Econ 137
Urban Economics

Lecture Notes IV

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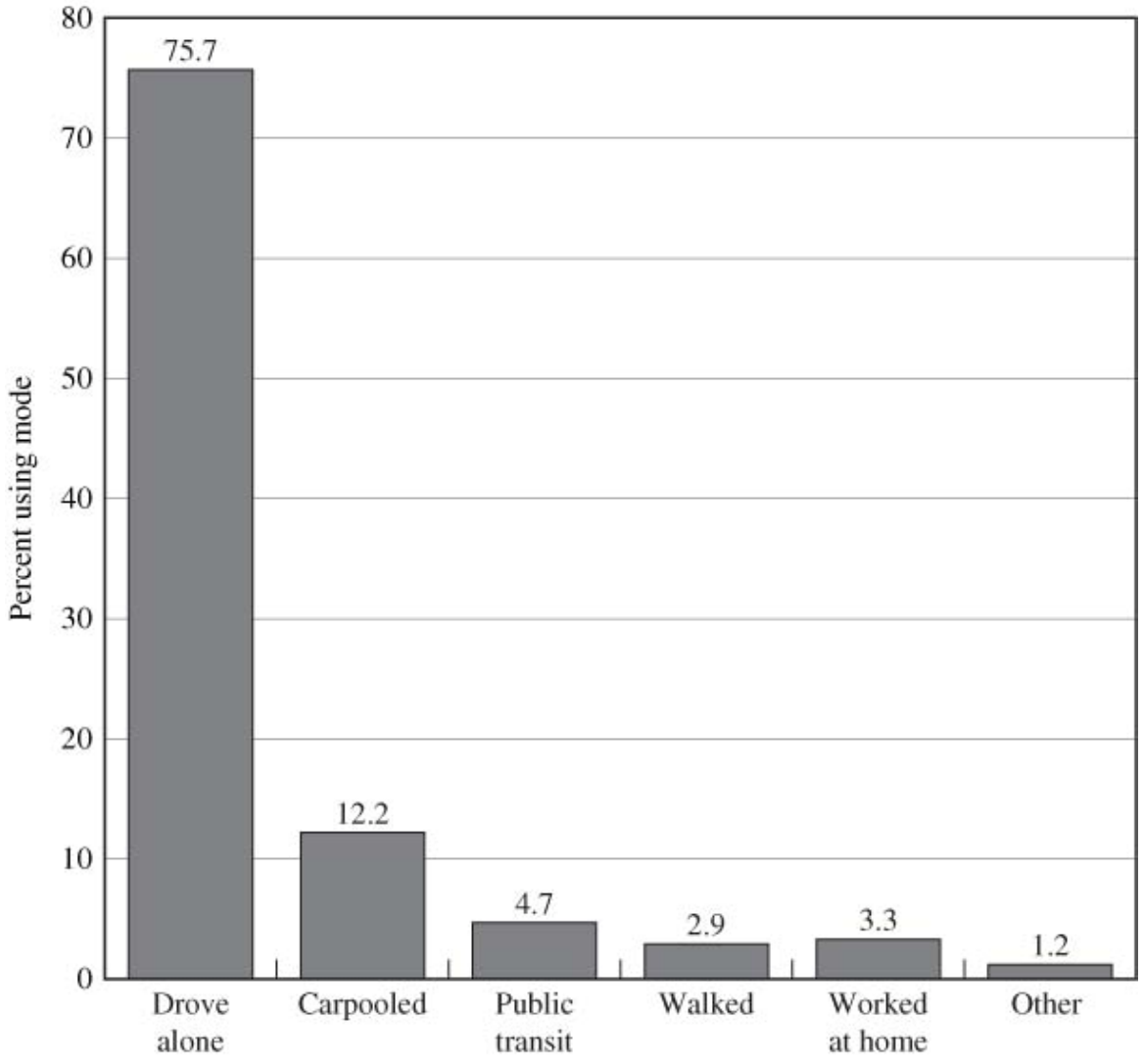
Questions for Lecture Notes IV

- How do governments deal with traffic problems such as Congestion, Pollution and Accidents?
- Why do so few commuters use mass transit?
- How do government policies affect mass transit?

Some facts about car use

FIGURE 10–1 Modal Choice for U.S. Commuters



Source: U.S. Census Bureau. *Journey to Work: 2000.* Washington DC: U.S. Census Bureau, 2004.

Externalities from autos

- There are big benefits from cars but also costs to society
- Negative externalities are the costs we impose to the rest of society from our actions, without paying for them.
- Externalities always lead to inefficiencies when considering the social optimum result.
- Negative externalities from the use of cars:
  - Congestion
  - Pollution
  - Accidents

Some facts about congestion

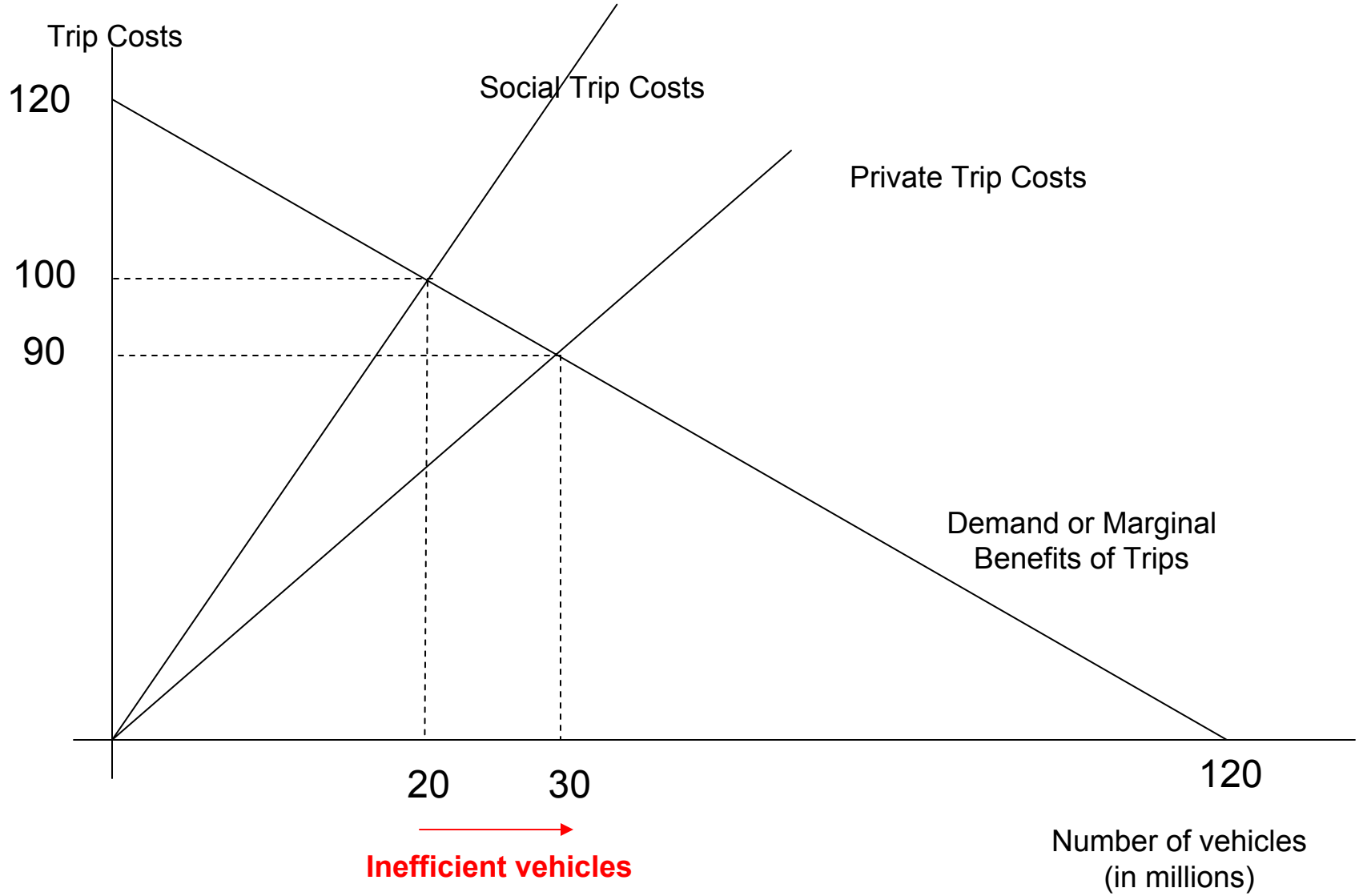
- In 2003 the typical commuter wasted 47 hours because of traffic congestion (93 in LA, 72 in San Francisco, 69 in DC)
- In 2003 waste of $5 billion worth of gasoline and diesel fuel because of delays and slow traffic.
- Adding these two costs, the annual cost of traffic in the US is around $63 billion per year.

Externalities from autos

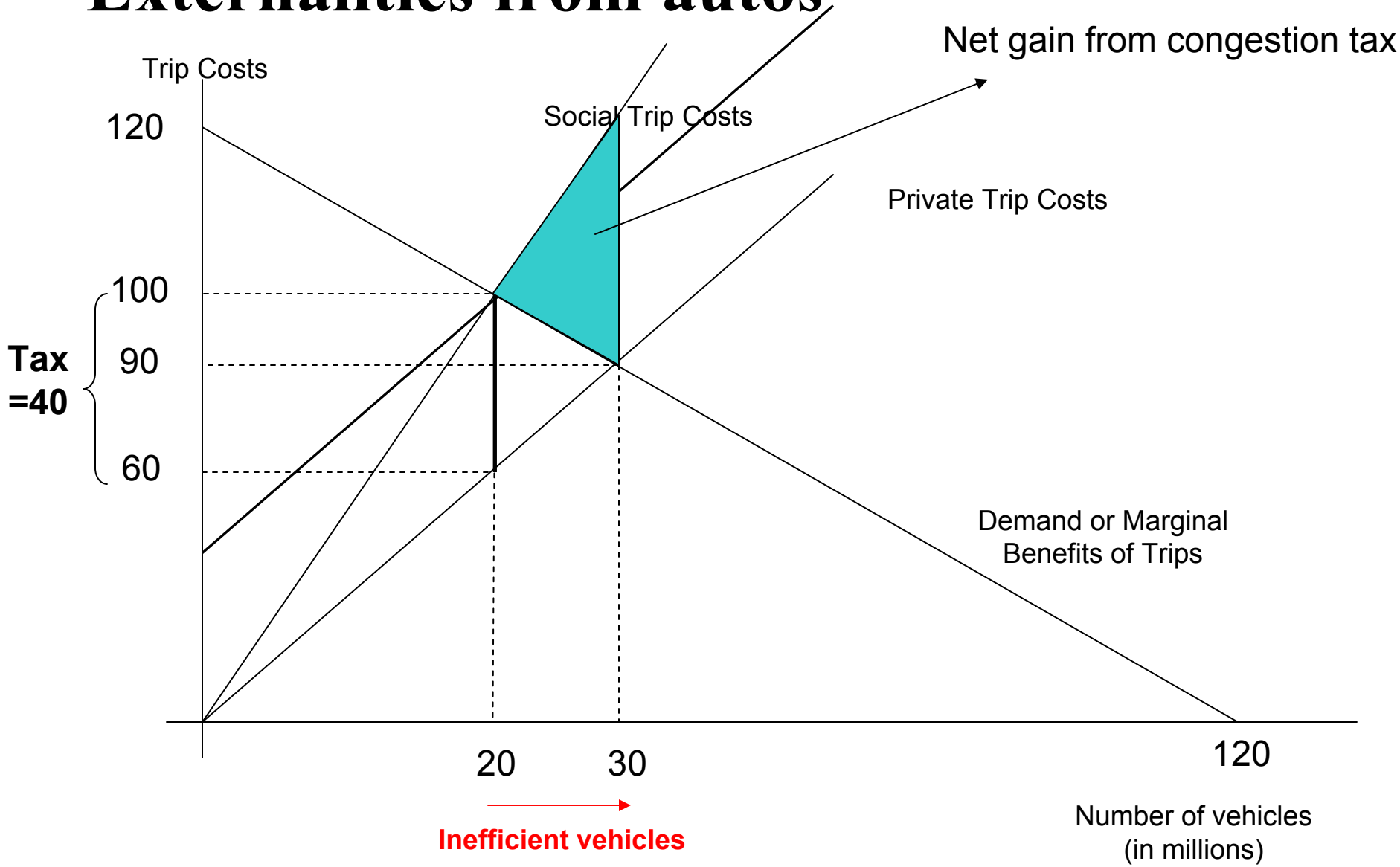
Consider T=Trip cost and V=Number of vehicles

- Demand of commuting trips $V = 120 - T$
- Private trip costs (time and car costs) as a function of the number of vehicles on road $T = 3V$
- Externalities (costs imposed to other cars by an additional vehicle) $E = 2V$
- SOCIAL COST $ST = T + E = 5V$

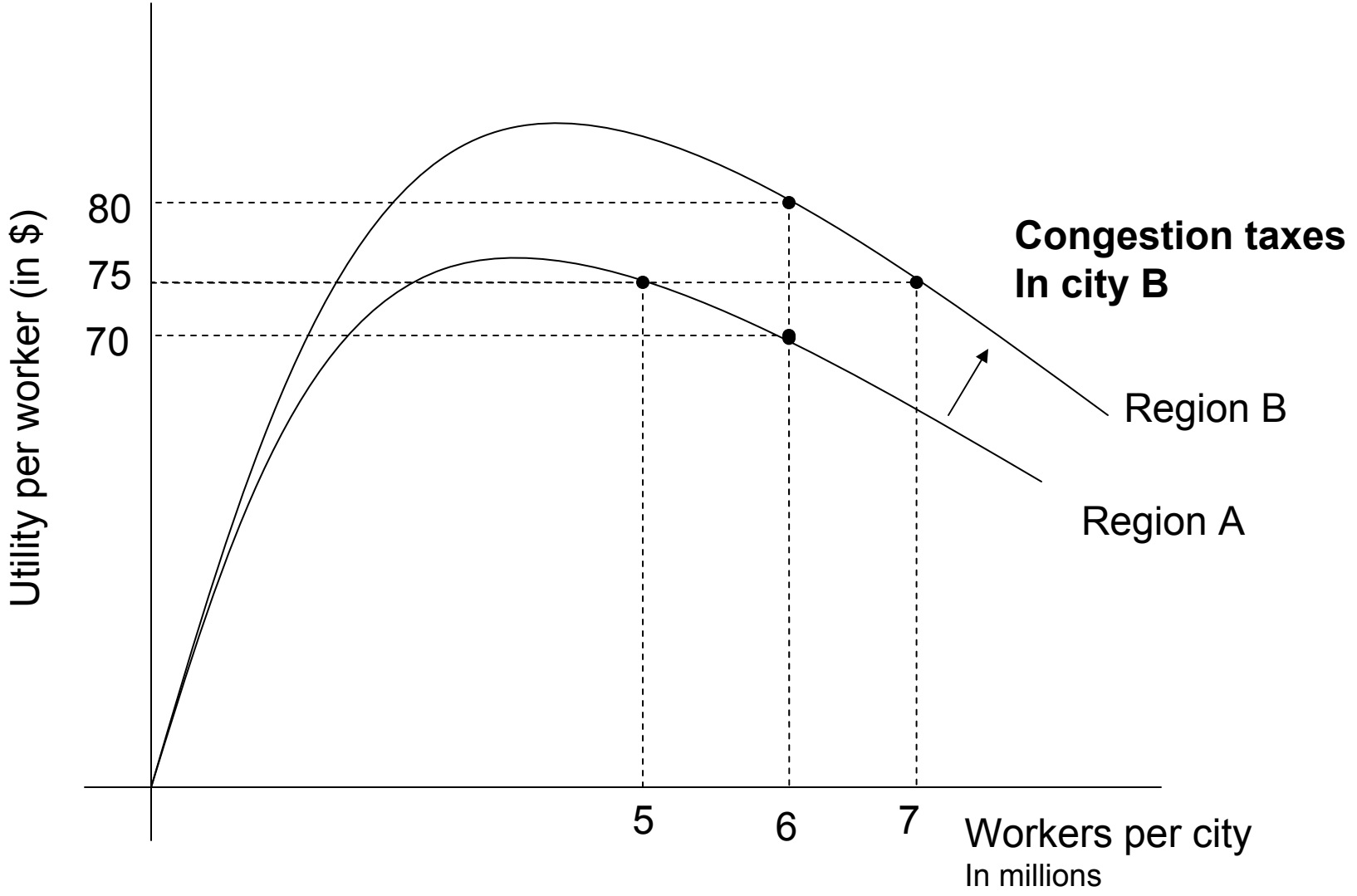
Externalities from autos



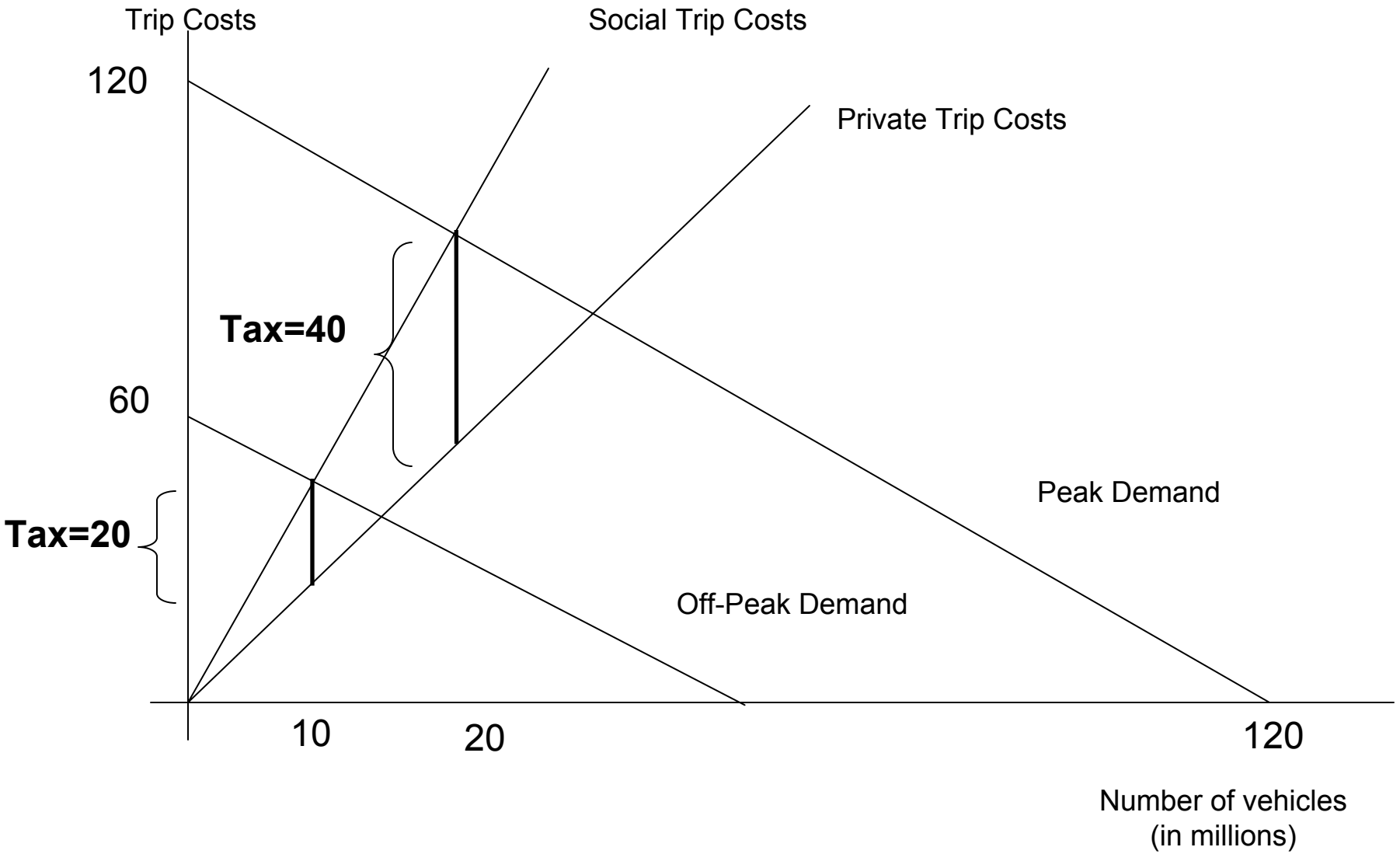
Externalities from autos



Congestion taxes and urban growth



Congestion taxes under “rush hours”



Some considerations on congestion taxes

- Estimations
  - San Francisco
    - Rush hour: Between $0.65 (per mile on central urban highways) and $0.17 (per mile on fringe highways).
    - Off-peak hours: Between $0.03 and $0.05
  - Los Angeles
    - Congestion exists around 28% of the time. Tax around $0.15/mile

- Implementation
  - VIS (Vehicle Identification System)
  - Prepaid System
  - Area Licensing System (Singapur)
  - Toll Roads
  - HOT (High Occupancy and Toll) lanes

Some considerations on congestion taxes

- Congestion pricing and taxes are a nice way to reduce traffic problems in cities.

- Prices is the best way to induce change in behavior:
  - **Modal substitution**: Forming carpools and switching to mass transit.
  - **Time of travel**: Switching to off-peak travel
  - **Travel route**: Picking alternative routes and combining two or more trips into a single one
  - **Location choices**: Decreasing commuting distances by moving closer to jobs

Some considerations on congestion taxes

- **Alternatives**
- Gasoline tax
  - Affect the cost of traveling in general. Helps in modal substitution and location choices but not in time or route of travel.
- Subsidies for mass transit
  - Only affects modal substitution. The volume of car transit is not very elastic with respect to the price of mass transit
- Elimination of parking subsidies
  - Estimations show these subsidies by employers increase the volume of traffic by 19% in LA. This alternative affect modal substitution. High elasticity with respect to the price of parking.

Road capacity decision

- Decision on road width. If the expected revenues from tax congestion coming from the road is greater than the construction cost, the road should be built.

Air pollution

- The idea is the same than congestion. Autos generate an externality which is not internalized by the person who makes the decision.
- An obvious solution is taxes:
  - Pollution tax (through a device to measure emissions)
  - One time pollution tax for new cars, charging the expected pollution in its “productive life”
  - Gasoline tax (incentives to use cars less but not to use cleaner cars)
  - Subsidize mass transit
- …and also **smog tests**.

Car accidents

- High costs to society
  - Property damages
  - Injuries (3.1 million per year in the US)
  - Deaths (40,000 per year in the US)
  - Costs are over $300 billion per year in the US (more than $1,000 per capita). Estimates from Miller, 1993.
  - More congestion after an accident ($5 billion per year)
  - External costs of young drivers is nearly 3 times as high as the external costs of middle-aged drivers.

- Why externalities? When a person collides, around 1/3 of the costs are borne by someone else.

Car accidents

- VMT (vehicle miles traveled) tax.
- Vehicle safety policies.
  - Mandated features in cars.
- Almost all countries require car occupants to wear seat belts.
  - Reduce death rates among car occupants
  - Increase the number of accidents
  - Increase the number of deaths among pedestrians and bicyclists
- This puzzle can be explained from the Theory of Risk Compensation (Peltzman, 1975). “Drivers in safer cars take more risk and endanger others”

Summary Ch. 10 O'Sullivan

- There are three types of negative externalities from the use of vehicles in cities. Congestion, pollution and accidents.
- Car drivers base their travel decisions on private costs, not on social costs. Hence the equilibrium traffic volume exceeds the socially efficient volume (typical result from negative externalities)
- Taxes may provide the internalization of externalities such that people optimally reduces the traffic and approaches to efficiency.

Mass Transit - Facts

TABLE 11–1 Means of Transportation to Work, 2000

Travel Mode	Number	Percent
Workers 16 years and over	128,279,228	100
Car, truck, or van	112,736,101	87.9
Drove alone	97,102,050	75.7
Carpooled	15,634,051	12.2
Public transportation	6,067,703	4.7
Bus or trolley bus	3,206,682	2.5
Streetcar or trolley car	72,713	0.1
Subway or elevated	1,885,961	1.5
Railroad	658,097	0.5
Ferryboat	44,106	
Taxicab	200,144	0.2
Motorcycle	142,424	0.1
Bicycle	488,497	0.4
Walked	3,758,982	2.9
Other means	901,298	0.7
Worked at home	4,184,223	3.3

Source: U.S. Bureau of the Census, *Journey to Work 2000*. Washington D.C.: U.S. Government Printing Office, 2004.

Mass Transit - Facts

- New York, Chicago, LA, DC, San Francisco, Boston Philadelphia and Seattle (in that order) are responsible for 80% of the transit passenger miles among 38 MAs with population of at least 1 million.
- Transit ridership higher among low income families
- Elasticities of demand for mass transit
  - -0.33 with respect to price
  - -0.39 with respect to travel time
  - -0.71 with respect to access time
  - Elasticities for non-commuting trips are higher.

Mass Transit – Modal choice

- Comparison factors among different transit possibilities.
  - **Collection time cost**: Time necessary to travel from home to the main travel vehicle.
  - **Line-haul time cost**: Time spent on the main travel vehicle.
  - **Distribution time cost**: Time necessary to travel from the main travel vehicle to the final destination.
- To improve the use of mass transit would be necessary to
  - Increase line-haul cost of cars (more taxes to gasoline)
  - Increase distribution time cost of cars (less parking subsidies).
  - Reduce line-haul cost of mass transit (less fares)
  - Reduce collection and distribution costs of mass transit (higher frequency of service)

Mass Transit – Density

TABLE 11–4 Minimum Densities to Support Mass Transit

	Built-up Density: People per Hectare	Residential Density: People per Hectare
One bus per hour	21	30
Two buses per hour	31	44
Light rail	37	53
Heavy rail	50	71

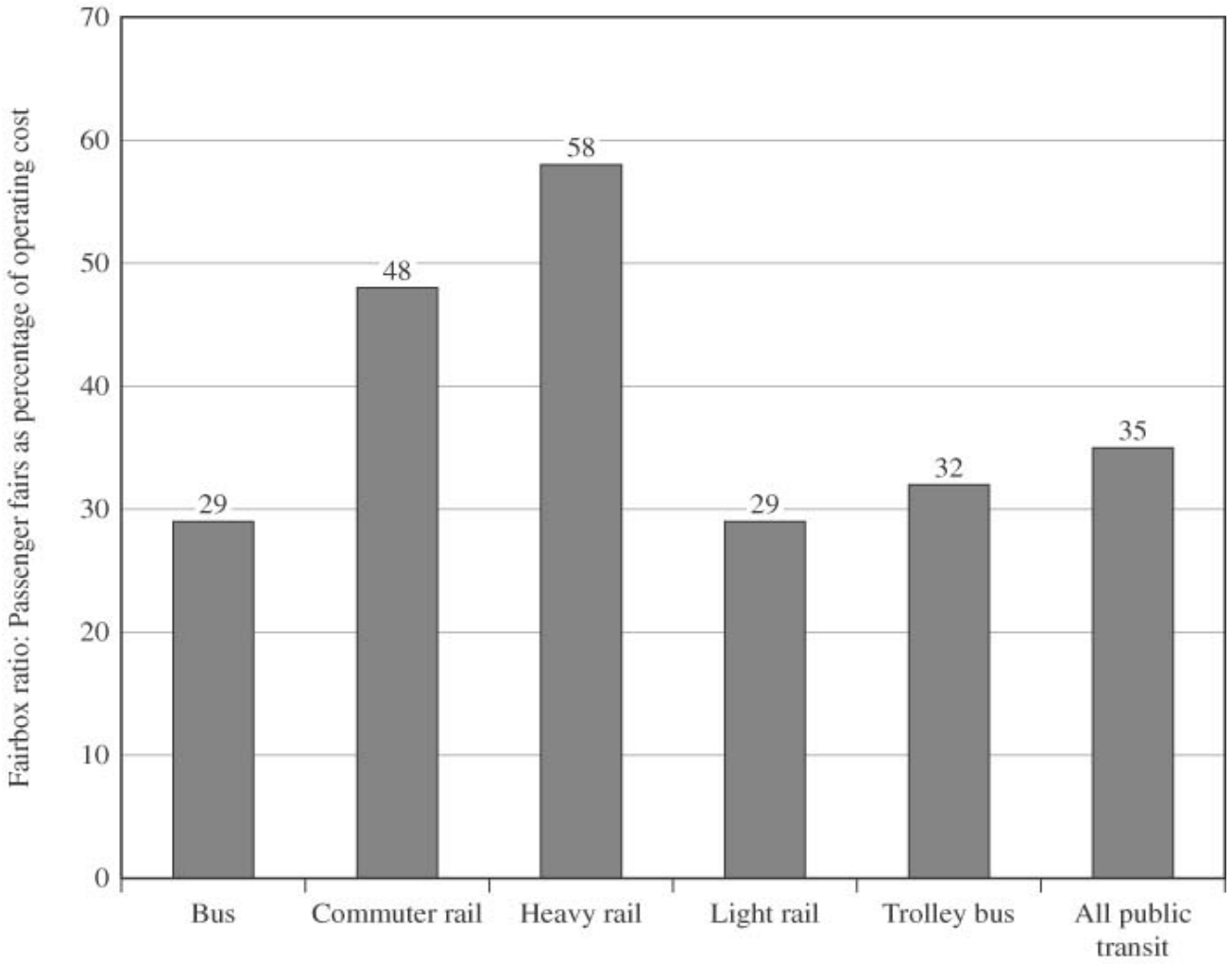
Notes: Hectare = 2.5 acres; Intermediate service = 40 buses per day; High service = 120 buses per day.

Source: J. Holtzclaw, "Using Residential Patterns and Transit to Decrease Auto Dependence and Costs, Washington, DC: Natural Resources Defense Council, June 1994.

- New York is one of the few US cities that meet these requirements (40 people per hectare).
- In Europe the requirements are easier to fulfill: Barcelona (171/hectare) and Paris (88/hectare)

Mass Transit – Subsidies

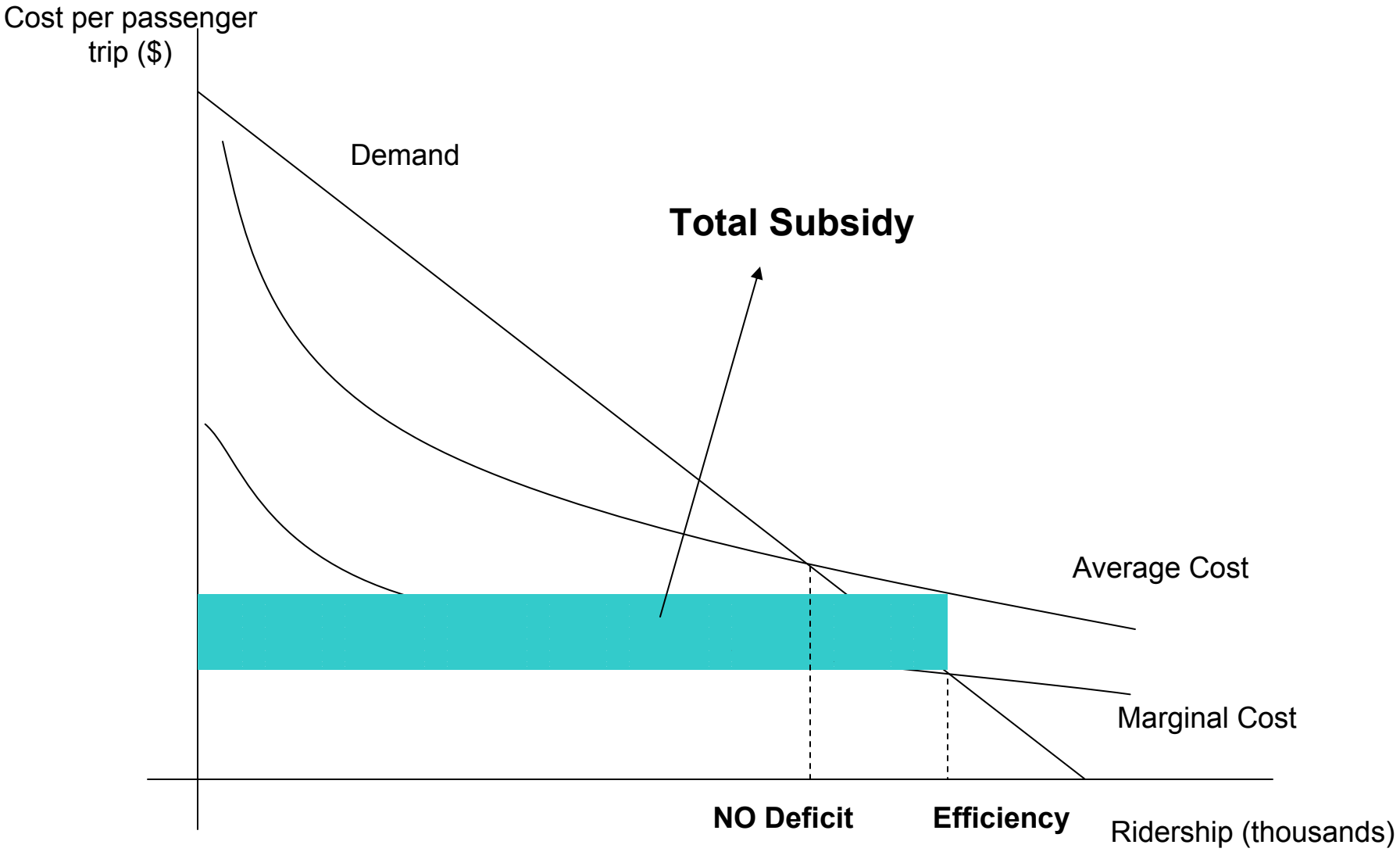
FIGURE 11–3 Fare-Box Ratios for Public Transit, 2002



Source: Author's calculations based on data from American Public Transit Association, *Transit Fact Book 2005* (Washington DC: American Public Transit Association 2005). Fare-box ratio: Passenger fares as percentage of operating cost.

Subsidies have been increasing over time

Mass Transit – Subsidies



Mass Transit – Regulation

- Government has a monopoly of mass transit in most cities and countries
- Problem with deregulation: Cream skimming
- Contracting for transit services
  - More efficient results than government (NOT CLEAR!)
- Paratransit
  - Alternatives in the middle of the two extremes regulated by the government (solo-ride taxis and large public buses)
  - Shared-ride taxis, jitneys, shuttles, subscription to commuter vans
- Experiences of deregulation
  - Good in Great Britain (improved competition)
  - Bad in Peru (reduced quality).

Mass Transit – Land use pattern

- Mass transit has not proved to be a good way to modify land use patterns. This is, new supply of stations do no generate demand and location among them.
- Experiences:
  - Good in San Francisco: BART
  - Not so good in Atlanta: MARTA

Summary Ch. 11 O'Sullivan

- Only around 5% of commuters use mass transit
- Subsidies for mass transit systems are high (and necessary)
- Deregulation may be harmful from a cream skimming and quality perspective but may be good from a competition perspective.
- Transit systems have modest effects on land-use patterns.

Los Angeles – A "freeway city"

- Based on Martin Wachs, 1993

- Los Angeles experience the heaviest traffic congestion among cities in the US.
- 77% of workers drive to work alone, 5% use the mass transit system and 15% vanpool.
- LA has the worst air quality of any major US city.
- Even when smog checks exist, it seems that 80% of air pollution comes from 10% of the vehicles.

Los Angeles – A "freeway city"

- As we discussed in previous notes, LA is a moderate density city connected by thousands of miles of high capacity freeways.
- Three transportation crises in LA.
  - 1920: Rapid growth of automobile ownership -> More highways
  - After WWII: Huge suburban growth -> More and wider highways.
  - 1990: More than a car by household -> Provision of alternatives for car use (light and heavy rail lines, bus transit system, transportation management (TDM) such as HOV lanes). Now more concerns on air quality

Los Angeles – A "freeway city"

- **Last transportation crises**
- Rail system
  - Blue Line: Light rail from Downtown LA to Long Beach
  - Red Line: Metro in the central core of Downtown LA
  - Metrolink: Commuter from suburbs to Downtown LA
  - Problems: Density in LA is very low and stations cannot be so close together. Very costly. Mostly benefit middle and upper income population.

Los Angeles – A "freeway city"

- **Last transportation crises**
- TDM (Transportation Demand Management)
  - Aimed at reducing reliance on the single-occupant automobile for the journey to work.
  - Employee transportation coordinator in each work site.
  - Number of workers driving alone to jobs decrease from 75% to 65% thanks to carpooling and vanpooling.
  - Preferential arrangements for parking as carpooling and subsidies to mass transit (example, UCLA!)

These policies seem to have had little success when compared with social costs

Los Angeles – A "freeway city"

Alternative policies

- Better pricing
  - Right now cars seem to be subsidized instead of taxed. Free parking, services in highways, traffic police, etc.
  - Ways to price: Gasoline taxes, Annual vehicle registration fee structure, congestion pricing
- Changing urban form and land use
  - Densification. Not clear since very dense cities such as Hong Kong or New York have important congestion problems as well.
- Wider range of mass transportation choices
  - Transit options that compete with cars (be able to cover low density areas, cheap and easily, as cars do)

Questions for Lecture Notes IV

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- Why do so few commuters use mass transit?
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Practice Exercises - Lecture Notes IV

- O'Sullivan
  - Chapter 10: Exercises 1, 2 and 3.
  - Chapter 11: All exercises.