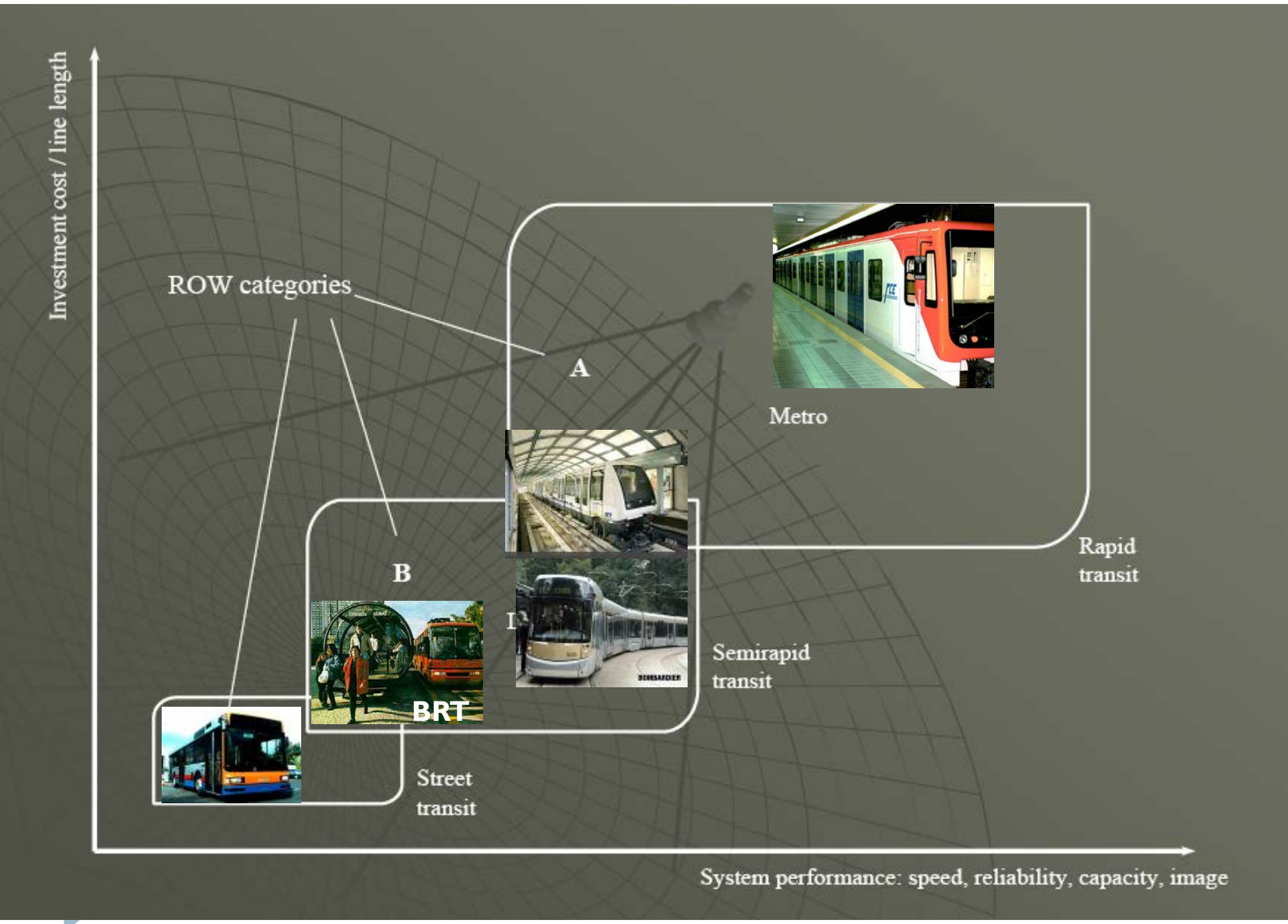


Esempi di reti a griglia




Bell Site
St. Sophia – Polyclinic
Grave Inn
Trapped – Balley Tell
lister White
St. John Gall
Barrier – Two Obelisks
St. Paul
Fig Rats
Can in Zero
Fase On
Stone Egg Road
Car Hub
Grave Inn Pass
Green Bay
Exagon
Palm Hill
University
New Light
Zone two
Zone one
Fleming
Joey Circus
Circum Valley
Jonian Sea
Côte Azur
Null
Peak Null
Cheeball
Argentina Arena
The Borg
Stadium
The Guard
The Roll
Rap's Hard Av.
Queen Margaret Av.
Etna Street
Europe Square
Italy Blvd
Plebiscite
Bellini Gardens
Central Station
Hospital
Four corners
Indipendence
Julian Hill
Marina Arches
Clay Ditch
Dome Square
Gary Bald's Arch
Fortress
Little Book
Fish Market
St. Christopher
Playa Circle
Lighthouse
Bee Cock
Zone one
Zone two
Red Fountain Int. airport
CATANIA
VLADYART.COM
CATANIA UNDERGROUND SYSTEM TI
1998 – 2008 ALL RIGHTS RESERVED
Circle line
North south line
Diagonal line
Etna line
Viale line
Sea side line
East west line

Public Transport quale sistema?



Vuchic, 2005, Transit Systems

Bus Rapid Transit

Bus Rapid Transit

Bus rapidi contro il caos

Aggiudicazione provvisoria della gara a un'impresa romana, un mese per l'avvio dei lavori della durata di un anno. In vista un secondo appalto per adeguare lo scambiatore

«Brt» Due Obelischi-Stesicoro corsia protetta di 14,5 chilometri

Linea veloce dalla periferia al centro in 25 minuti

CESARE LA MARCA

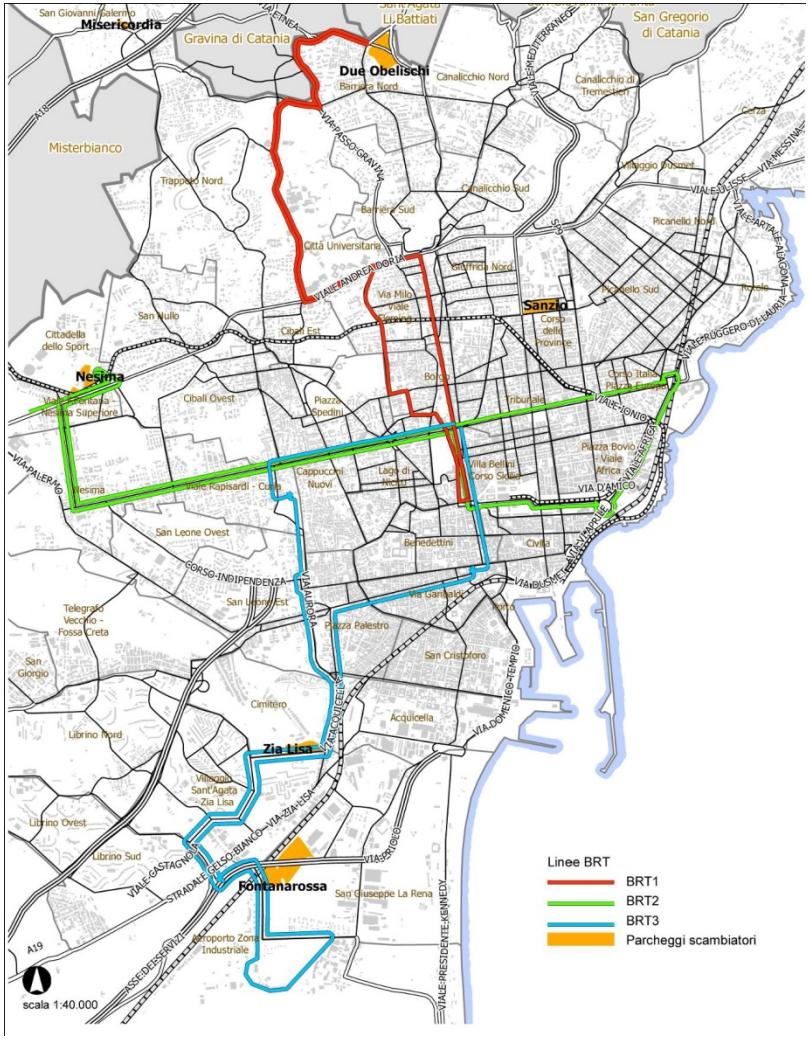
Sono stati assegnati a un'impresa romana i lavori per la realizzazione della prima linea "Brt" (Bus rapid transit) per il collegamento veloce con autobus ecologici dell'Amt tra il parcheggio scambiatore a Due Obelischi e il capolinea di piazza Stesicoro. Siamo ancora nella fase dell'aggiudicazione provvisoria - che prevede una serie di verifiche sulla documentazione oltre alla valutazione di eventuali ricorsi, e dunque circa un mese prima dell'assegnazione definitiva dei lavori - di un appalto su cui l'Amministrazione conviene sia scommesso per rimpinguare una volta le strategie di mobilità urbana con cui affrontare l'emergenza traffico.

Un progetto, quello della linea bus a velocetra la zona nord delle città e il centro storico, che rappresenta anche il tentativo di utilizzare finalmente il parcheggio scambiatore Due Obelischi, oggetto di un secondo appalto legato allo stesso Brt, abbandonato a sé stesso e sfruttato nei modi più impensabili ormai da anni dopo essere stato realizzato proprio per dare un'alternativa di mobilità sostenibile alle migliaia di pendolari che ogni giorno dall'hinterland entrano in città.

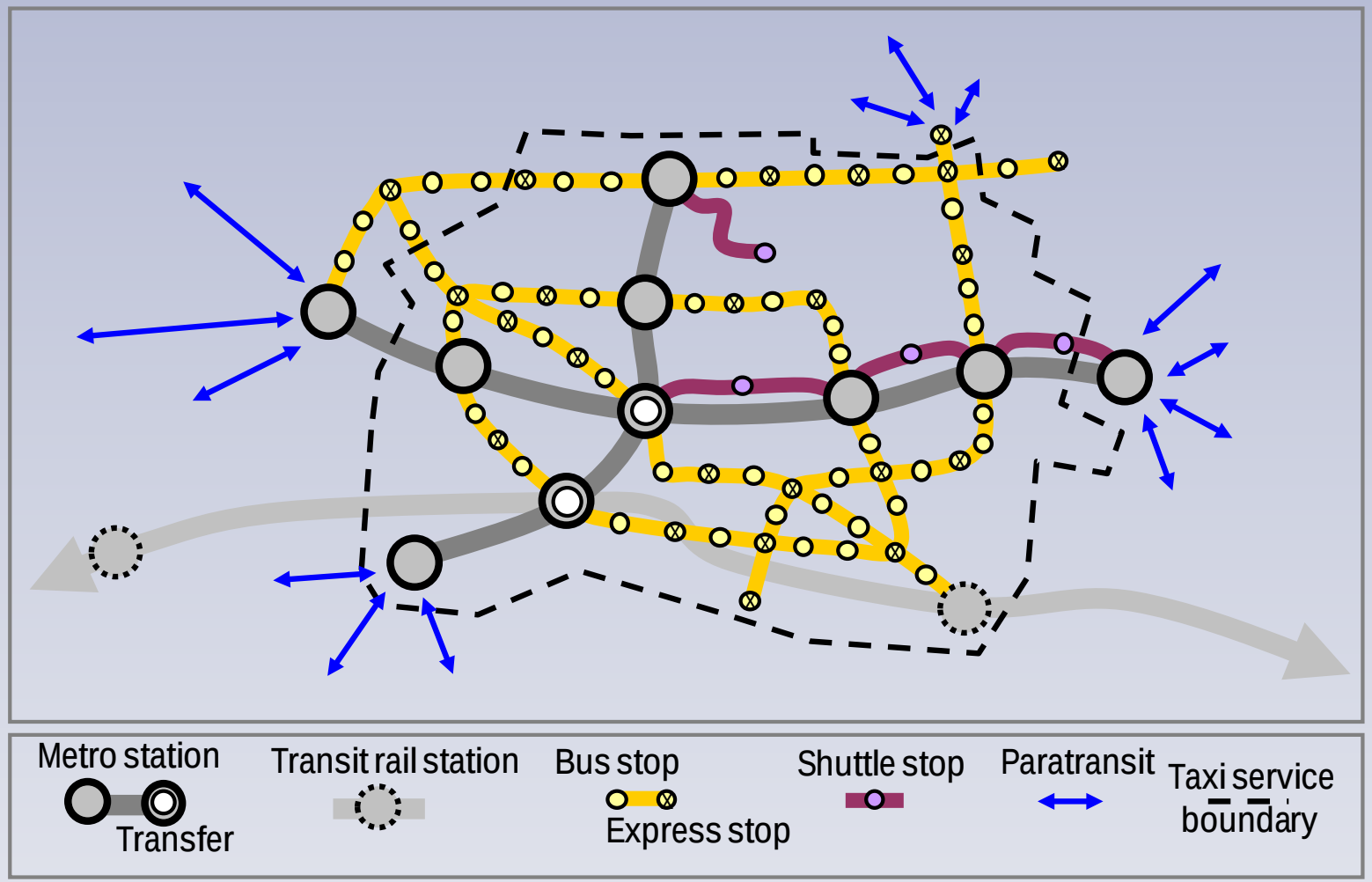
I lavori prevedono la realizzazione di una corsia protetta che si snoderà tra andata e ritorno su un percorso di 14,5 chilometri, che sarà separata da cordoli alti 15 centimetri e su cui i bus dell'Amt dovranno avere priorità, tanto da rendere possibile il collegamento tra lo scambiatore e il centro storico in 25 minuti, con frequenza delle corse ogni dieci minuti. Tra dicembre e gennaio dovrebbero dunque essere avviati i lavori della durata di circa un anno per la realizzazione delle corsie preferenziali, per adeguare incroci e semafori, realizzare le fermate e metterle a regime e gli altri accorgimenti tecnici. Il progetto del Brt prevede per essere operativo anche una seconda gara da aggiudicare entro l'anno, con durata prevista dei lavori di circa sei mesi, proprio per il adeguamento del Due Obelischi. Qui dovranno essere realizzati una serie di servizi di accoglienza e logistici tali da farne un polo di scambio dove lasciare l'auto e spostarsi in città col mezzo pubblico, magari con un unico biglietto, come si prevede di fare in seguito anche con gli altri scambiatori di Fontanarossa, Nesima e Aci Castello.

CORDOLI PER I BUS IN CENTRO

Comincia da questa settimana in centro storico la collocazione dei cordoli previsti in via Vittorio Emanuele, corso Sicilia e via Dusmet per separare le corsie dei bus nell'ambito nel recente piano viario



Integrated policy of public transport



Integrated policy of public transport

integrating the **different modes of transport** by ease and reliable connections, shared payment technologies and timetables

planning land use and making transport policies consistent with objectives related to environment, health, economy and society in general

integrating **all social groups**, including the disadvantaged and those with impaired mobility

cooperation amongst all relevant institution and policymakers

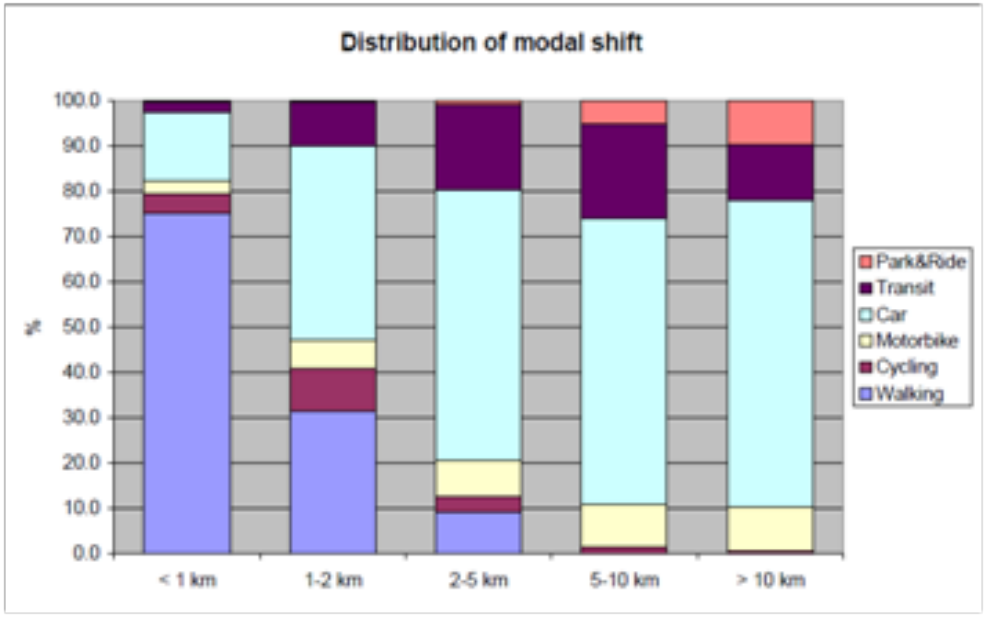
Strumenti di Pianificazione

Mobilità pedonale e ciclistica

Azioni per la mobilità sostenibile

Walking and cycling in Europe

- More than 30% of car trips in Europe are shorter than 3 km and 50% shorter than 5 km. These distances can be covered by bicycle within 15-20 minutes or by 30-50 minutes walking.
- Apart from few exceptions like some Dutch, Danish and Swedish cities, modal share of bicycle is less than 5% in most of Europe
- In Italian urban areas, only 20% of all trips are made by walking or cycling, while, 60% of trips in the range 1-2 km use motorized vehicles.



Benefici trasportistici

congestion mitigation: bicycling and walking require less space per traveller than cars

increase in transport options and sustainable wide **accessibility to all categories of citizens**

reduction of car dependency urban development

increasing in **transit ridership** deriving by the improvement in pedestrian/cyclist access to transit stations and stops

optimizing **parking investment** in park-and-ride facilities (up to 15 bikes can be parked in -the space required by one car)

Benefici economici

reduction in **direct transport costs** for users

reduction in **indirect transport costs** due to general taxation applied to finance road infrastructure maintenance and building, public transport subsidy, accident and pollution related costs

increasing in transport **affordability**

increasing in **retail sales** and **property values**

Benefici ambientali

reduction of **noise**, **energy** and not **renewable fuel** savings

reduction of **air pollution**

contribution to **climate change mitigation and adaptation** (less paved parking surfaces and more green spaces)

Benefici sociali

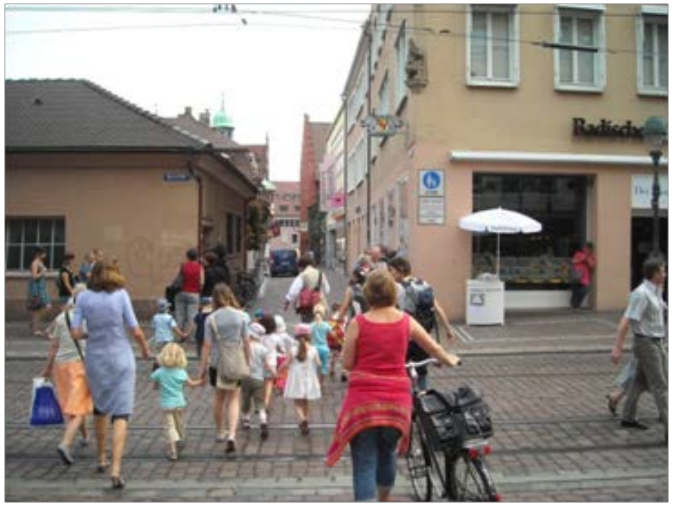
improve public **safety**, **fitness** and **health**

support to **Smart Growth** land use objectives

support to community **liveability** and **equity**

providing recreational benefits and **social development**

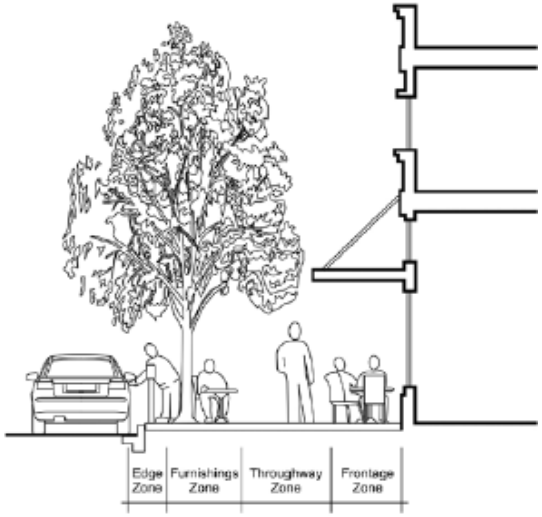
Promoting Walking and Cycling



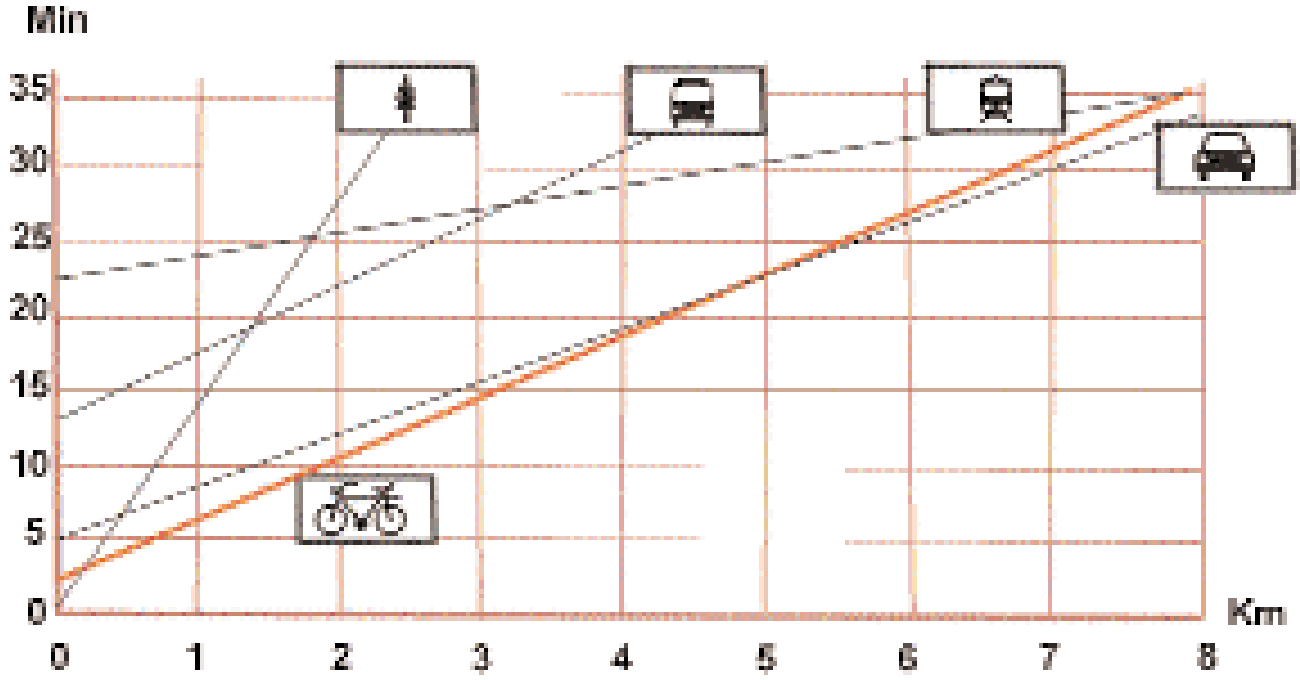
Walking

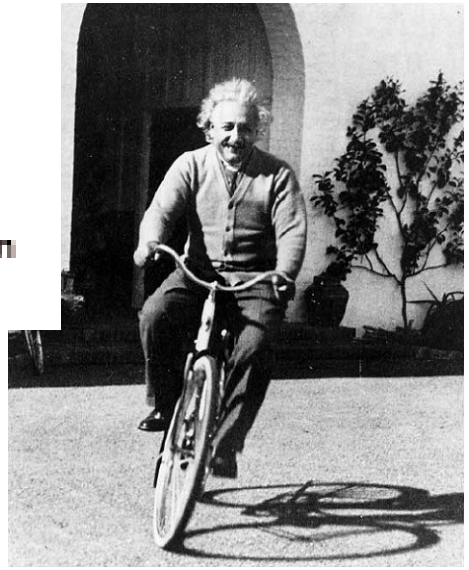
- Ogni spostamento comincia e finisce a piedi
- Per molti è l'unico modo di trasporto
- Amplifica il bacino di utenza del TPL
- È un indicatore di una comunità in salute

Walking

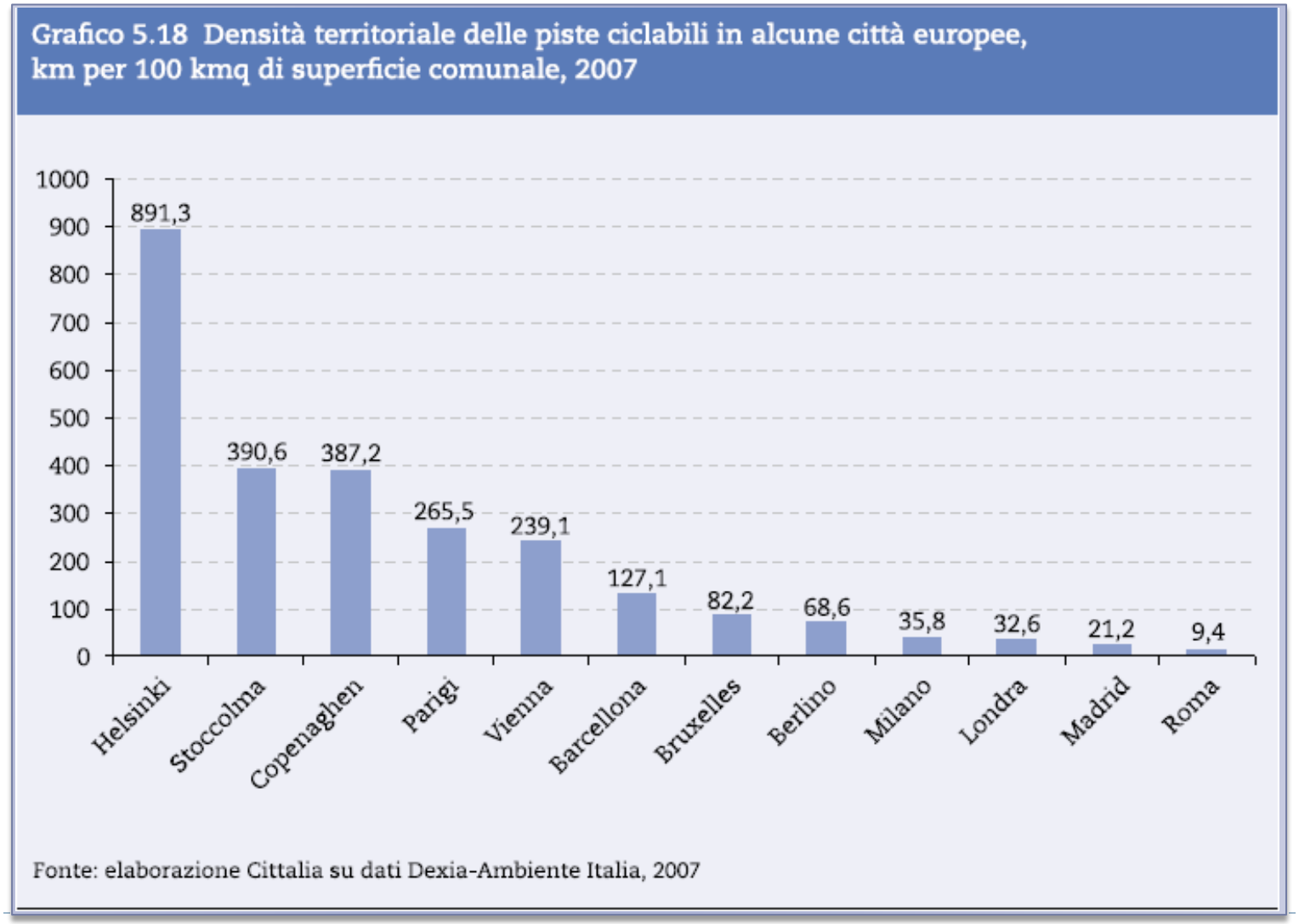


Cycling convenience





Cycling diffusion



Cycling: bike sharing and priority

Cycling promotion and image

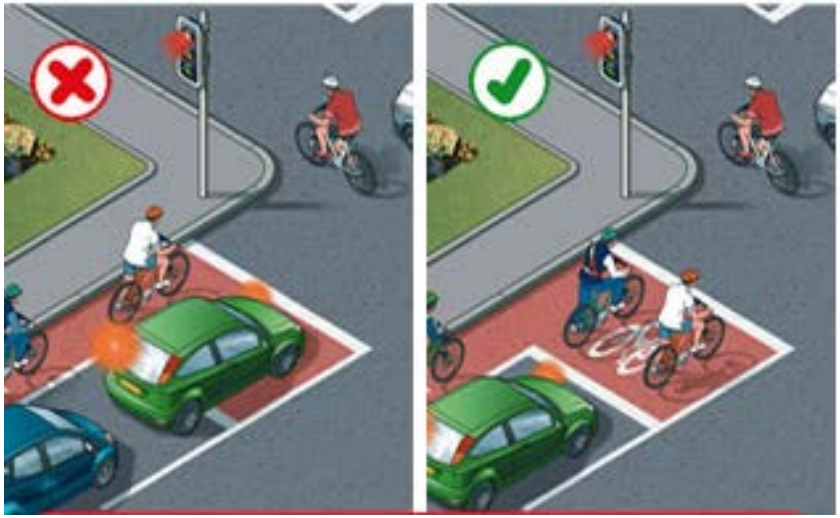
Cycling infrastructure

Cycling infrastructure

Cycling and Transit

Cycle lanes

Intersections and crossings



Strumenti di regolazione

Azioni per la mobilità sostenibile

Parking management

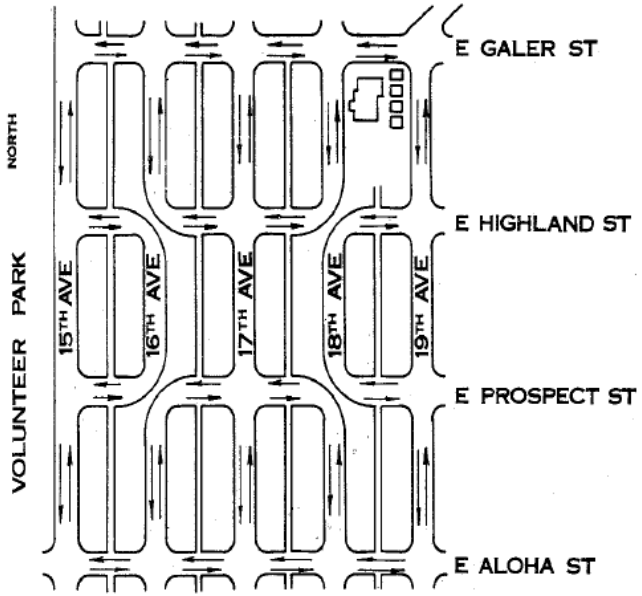
Strategy	Description
Shared Parking	Parking spaces serve multiple users and destinations.
Parking Maximums	Establish maximum parking standards.
Remote Parking	Provide off-site or urban fringe parking facilities.
Smart Growth	Compact and mixed multi modal development allow more parking share and use of alternative modes

Parking management

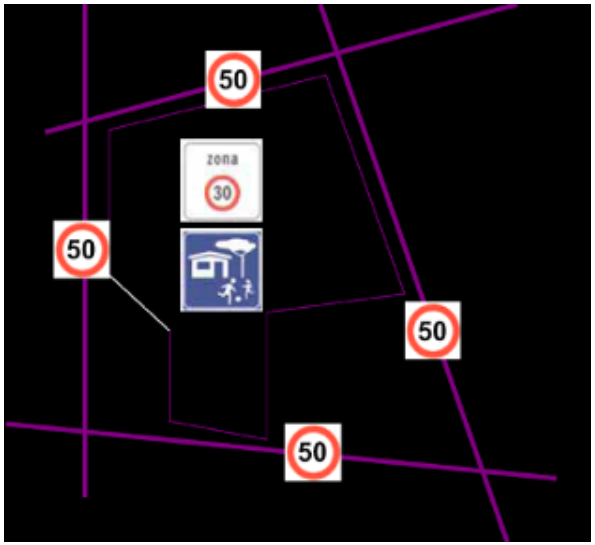
Strategy	Description
Walking and cycling improvement	To expand the range of destinations served by a parking facility
Improve User Information and Marketing	Provide convenient and accurate information on parking availability and price, using maps, signs, brochures and electronic communication
Improve Enforcement	Insure that parking regulation enforcement is efficient, considerate and fair.

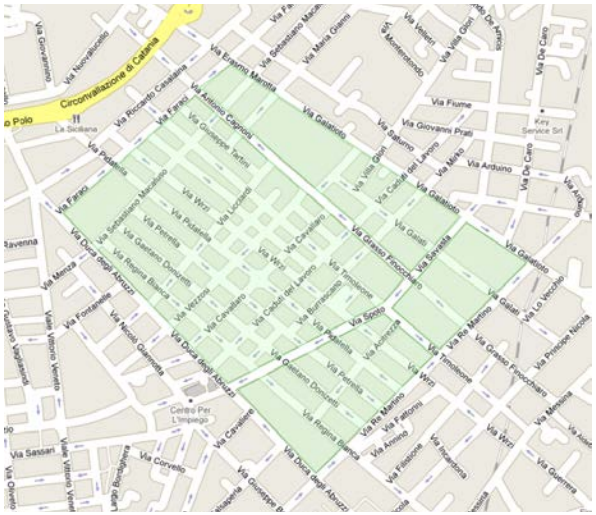
Vehicle restrictions

- set Car-Restricted Zones that limit car access, for example, to residents and commercial vehicles
- divide the urban area into traffic cells that have direct walking, cycling and transit connections, but require a longer trip to travel between by private car (isole ambientali in Italia)

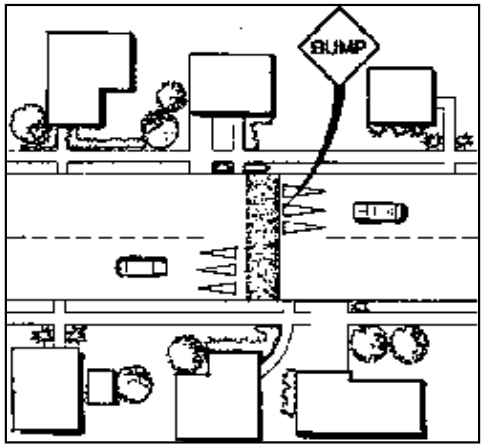


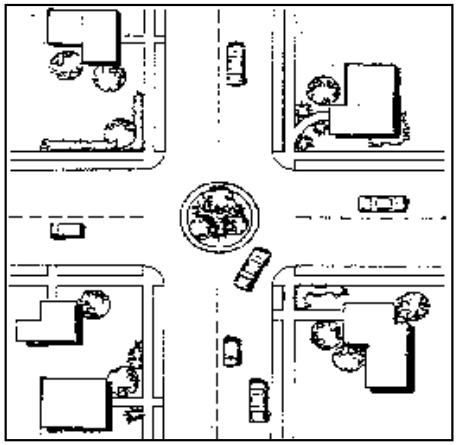
Isola ambientale

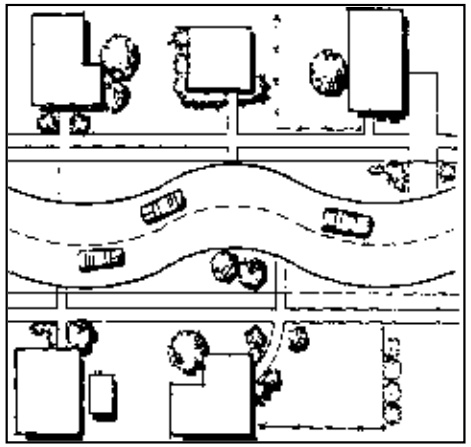


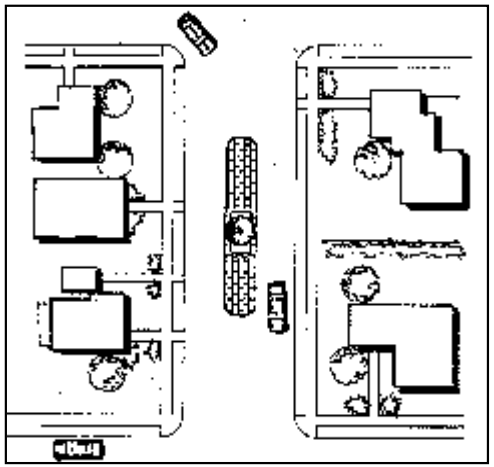


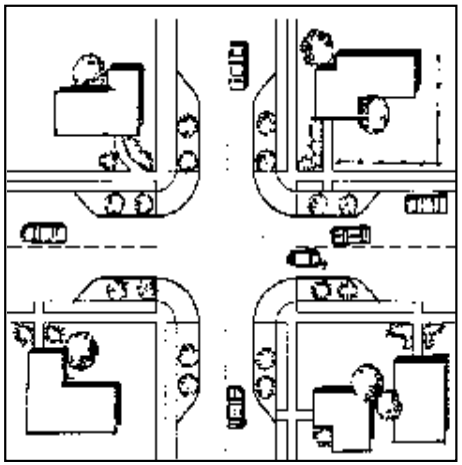
Traffic calming

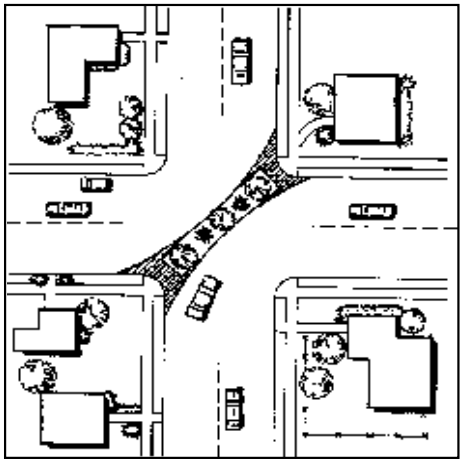




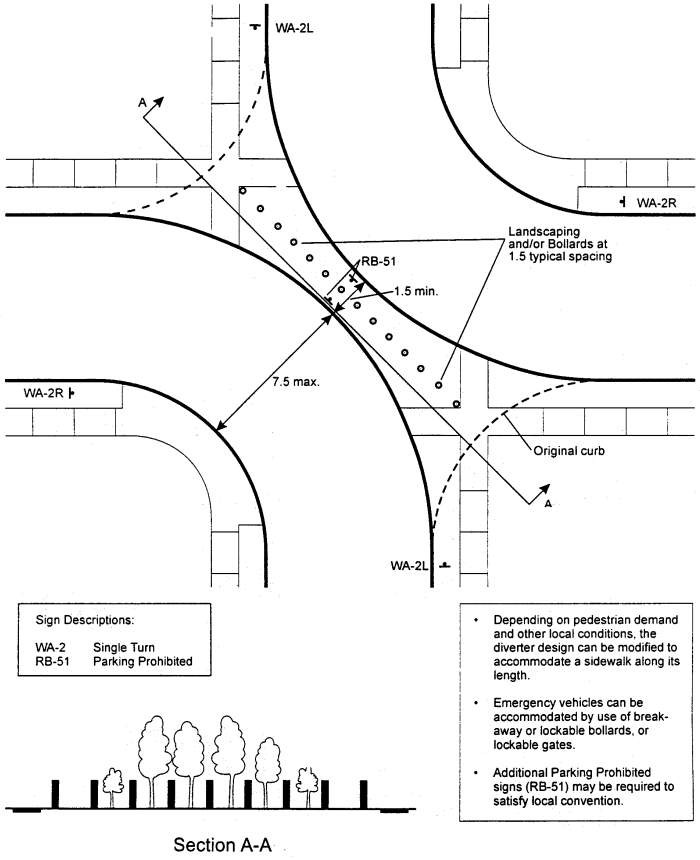




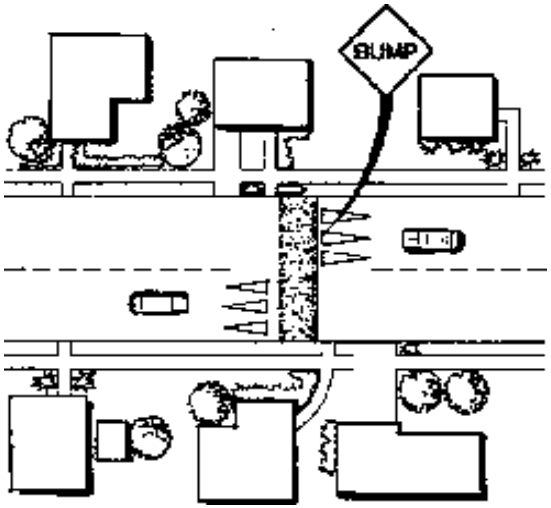




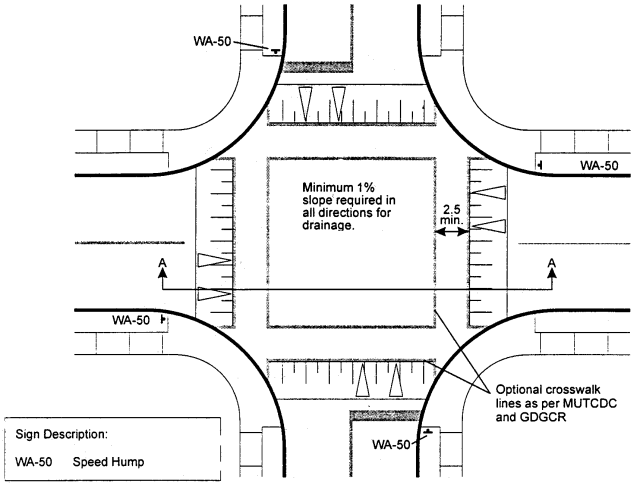
Diagonal diverter



Speed humps



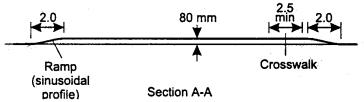
Raised intersection and crossings



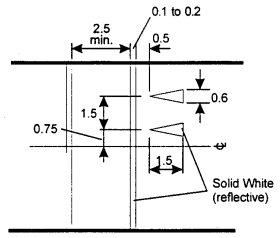
Sign Description:

WA-50 Speed Hump

- If intersection is Stop sign controlled, WA-50 signs are not required on the Stop sign approaches.
- A 15 mm curb face should be retained at all crosswalk locations.



Section A-A



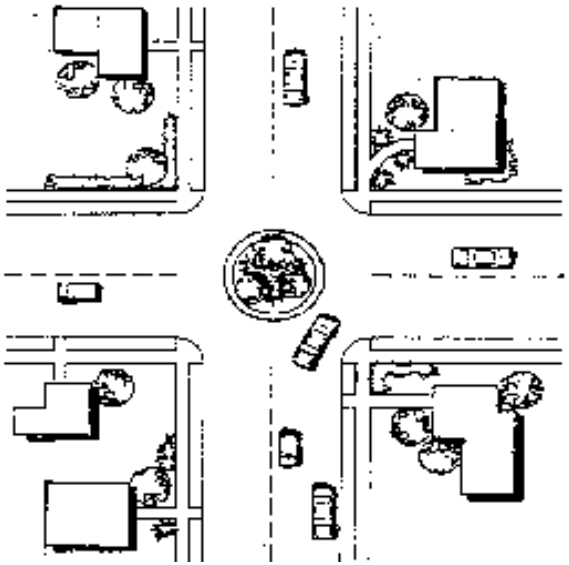
Pavement Markings

Ramp Height Development

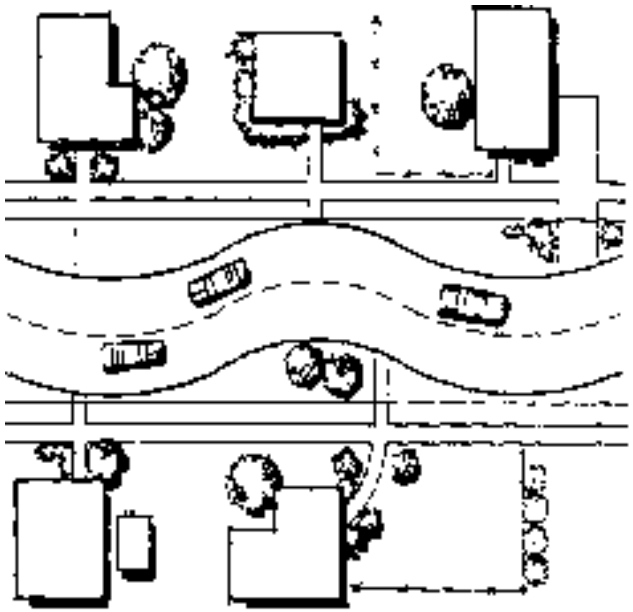
Crosswalk profile parallel to roadway surface.

Distance (m)	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	1.000	1.125	1.250	1.375	1.500	1.625	1.750	1.875	2.000
Finished Height (mm)	0	1	3	7	12	18	25	32	40	48	55	62	68	73	77	79	80

Traffic circles

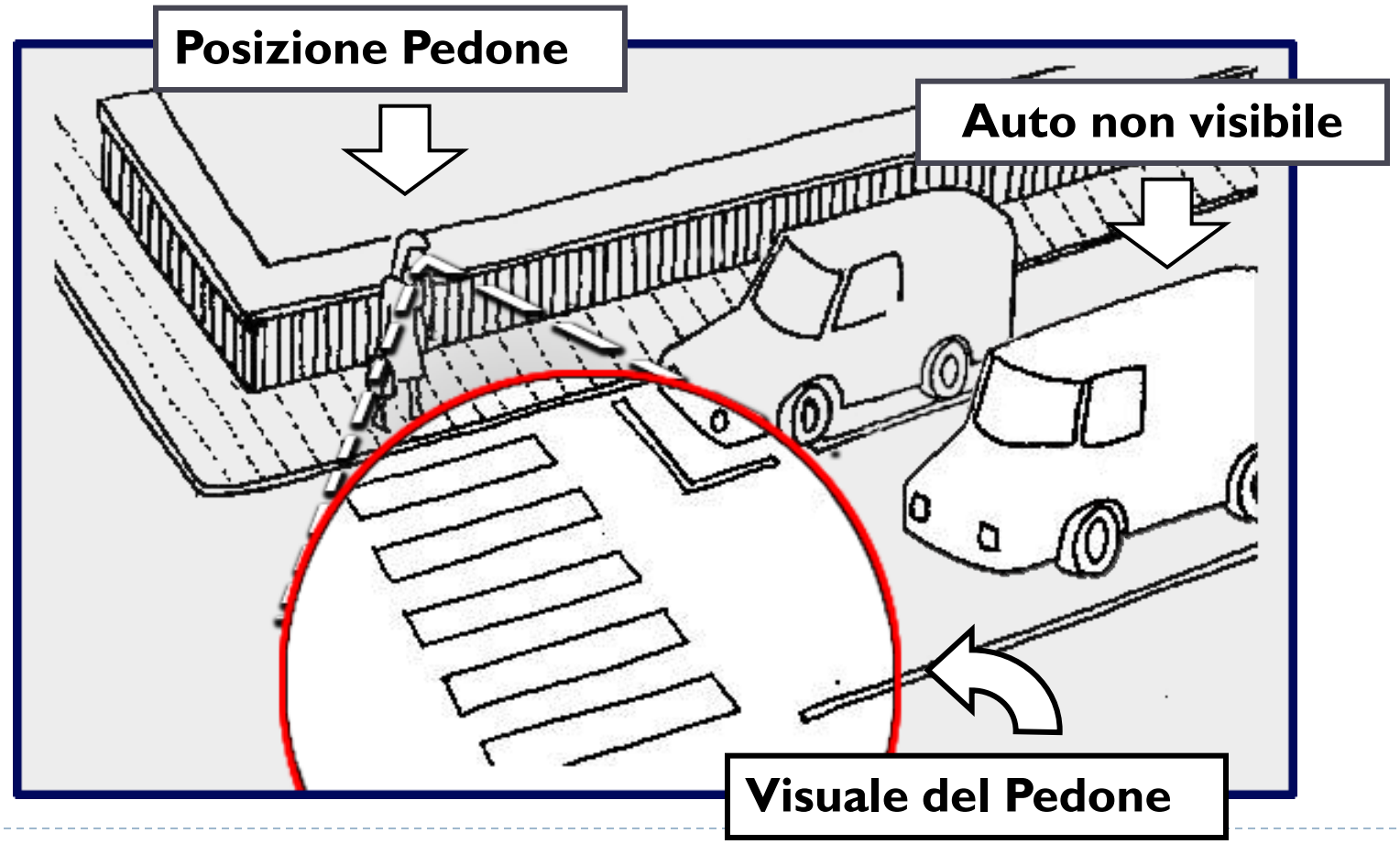


Chicanes

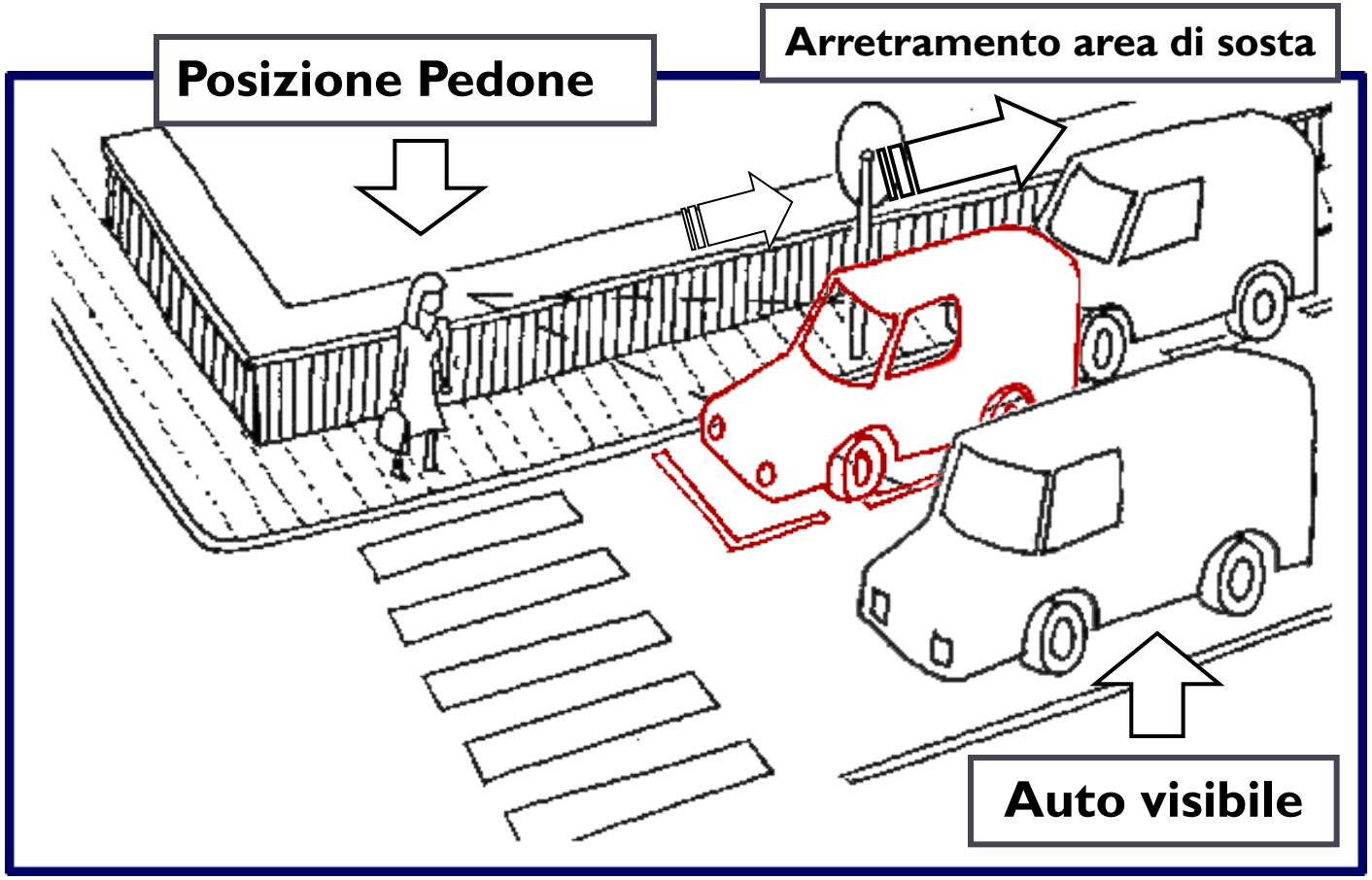


Simple solutions

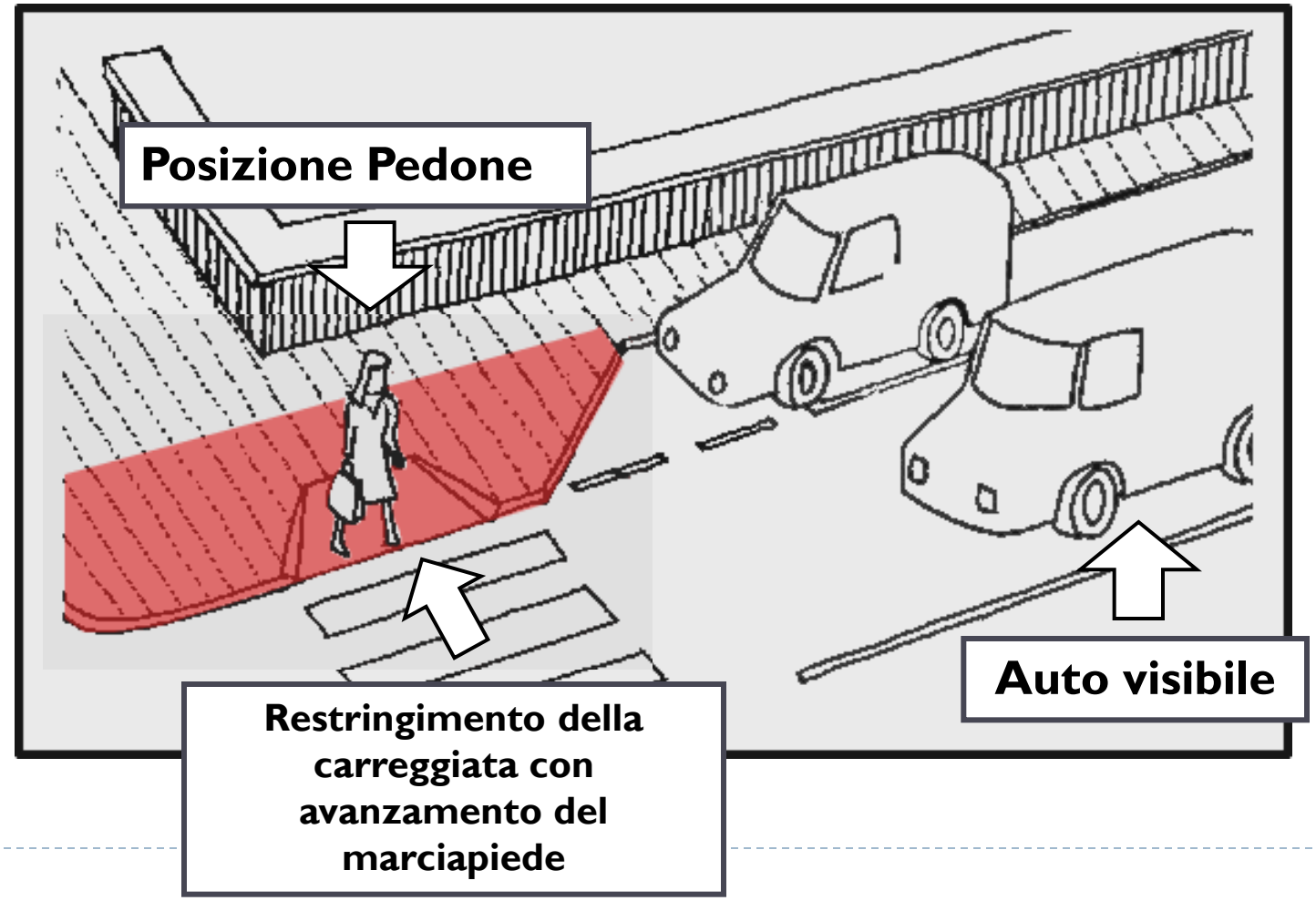
Problemi di scarsa visibilità nell'attraversamento pedonale



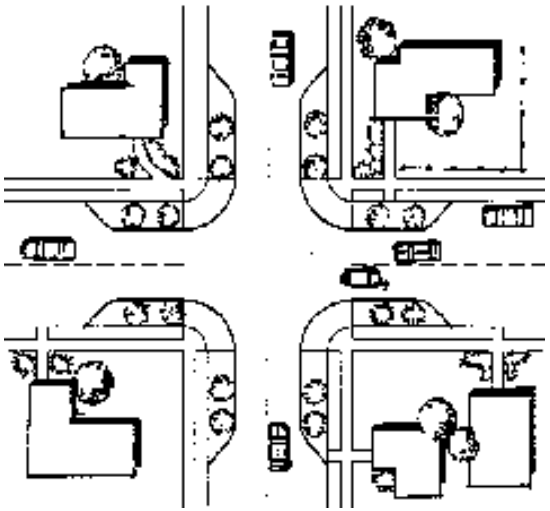
Simple solutions

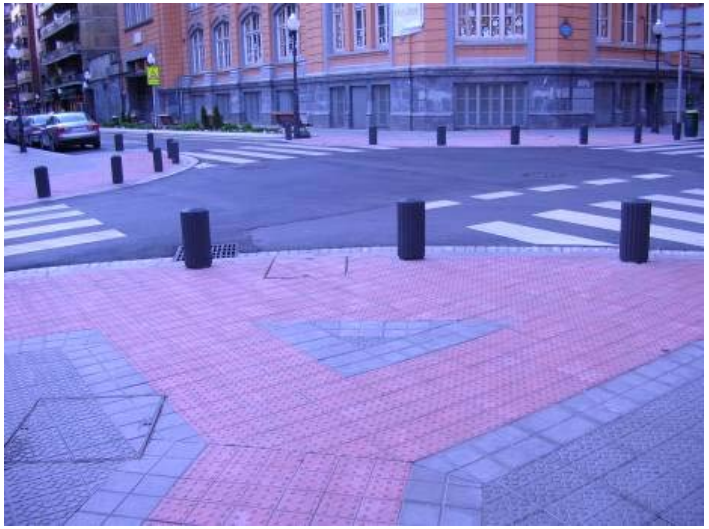


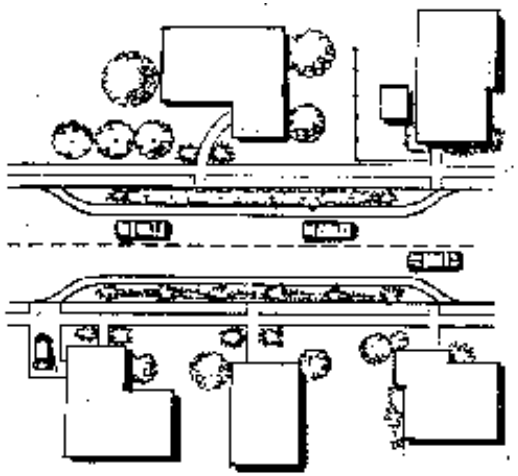
Simple solutions



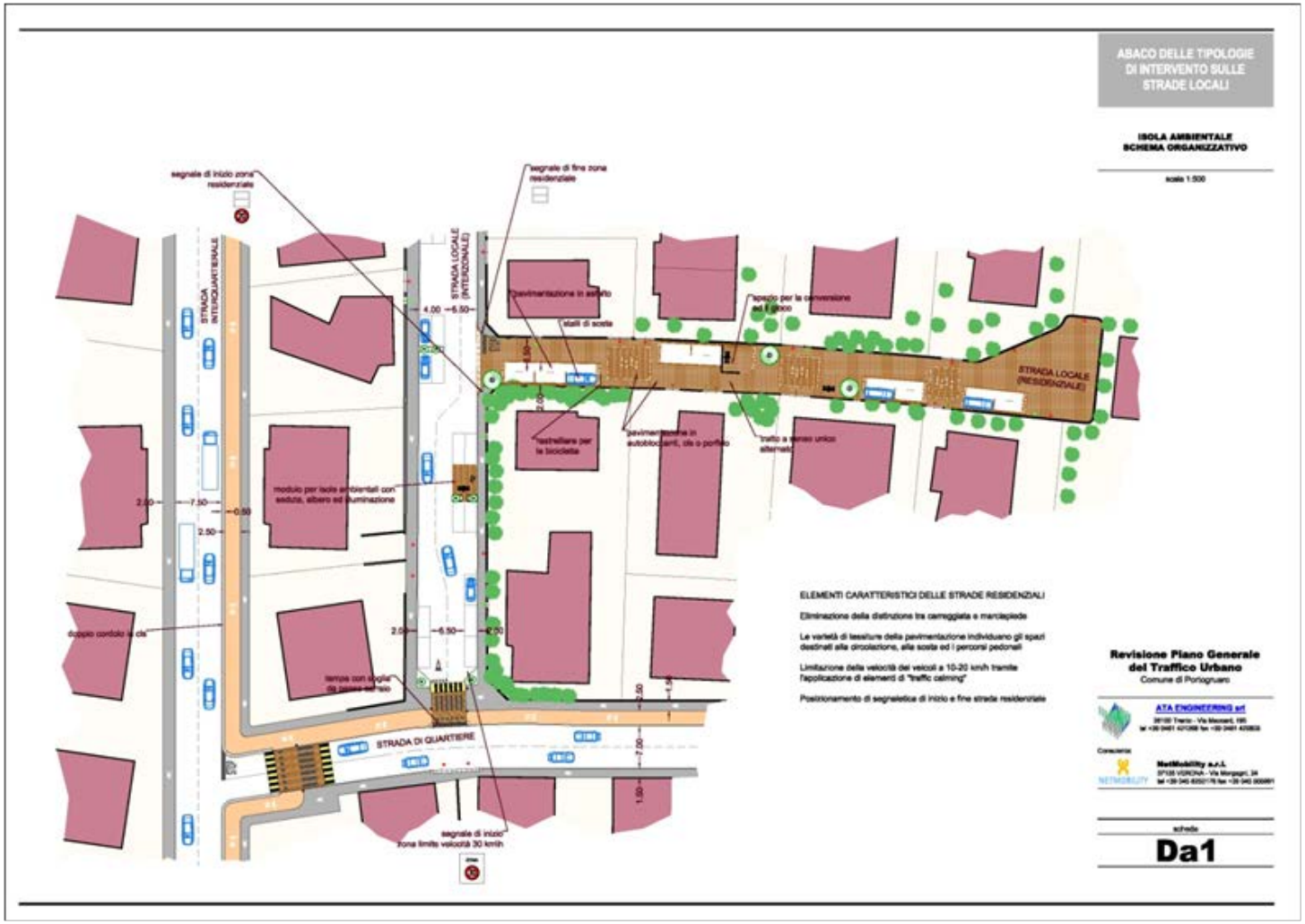
Chockers and road narrowing



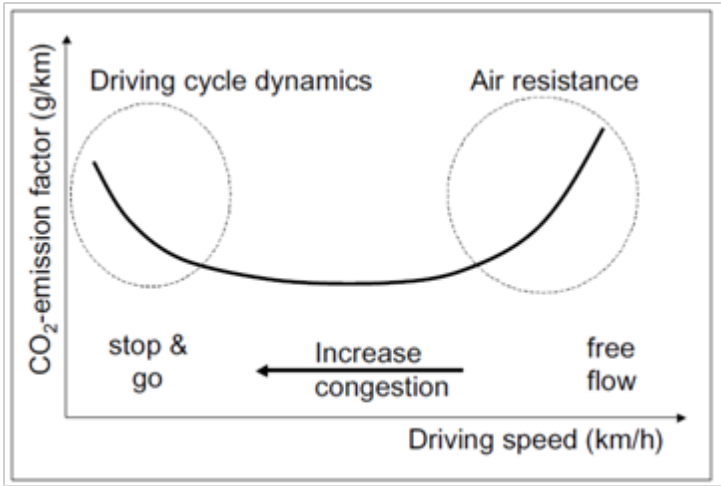


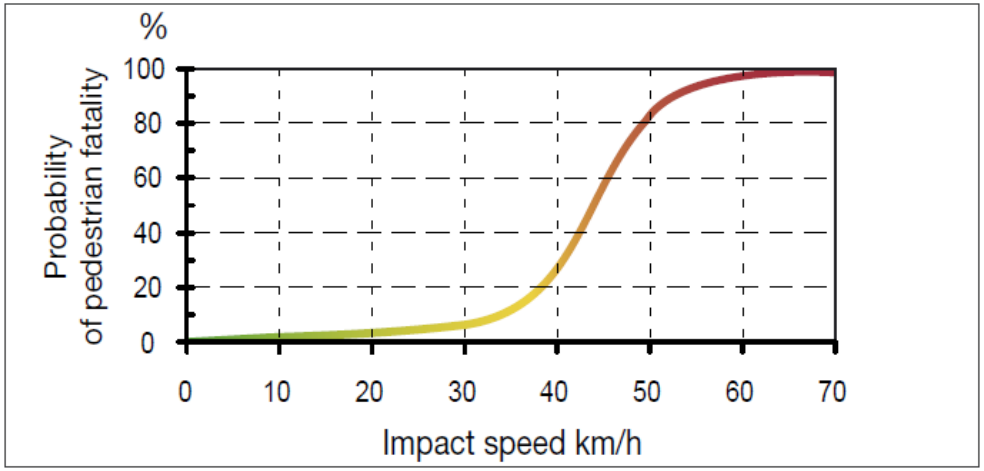


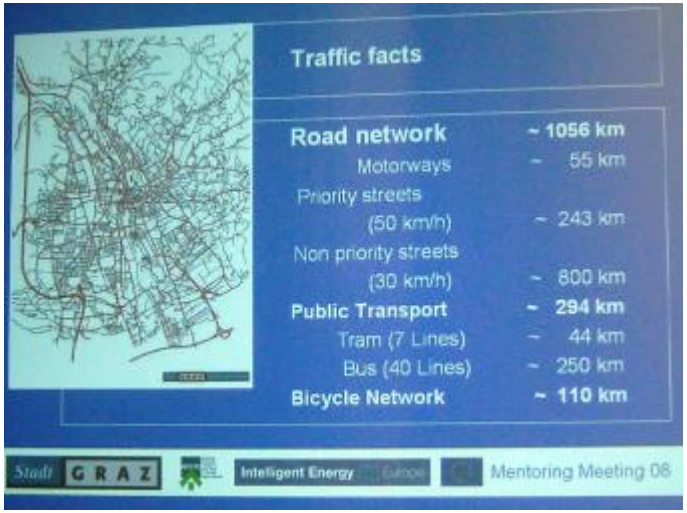
Isola ambientale



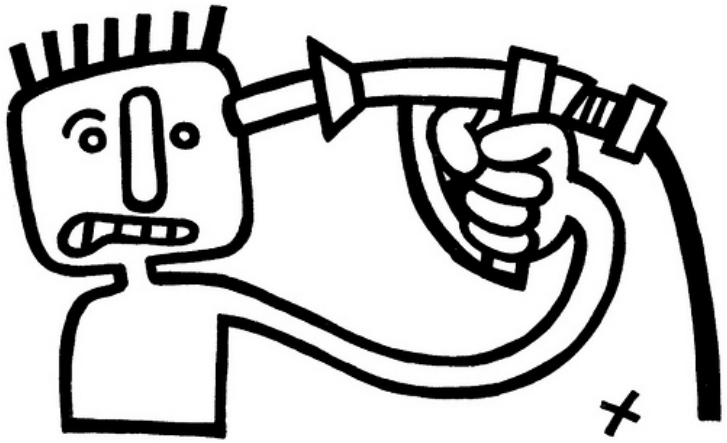
Speed limits – Zone 30







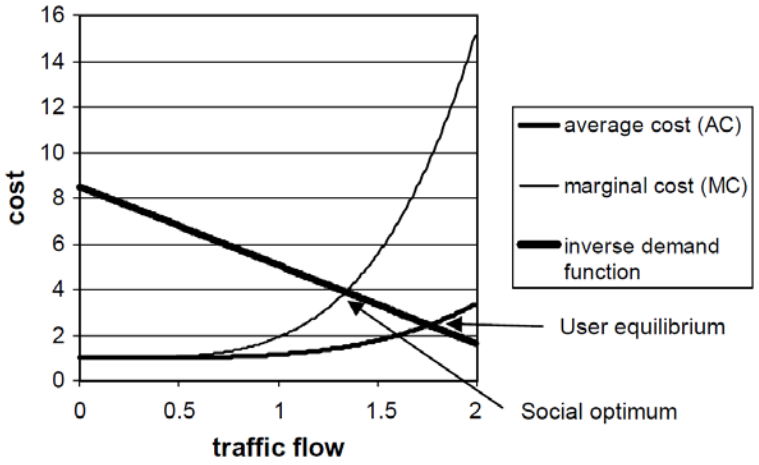
Natural traffic calming in Catania

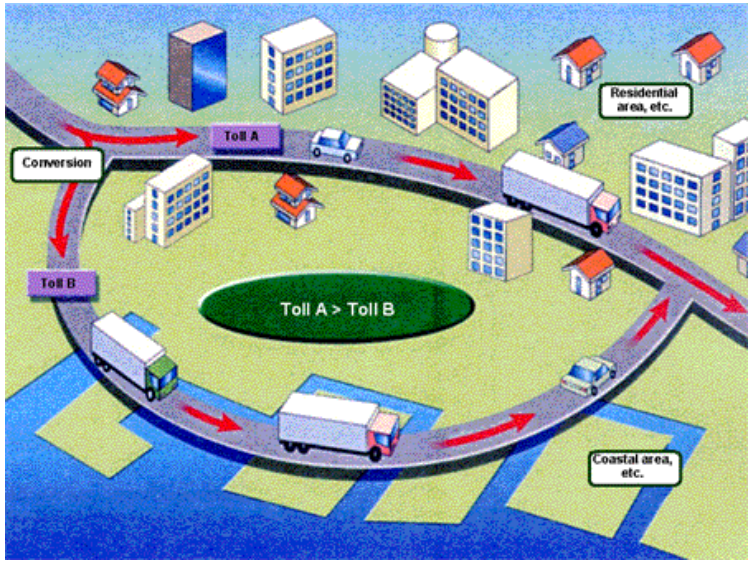


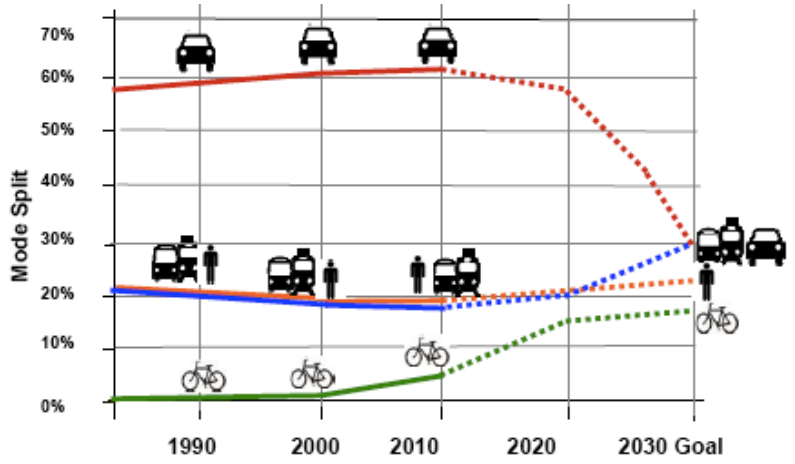
Strumenti economici

Azioni per la mobilità sostenibile

Road Pricing or Congestion Pricing







Bold Sustainability Goals: Transit, Walking & Bicycling City

Dutch plan to charge car drivers by the kilometre (Source: EurActiv.com 6 December 2009).

- *Dutch drivers will be first in Europe to start **paying** according to the **kilometres they drive rather than for owning a car**, if a legislative proposal submitted to the lower house of the country's parliament on Friday (14 November) goes through.*
- *The kilometre charge would **replace road tax and purchase tax** in 2012. The idea is to cut CO2 emissions while halving traffic jams in what is one of Europe's most congested road networks. The transport ministry expects the number of **kilometres travelled to drop by 15%** as the charge on the distance driven will lead people to opt more readily for public transport. This would **reduce** carbon and fine particle **emissions by over 10%,** it estimates.*
- *The kilometres will be tracked with a **GPS** device to be installed in every vehicle. This will record each journey and send the information to a billing agency. Nevertheless, **most people will end up paying less,** as the charge will not exceed current taxes and the abolition of the purchase tax will slash a quarter off a car's price, the ministry argues.*
- *All the **revenue collected** from the charge would go directly to building roads, railways and other transport infrastructure.*

ECOPASS in Milan, Italy

- *ECOPASS is a pollution charge program administered by the City of Milan wherein motorists travelling within a designated traffic restricted zone or ZTL are charged a fee.*
- *The amount of the charge is based on the vehicle's engine emissions standard and varies from* ***€2 to €10****.*
- *Since 2008, there has been a* ***15.7% reduction in traffic*** *within the traffic restricted zone. Traffic has also been reduced by 8% outside of the traffic restricted zone.*
- *The* ***speed of the public transport*** *system has increased by* ***6.8%*** *and the* ***number of passengers*** *using the metro system has increased by* ***11%.***
- *Most importantly,* ***PM10*** *emissions caused by traffic have dropped by* ***15%*** *within the traffic restricted zone and* ***CO2*** *emissions have dropped by* ***6%.***

Parking Pricing

Type of Facility	Land Costs	Land Costs	Construction Costs	O & M Costs	Total Cost	Monthly Cost
	Per Acre	*Per Space*	*Per Space*	*Annual, Per Space*	*Annual, Per Space*	*Per Space*
Suburban, Surface, Free Land	$0	$0	$1,500	$100	$242	$20
Suburban, Surface	$50,000	$455	$1,500	$100	$284	$24
Suburban, 2-Level Structure	$50,000	$227	$6,000	$200	$788	$66
Urban, Surface	$250,000	$2,083	$2,000	$150	$535	$45
Urban, 3-Level Structure	$250,000	$694	$8,000	$250	$1,071	$89
Urban, Underground	$250,000	$0	$20,000	$350	$2,238	$186
CBD, Surface	$1,000,000	$7,692	$2,500	$200	$1,162	$97
CBD, 4-Level Structure	$1,000,000	$1,923	$10,000	$300	$1,425	$119
CBD, Underground	$1,000,000	$0	$22,000	$400	$2,288	$191

Worksite Setting	$1	$2	$3	$4
Low density suburb	6.5%	15.1%	25.3%	36.1%
Activity center	12.3%	25.1%	37.0%	46.8%
Regional CBD/Corridor	17.5%	31.8%	42.6%	50.0%

Percent Vehicle Trips Reduced by Daily Parking Fees

Other economic measures

- Carbon tax
- Transit integrated fare
- Pay-as-you-drive assurance

Pay-as-you-drive assurance

Mileage Fee	Travel Reduction
1¢	-1.8%
2¢	-3.5%
3¢	-5.1%
4¢	-6.7%
5¢	-8.2%
6¢	-9.7%
7¢	-11.2%
8¢	-12.5%
9¢	-13.8%
10¢	-15.2%

Internalizzazione dei costi di trasporto

- The European Commission released a handbook with estimates of external costs in the transport.

CE Delft
Solutions for environment, economy and technology

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2611 HH Delft
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e-mail: ce@ce.nl
website: www.ce.nl
KvK 27251086

Institut System- und Innovationsforschung

Handbook on estimation of external costs in the transport sector

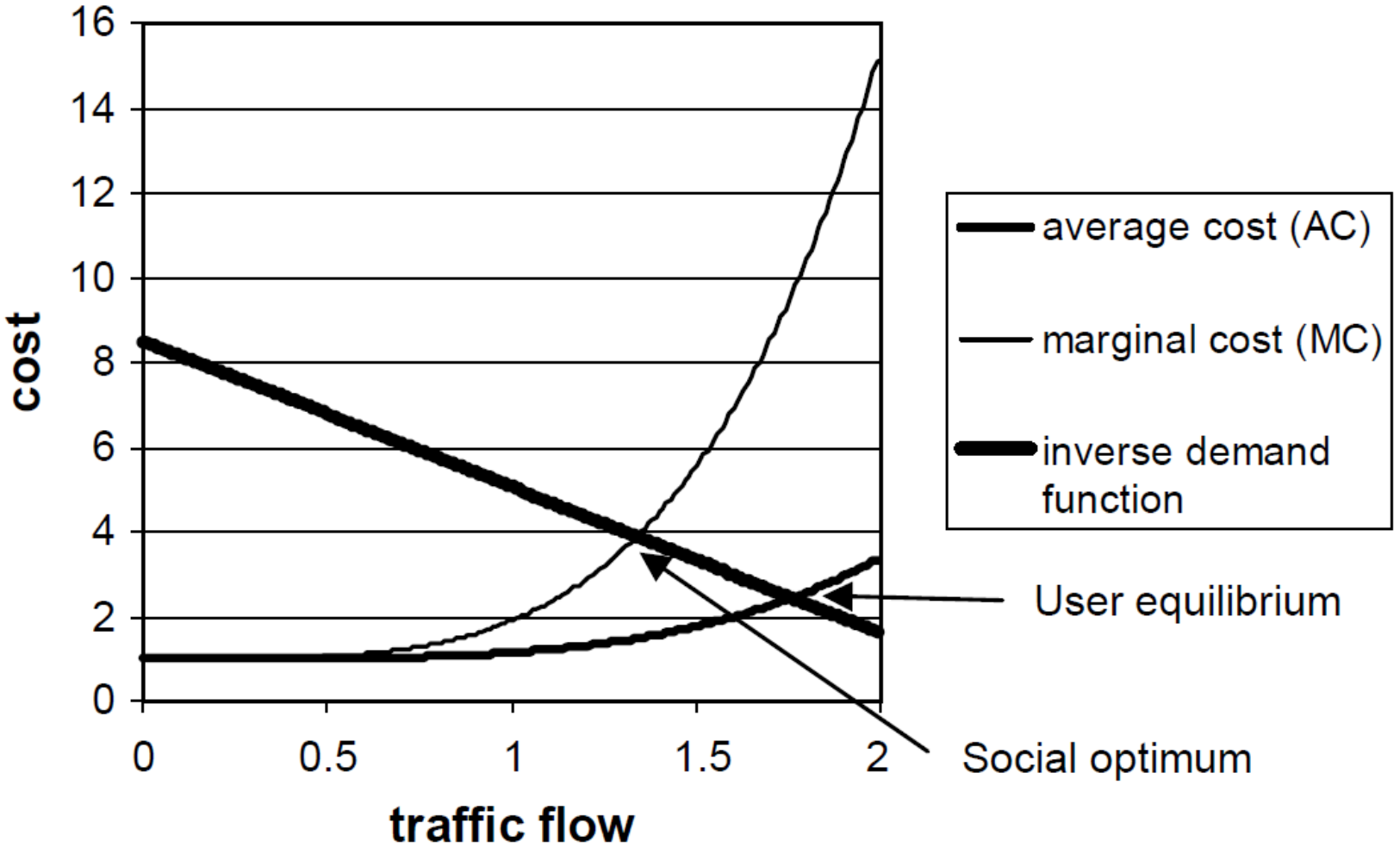
Produced within the study Internalisation Measures and Policies for All external Cost of Transport (IMPACT)

Cost component		*Passenger car*	*Heavy duty vehicle (HDV)*
€ct/vkm		*Unit costs (bandwidths)*	*Unit costs (bandwidths)*
Noise	Urban, day	0.76 (0.76 - 1.85)	7.01 (7.01 - 17.01)
	Urban, night	1.39 (1.39 - 3.37)	12.8 (12.8 - 31)
	Interurban, day	0.12 (0.04 - 0.12)	1.1 (0.39 - 1.1)
	Interurban, night	0.22 (0.08 - 0.22)	2 (0.72 - 2)
Congestion	Urban, peak	30 (5 - 50)	75 (13 - 125)
	Urban, off-peak	0 (-)	0 (-)
	Interurban, peak	10 (0 - 20)	35 (0 - 70)
	Interurban, off-peak	0 (-)	0 (-)
Accidents	Urban	4.12 (0 - 6.47)	10.5 (0 - 13.9)
	Interurban	1.57 (0 - 2.55)	2.7 (0 - 3.5)
Air pollution	Urban, petrol	0.17 (0.17 - 0.24)	(-)
	Urban, diesel	1.53 (1.53 - 2.65)	10.6 (10.6 - 23.4)
	Interurban, petrol	0.09 (0.09 - 0.15)	(-)
	Interurban, diesel	0.89 (0.89 - 1.8)	8.5 (8.5 - 21.4)
Climate change	Urban, petrol	0.67 (0.19 - 1.2)	(-)
	Urban, diesel	0.52 (0.14 - 0.93)	2.6 (0.7 - 4.7)
	Interurban, petrol	0.44 (0.12 - 0.79)	(-)
	Interurban, diesel	0.38 (0.11 - 0.68)	2.2 (0.6 - 4)
Up- and downstream processes	Urban, petrol	0.97 (0.97 - 1.32)	(-)
	Urban, diesel	0.61 (0.61 - 1.05)	3.1 (3.1 - 6.9)
	Interurban, petrol	0.65 (0.65 - 1.12)	(-)
	Interurban, diesel	0.45 (0.45 - 0.92)	2.7 (2.7 - 6.7)
Nature & landscape	Urban	-	0 (0 - 0)
	Interurban	0.4 (0 - 0.4)	1.15 (0 - 1.15)
Soil & water pollution	Urban/Interurban	0.06 (0.06 - 0.06)	1.05 (1.05 - 1.05)

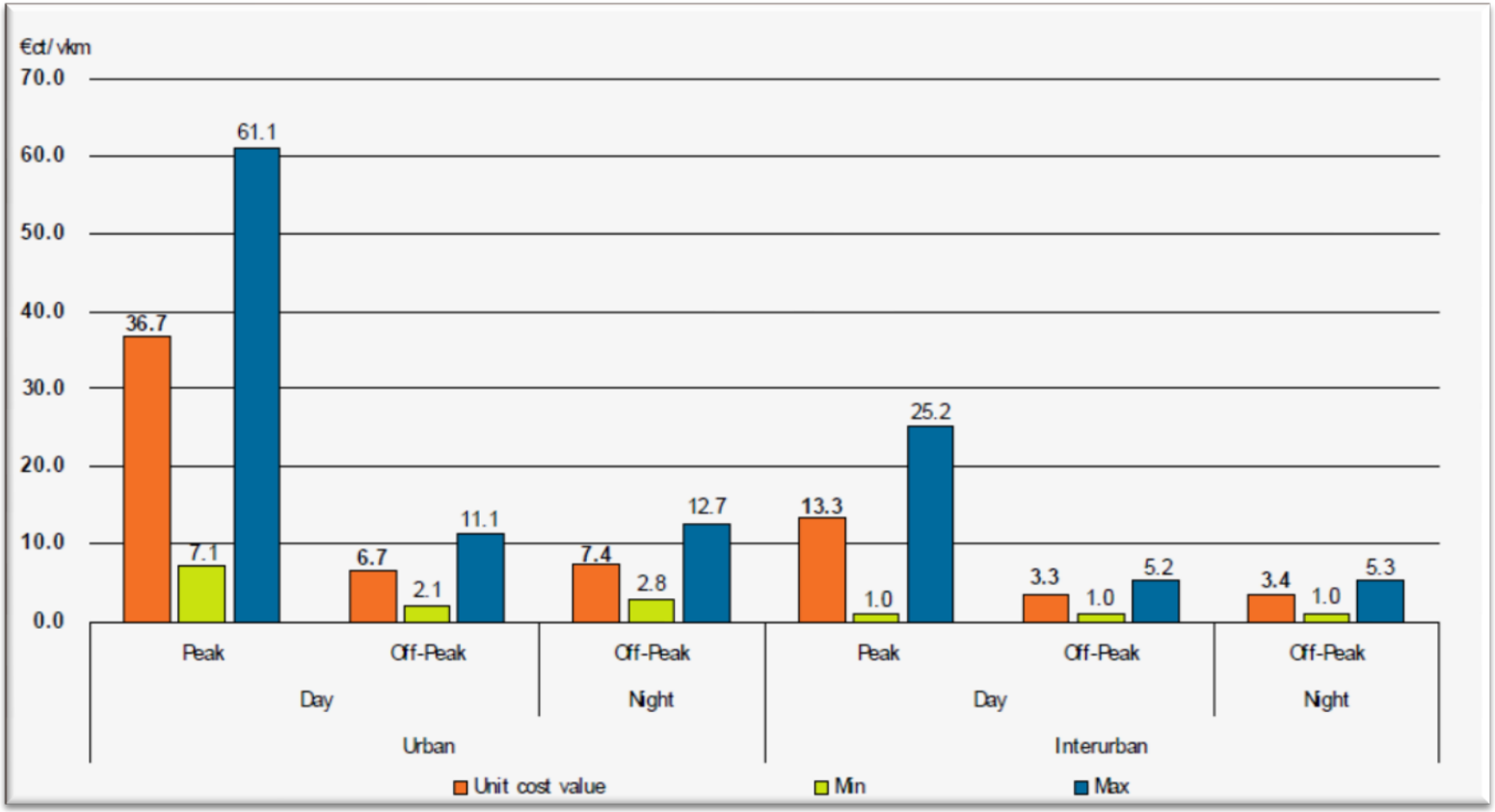
Approfondimenti teorici

- Paradosso di Braess
- Principii di Wardrop
- Ottimo dell'utente ed ottimo di sistema
- Il concetto di costo marginale sociale
- Calcolo della tariffa ottima

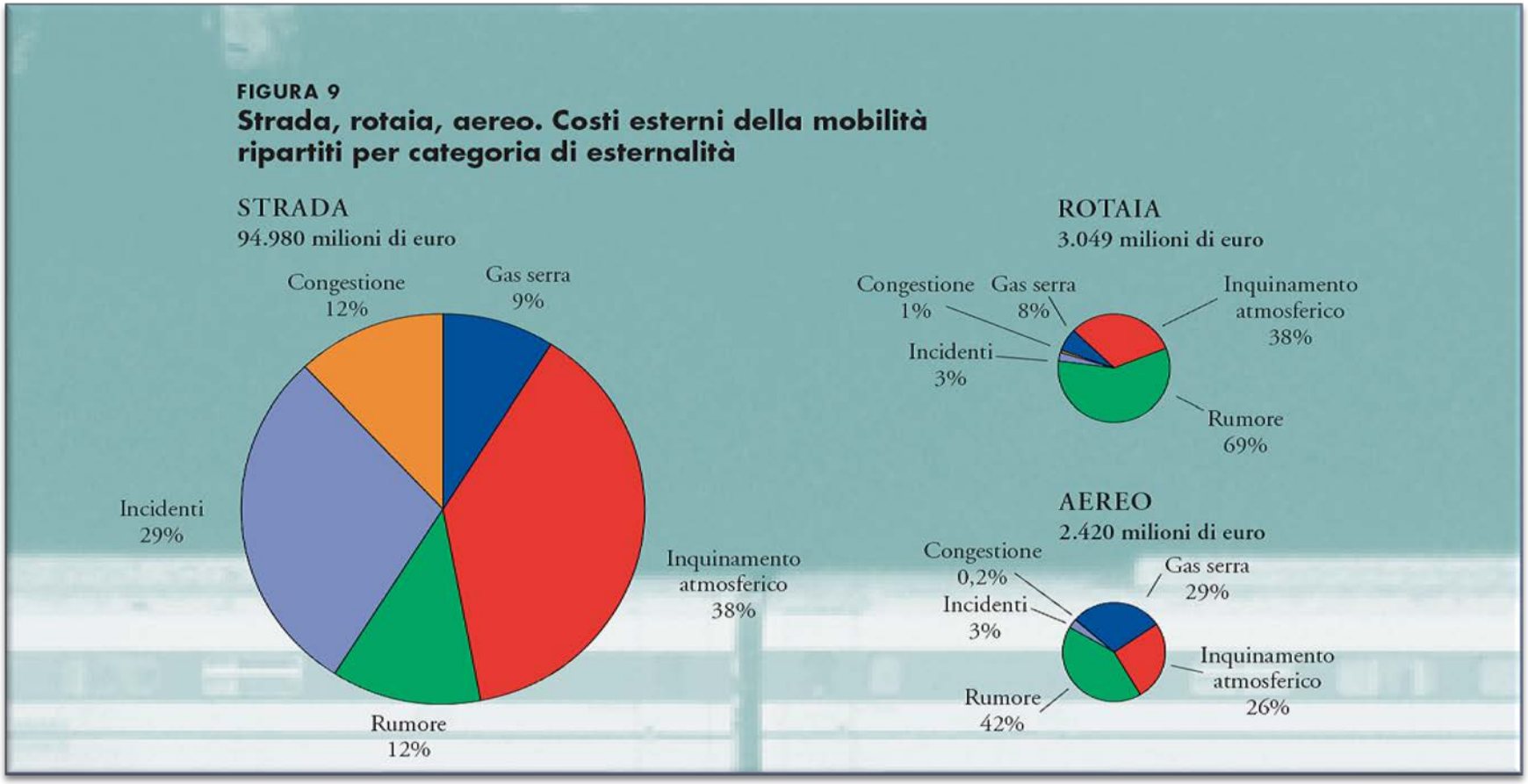
Internalizzazione dei costi esterni della mobilità



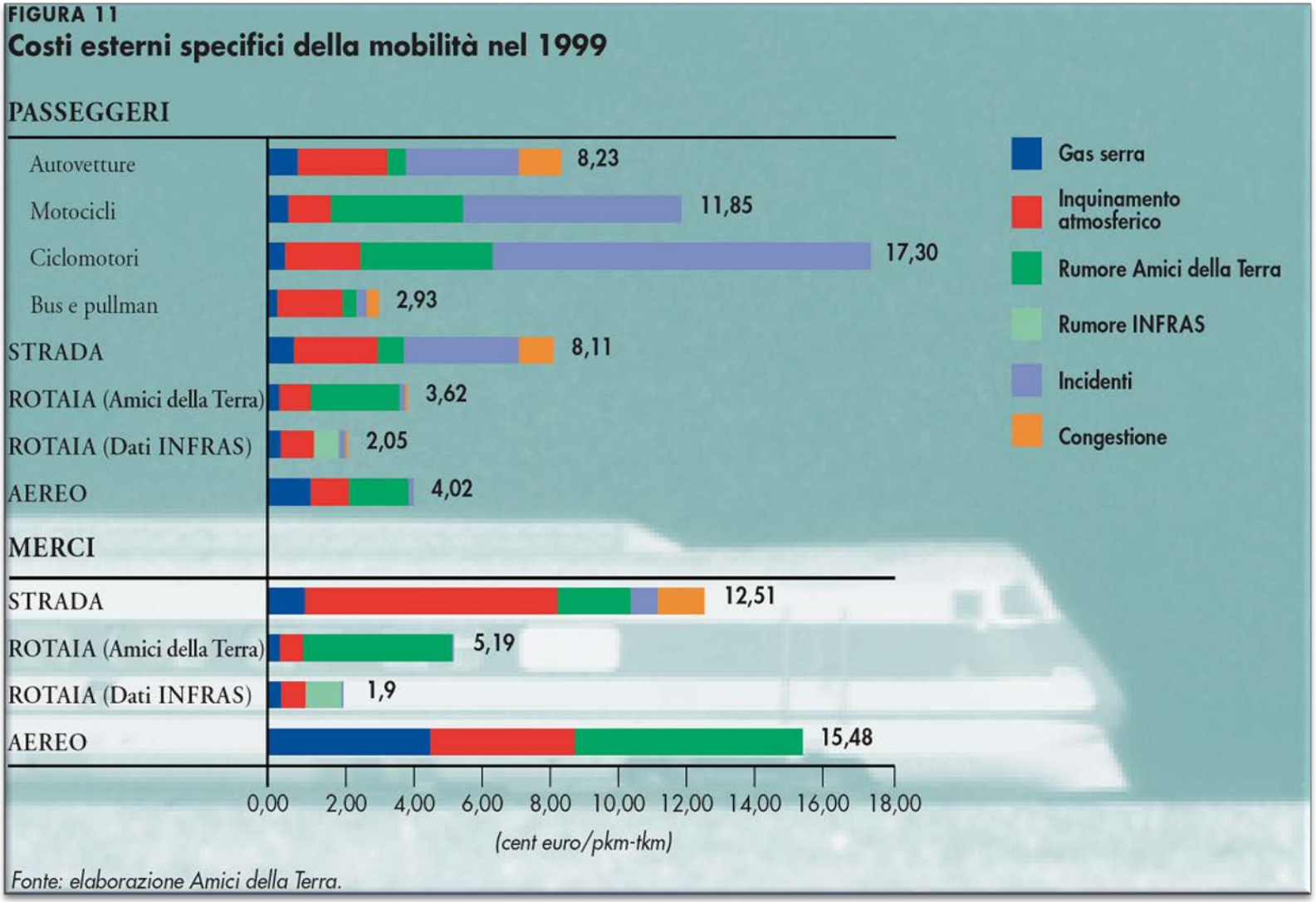
Costi esterni per trasporto su autovetture (€ct/veic-km)



Costi esterni della mobilità (Amici della Terra e FS)



Costi esterni della mobilità (Amici della Terra e FS)



Strumenti di informazione

Azioni per la mobilità sostenibile

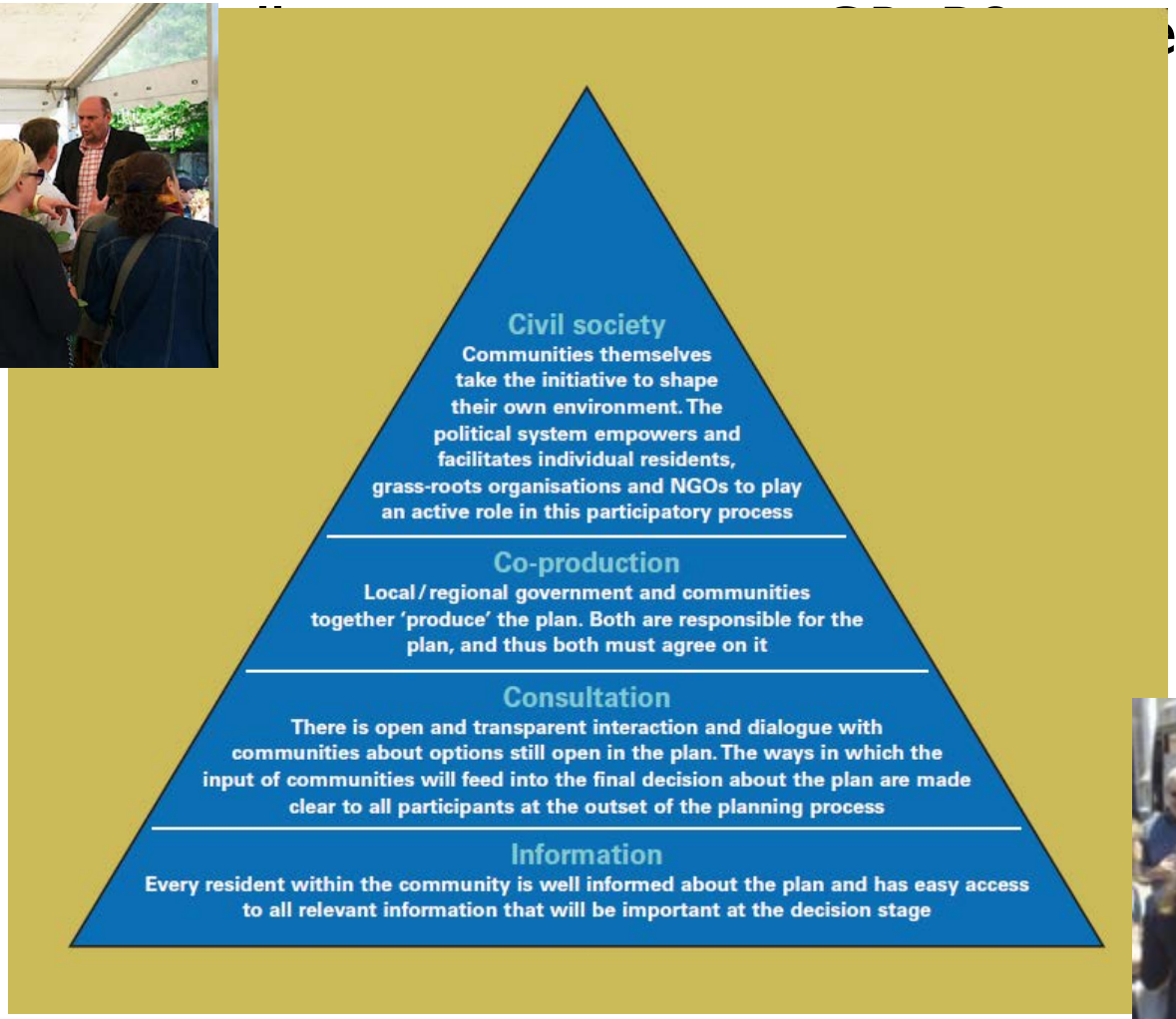
Information tools

Public awareness campaigns

Stakeholder conferences

Driver Training / Eco Driving

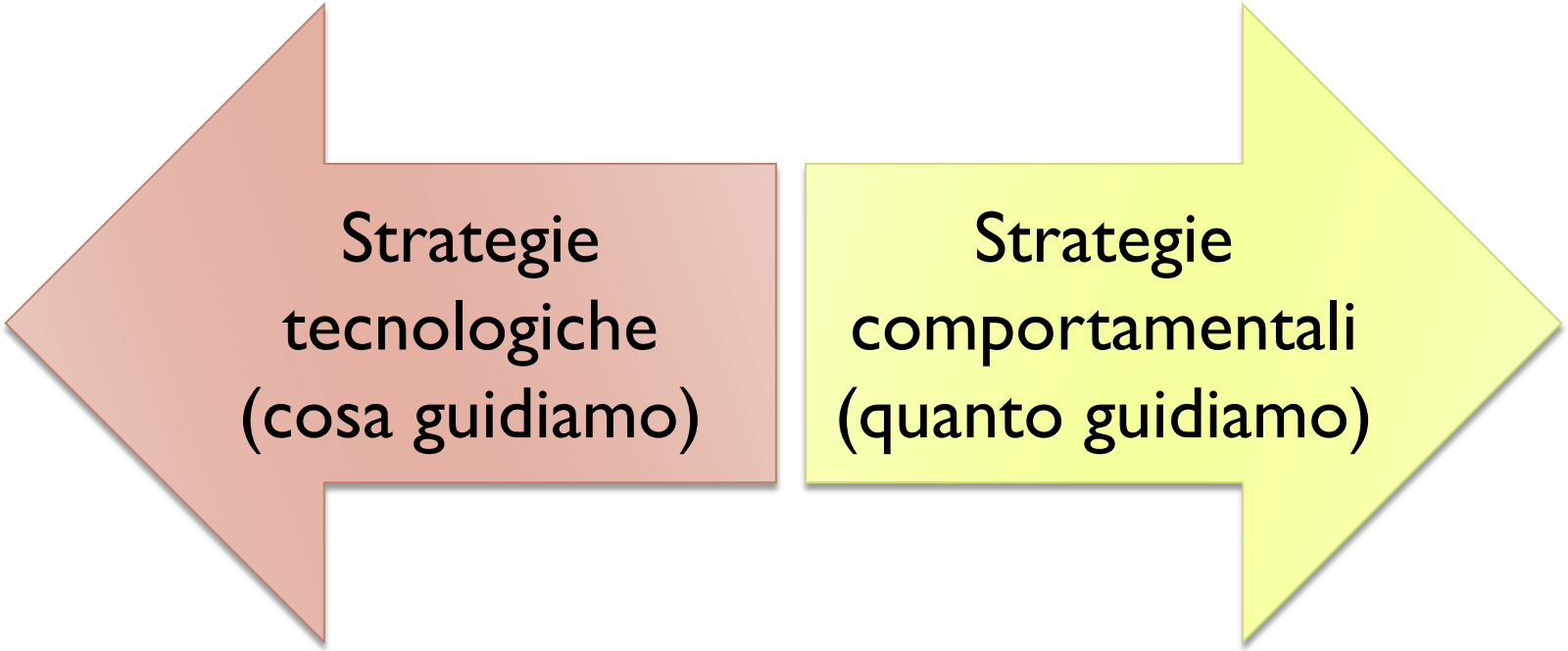
Public Engagement – Community Involvement



145

Awareness campaign

- Providing personalised information about the environmental impact of travel behaviour as a tool for promoting sustainable mobility (Meloni e Spissu, SIDT 2011)



Awareness campaign

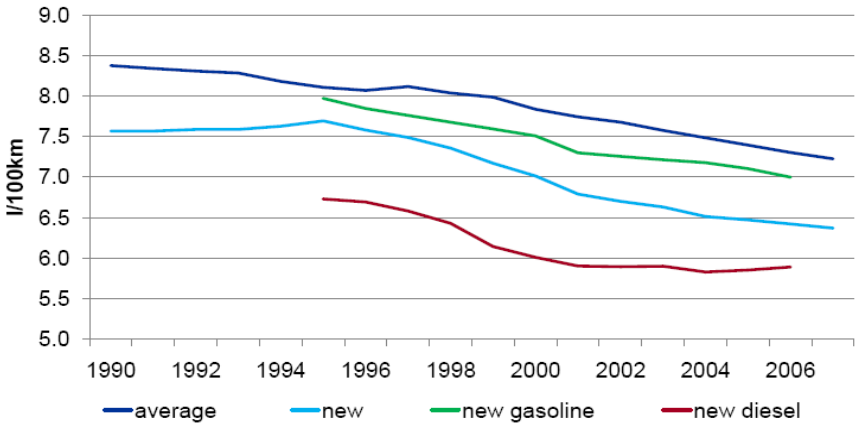
- Politiche coercitive
  - ZTL
  - Pricing
- Vs. comportamenti volontari

Strumenti tecnolgici

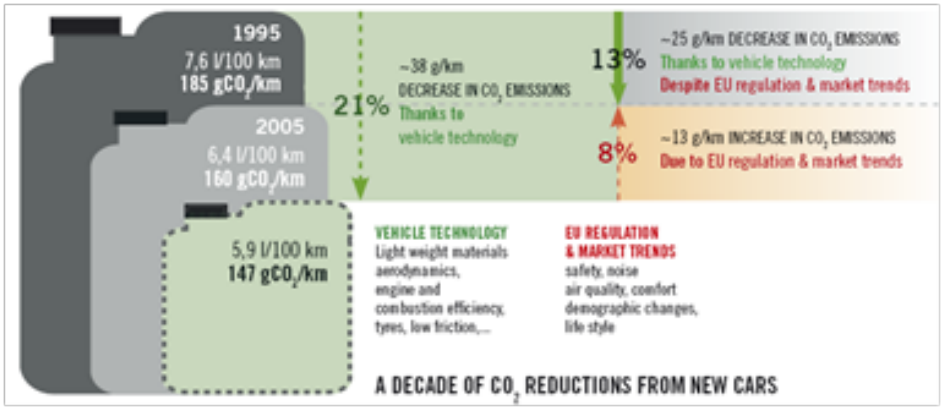
Azioni per la mobilità sostenibile

Nonostante i progressi tecnologici

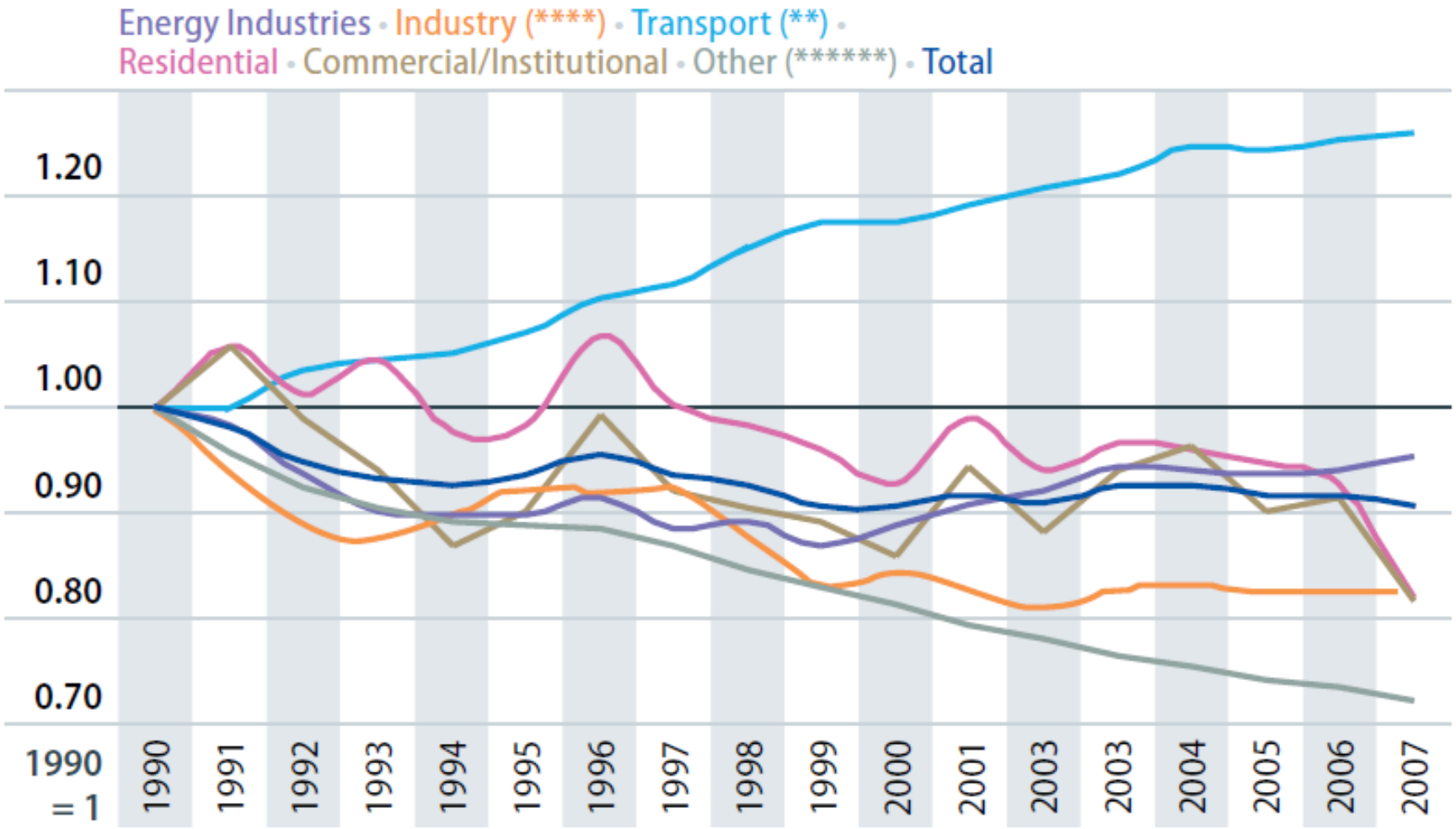
Specific consumption of new cars and stock average (EU-27)



Improving in vehicle technology

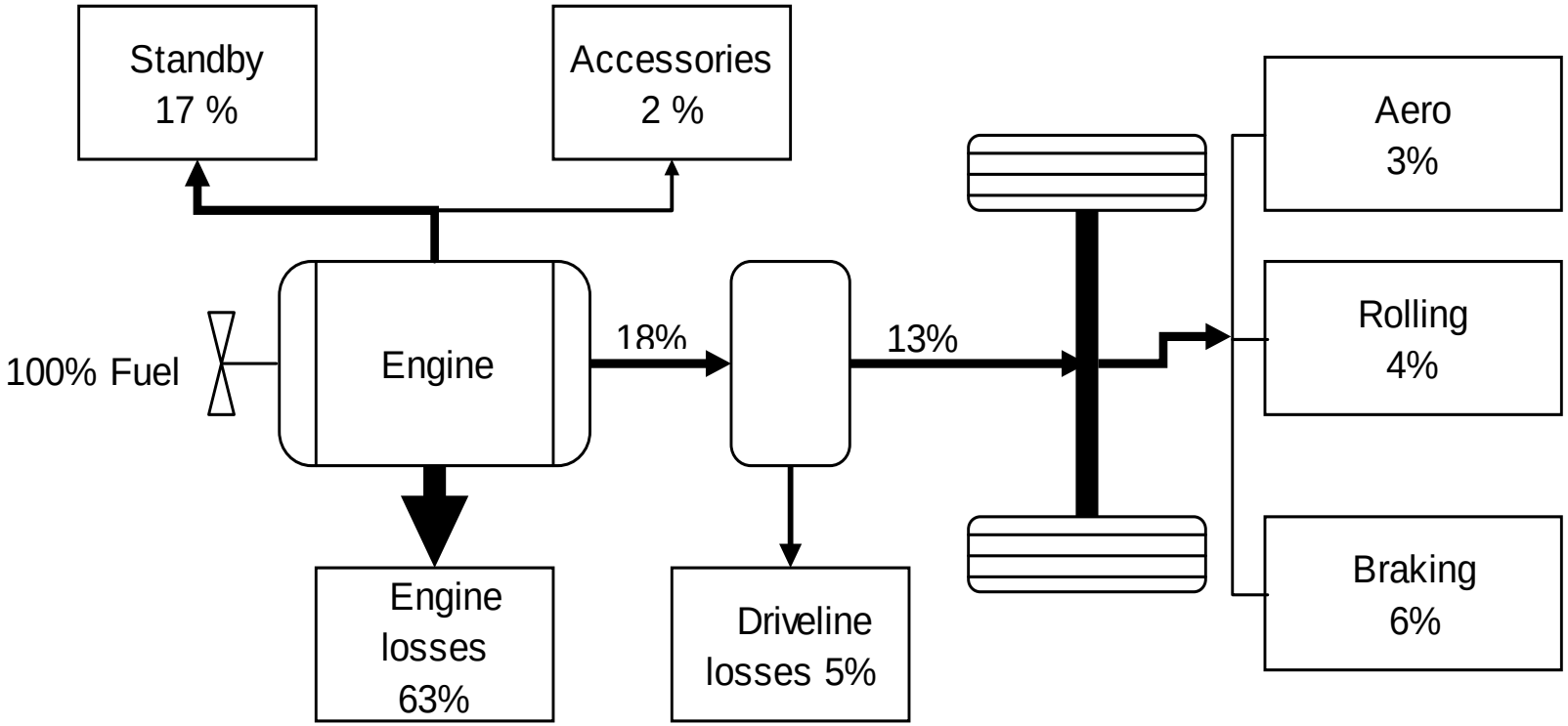


Le emissioni crescono, perché cresce la mobilità



EU Energy and Transport in Figures
St atistical Pocket book 2010

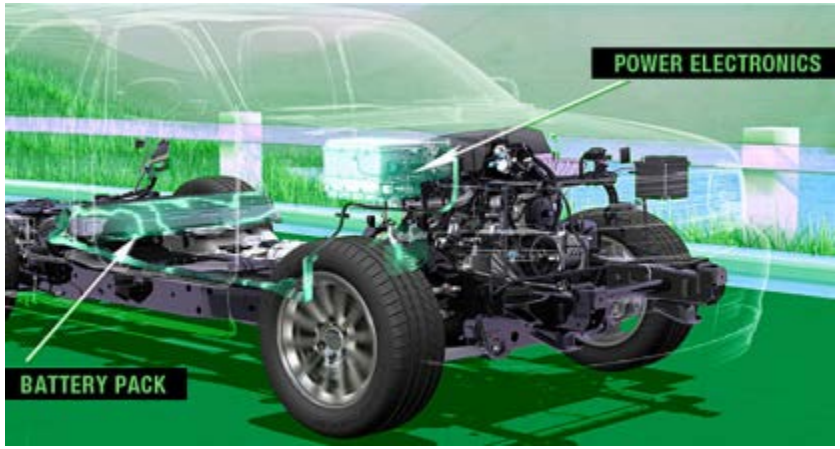
L'automobile ha una bassa efficienza energetica



Improve vehicle efficiency

Electric vehicle

Hybrid propulsion

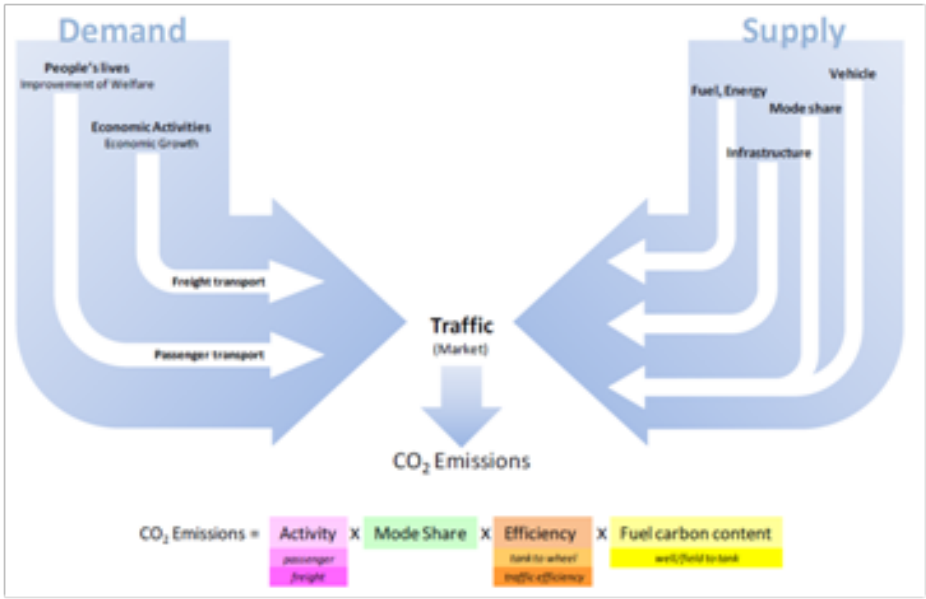


Other energy efficiency improvement

- Abatement emission systems
- Vehicle weight reduction
- Air conditioning efficiency
- Rolling drag reduction

Cleaner fuels

- Natural gas
- Conventional biofuels
- Advanced biofuels
- Hydrogen fuel cells



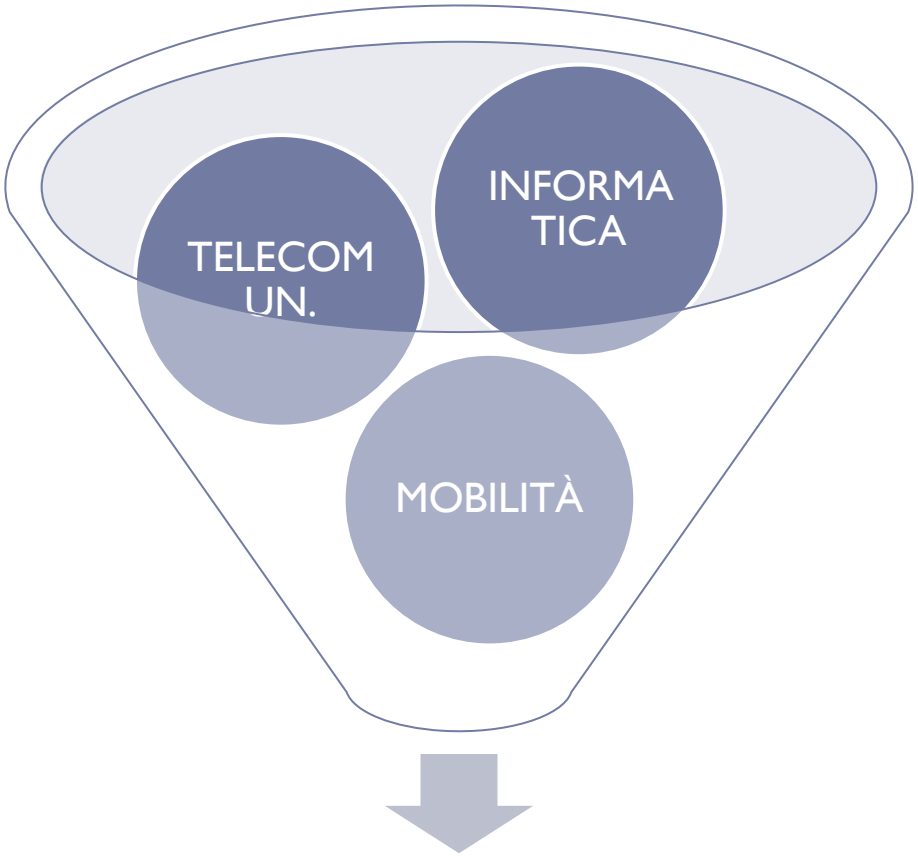
Intelligent Transport Systems

nuove tecnologie e disponibilità a livello civile di alcuni traguardi da tempo raggiunti in ambito militare (**GPS**),

diffusione della **telefonia mobile** e del **mondo web**

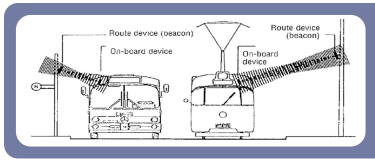
controllo e regolamentazione dei trasporti e del traffico in modo globale, integrata e con possibilità concrete di conoscere in tempo reale la situazione sul traffico ed influire su di esso adottando metodologie e soluzioni tecnologiche prima impensabili.

Intelligent Transport Systems



INFOMOBILITÀ

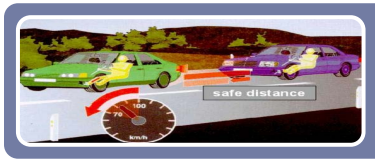
Tecnologie (ITS)per migliorare la mobilità



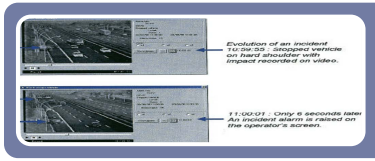
la gestione del traffico e della mobilità (*gestire* e *ottimizzare, non costruire*)

la gestione del trasporto pubblico

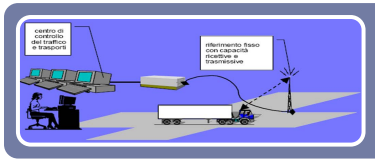
l'informazione all'utenza (*essere informati per scegliere bene*)



il controllo avanzato del veicolo (aumento della sicurezza e della capacità di traffico)



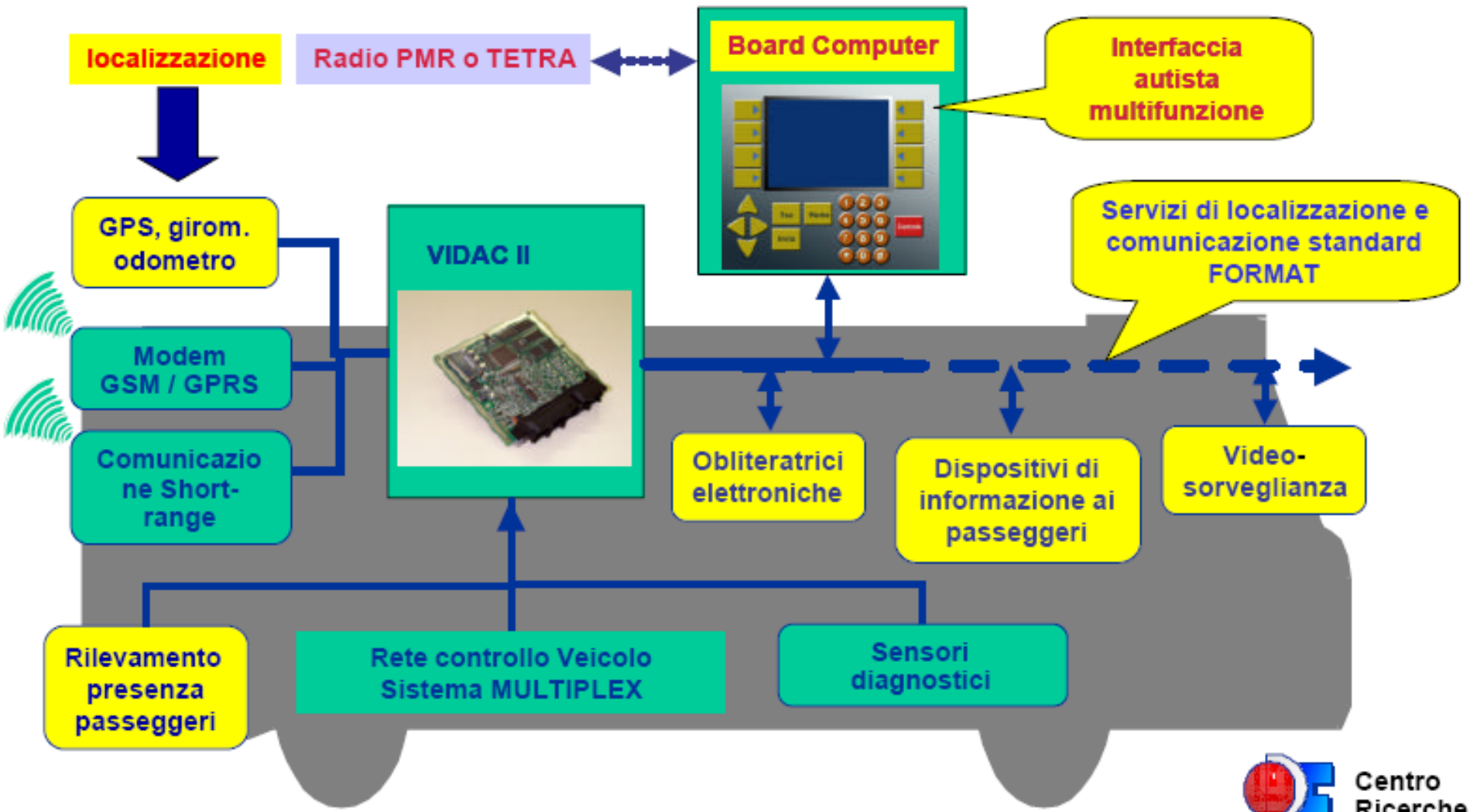
la gestione delle emergenze



la gestione delle flotte e del trasporto merci

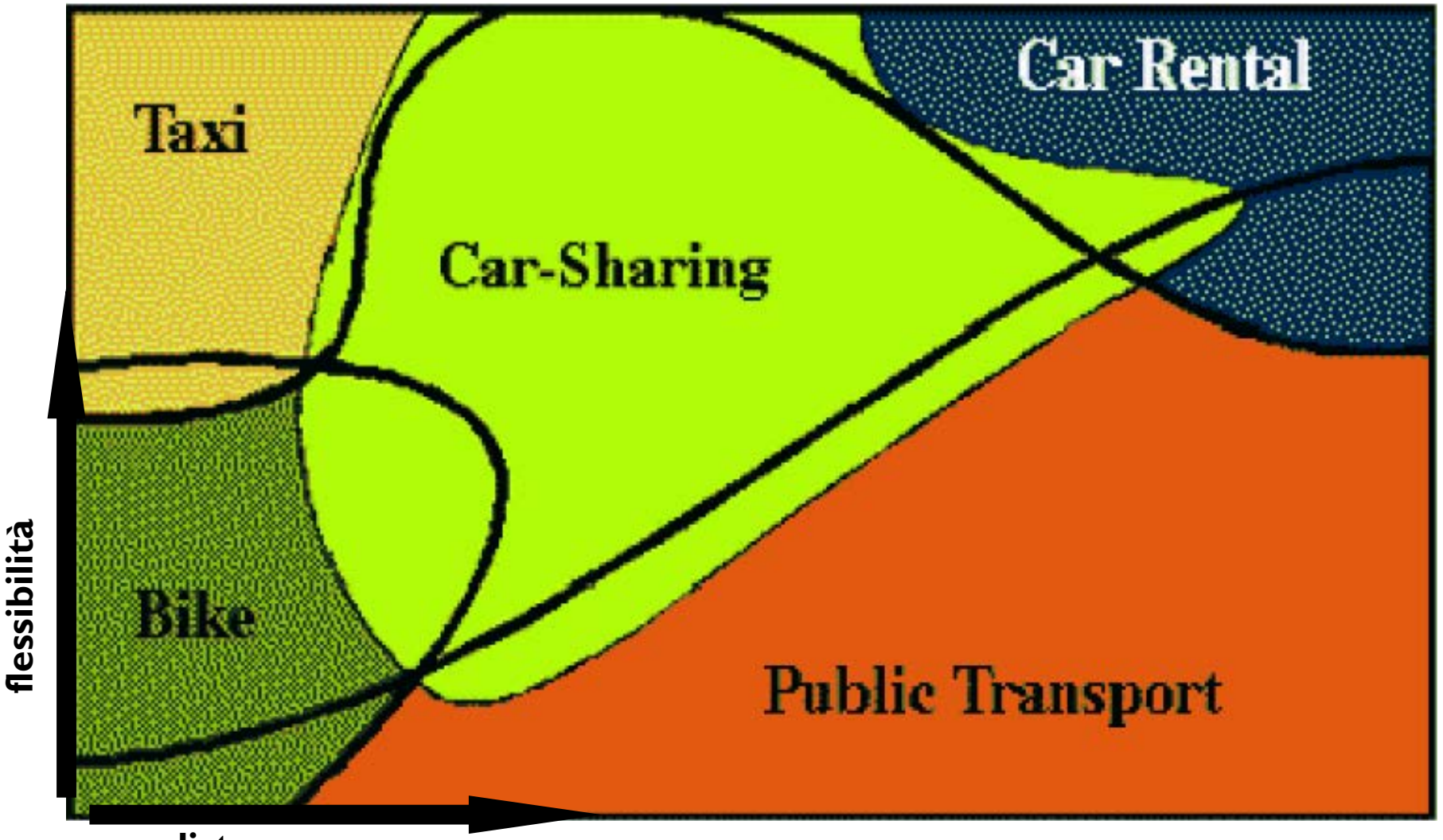
MATRIX

Il sistema di bordo integrato



Centro Ricerche Fiat

Modi alternativi di usare l'auto



Car sharing

- Il *Car Sharing* è un servizio di mobilità innovativo cui si accede versando una quota associativa.
- I soci/utenti dispongono di una flotta comune di veicoli distribuiti su più aree di parcheggio in prossimità di residenze e di importanti nodi di scambio intermodale.
- L'accesso ai veicoli avviene in modo autonomo e ne è consentito l'uso anche per periodi limitati di un'ora.
- Il costo complessivo sostenuto dall'utente comprende la quota fissa d'iscrizione e una quota proporzionale al tempo di utilizzo e alla percorrenza realizzata.
- In pratica si noleggia un veicolo anche per un singolo spostamento.

Tecnologie (ITS) per ridurre la mobilità

- Telecommuting
- Teleworking
- Teleshopping
- Telebanking
- …

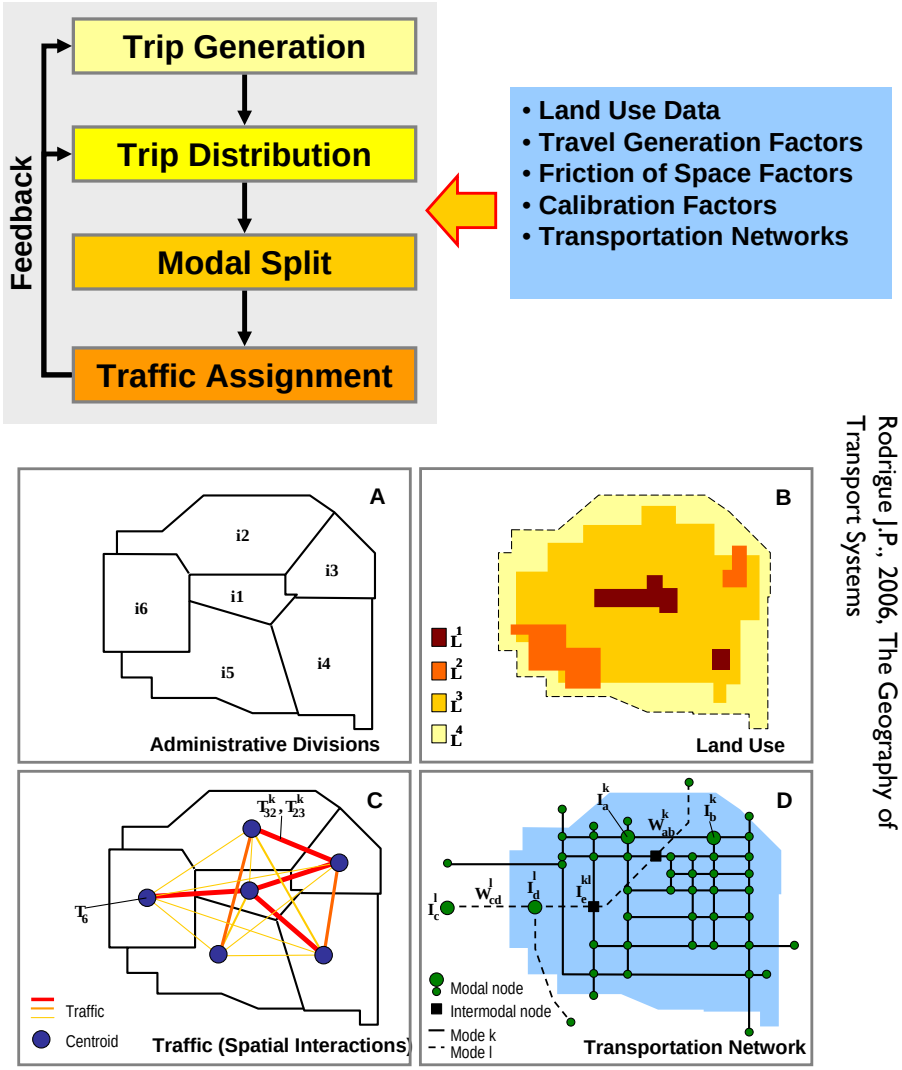
Pianificare la mobilità sostenibile

Piani di azione per la mobilità sostenibile

Alcuni limiti della pianificazione tradizionale

Conventional Transport Planning and Modelling

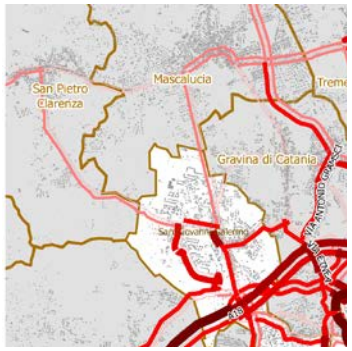
- Conventional traffic models (Lewis, 1998)
  - Land use, social and economic issues not properly included
  - Focus only on satisfying a growing demand
  - Measuring the network performance in terms of high speed and low congestion, leads to self-prophetic always increasing transport supply and car dependency



Rodrigue J.P., 2006, The Geography of Transport Systems

Conventional Transport Planning and Modelling

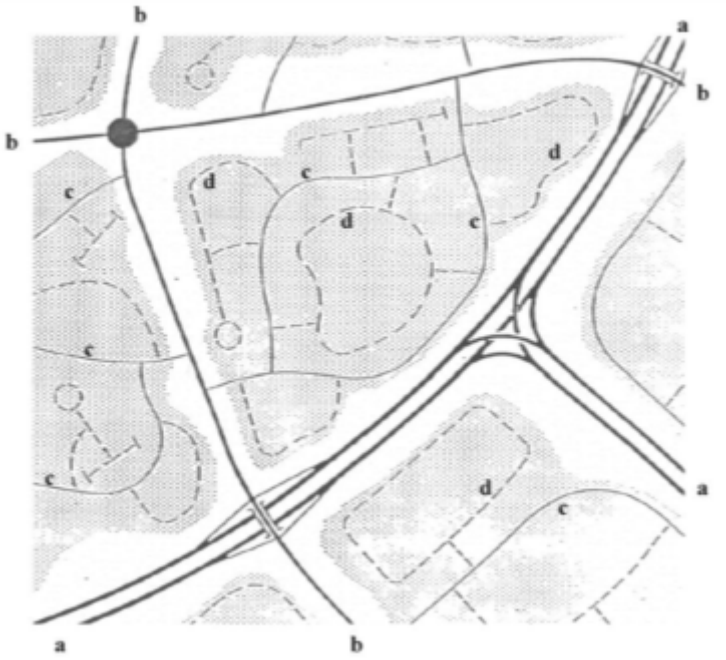
- Conventional traffic models (Litman, 2011)
  - Only account for travel between zones, not travel within zones
  - Fail to account for generated traffic impacts
  - Rarely include transit quality factors other than speed
  - Rarely predict the impact of mobility management measures



Functional hierarchy of the road network

- The stiff road network hierarchy suggested by the law, leads to good mobility and bad accessibility

TIPO DI STRADA / FUNZIONE	PRIMARIA	PRINCIPALE	SECONDARIA	LOCALE
transito, scorrimento	●	○		
distribuzione	○	●	○	
penetrazione		○	●	○
accesso			○	●

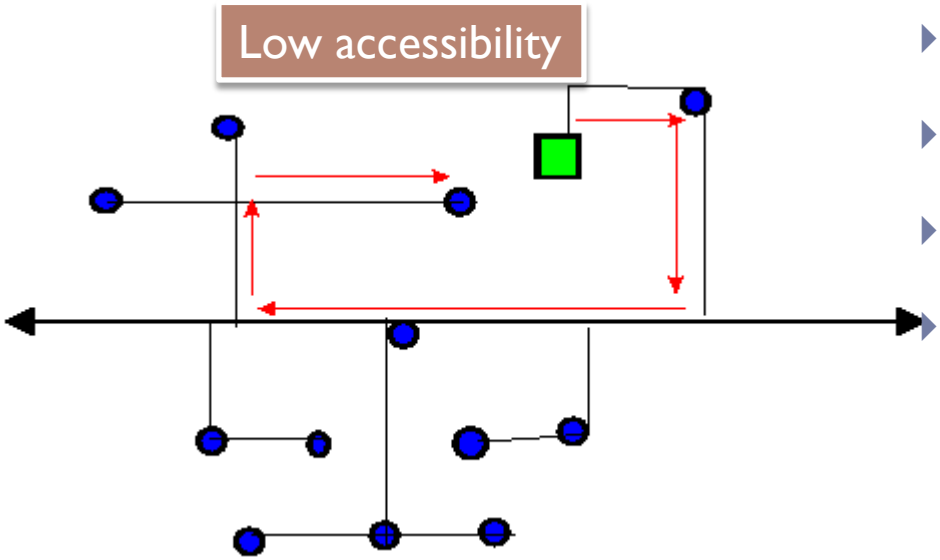


Ministero dei Lavori Pubblici, Norme Funzionali e Geometriche per la Costruzione delle Strade, DM 5.11. 2001

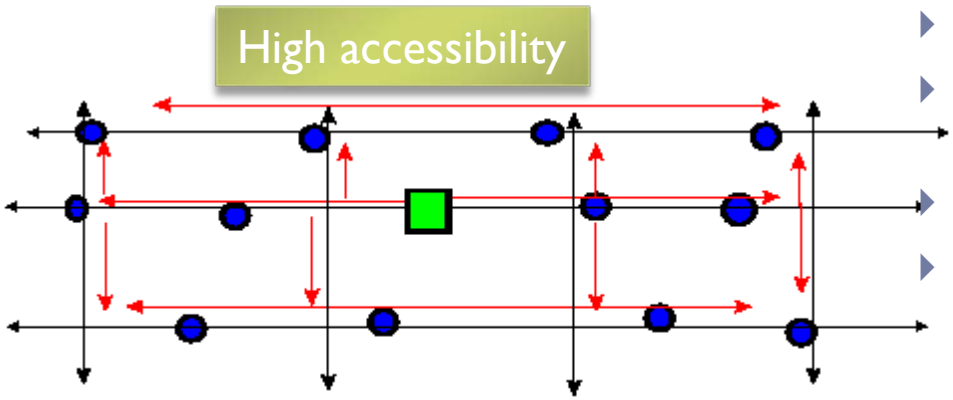
Functional hierarchy of the road network

- The goal of hierarchy network is efficiency as we specialize some roads to fast traffic and other roads to more amenable environmental space
- It is quite controversial (in terms of SM) that faster is better, in facts high vehicle speeds can
  - reduce total traffic capacity
  - increase resource consumption
  - increase costs
  - reduce transportation options
  - increase crash risk
  - create less accessible land use patterns, and
  - increase automobile dependency, reducing overall system efficiency.

Hierarchical vs Grid Road Network

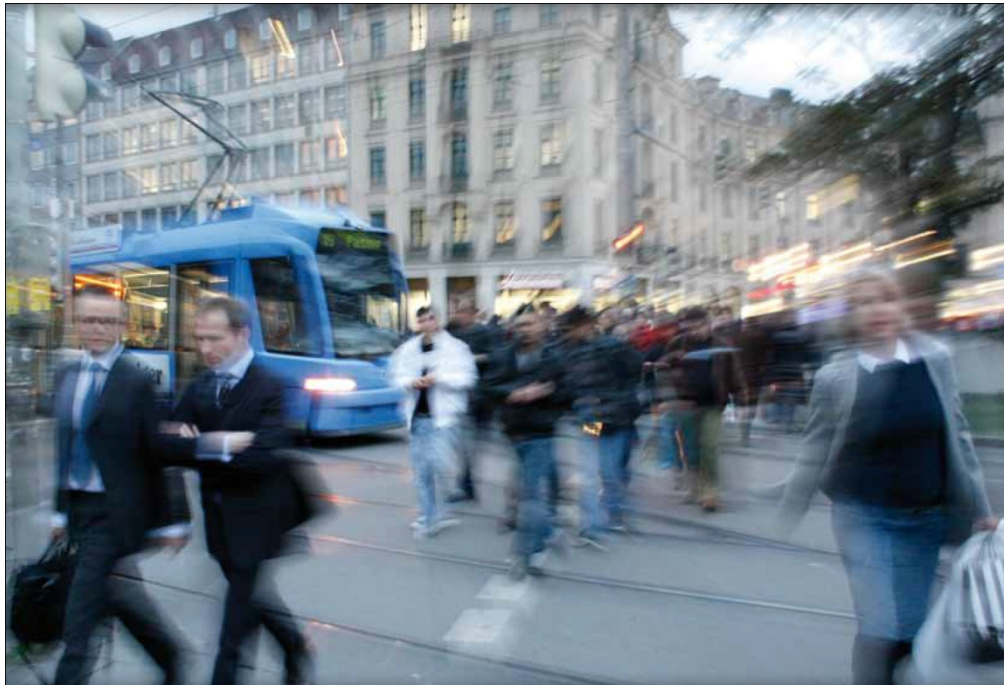


- Higher average traffic speed
- Longer distances
- Increasing congestion
- Poor walking and cycling conditions



- Shorter connected roads
- More direct connections between destinations
- Narrower streets and lower speed
- More walking and cycling and then transit trips

Litman, 2011



Piani di azione per la mobilità sostenibile

Esigenza di un nuovo approccio alla pianificazione dei trasporti

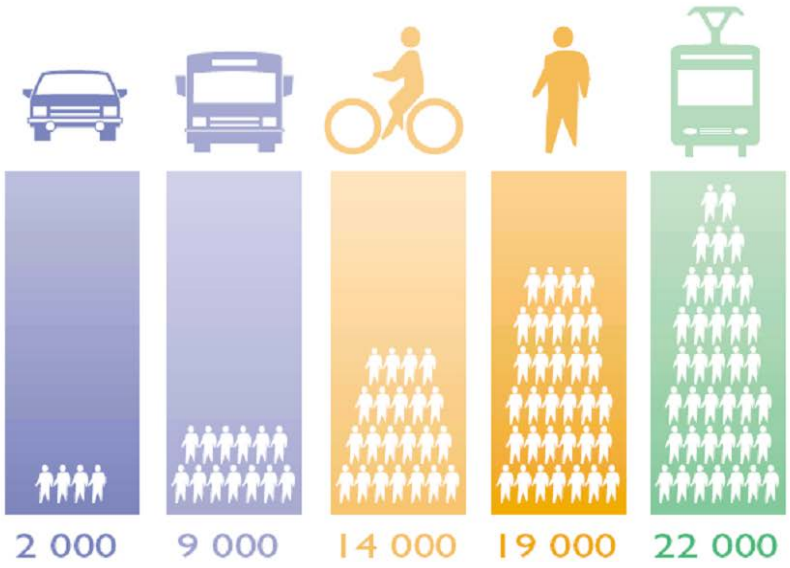
Need for a new transport planning approach (Banister, 2008)

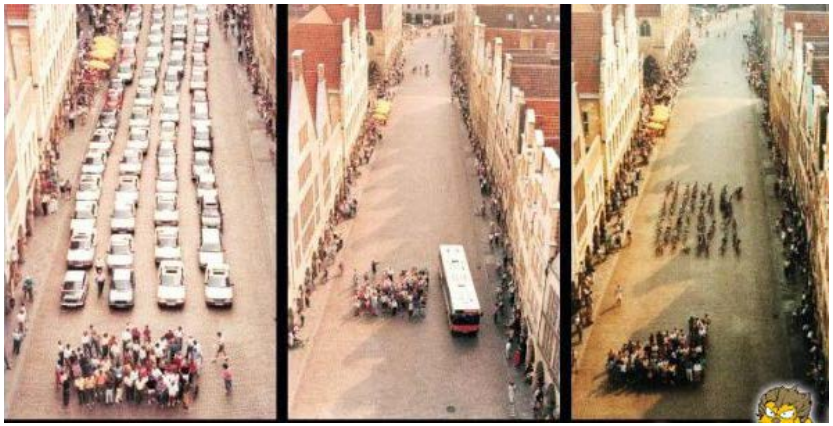
Conventional transport planning	Planning for sustainable mobility
Mobility	Accessibility
Traffic	People
Large in scale	Local in scale
Street as a road	Street as a space
Motorized transport	All modes, pedestrian and cyclist first
Forecasting approach	Visioning on cities
Economic evaluation	Multicriteria approach
TSM	TDM
Minimum travel time	Time reliability
Segregation of people and traffic	Integration of people and traffic

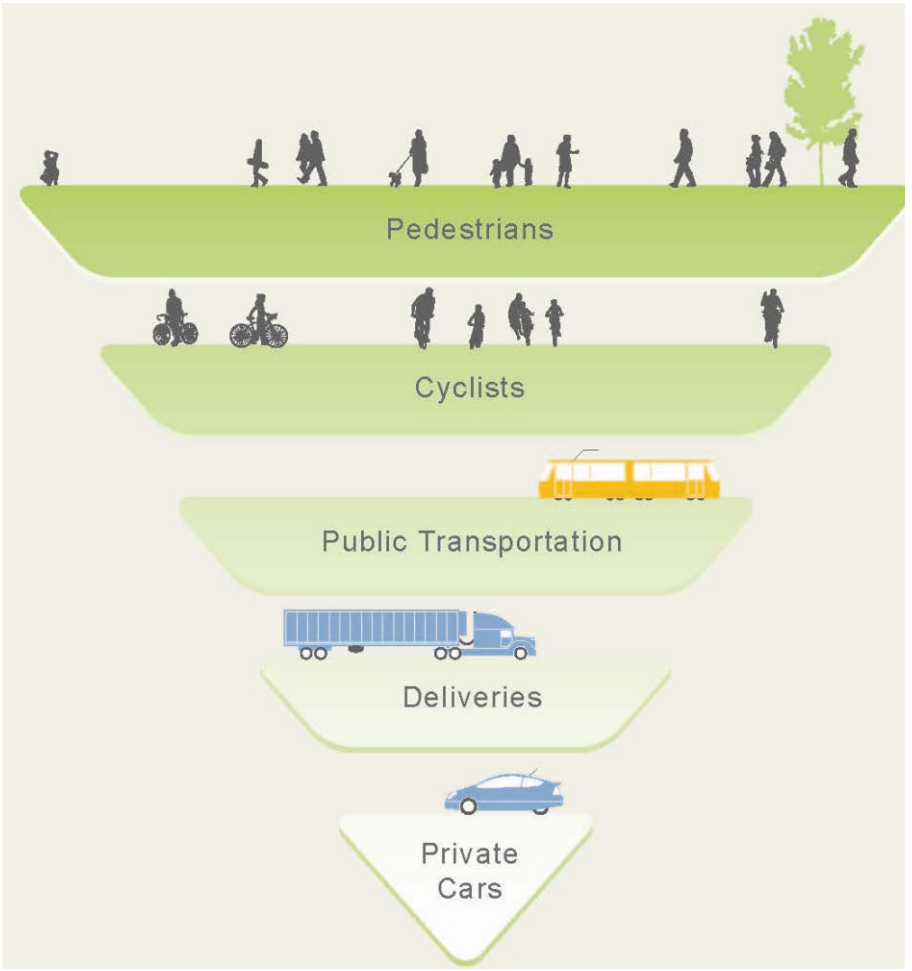
Basic elements of Sustainable Mobility Planning

- Commitment for **sustainability**
  - balancing economic development, social equity and environmental protection
  - Include wider societal and environmental costs and benefits into alternative evaluations
- Adequate **territorial scale** and authority
  - Urban, metropolitan, neighbouring authorities
- **Community** involvement
  - Citizens and stakeholders participate in decision making, implementing and monitoring the plan
- **Integrated approaches** and tools
  - Integrate SM planning into a city-wide sustainable development long-term vision
  - Integrate **Accessibility Planning**, Regulatory, Economy, Information, and Technology tools
- Focus on achievable targets based on **assessable indicators** while selecting plan actions and **measurable indicators** to continuously monitoring impacts and results and re-addressing the planned actions

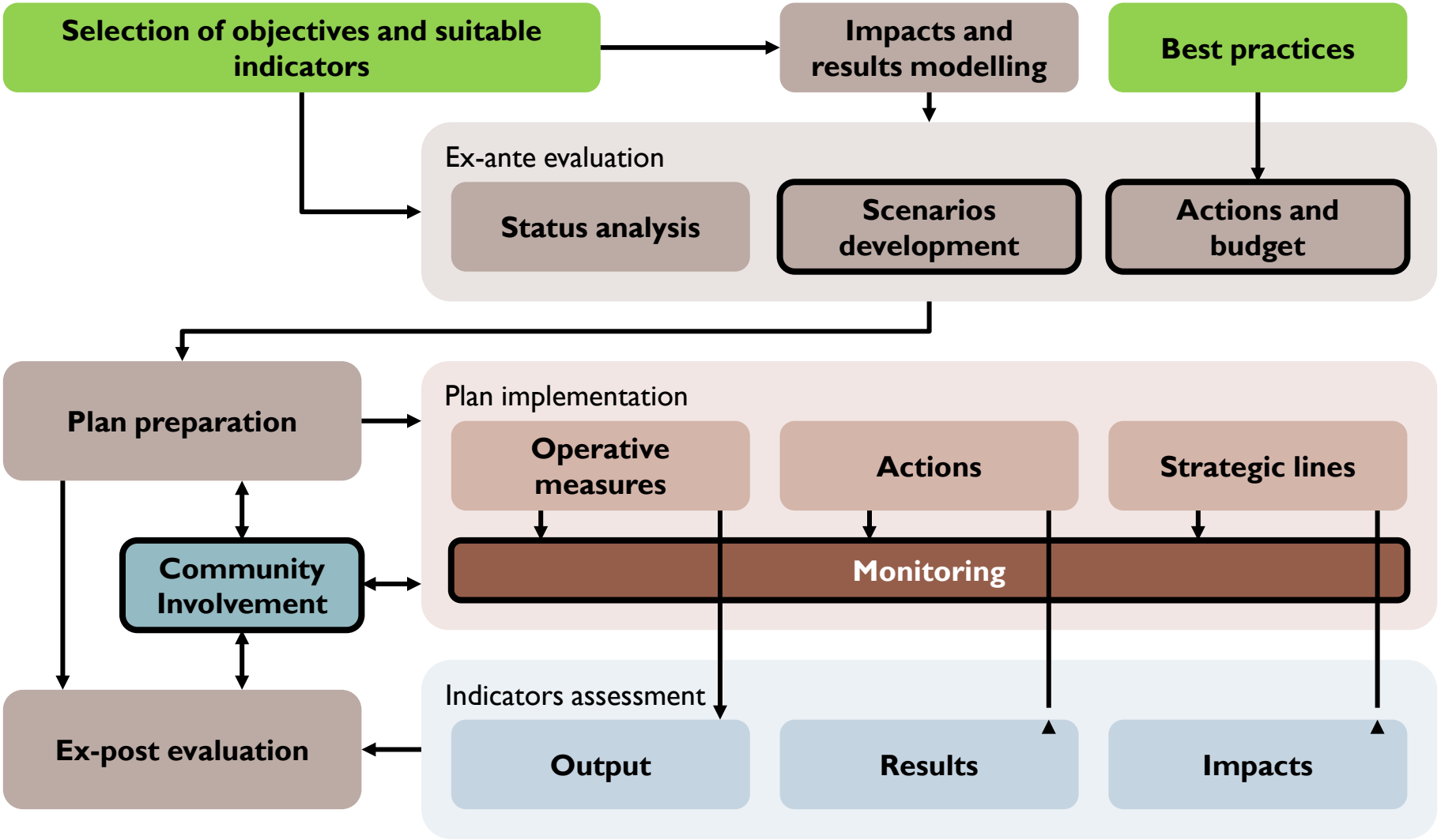
Capacità di traffico, occupazione di spazio e priorità dei modi di trasporto







Sustainable Mobility Planning process



 Adapted from PILOT Manual www.pilot-transport.org/

Elementi di base di un piano di azione per la mobilità sostenibile

- Obiettivi generali
- Strumenti di pianificazione (per l'accessibilità)
- Partecipazione pubblica alle decisioni
- Analisi di scenario
- Azioni di piano e Best practice
- Monitoraggio del piano

Obiettivi del piano

Gli obiettivi devono essere S-M-A-R-T:

- **S**pecific : essere chiaramente definiti per non dare luogo a fraintendimenti;
- **M**easurable: in modo da poter dimostrare il loro raggiungimento;
- **A**ction-orientated : finalizzati ad un processo o ad un'attività specifica;
- **R**ealistic: realizzabili in base al tempo ed alle risorse disponibili;
- **T**ime-related: con tempi di realizzazione ragionevoli.

Esempio di Obiettivi Generali

1. Promuovere un'**accessibilità** urbana diffusa e sostenibile
2. Ridurre i **costi** individuali e collettivi della mobilità
3. Ridurre la **congestione**
4. Aumentare la **sicurezza** stradale, misure forti per gli utenti deboli
5. Ridurre l'**inquinamento** acustico, atmosferico e i **danni alla salute**
6. Ridurre i **consumi** energetici e mitigare gli impatti del cambiamento climatico
7. Aumentare il **benessere** fisico
8. Aumentare l'**equità** sociale e ridurre il degrado e la marginalizzazione
9. Aumentare le opportunità di **interazione sociale** negli spazi pubblici della città
10. Minimizzare l'uso dell' **auto individuale**

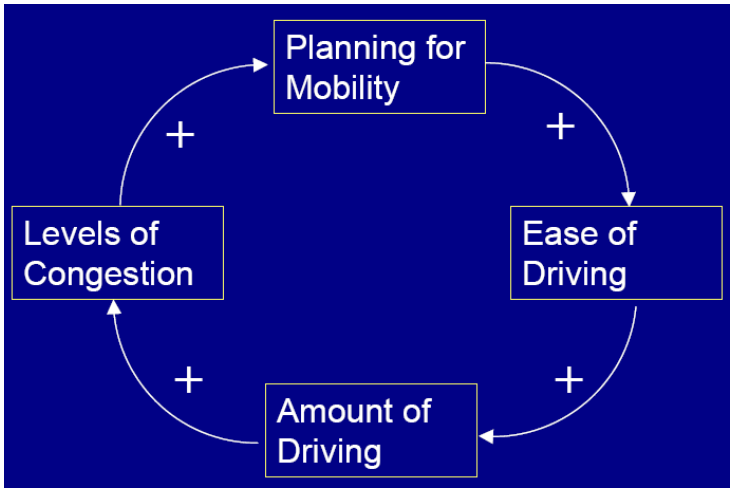
Pianificare per l'accessibilità

Pianificare per la mobilità sostenibile

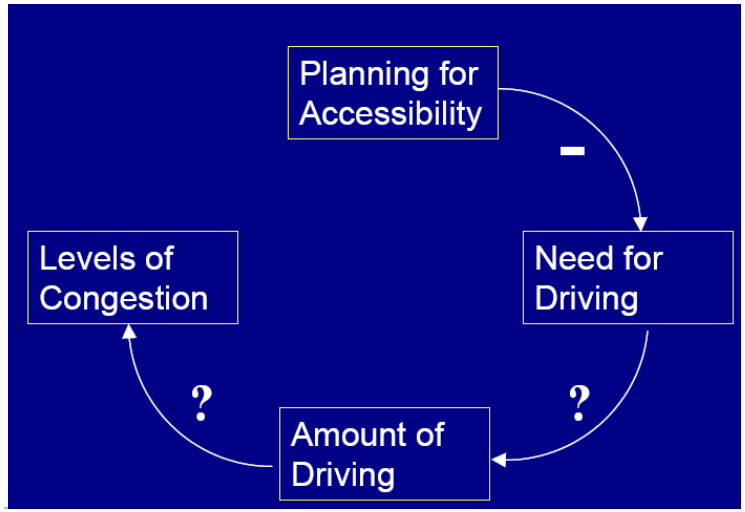
Mobility Vs. Accessibility (Handy, 2002)

- Need to resolve the duality

- Mobility is the potential for movement, the ability to get from one place to another
- It increases if the number travelled veic-km's increases



- Accessibility is the potential for interacting among different and distributed urban activities
- It increases if the number of opportunities, within a fixed time or distance, increases



Scarsa Mobilità

Impossibilità di muoversi

Buona Accessibilità

- Possibilità di avere ciò di cui si ha bisogno:
  - Destinazioni vicine (città dense)
  - Scelta di diverse destinazioni (uso misto del territorio)
  - Diversi modi di trasporto utilizzabili da tutti gli utenti (trasporto pubblico e mobilità non motorizzata, oltre all'automobile)

Scarsa Accessibilità

- Impossibilità di avere ciò di cui si ha bisogno:
  - Destinazioni lontane (città disperse)
  - Scarsa scelta di diverse attività urbane (zone omogenee e distanti)
  - Scarsa scelta modale (solo automobile)

Accessibilità Vs Mobilità

- In genere una buona mobilità contribuisce ad una buona accessibilità, MA
  - si può avere una buona accessibilità con una scarsa mobilità (destinazioni numerose e vicine con alta intensità di traffico)

  - si può avere una scarsa accessibilità con una buona mobilità (destinazioni scarse e distanti con bassa intensità di traffico)

Mobility indicators

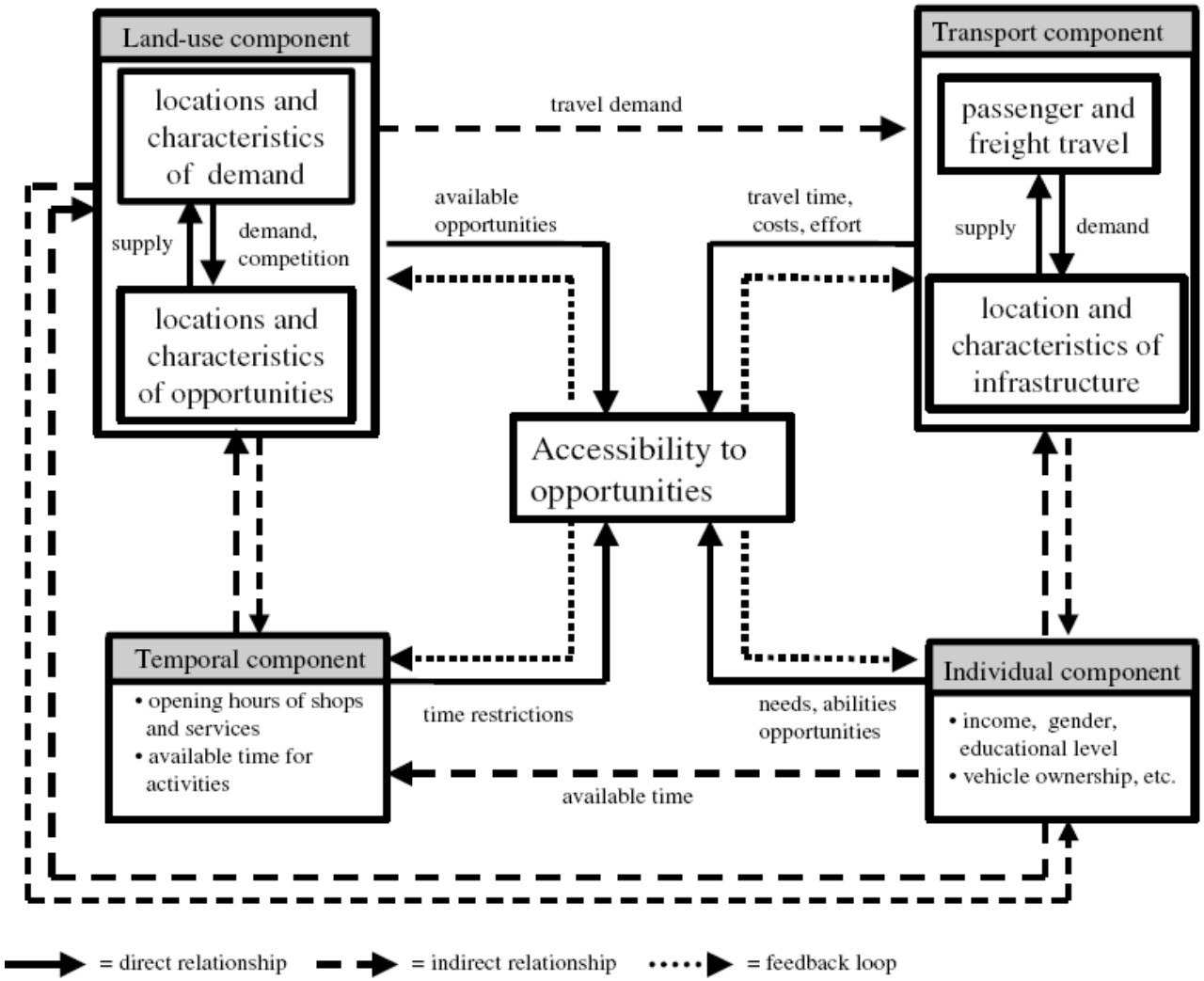
- **Level of Service**
  - Average speed
  - Traffic intensity
- Vehicle-km travelled
- the current goal of a transport engineer is:
  - to find the capacity that is needed to allow more vehicles driving faster
- building new roads or enhance the existing ones is an automatic self-prophecy
- This can reduce other forms of accessibility, by constraining pedestrian travel and stimulating more dispersed, automobile-oriented development patterns

Level of Service	Flow Conditions	Operating Speed (mph)	Technical Descriptions
A		70	Highest quality of service. Traffic flows freely with little or no restrictions on speed or maneuverability. **No delays**
B		70	Traffic is stable and flows freely. The ability to maneuver in traffic is only slightly restricted. **No delays**
C		67	Few restrictions on speed. Freedom to maneuver is restricted. Drivers must be more careful making lane changes. **Minimal delays**
D		62	Speeds decline slightly and density increases. Freedom to maneuver is noticeably limited. **Minimal delays**
E		53	Vehicles are closely spaced, with little room to maneuver. Driver comfort is poor. **Significant delays**
F		<53	Very congested traffic with traffic jams, especially in areas where vehicles have to merge. **Considerable delays**

Accessibility indicators

- HCM LoS is related to traffic
- We need a LoS related to land-use/transport and social system as a whole
- Current measures of accessibility include
  - an **impedance** factor, reflecting the time or cost of reaching a destination,
  - an **attractiveness** factor, reflecting the qualities of the potential destinations
- They should better include the number of choices in both destinations and modes and the social group involved
  - low incomes, without a car, disabled, children, young, older, migrants, minorities

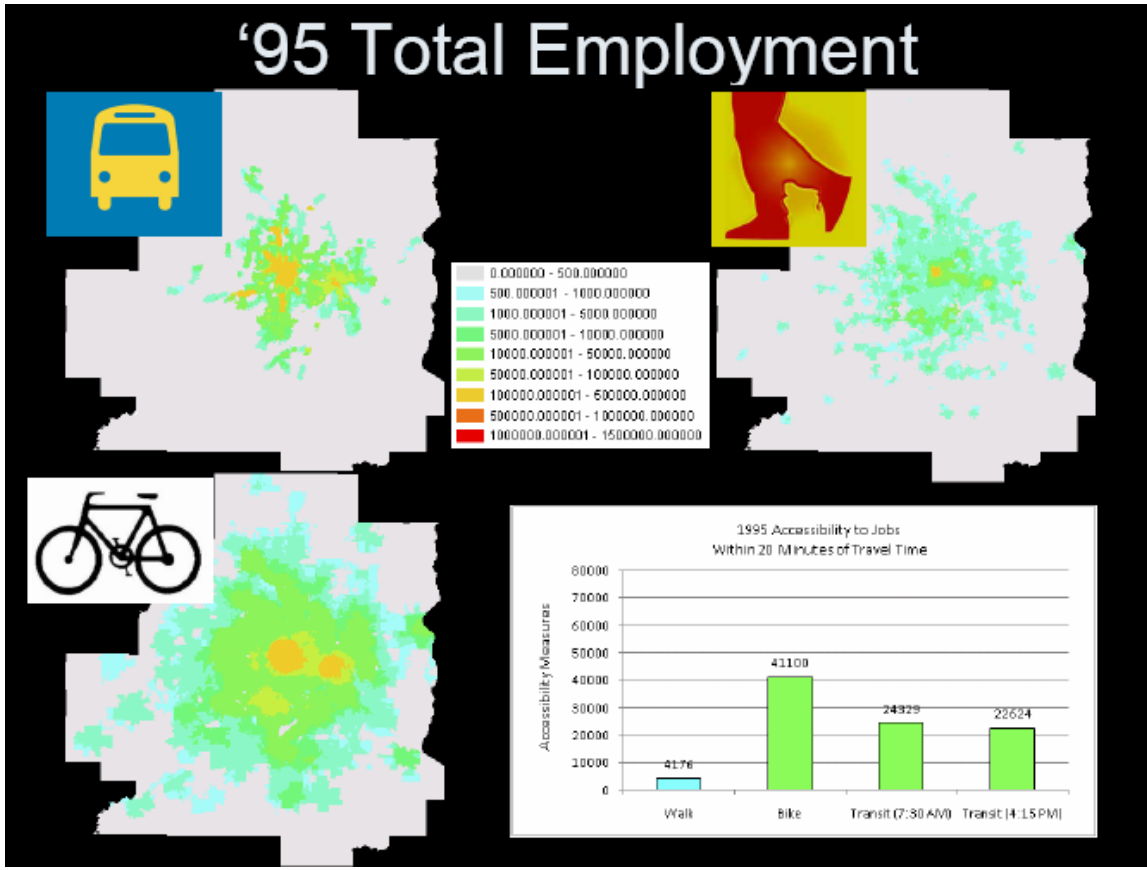
Accessibility indicators



Geurs K. T., van Wee B. (2004), Accessibility evaluation of land-use and transport strategies: review and research directions. Journal of Transport Geography, 12 127–140

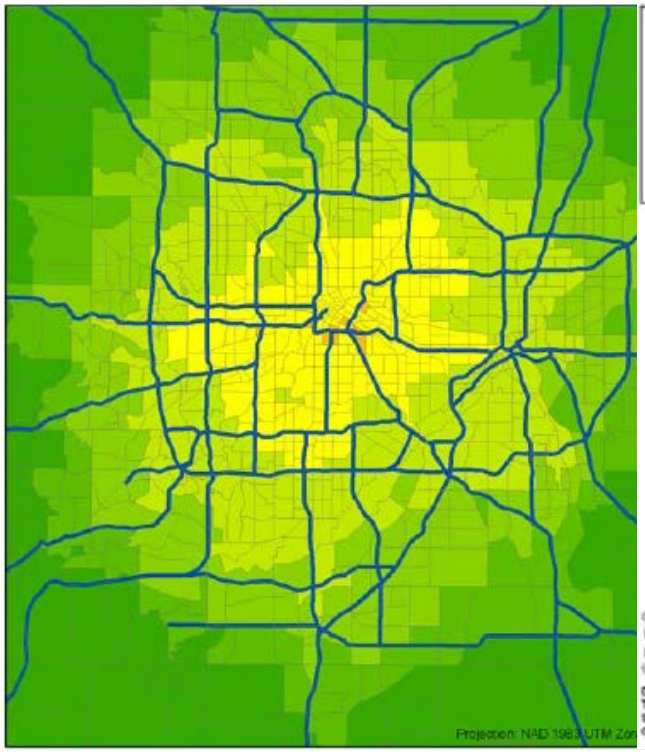
Accessibility maps

- The Access to Destinations study (El-Geneidy and Levinson 2006) evaluates accessibility including
  - Detailed land use activities at destination
  - Accessibility measures by mode of transport
  - Accessibility measures by group of users

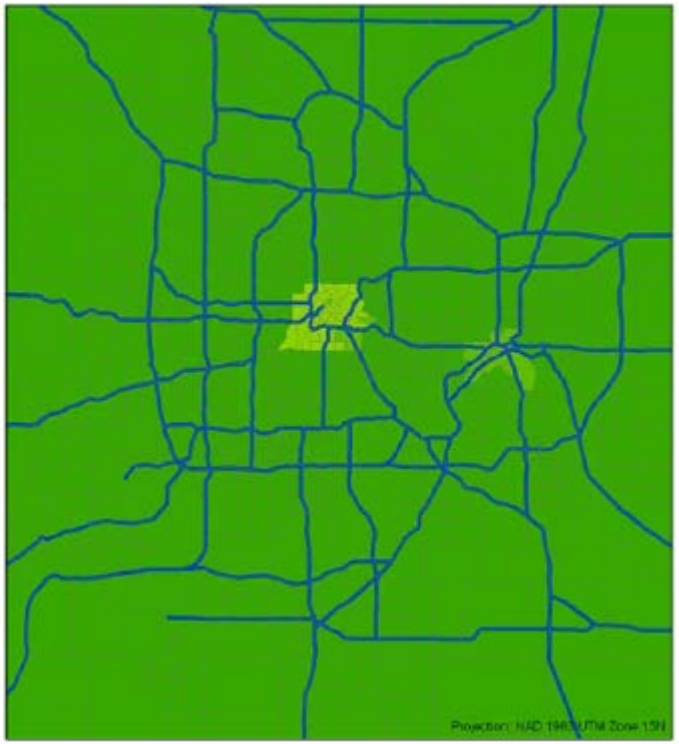


http://www.cts.umn.edu/access-study/

an example: Twin Cities region (Minnesota)



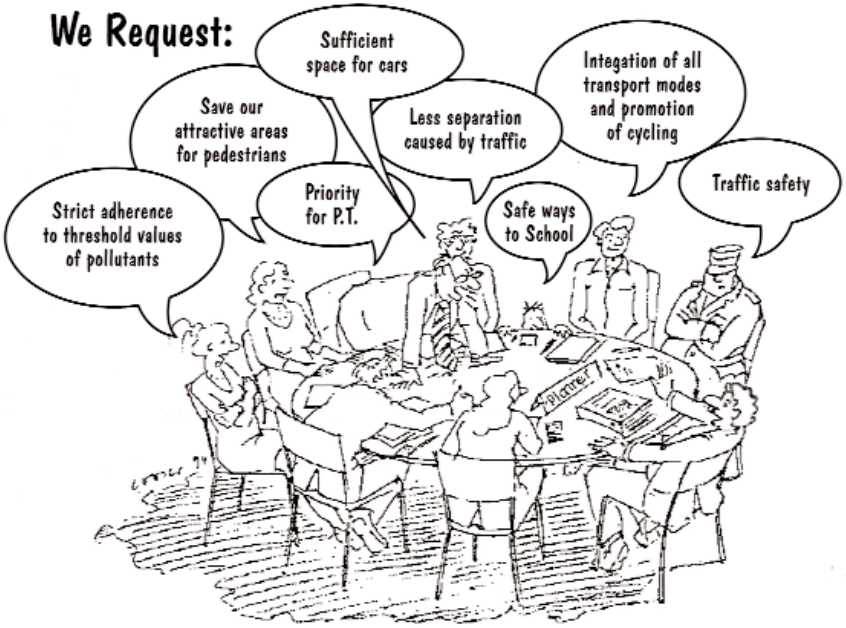
Number of jobs within 15 minutes of travel time in the year 2000 (Auto)



Number of jobs within 15 minutes of travel time in the year 2000 (Transit)

Planning for Accessibility

- We believe that **Shifting from Mobility-Oriented to Accessibility-Based Transport Planning is the key towards Sustainable Transport Planning**
- Accessibility and social issues
  - Equity in access to opportunities (e.g., employment, services, shopping, education, health care, and amenities) contributes to meeting basic human needs and aspirations for a better life (Boschmann, 2008) and reduce social exclusion
- Accessibility and economic issues
  - Mix land use, compact and walkable cities reduce individual and collective costs of mobility and enhance the opportunities for economic and trade interactions both for employer and employees, retailers and consumers
- Accessibility and environmental issues
  - High density urban areas, close urban destinations, accessible to a wide range of low impact transport mode (walking, cycling, transit), reduce the environmental impacts



Community Involvement (Public Engagement)

Pianificare per la mobilità sostenibile

Community Involvement in planning for sustainable mobility

- È il processo teso a identificare e includere esigenze, preoccupazioni e valori dei soggetti interessati (stakeholder) nei processi decisionali di pianificazione
- È un atteggiamento alternativo alla più comune strategia
  - DAD (Decide-Announce-Defend)
  - e alla reazione NIMBY (Not In My BackYard)
  - o alla reazione BANANA (Build Absolutely Nothing Anywhere Near Anyone)

Community Involvement in planning for sustainable mobility

I 5 livelli del Community Involvement

- Identificazione stakeholder
- Ascoltare
- Informare
- Consultare
- Partecipare

Community Involvement in planning for sustainable mobility

- Gli stakeholders possono essere una persona, un'organizzazione o un gruppo di persone che detiene un "titolo" per entrare in relazione con chi ha la responsabilità del Piano
- Un soggetto le cui opinioni o decisioni, i cui atteggiamenti o comportamenti, possono oggettivamente favorire od ostacolare il raggiungimento di uno specifico obiettivo del Piano. Possono essere considerati stakeholders:
  - rappresentanze di istituzioni pubbliche;
  - gruppi organizzati: sindacati, associazioni di categoria, partiti e movimenti politici, mass media, associazioni culturali, ambientali, di consumatori, sociali, gruppi sportivi o ricreativi, ecc.
  - gruppi non organizzati: cittadini e collettività (l'insieme dei cittadini componenti la comunità locale).
- Nel rapporto con gli stakeholders è necessario riuscire a sviluppare una visione comune e comuni intenti. Per fare questo bisogna: garantire trasparenza nel processo di pianificazione; stimolare il dibattito; mettere bene in chiaro i problemi e le opportunità che si riscontrano nella realizzazione di un piano di mobilità sostenibile.
- Vedi procedure di Agenda 21

Community Involvement in planning for sustainable mobility

Istitutions/Autorithies	Social parties and enterprise	Transport operators	Local communities
European Union	National and local enterprise associations	Transport companies	Environmental associations
National government	National and local trade union	Consultants	Transport users associations
Ministry of Transport	National and local craft union	Transport company associations	Media (TV, newspapers, etc.)
Other Ministeries	Building firm and production enterprise of vehicles and technologies		Local interest groups (eg. borough associations)
Parliament and parliament commissions	Retailers associations		Citizens
Regional government	National and local builders associations		Visitators
Regional transport authority regionale			
Regional council and council commissions			
Local authorities (Province and Municipality)			
Local transport authority			
Town council and council commissions			
Other bodies and local transport agencies			
Political parties and single members			
Project staff			

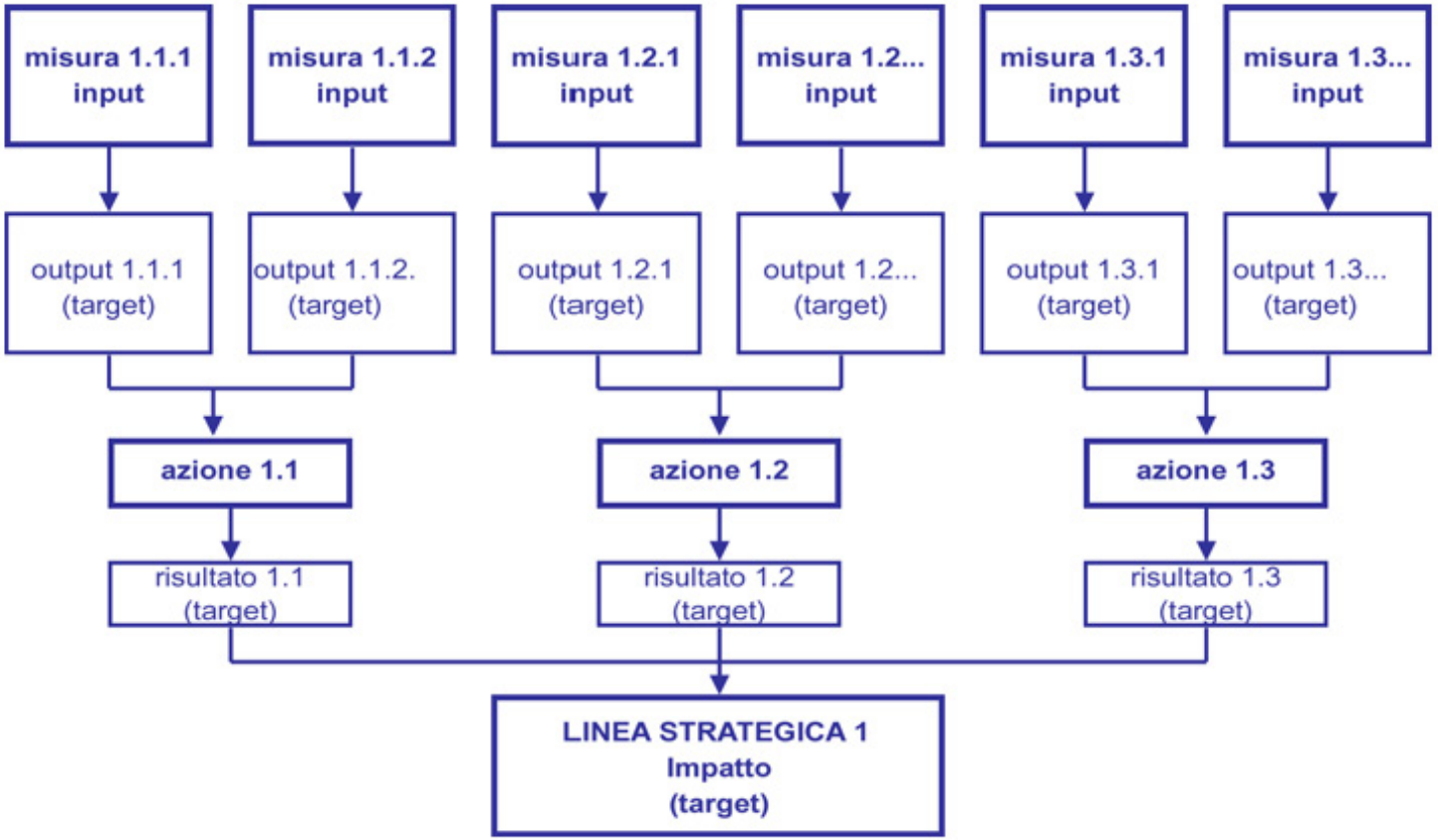
Metodi di monitoraggio e valutazione del piano di MS

Indicatori di monitoraggio e valutazione

Selection of SM indicators

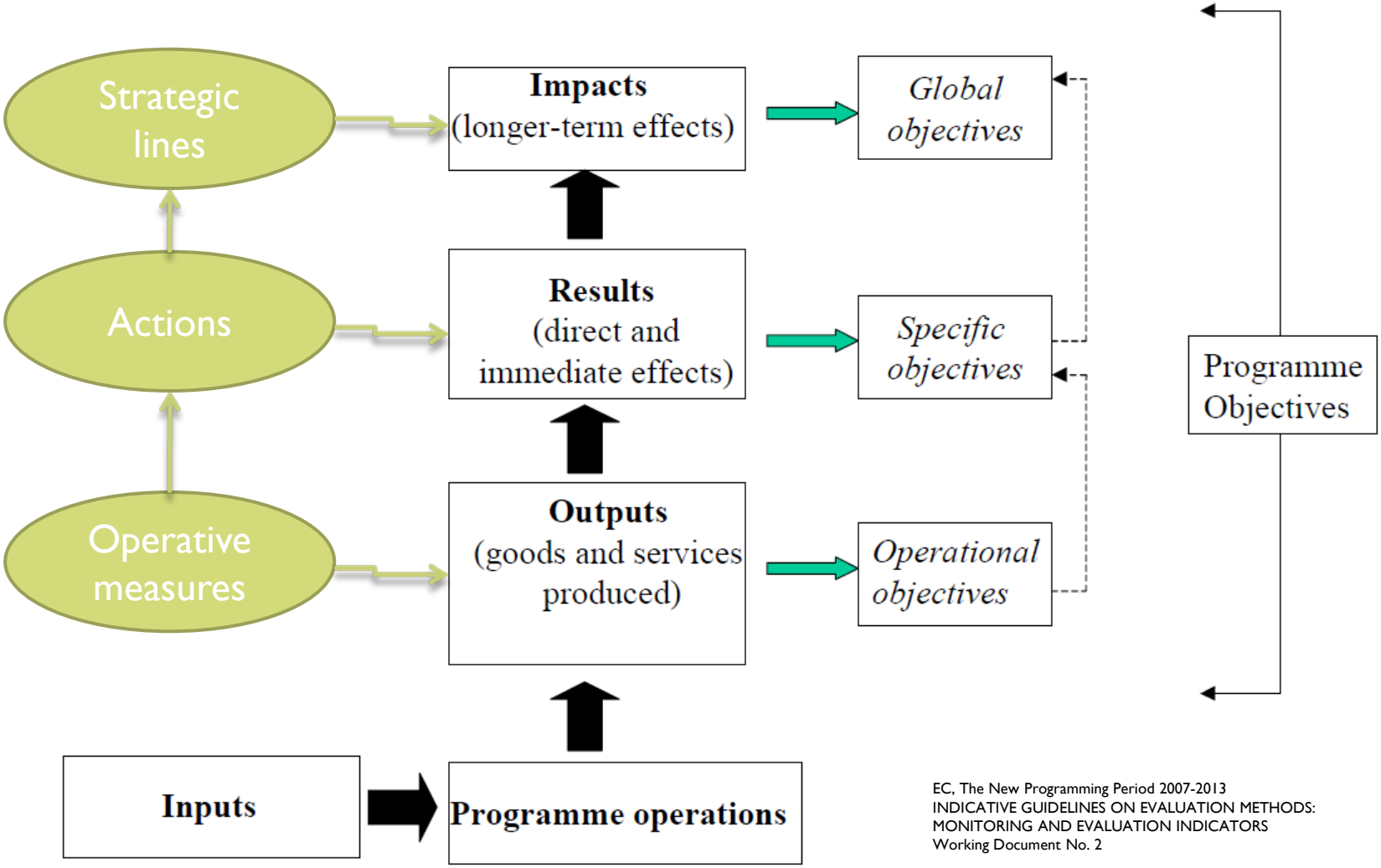
- Literature on SM indicators
  - DISTILLATE project (http://www.distillate.ac.uk/)
  - SUMMA (www.summa-eu.org)
  - CE , 2005. Manual on SEA of transport infrastructure palns.
  - DETR, 2000. Guidance on the Methodology for Multi-Modal Studies
  - ISFORT, 2005. Studio sugli indicatori di valutazione delle politiche per la mobilità urbana sostenibile
  - OCS, 2010. Il Piano Urbano di mobilità sostenibile
  - CE, 2005. Manual on strategic environmental assessment of transport infrastructure plans
  - UK DETR, 2000. NATA: New Approach to Appraisal - Guidance on the Methodology for Multi-Modal Studies

Framework IORI – tree structure of measures, actions, strategic lines



Carlo Socco, Il Piano urbano di mobilità sostenibile, OCS, 2009

Framework IORI – matching indicators and objectives



EC, The New Programming Period 2007-2013
INDICATIVE GUIDELINES ON EVALUATION METHODS:
MONITORING AND EVALUATION INDICATORS
Working Document No. 2

Framework IORI – definitions

Input

- previsione del flusso delle risorse che saranno effettivamente disponibili e verranno impiegate per attuare le misure del piano, cioè i mezzi finanziari, umani, materiali, organizzativi e regolamentari;

Output

- prodotti che ciascuna misura si propone di realizzare, per cui l'indicatore di output serve per verificare il grado di realizzazione del piano;

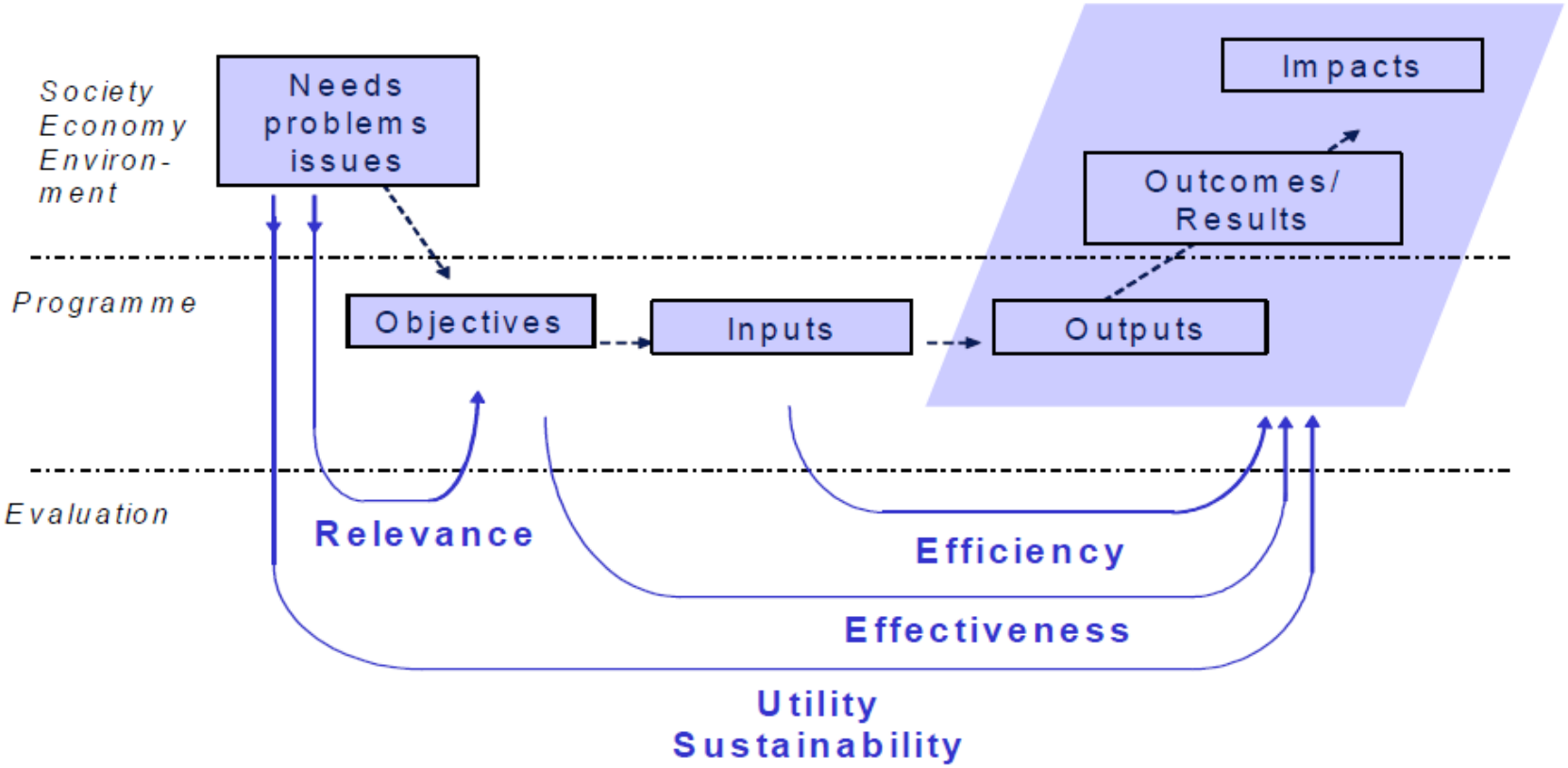
Result

- vantaggi immediati per i diretti beneficiari, dove un vantaggio è immediato se si verifica nel periodo di attuazione del piano o del programma medesimi

Impact:

- conseguenze di medio/lungo periodo che riguardano sia i diretti beneficiari, sia le persone o le organizzazioni che non sono diretti beneficiari, con particolare riferimento agli obiettivi di sostenibilità ambientale, sociale ed economica

Framework IORI – efficiency, effectiveness, sustainbaility



EC, The New Programming Period 2007-2013
INDICATIVE GUIDELINES ON EVALUATION METHODS:
MONITORING AND EVALUATION INDICATORS
Working Document No. 2

OCS
(IL PIANO URBANO DI MOBILITA' SOSTENIBILE, 2010)

TIPO DI SOSTENIBILITÀ	INDICATORI DI IMPATTO
a. **Sostenibilità economica.** *"Per un nelle cit*	i.a.1. Costo esterno marginale da congestione della mo-
b. **Sostenil** *"Per un accessil*	
c. **Sostenib** *"Per una* *"Per un sicuro"*	

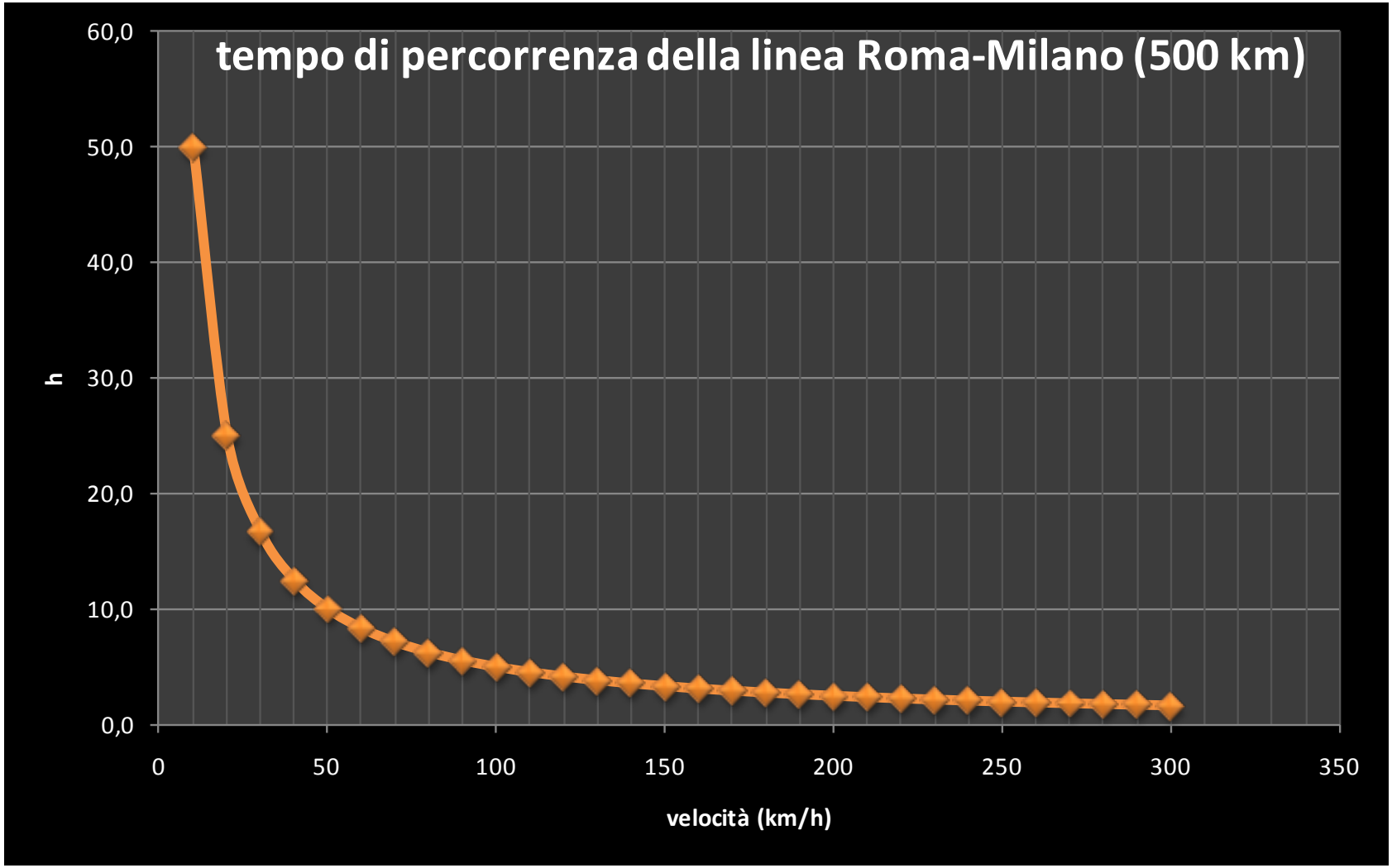
TIPO DI AZIONE	INDICATORE DI RISULTATO
a. Azioni mirate alla sostenibilità economica	
a.1. Miglioramento dell'infrastruttura stradale L'azione d sostenibile strozzatur senza di l segmenti traffico fis atteso è d il traffico.	r.a.1. Tempo complessivo di attesa in corrispondenza
a.2. Mig L'azione c nella rete rendere pi	
a.3. Po Laddove una riduzi vo. L'inter *push and* quello priv	
a.4. Ric L'azione c urbana. Es fico privat	

AZIONE	MISURA OPERATIVA	INDICATORE DI OUTPUT
a.1. Miglioramento dell'infrastruttura stradale	a.1.1. Eliminazione dei "colli di bottiglia" alle intersezioni	Numero interventi per tipo ed entità
	a.1.2. Realizzazione di nuovi assi viari per fluidificare il traffico	Km di strada per categoria
a.2. Miglioramento della gestione del traffico	a.2.1. Sviluppo dei Sistemi di Trasporto Intelligenti STI) per la regolazione del traffico	Numero di interventi per tipo ed entità
	a.2.2. Razionalizzazione della logistica urbana	Numero di interventi per tipo ed entità
	a.2.3. Adozione di modalità di utilizzo flessibile e differenziato dell'infrastruttura	Numero di interventi per tipo ed entità
a.3. Potenziamento del trasporto pubblico	a.3.1. Potenziamento dell'infrastruttura del trasporto pubblico (ferrovia metropolitana, metro, tram, corsie riservate, ecc.)	Km per tipo di infrastruttura
	a.3.2. Rafforzamento dell'interscambio modale delle ferrovie e del metro	Numero di interventi per tipo ed entità
	a.3.3. Sviluppo dell'uso di STI per l'assistenza e il controllo dinamico del trasporto pubblico	Numero di interventi per tipo ed entità
	a.3.4. Adozione di soluzioni più flessibili per il trasporto passeggeri	Numero di interventi per tipo ed entità
	a.3.5. Sviluppo della tariffazione intelligente (smart cards interoperabili, ecc.)	Numero di interventi per tipo ed entità

Alcuni miti da sfatare

Il dogma della velocità

Caso extra-urbano



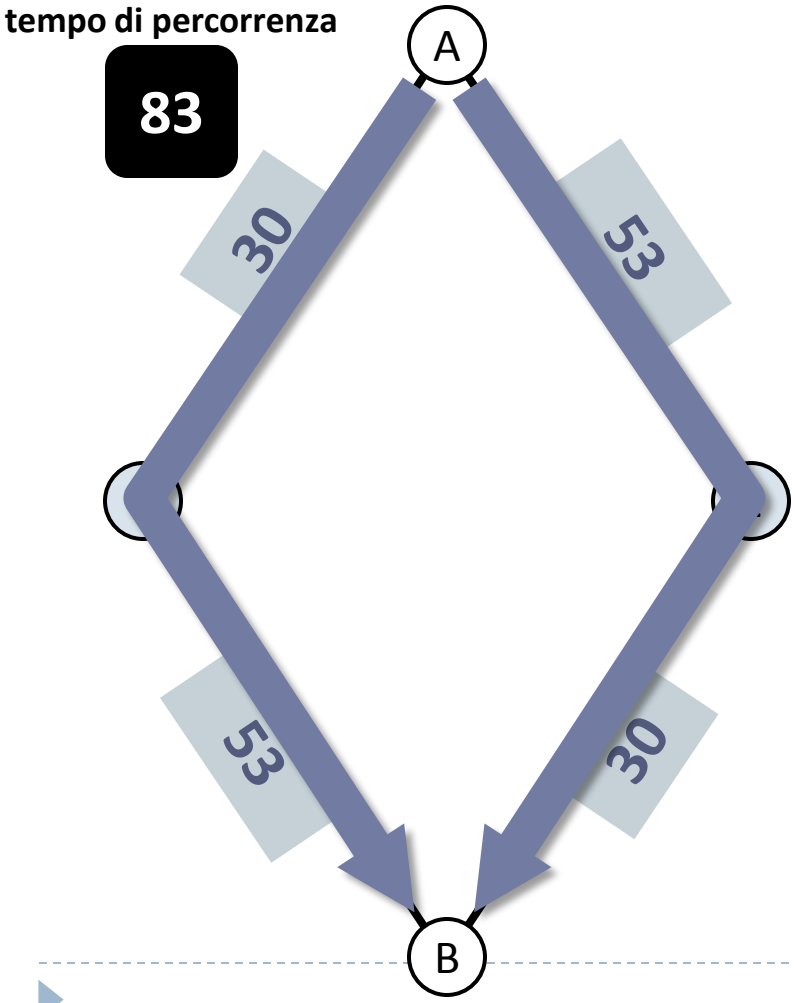
Caso urbano

caso urbano					tempo di viaggio totale (min)
distanza	km	1	7	1	9
modo		bus	metro	bus	
velocità	km/h	10	42	10	
tempo	min	6	10	6	22
raddoppio velocità metro					
velocità	km/h	10	84	10	
tempo	min	6	5	6	17
raddoppio velocità bus					
velocità	km/h	20	42	20	
tempo	min	3	10	3	16

Il dogma dell'aumento della capacità stradale 1

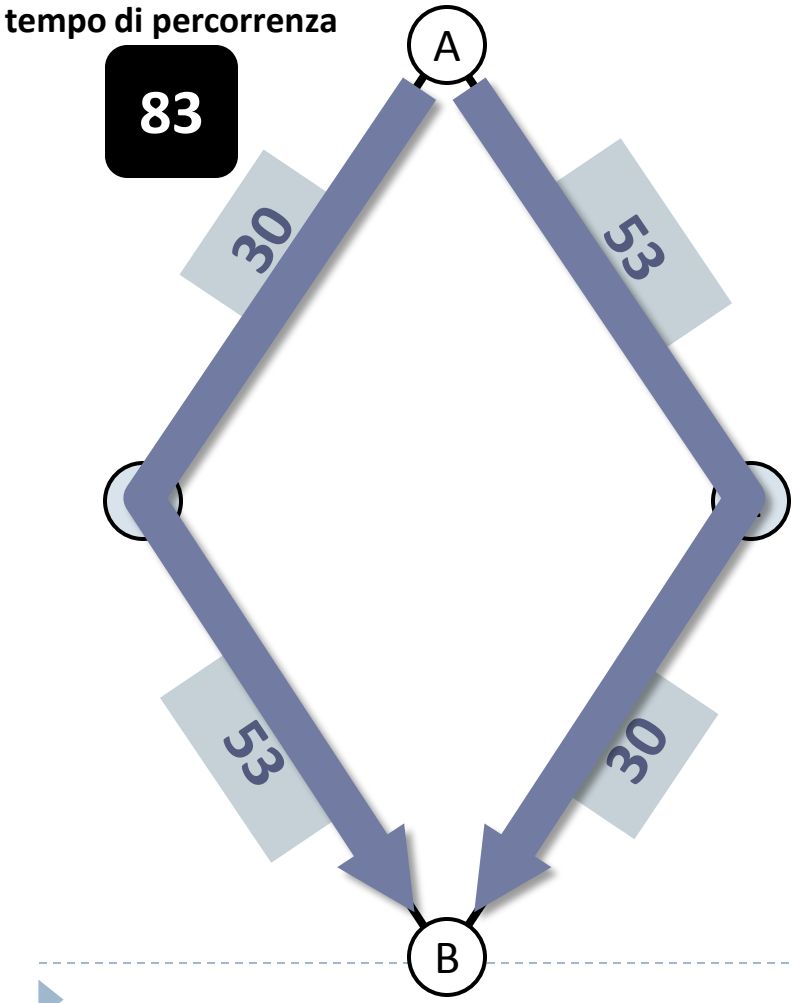
Paradosso di Braess

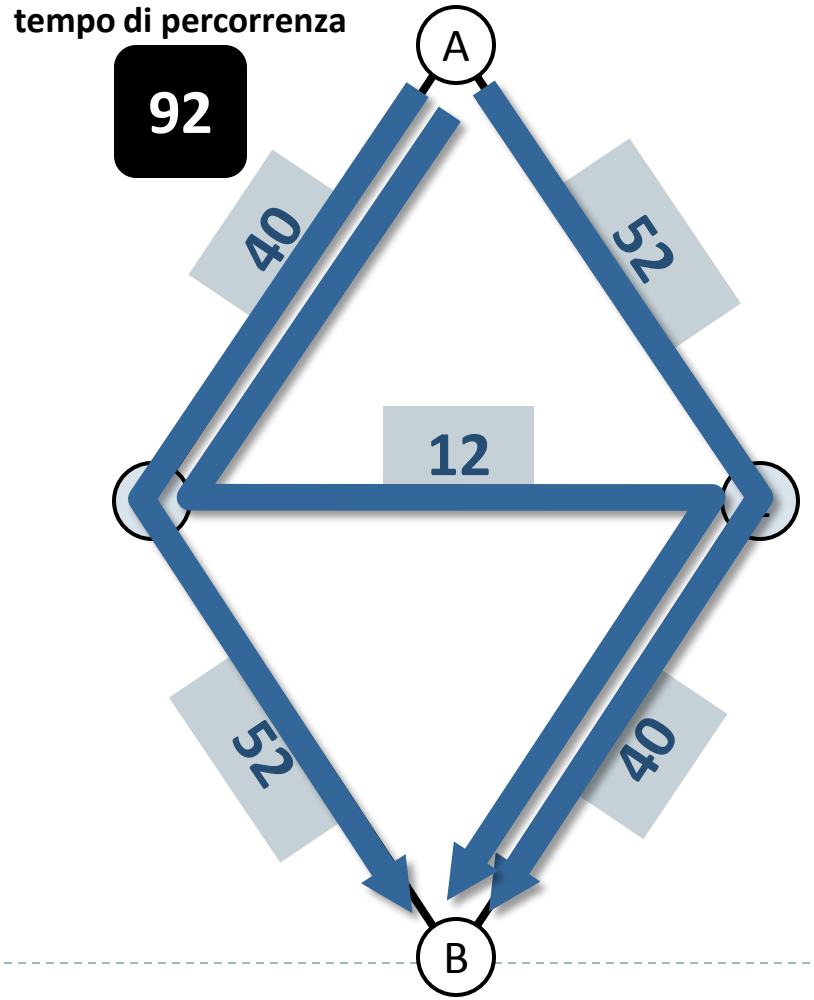
Paradosso di Braess



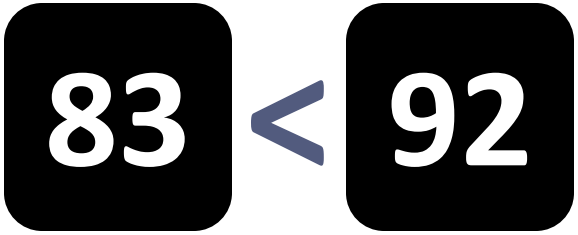
- **6 utenti** della rete che viaggiano da A a B
- tempi di percorrenza degli archi che dipendono dal traffico
- equilibrio dei tempi dei percorsi

Paradosso di Braess





Paradosso di Braess

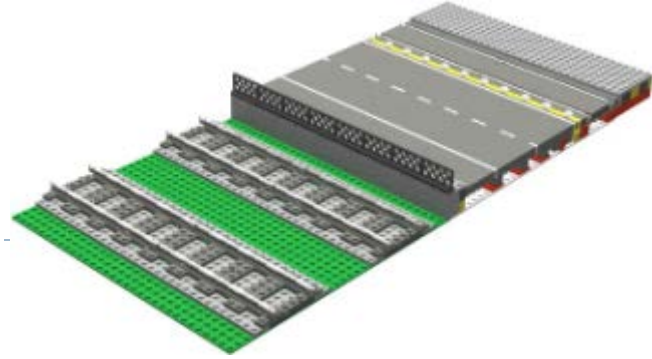


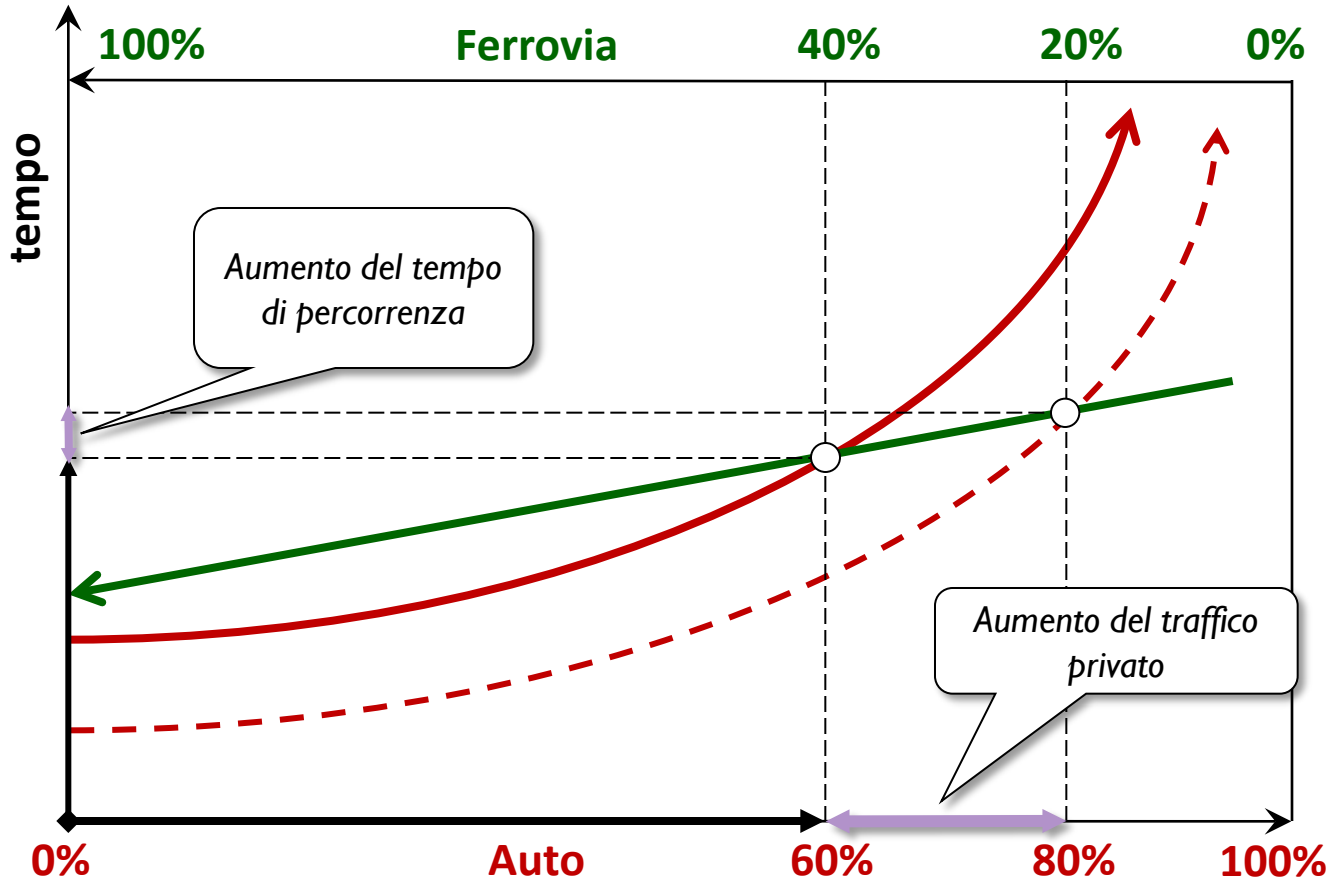
- Potenziando la rete di trasporto, e **in assenza di un comportamento collaborativo** degli utenti, può verificarsi un peggioramento delle prestazioni complessive del sistema.

Il dogma dell'aumento della capacità stradale 2

Paradosso di Downs-Thomson

Paradosso di Downs-Thomson





Paradosso di Downs-Thomson

- In presenza di un sistema di trasporto pubblico e di un sistema di trasporto privato, il potenziamento di quest'ultimo produce un **peggioramento delle prestazioni del sistema complessivo** dei trasporti

References (books and articles)

- An Introduction to Sustainable Transportation. Policy, Planning and Implementation. By Preston L. Schiller, Eric C. Bruun and Jeffrey R. Kenworthy. Earthscan
- David Banister. The sustainable mobility paradigm. Transport Policy 15 (2008).
- David Banister. Unsustainable Transport. City Transport in the new century. Routeledge.
- Georgina Santos et al. Externalities and economic policies in road transport. Research in Transportation Economics 28 (2010)
- Georgina Santos et al. Policy instruments for sustainable road transport. Research in Transportation Economics 28 (2010)
- Commission of the European Communities, 2006. Keeping Europe moving: sustainable mobility for our continent. Midterm Review of the European Commission's 2001 Transport White Paper, COM(2006) 314 Final, 22 June 2006, Brussels.
- Online TDM Encyclopedia. http://www.vtpi.org/tdm/index.php

References (european projects)

- ADONIS. (1999). Best practice to promote cycling and walking and how to substitute short car trips by cycling and walking. ADONISTransportprogram.European Union. http://cordis.europa.eu/transport/src/adonisrep.htm
- ASTUTE (2008). Adavancing Sustainable Transport in Urban areas To promote Energy efficiency. http://www.astute-eu.org/
- GRaBS (2011). Green and Blue Space Adaptation for Urban Areas and Eco Towns. http://www.grabs-eu.org/
- EU Land Use and Transportation Research: http://www.lutr.net/
- SPICYCLES (Promoting Cycling by implementing Bike Sharing, Awareness Raising, Cycling Planning, Local partnerships)
- WALCYNG: http://www.cordis.lu/transport/src/walcyngrep.htm#results
- CIVITAS initiative: http://www.civitas-initiative.org/

References

- Banister and Button (eds, 1993), Transport, the Environment and Sustainable Development, (London: E & FN Spon).
- Banister D., (2005). Unsustainable Transport. (London: Routledge).
- Banister D., (2008). The sustainable mobility paradigm. Transport Policy (15).
- Boschmann EE, and Kwan M.P, 2008. Toward Socially Sustainable Urban Transportation: Progress and Potentials . International Journal of Sustainable Transportation, 2:138–157, 2008
- Brundtlnad, H. 1987. Our common future, the final report of the UN Commission on Environment and Development.
- Calthorpe, Peter. 1993. The Next American Metropolis: Ecology, Community and the American Dream. New York: Princeton Architectural Press
- CEC (1992), Green Paper on the Impact of Transport on the Environment. A Community strategy for 'sustainable mobility', COM (92) 46 Final
- CEC (1993), The Future Development of the Common Transport Policy – A global approach to the construction of a community framework for sustainable mobility, Bulletin of the European Communities, Supplement 3/93
- CEC (1998), The Common Transport Policy – Sustainable Mobility: Perspectives for the Future. COM (98) 716 Final
- CEC (2001), White paper. European transport policy for 2010: Time to decide, COM (2001) 370 Final
- Cervero, Robert and Kara Kockelman. 1997. Travel Demand and the 3Ds: Density, Diversity, and Design. Transportation Research Record D: Transport and the Environment, Vol. 3, pp. 199-219
- Chapman S., Weir D., 2008. Accessibility planning methods. NZ Transport Agency Research Report 363.
- Congress for the New Urbanism (CNU). 2002a. CNU Charter. Available: http://www.cnu.org/aboutcnu/index.cfm.
- El-Geneidy A, and Levinson D., (2006), Access to Destinations: Development of Accessibility Measures, Center for Transportation Studies, University of Minnesota (www.cts.umn.edu); at www.cts.umn.edu/access-study/publications

References

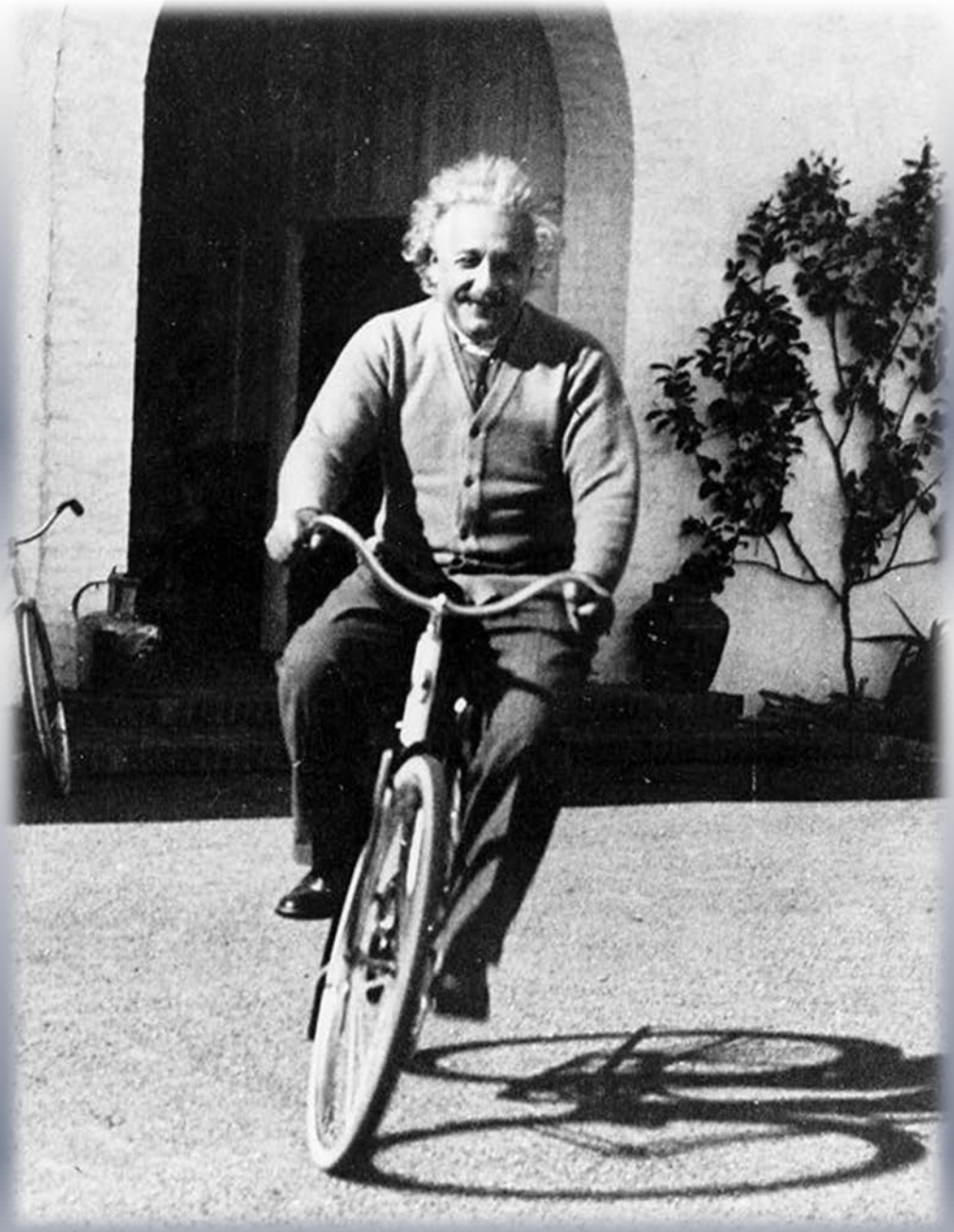
- Feitelson, E. (2002), 'Introducing Environmental Equity Concerns into the Discourse on Sustainable Transport: A Research Agenda', in Black and Nijkamp (eds),
- Gatersleben, B. and Uzzell, D. (2002). Sustainable transport and quality of life. In Black and Nijkamp (2002). Social Change and Sustainable Transport. Indiana University Press
- El-Geneidy A, and Levinson D., (2006), Access to Destinations: Development of Accessibility Measures, Center for Transportation Studies, University of Minnesota (www.cts.umn.edu); at www.cts.umn.edu/access-study/publications
- Gorham, R. (2002), 'Car Dependence as a Social Problem: A Critical Essay on the Existing Literature and Future Needs', in Black and Nijkamp (eds),
- Hallegatte S, 2009. Strategies to adapt to an uncertain climate change. Global Environmental Change 19
- Handy, S. and D. Niemeier. 1997. Measuring Accessibility: An Exploration of Issues and Alternatives. Environment and Planning A, Vol. 29, pp. 1175-1194.
- Handy S., 2002. Accessibility- vs. mobility-enhancing strategies for addressing automobile dependence in the U.S. . European Conference of Ministers of Transport.
- Høyer K.G. (2000), Sustainable Mobility – the Concept and its Implications, PhD Thesis
- Katz, Peter. 1994. The New Urbanism: Toward an Architecture of Community. New York: McGraw-Hill.
- Litman T., 2011. Evaluating Accessibility for Transportation Planning Measuring People's Ability To Reach Desired Goods and Activities. Victoria Transport Policy Institute
- Lewis S.L., 1998. Land use and transportation: Envisioning regional sustainability. Transport Policy (5).
- Newman, P.W.G. and Kenworthy, J.R. (1999), Sustainability and Cities. Overcoming Automobile Dependence (Washington DC: Island Press).

Materiale didattico

- Appunti delle lezioni
- Approfondimenti
  - David Banister. The sustainable mobility paradigm. Transport Policy 15 (2008).
  - GUIDELINES - Developing and Implementing a Sustainable Urban Mobility Plan. www.mobilityplans.eu
  - EC, Sustainable Urban Transport Planning. SUTP Manual • Guidance for stakeholdershttp://www.pilot-transport.org/fileadmin/WP2/Pilot_EN_WEB.pdf
  - Carlo Socco, 2010. Il piano urbano di mobilità sostenibile. http://www.ocs.polito.it/casi/pums.htm
  - An Introduction to Sustainable Transportation. Policy, Planning and Implementation. By Preston L. Schiller, Eric C. Bruun and Jeffrey R. Kenworthy. Earthscan

Materiale didattico

- Inturri G., Ignaccolo M., 2011. Adapting Transport Systems to Climate Change, Grabs Report. DICA. UNICT.
- Inturri G., Ignaccolo M., (2011). Modelling the impact of alternative pricing policies on an urban multimodal traffic corridor. Transport Policy (18) pp 777–785. doi: 10.1016/j.tranpol.2011.04.002
- LA Greca P., Inturri G., Barbarossa L., Martinico F., Ignaccolo M. (2011). The density dilemma. A proposal for introducing Smart Growth principles in a sprawl settlement within Catania Metropolitan Area. Cities, Elsevier Special Issue on Low Carbon Cites, in press; doi: 10.1016/j.cities.2011.06.009
- Ignaccolo M., Inturri G., Capri' S., Giunta U. (2006). Discrete choice model for defining a parking-fee policy on island of Ortigia, Siracusa. Journal of Urban Planning and Development. vol. 132, No. 3, pp. 147-155 ISSN: 0733-9488. doi:10.1061/ (ASCE)0733-9488(2006)132:3(147).)
- Ignaccolo M., Caprì S., G. Inturri, (2008). Promuovere la mobilità non motorizzata in città: il progetto ASTUTE per l'isola di Ortigia, Siracusa, In: I trasporti nella città del XXI secolo. scenari per l'innovazione. Aracne Editrice. ISBN: 978-88-548-2168-2 p. 173-182
- Ignaccolo M., Inturri G., Caprì S., (2009). Un modello di rete a supporto della pianificazione della mobilità ciclistica. In "Interventi e metodologie di progetto per una mobilità sostenibile". Seminario scientifico 2008 a cura di Vittorio Astarita, Sergio d'Elia e Demetrio Carmine Festa. ISBN 978-88-568-1230-5 pp 371-384
- Inturri G., Ignaccolo M., 2011, The Role of Transport in Mitigation and Adaptation to Climate Change Impacts in Urban Areas. In K. Otto-Zimmermann (ed.), Resilient Cities Local Sustainability, 2011, Volume 1, Part 5, 465-478, DOI 10.1007/978-94-007-0785-6_46, © Springer Science+Business Media B.V. 2011, ISBN: 978-94-007-0784-9.



'La vita è come andare in bicicletta: se vuoi stare in equilibrio devi muoverti'
(Albert Einstein)