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Urban Transportation, Land Use, and
the Environment in Latin America:
A Case Study Approach

Lecture 6 Part 1:

The Mexico City Metropolitan Area

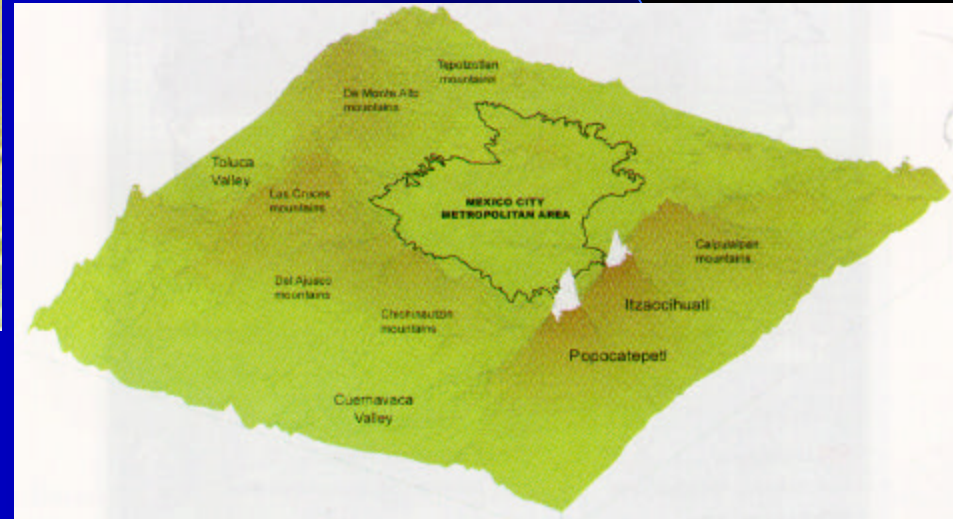
The Mexico City Metropolitan Area (MCMA)



MCMA Topography and Meteorology

- Elevated basin – 2240 m above sea level
 - 5000 km² plateau surrounded on E, S, W by mountain ridges (approx. 800-1000 m above basin)
- Altitude effects
 - Greater chance of incomplete combustion, higher emissions
 - Thinner air requires deeper breathing, more pollutants inhaled
- Subtropical latitude
 - Combined with the altitude, conducive to year-round ozone production, but particularly during dry winter months (including through thermal inversion)

Topography of MCMA



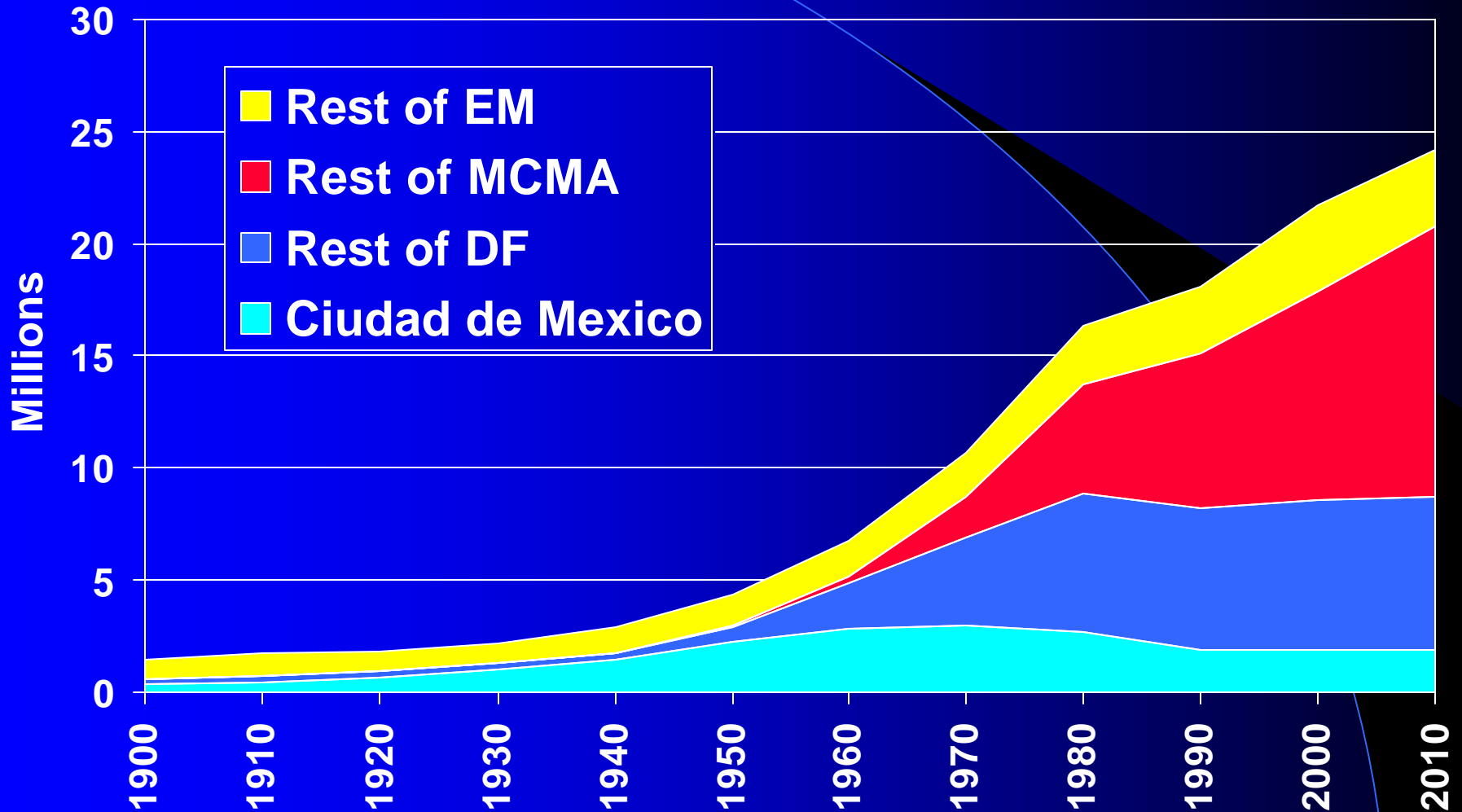
Thermal Inversion



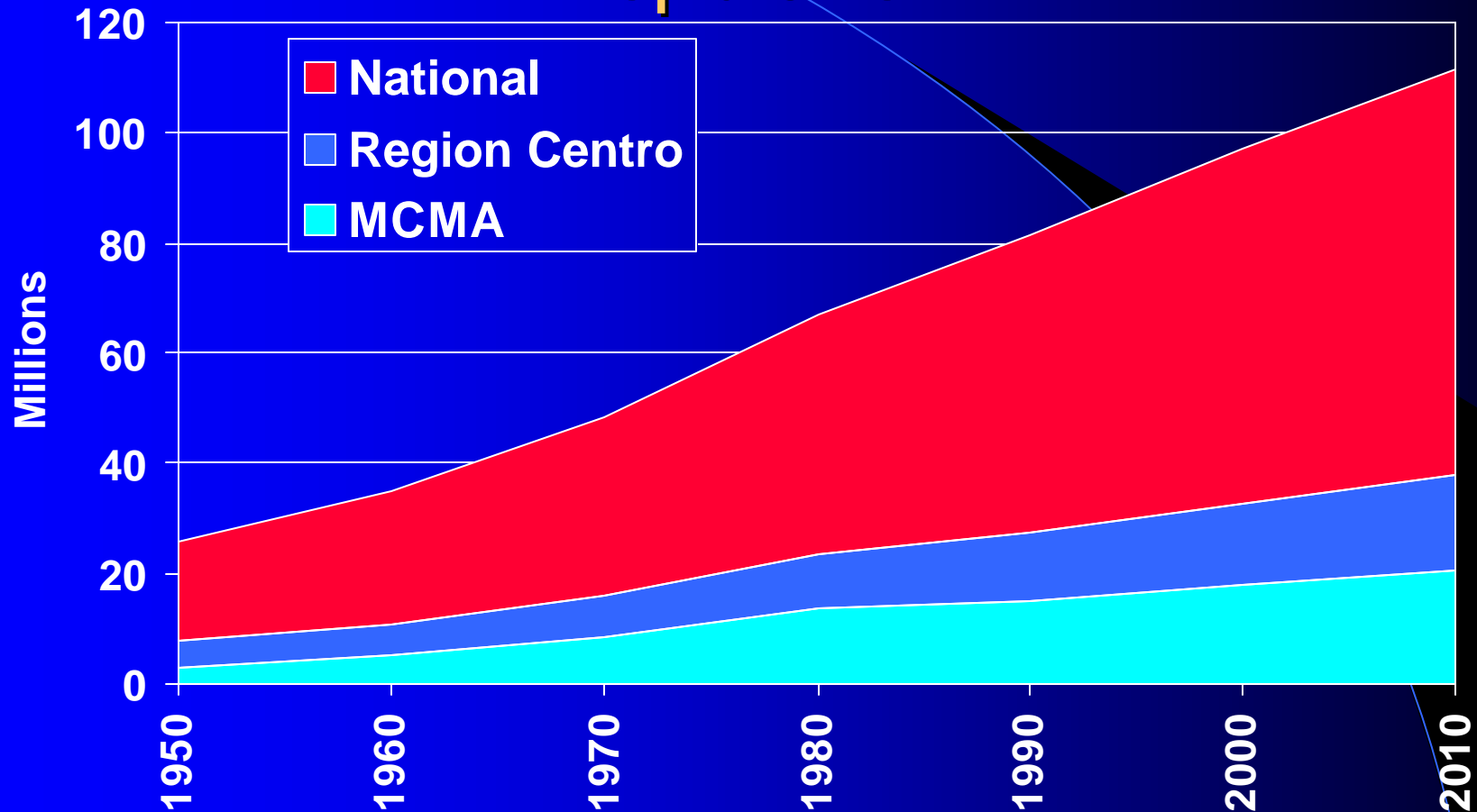
Evolution of the MCMA

- Population
 - 1950: 3 million
 - 2000: >18 million, 2nd largest city in world
- Urban Area
 - 1940: 118 km²
 - 1995: 1,500 km²
- Jurisdictions in the MCMA
 - Distrito Federal (DF), 16 *delegaciones*
 - State of Mexico (EM), 38 urbanized *municipios*
- The “Megalopolis” and the Región Centro
 - “Crown of cities” – Puebla, Tlaxcala, Cuernavaca, Cuautla, Pachuca, Toluca (75-150 kms from city center)
 - States of Hidalgo, Morelos, Puebla, Querétaro, Tlaxcala

MCMA Population Evolution



MCMA, Central Region, and National Population



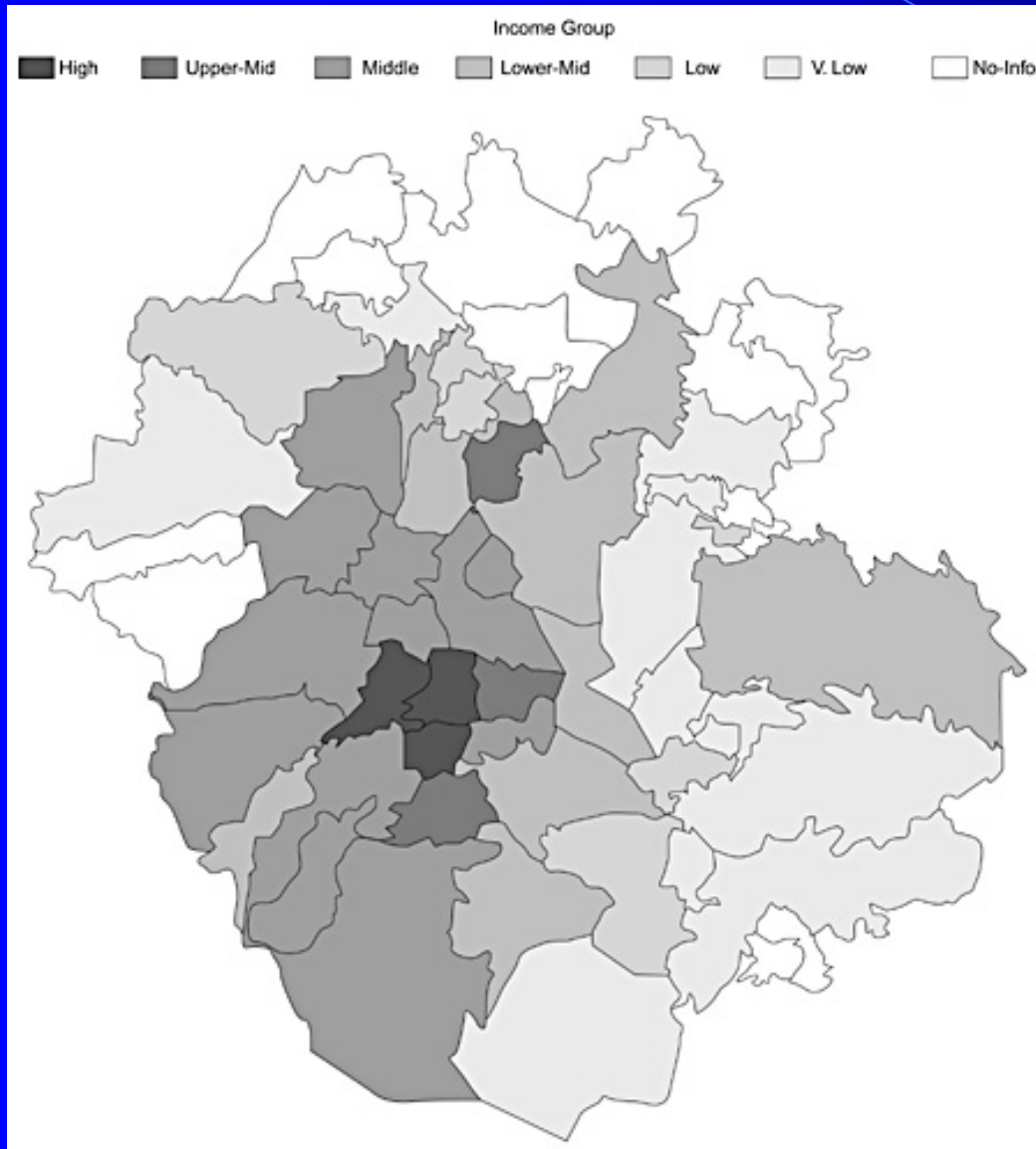
1950: MCMA 38% of Región Centro; 2000: 54%

1950: RC 30% of National; 2000: 34%

Population Growth & Demographics

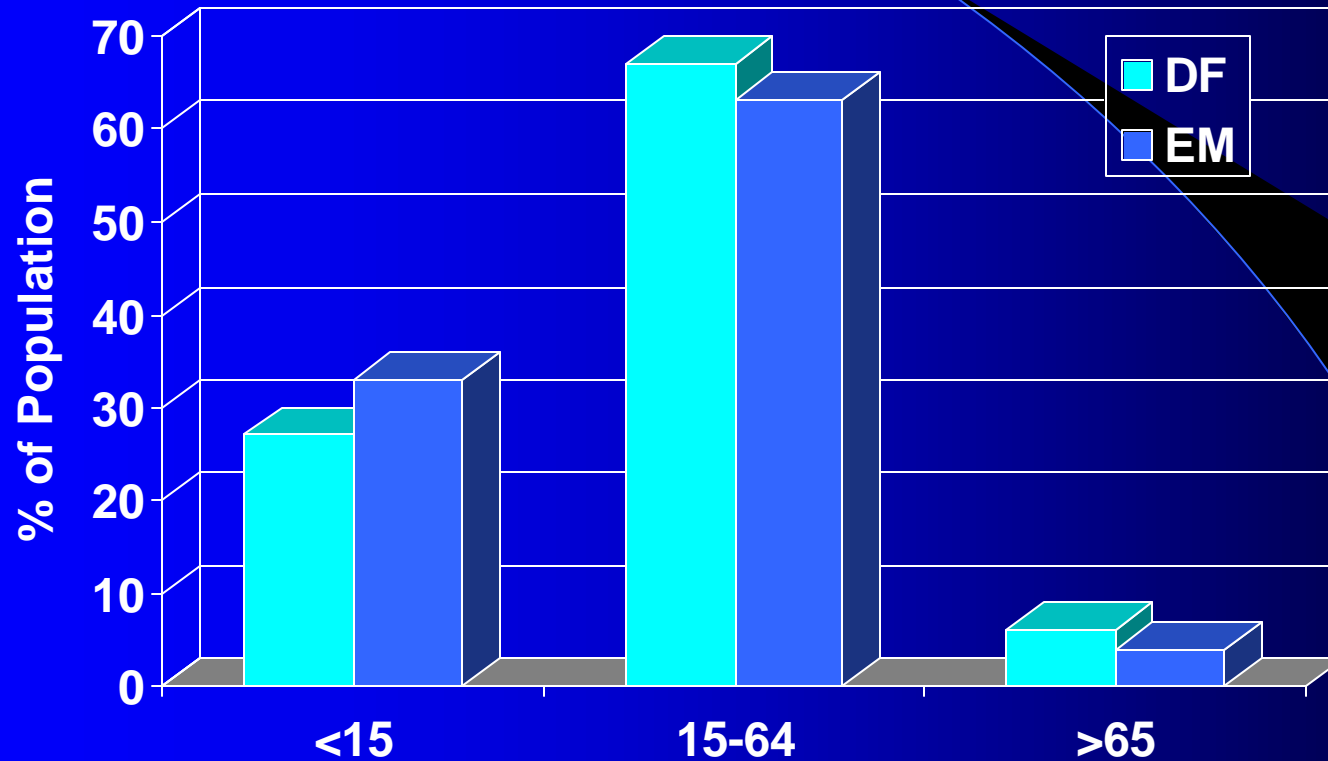
- Historical patterns influenced by migration
 - City as major national economic generator
 - Migrants to fringe communities
- In general, incomes decline from city center; with west/southwestern parts concentrating most wealth
 - A few *delegaciones* (in SW) have some degree of socio-economic integration
- Projected Future Growth to 2020
 - 1.5% to 2.0% annual
 - Primarily in State of Mexico
 - 26 million (or more?) by 2020; ~35 million, including “megalopolis”

Socioeconomic Distribution



- In MCMA 10% of wealthiest have 20 times more income than the 10% poorest (nationally 24 times higher)
- 50% of the population has just 19% of the wealth (same as national)
- 10% of population has 40% of wealth (roughly same as national)
- Gini Coefficient in 1995: .43 (national .46)

Age Distribution

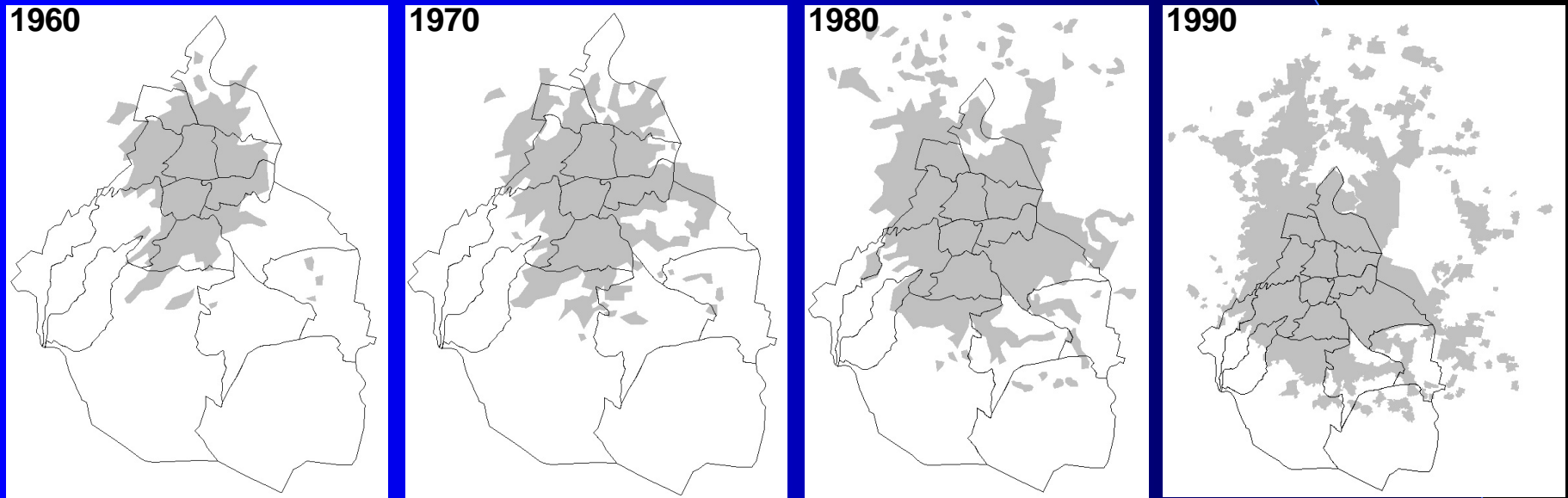
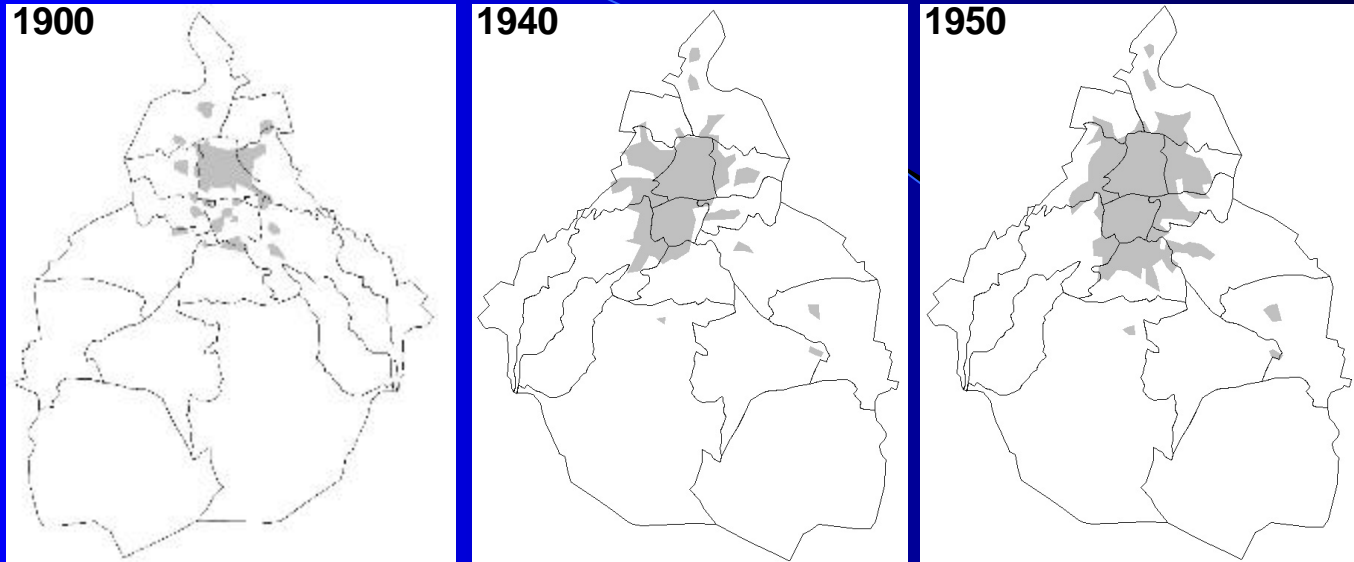


Declining fertility rates in recent years

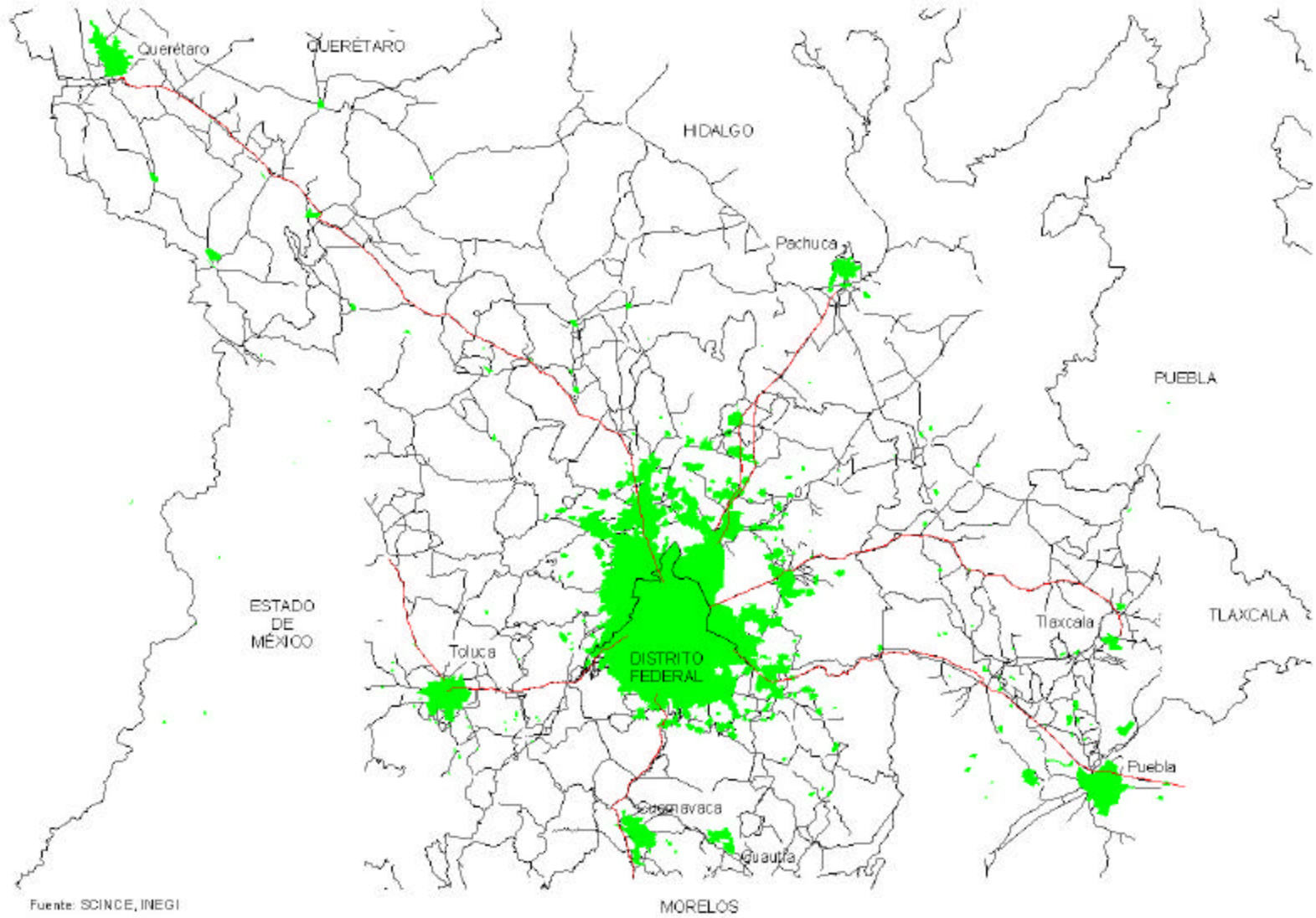
Urban Expansion – Influencing Factors

- Population growth
- Irregular settlements of poor & Real estate projects for higher income groups
 - Both have invaded natural areas
- Irregular settlements
 - House roughly 62% of MCMA population
 - occupy almost 50% of the urbanized area
- “Crown Cities” expansion and the merging of the “megalopolis”

Urban Expansion – the MCMA



The “Megalopolis”

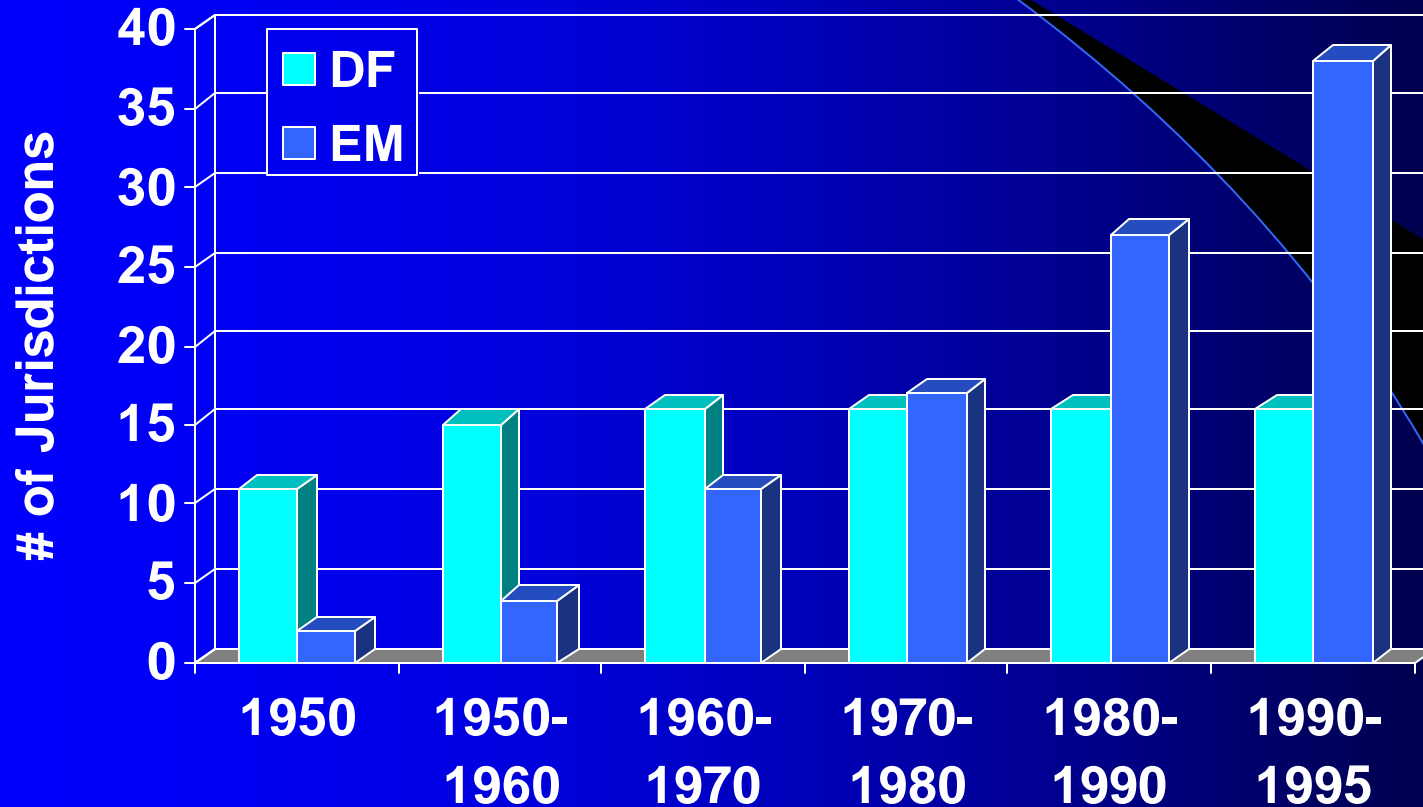




Urban Expansion – Irregular Settlements



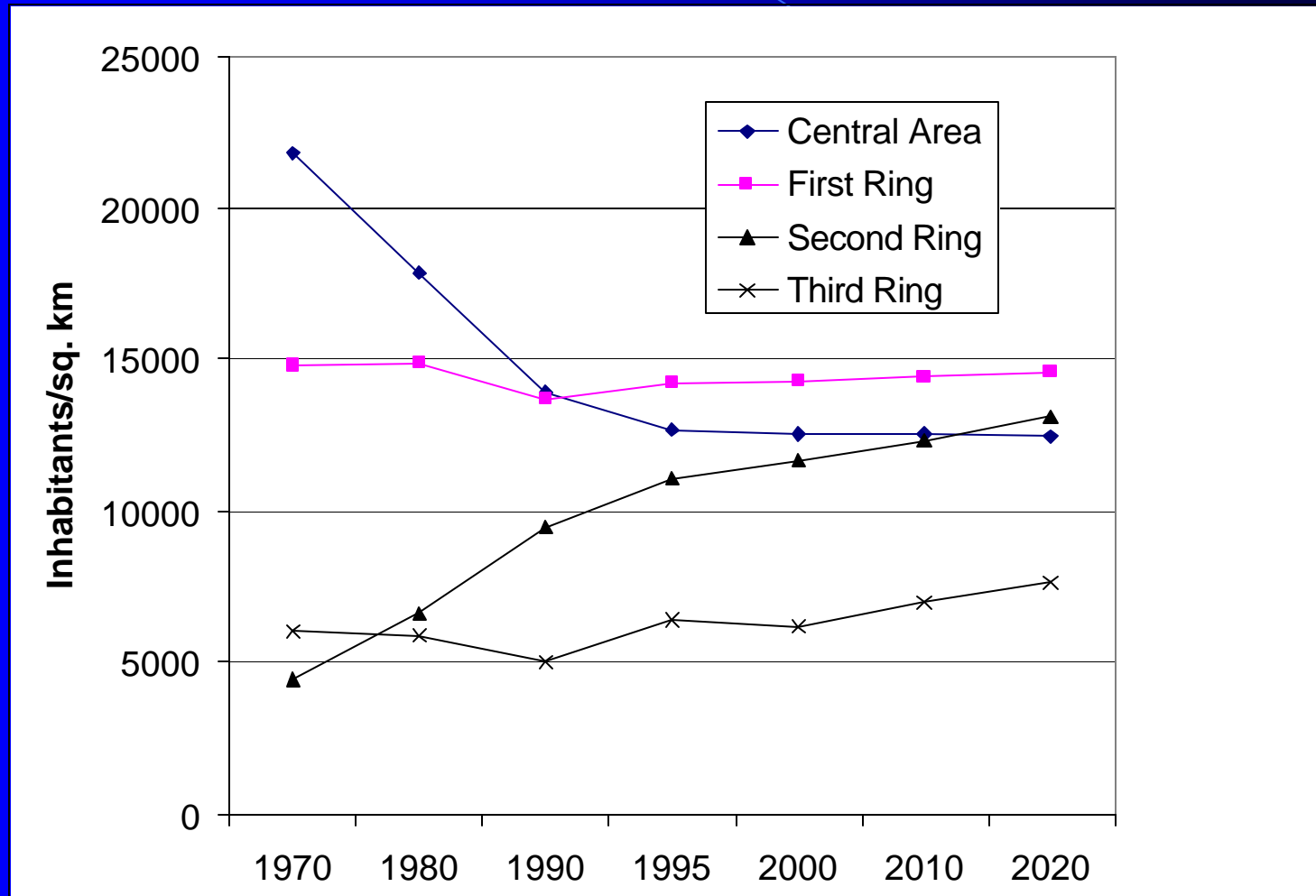
MCMA Jurisdictions



Population Densities

- Average MCMA-wide: ~12,000 km²
 - Population per apparent urbanized area
- In comparison
 - New York City: 9,100; NY Metro Area: 2,000
 - Los Angeles (city): 2,900; LA Metro: 2,000
 - Boston (city): 4,400; Boston Metro: 1,162
 - San Francisco (city): 6,000; SF Metro: 1,500
- MCMA influencing factors
 - “illegal settlements”, varying efforts of government control (especially in the EM)

Population Densities in DF



Land Uses

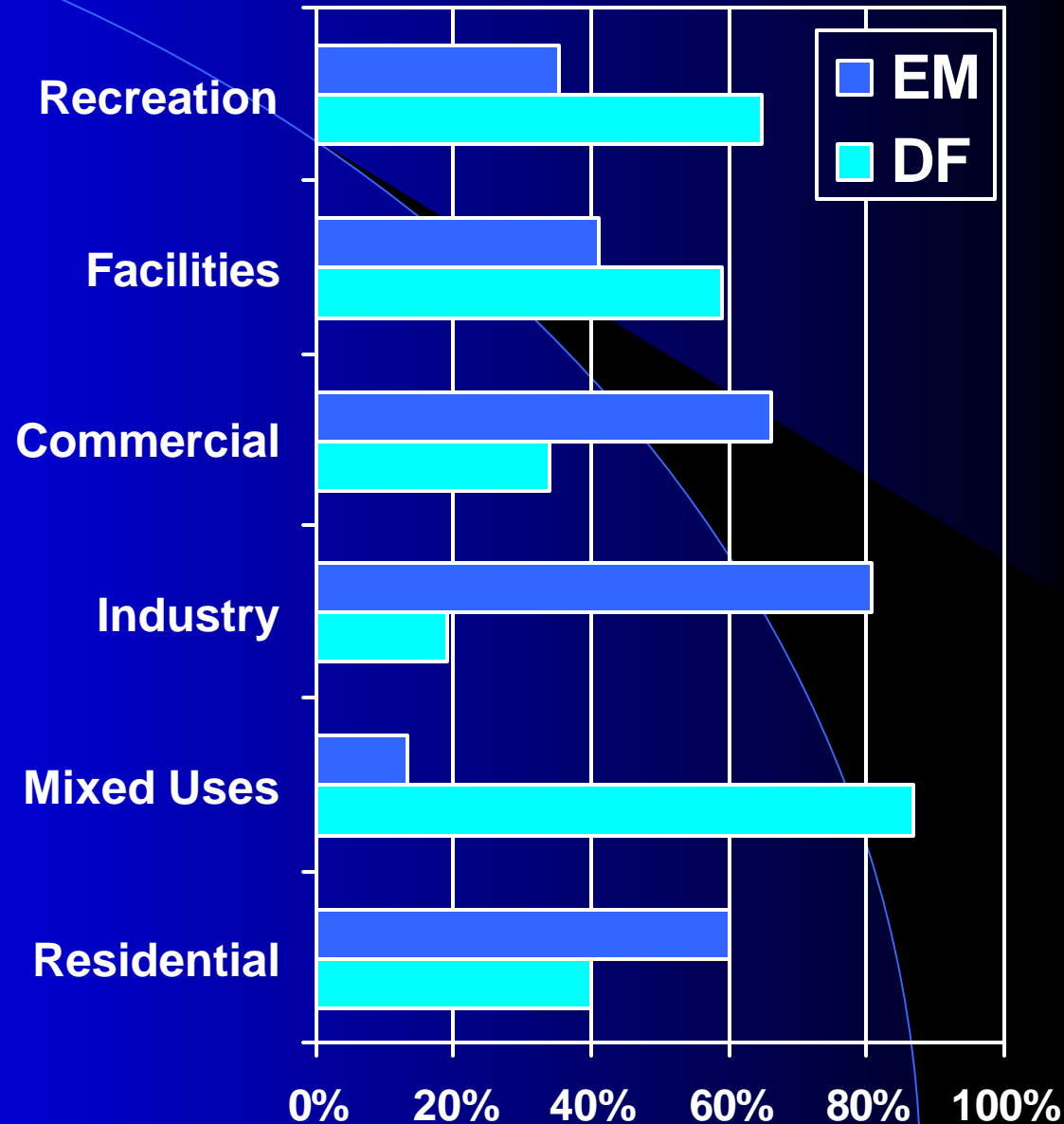
Percentage of MCMA Land Uses

Noteworthy Traits (87-97)

- Alarming loss of “open space” in EM: -72%; DF has double the open space per capita
- Net decline in industrial lands (especially in DF)
- Large growth in “facilities” (public buildings, etc.) in EM
- DF totals 60% of space dedicated to economic activities

Influencing Factors

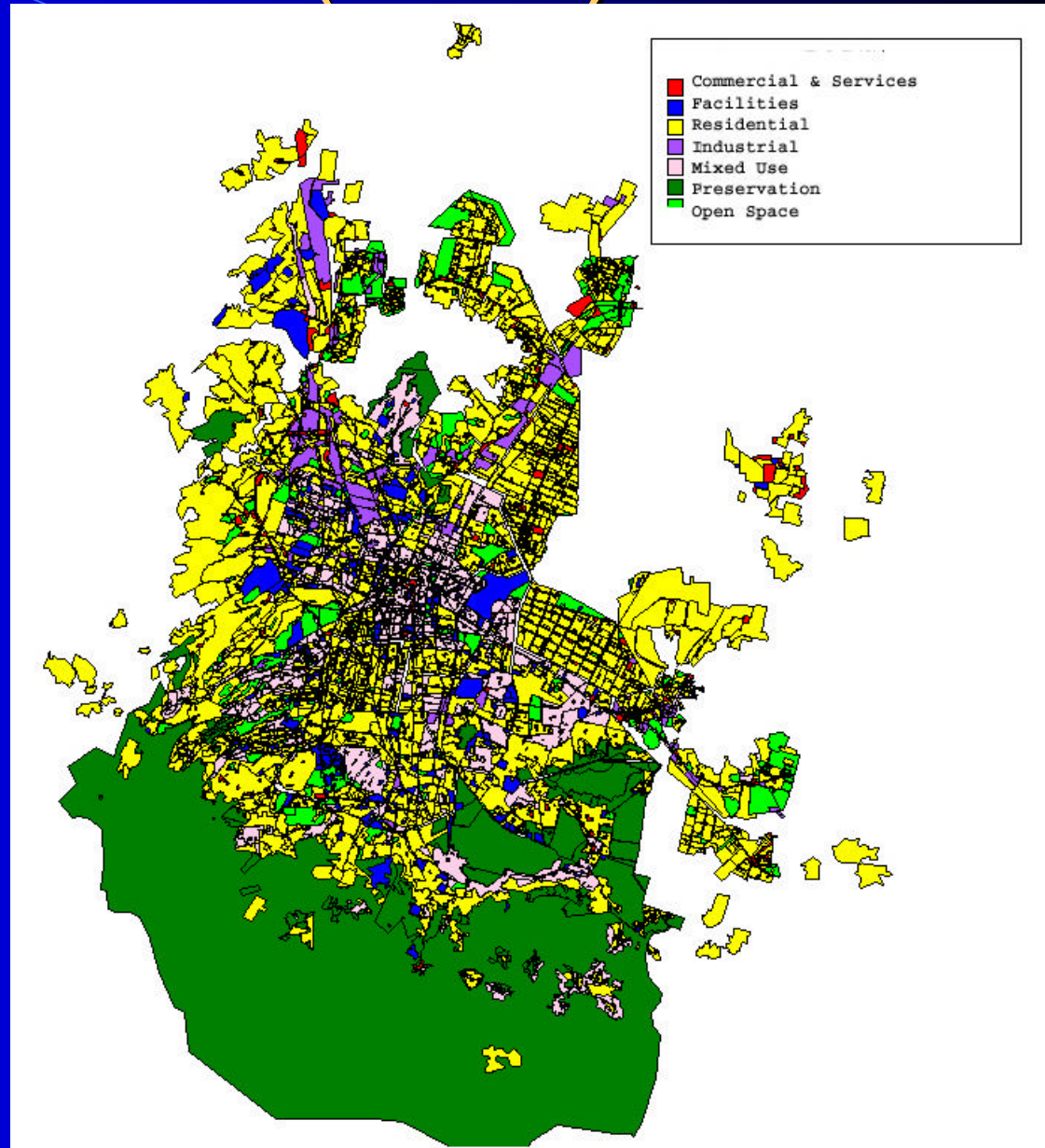
- Industrial sites in DF limited by regulations; promoted through subsidies for location in “technology parks” in EM
- Social segregation, service quality – “Tiebout sorting”



Land Uses (1997)

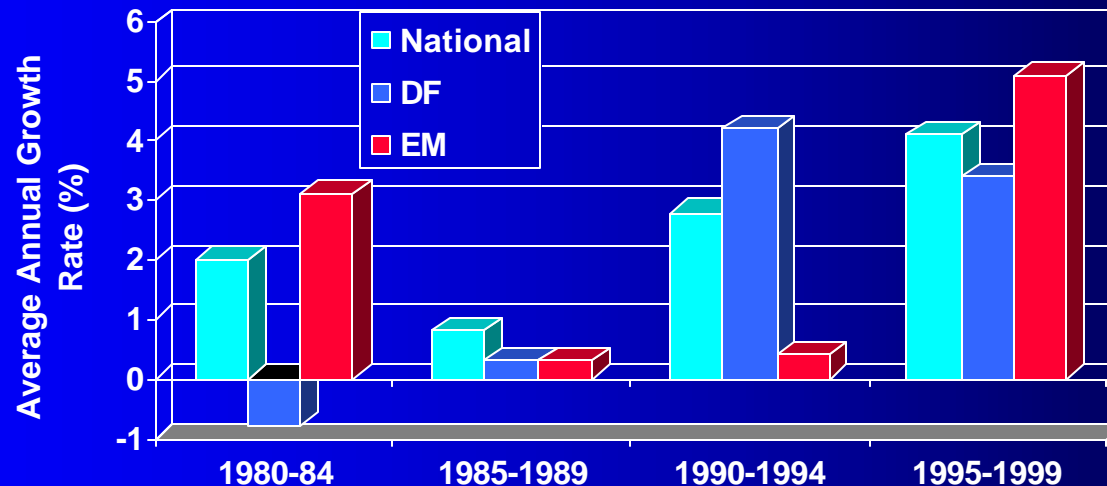
Observations

- Spatially decentralized commercial areas
- Wealthier areas have access to significant open spaces & modern commercial services, isolated from industry
- “Commerce/Service” corridors (Paseo de la Reforma y Av. Insurgentes) that both end in large shopping centers – oriented towards wealthier West/Southwest
- Industry on important corridors
- In the (poorer) North and East, less general services, more industry and *mercados populares* (like La Merced)



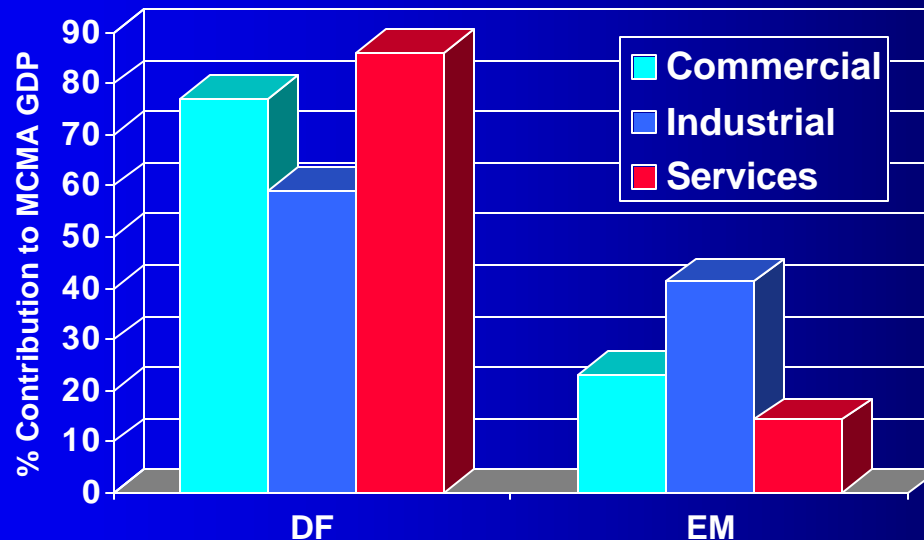
Economy

- MCMA as important, but declining, force in national economy
 - 38% of GDP in 1970; 33% of GDP in 1998
 - Most significant decline in Manufacturing
 - 47% to 29%
 - Relatively constant contribution of Financial Services (33%); Social Services (40-45%) and Construction (30-35%)
- In general, as goes the country, so goes the MCMA, but ...

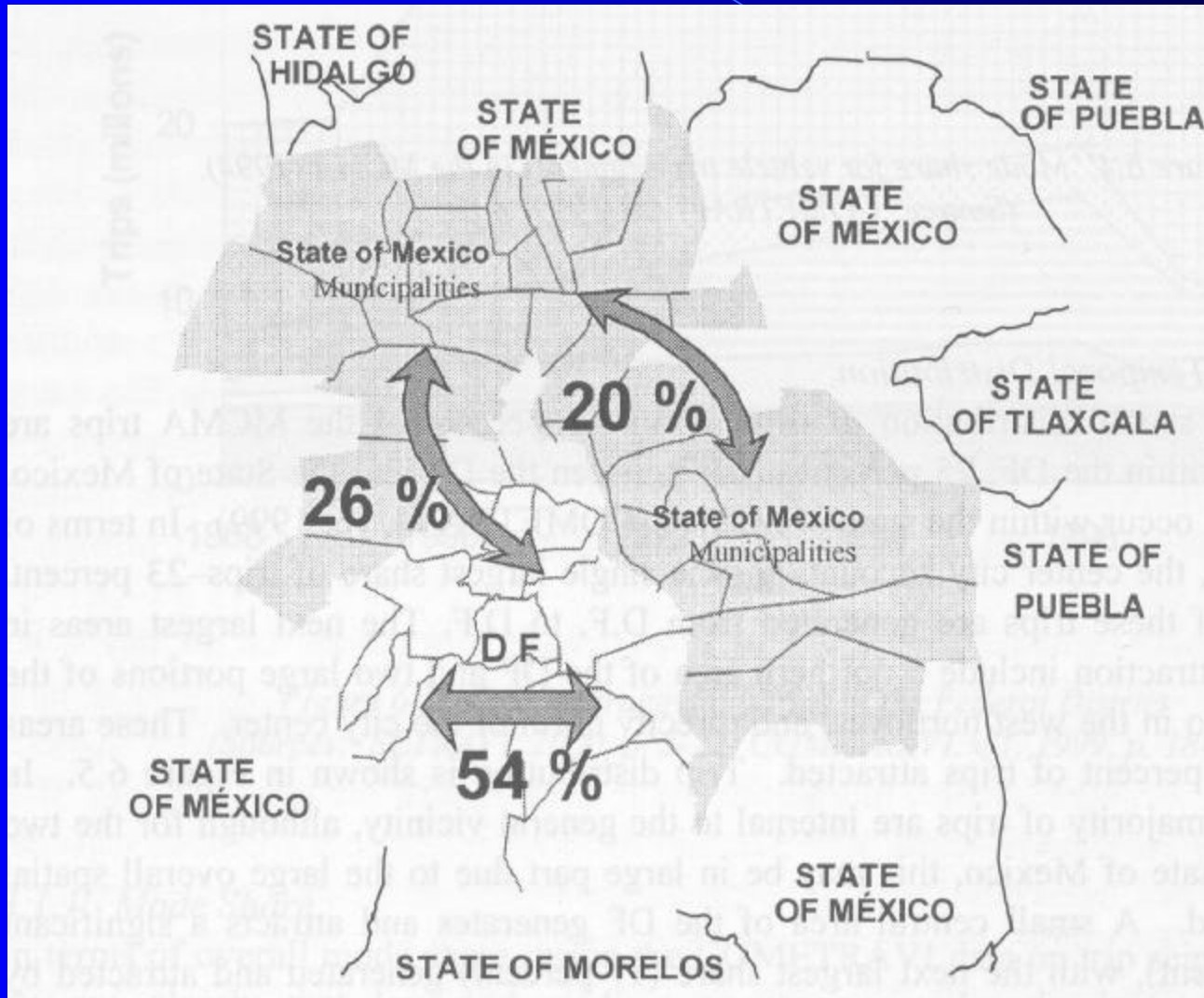


Intra-Municipal Economy

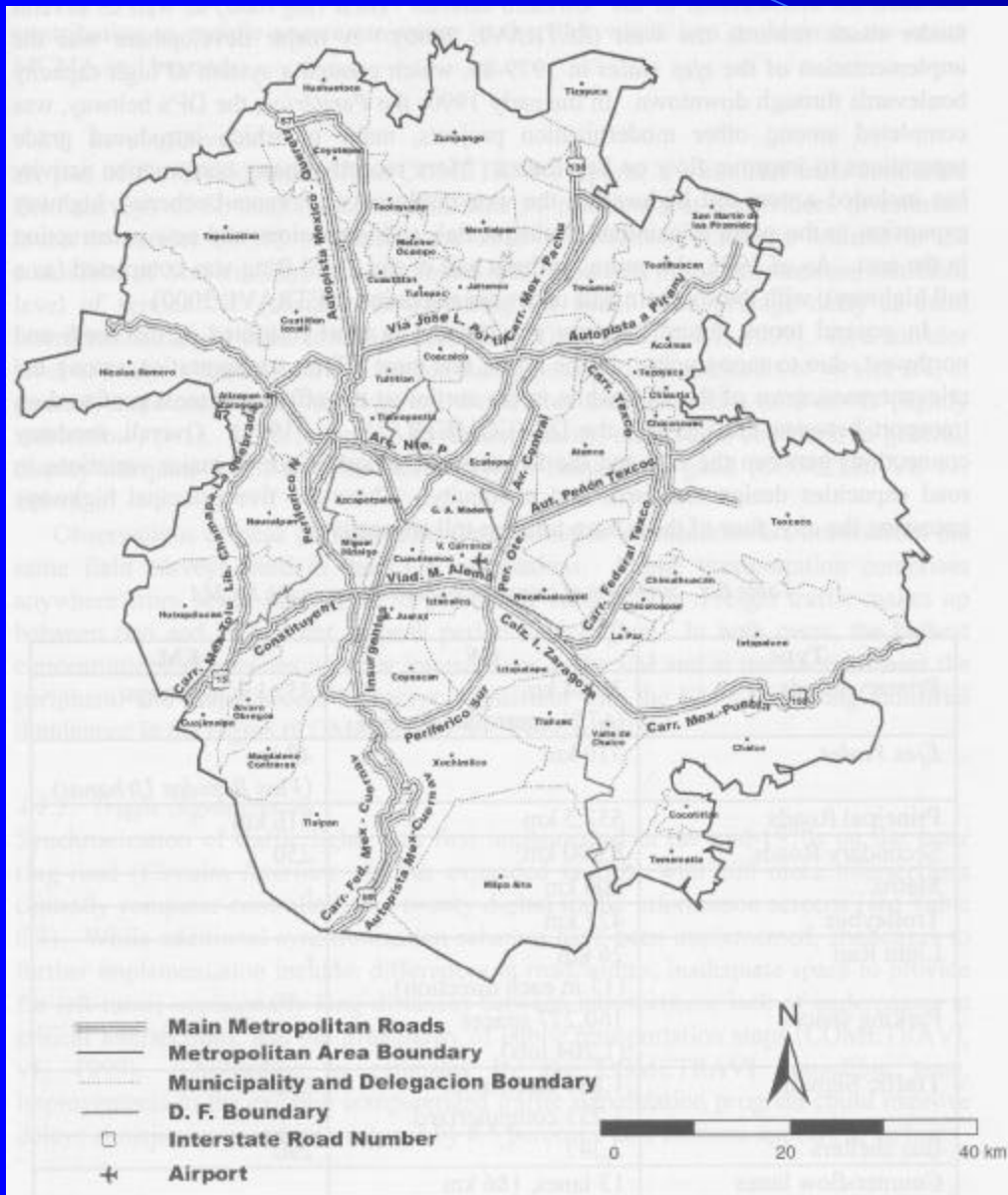
- EM expected to have higher economic growth rates in future
 - But, also, higher population growth
 - DF will, thus, likely maintain higher GDP/Capita
- As of 1993, Relative contribution to GRP:



MCMA Macro Trip Patterns



MCMA Major Roads & Salient Characteristics



General Characteristics

- Concentration of suburban and interurban bus terminals (and main subway stations) in northern and eastern DF/EM boundaries
- Northern and Eastern roads primary means of access from suburban/exurban areas
- Existing airport on Eastern edge of DF (on Periferico) ~ 50,000 passenger trips/day

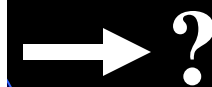
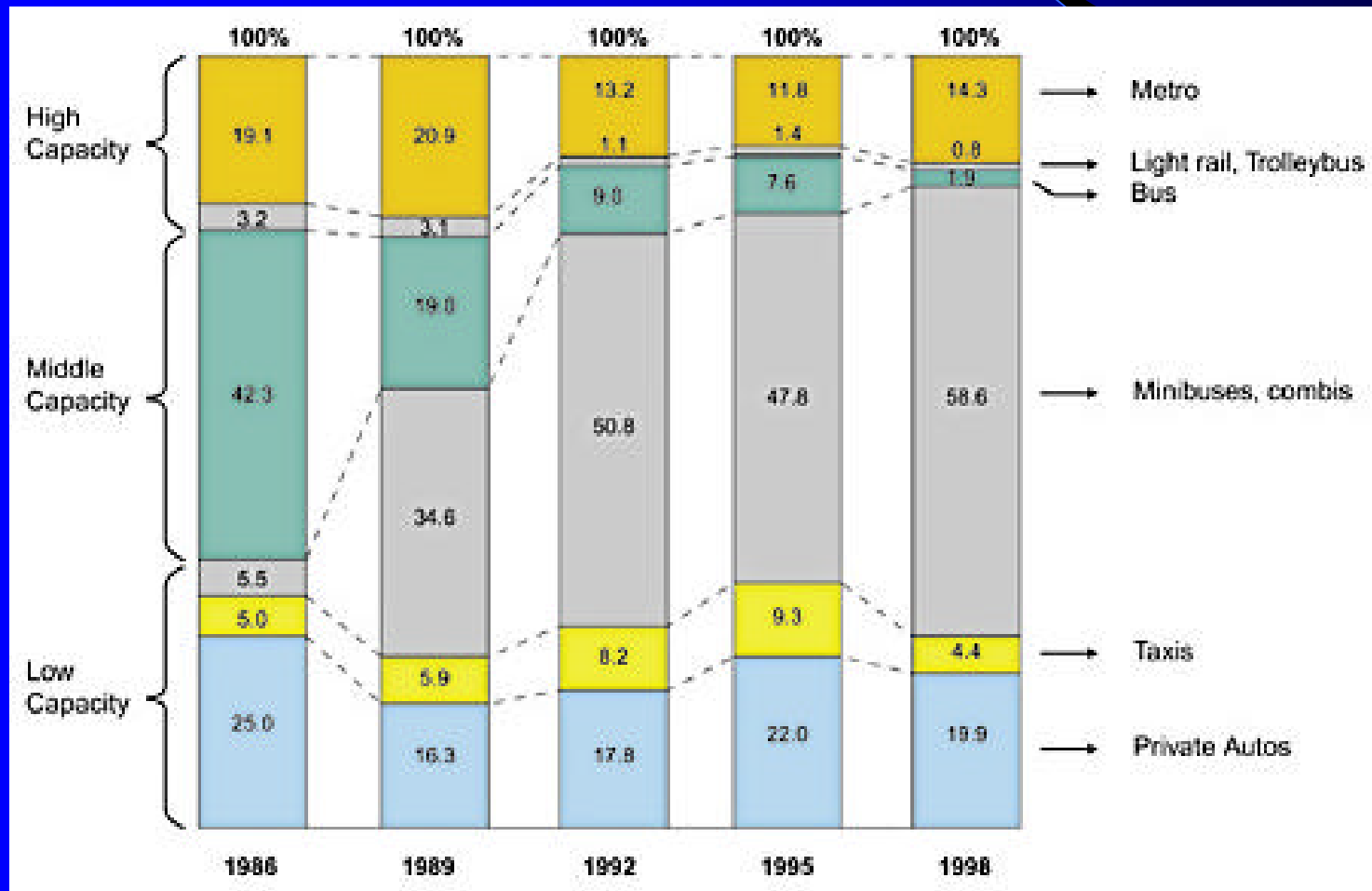
Passenger Travel Demand

- Data
 - Origin-destination surveys reportedly conducted in 1977/78, 1983 and 1994
 - 1994 survey done by the national statistics institute (INEGI) in cooperation with DF
 - Reportedly 29,700 households (~1%), using 135 traffic analysis zones (TAZs)
- 29.1 *vehicle* trip segments
 - 82% by public transport; 18% private transport
- Roughly 21 million *vehicle trips*
 - 75% public transport, 25% private transport
 - 1.2 per person or 5.4 per HH; Santiago 1.7/person 6.4/HH
- Does not include walking trips (10% in Buenos Aires, 20% in Santiago, 30% in Sao Paulo)
 - Conservatively (15%) adds 3.6 million trips – 1.4 per person or 6.4 per HH (Santiago – 2.12 per person or 8 per HH)
- Other estimates, significantly different
 - 19 million (1.35/person) in 1983 to 31 million (2/person) in 1994

Passenger Travel Demand – What Future?

- DF Transport authority (2000) predicts Region-wide change
 - 21 million trips 1994 (1.2 per capita)
 - 14 million in DF (1.6/capita); 7 million in EM (.8/capita)
 - 28 million in 2020 (1.08 per capita)
 - 17 million in DF (1.9/capita); 11 million in EM (.63/cap)
- How Realistic??
 - Data from Santiago 1977-1991
 - Elasticity of per capita trips to income: 1.87
 - Elasticity of auto trips to income: 1.69
 - Elasticity of public transport trips to income: -0.46
- What will the future really bring?

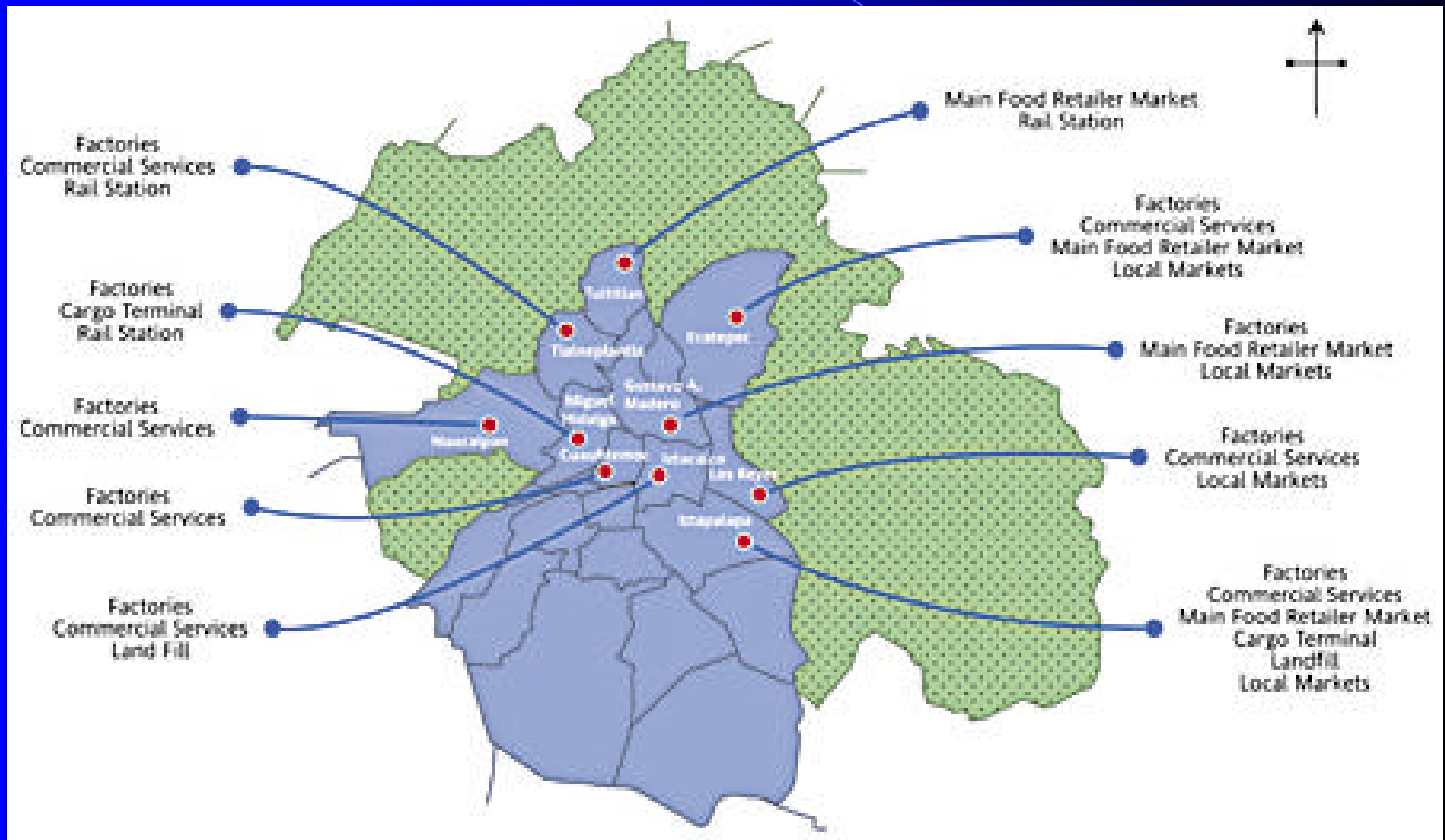
Passenger Travel Demand – What Future?



Freight Demand

- Rail freight enters at two terminals in Northwest
- Truck through traffic major influence (lack of bypass)
- Major freight terminal on southeastern boundary of DF; trucks heavier than 3.5 tonnes unload farm and agricultural products for delivery via lighter vehicles throughout the MCMA
- 29% of freight transported in MCMA originates in DF; 12% in EM; 59% outside MCMA

Major Freight Generators



Passenger Supply

- Private Autos
 - 2.3-3 million
 - 78 per 1000 pop. in 1976 to 135-166 per 1000 in 1996
 - 1.2 - 1.76 persons per vehicle
- Taxis
 - 69,000 – primarily in DF; no DF-EM inter-operation
- *Hoy No Circula*
- Buses, major decline since mid-1970s
 - 15,000 in 1976; today roughly 4,000 in DF
 - 1000 operated by state-owned RTP
 - Roughly 1,200 operated by private owned companies (former R-100 and more recent concession winners)
 - Estimated 1,800 introduced by *colectivo* organizations
 - “Suburban Services” in EM, uncertain number of vehicles
 - Some Metropolitan Routes, but generally “border transfer”
 - Marginal trolleybus service

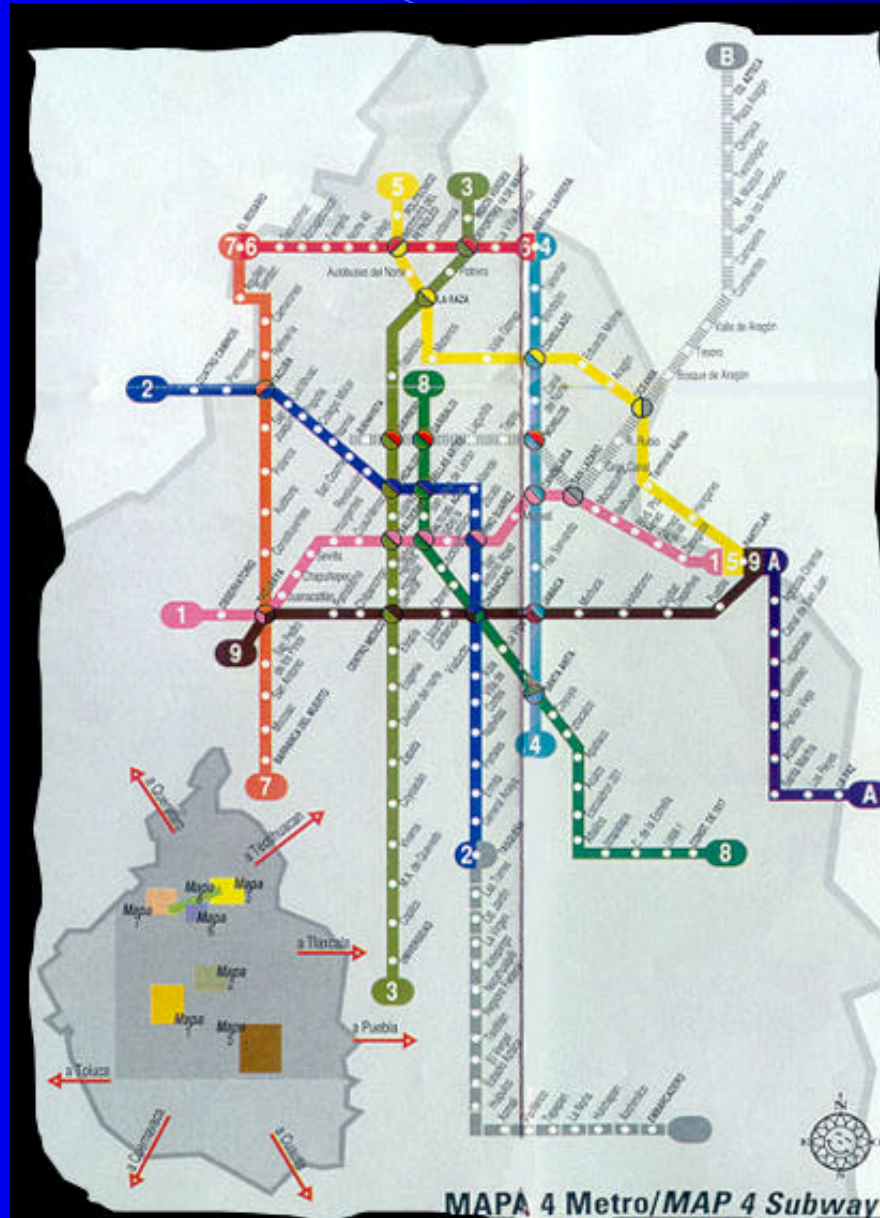
Passenger Supply

- The rise of the *Colectivo*
 - Originated as shared taxi sedans in 1950s
 - Tolerated “informally” until some formalization in the late 1960s
 - By early 1980s with government takeover of the bus system, *colectivos* thrived
 - Unregulated, “licensed” service
 - Owner-operator, in route association structure
 - DF: 103 *colectivo* organizations
 - ~27,000 vehicles
 - EM: 172 organizations, 94 companies
 - Probably similar, if not greater, number of vehicles

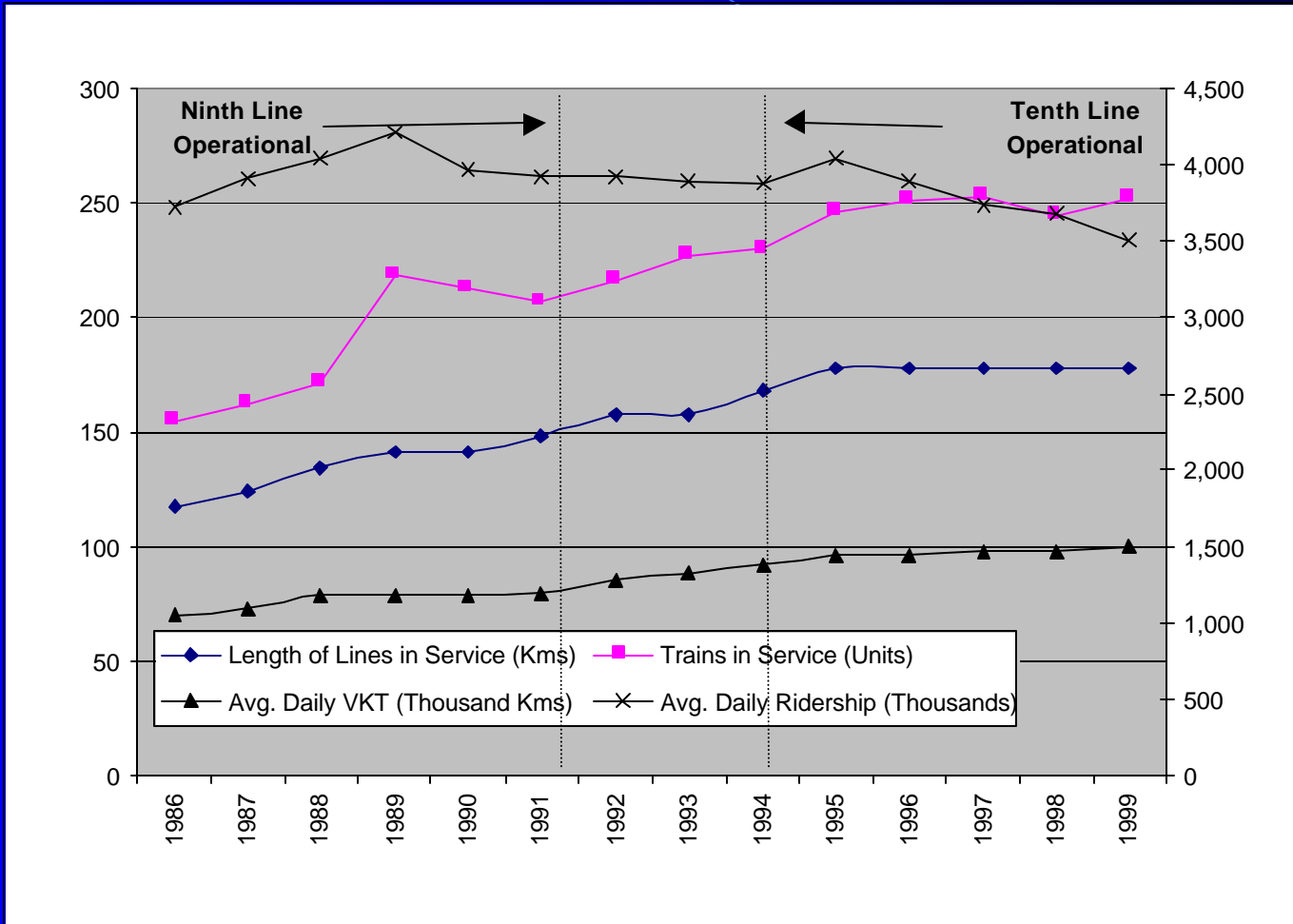
Passenger Supply – Metro & Light Rail

- First lines built in late 1960s
- 11 lines, 200 kms, 167 stations
- Original 3 lines carry 64% of passengers
- “Lowest Fares in the World”
- Fares cover approximately 40-50% of operating costs
- Service confined to DF
- Ability to “keep up” with urban expansion?
 - Exacerbating expansion?
- Realistic expansion plans?
- Light rail of 13 kms.

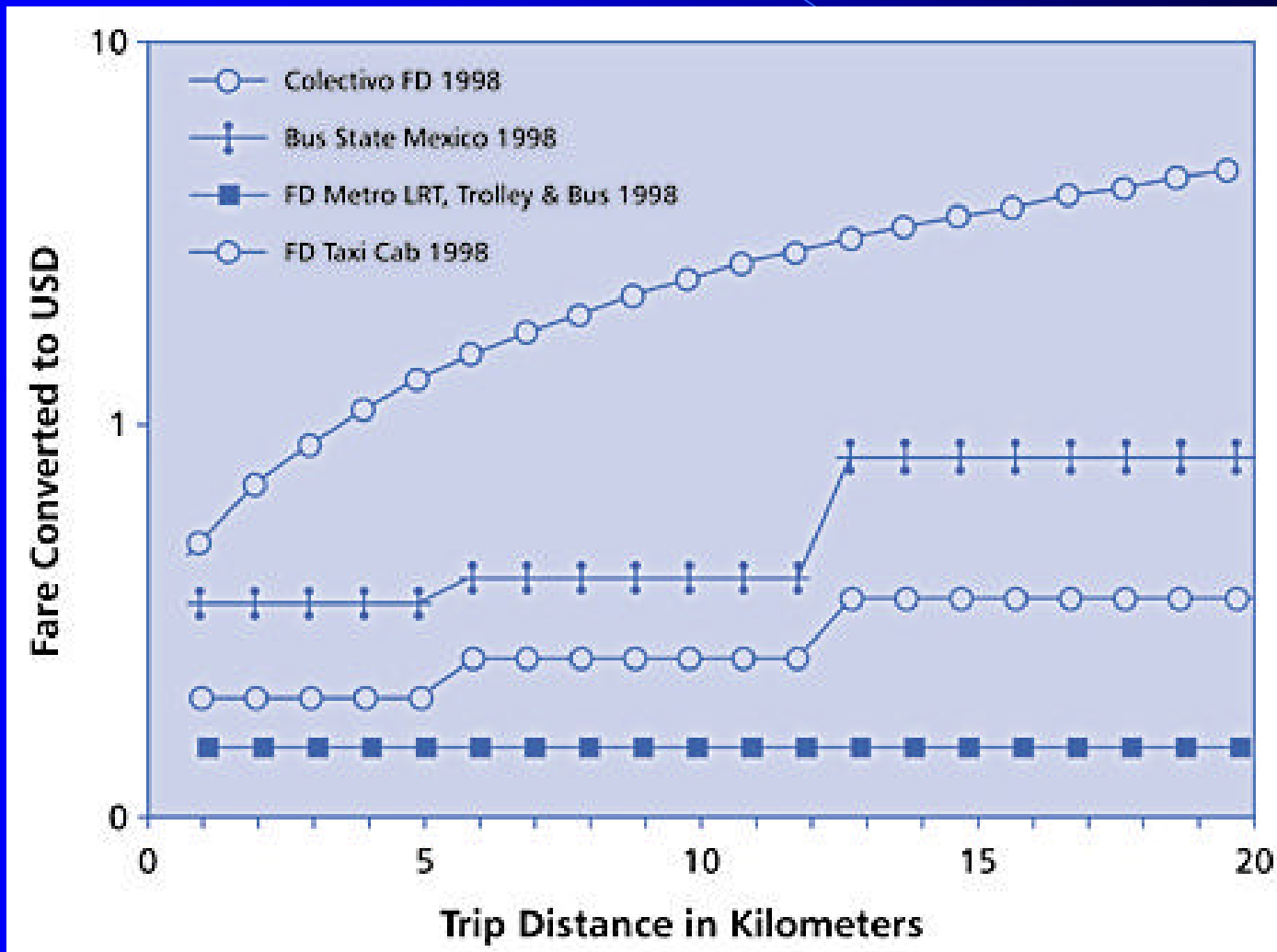
Metro Routes



Metro Indicators



Public Transport Fares



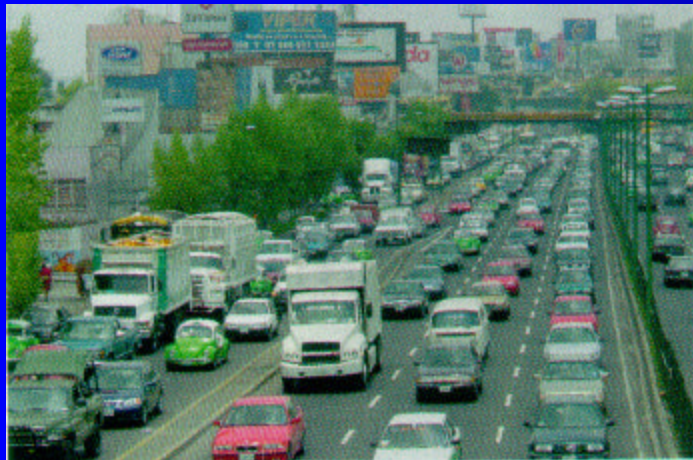
Colectivos



Metro



Roadway Congestion



Motor Vehicle Contribution to MCMA Pollutants

	PM ₁₀ ¹	SO ₂	CO	NO _x	VOC ²
Light Duty Private Vehicles ³	5.2%	11.6%	62.2%	32.4%	23.4%
Colectivos	0.3%	0.9%	13.4%	5.1%	4.6%
Taxis	1.0%	2.5%	7.4%	5.4%	3.2%
Buses	5.9%	1.0%	0.5%	5.7%	0.8%
Trucks	23.4%	4.8%	14.4%	32.0%	7.5%
All Vehicles	35.9%	20.8%	98.0%	80.5%	39.5%

1. Does not include Road dust. 2. Does not include refueling. 3. Includes pick ups, motorcycles, diesel vehicles under 3 tonnes.

Source: CAM, 2001.

Next Time

- Regional Architecture
- Some Responses
- Looking to the Future