

1.201J/11.545J/ESD.210J *Introduction to Transportation Systems*

Fall 2006

LECTURE 22:

MEXICO CITY:

TRANSPORTATION AND THE ENVIRONMENT

SPEAKER: Joseph M. Sussman

MIT

November 28, 2006

Relating the Mobility Engendered by Transportation to Environmental (and Energy) Impacts: A Key Public Policy Question

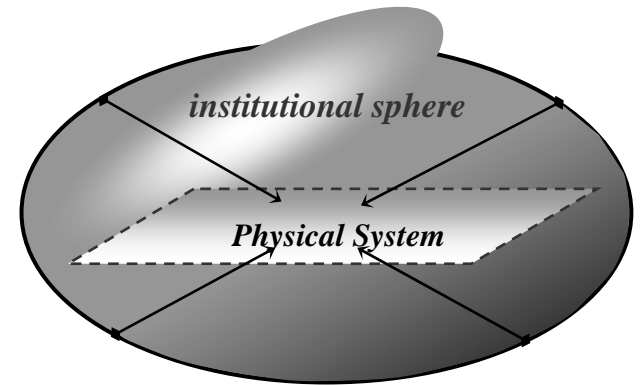
**SUSTAINABILITY--THE 3 Es--
economic development, environmental
impact and social equity**

KEY POLICY QUESTIONS

- **What is the issue (problem)?**
- **What are the competing values and interests?**
- **Who are the stakeholders and what is their ability to change things?**
- **How do we negotiate a “solution” that appropriately weighs the competing interests?**
- **What methods are appropriate to study the issue?**
- **What is the process by which policy is changed?**
- **How does one implement the changed policy and make sure it works in practice?**

Nested Complexity

- **Physical system “layer”**
 - More quantitative principles
 - Engineering & economic models
- **Institutional sphere “sphere”**
 - More qualitative in nature and often more participatory
 - Stakeholder evaluation and organizational analysis
- **Different methodologies are required**
 - within the physical system
 - between the institutional sphere and the physical system
 - within the institutional sphere



The Mexico City Megacity Issues

“Checklist”

- **“Megacity” close to 20 million people in Mexico City Metropolitan Area (MCMA).**
- **The combination of topography and meteorological conditions, together with increased auto ownership, producing an air quality problem of the first magnitude.**
- **As with many developing countries, a tremendous range in wealth among its citizens.**
- **A sprawling land use pattern fueled by both illegal settlements on the fringes and “suburbanization” and the resistance of central city “delegaciones” to densification.**

The Mexico City Megacity Issues

“Checklist” (cont.)

- A surface transportation subject to substantial congestion – throughout the day in some parts of the city – exacerbating the air quality issue in the MCMA.
- The MCMA as institutionally complex, considering its relation to the federal government and relationship between the Distrito Federal (DF) and the Estado de Mexico (EM).
- The MCMA as the economic engine of Mexico, but dependent on the economic health of its neighbor to the north.
- Economic growth as a driving policy.
- A potentially extraordinary political shift for Mexico with the election of President Fox in 2000, after 71 years of presidential rule by the same party-- the PRI
- And in 2006, a very close and contentious election between (pres- elect) Calderon and Lopez Obrador

The Mexico City Megacity Issues

“Checklist” (con’t)

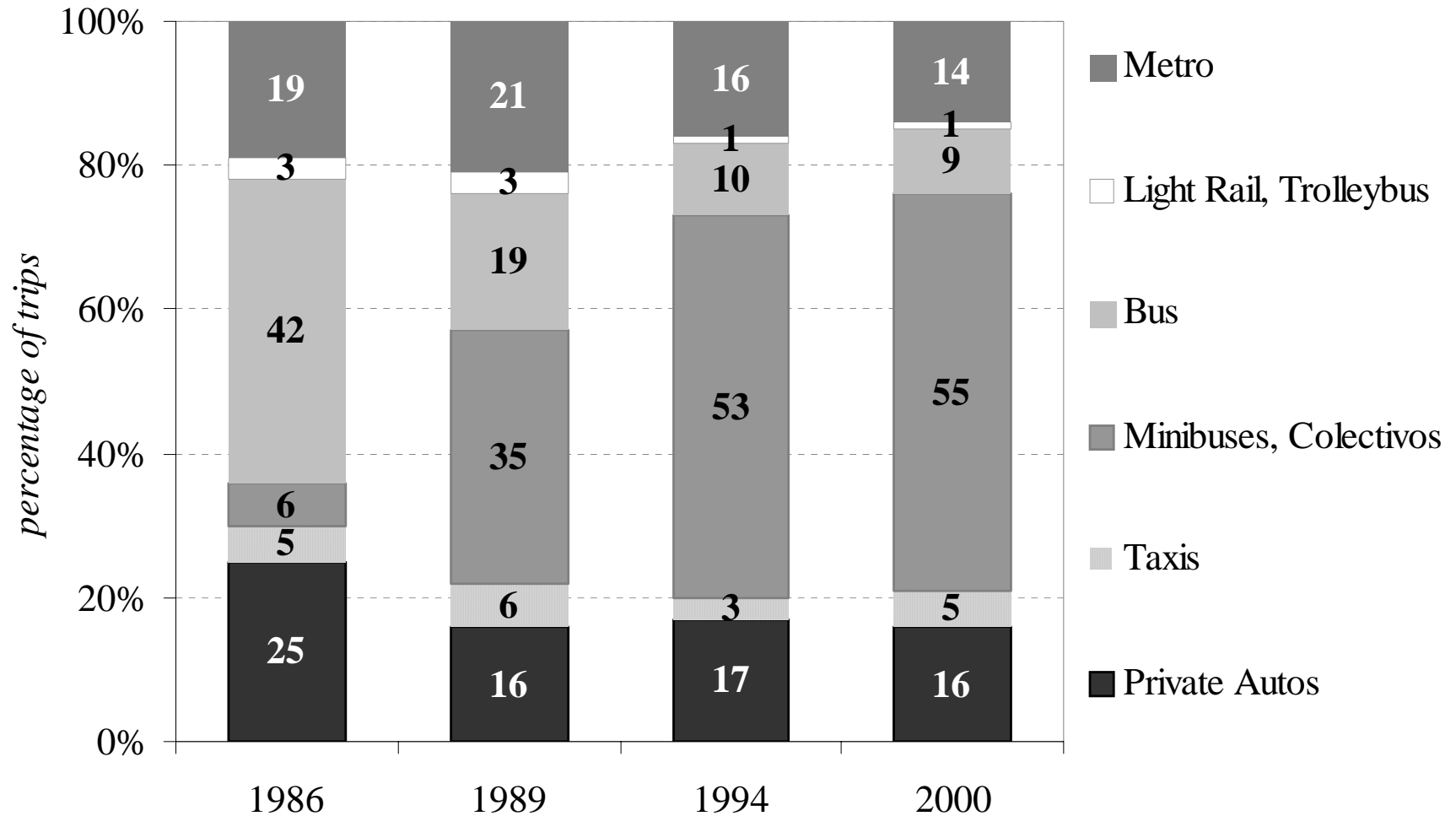
- **18 million in Mexico City Metropolitan Area (approx. 20% of national pop.)**
- **Political, economic and population center of Mexico**
- **Emerging federalism – shift of power to states**

The Mexico City Megacity Issues

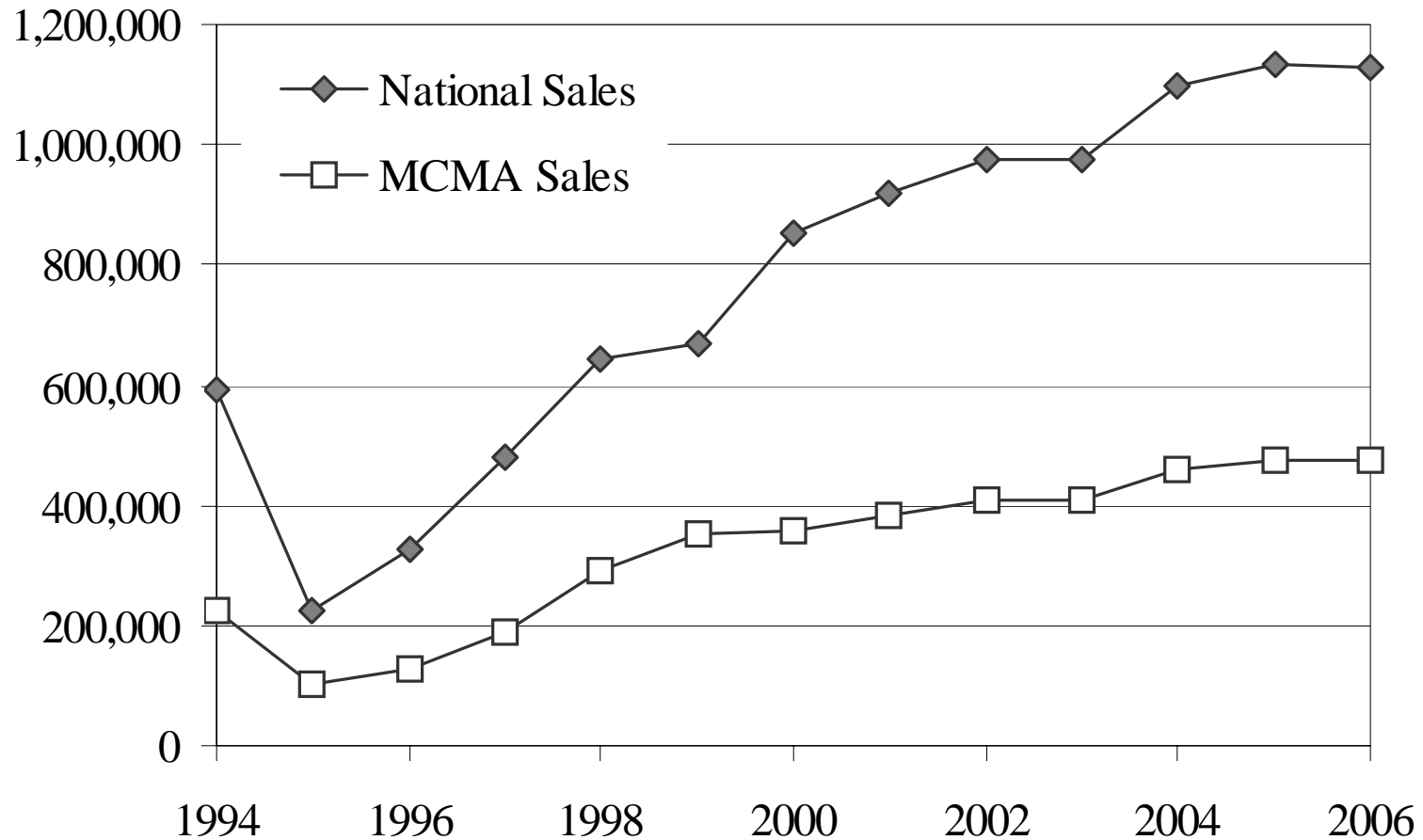
“Checklist” (con’t)

- **Expansion of urban area into less habitable zones**
- **Pressure on transportation, water and other infrastructures**
- **Change in travel demand and mode share**
- **Irregular settlements are “complemented” by irregular/informal public transportation modes**

Changes in mode split



Booming market (annual new car sales)



THE MEXICO CITY CHALLENGE

- **Retaining and improving mobility while enhancing air quality.**
 - Recognize the exceptional close linkage of transportation and air quality in Mexico City
 - Recognize that air quality improvement is not a “luxury” -- profound health effects
 - Recognize that economic activity and growth are fundamental to Mexico’s long-term interests and mobility is essential - but further, recognize that *distribution* of economic benefits is *critical*

TWO BASIC APPROACHES

- **Throttle down mobility (and economic growth) to improve air quality**
- **Attain improved air quality through growth -- get rich and clean**

**Is there a
“win-win” approach?**

THE MCMA CLIOS SYSTEM

- **The Mexico City Metropolitan Area is a CLIOS System**
 - Complex
 - Large-Scale
 - Interconnected
 - Open
 - Sociotechnical System
- **Everything affects everything else**
- **Need to work on many alternatives -- both tactical and strategic -- and be sensitive to unintended consequences**

MANY IMPORTANT TACTICAL ACTIONS

- **Enforcement**
- **Improvement in Traffic Management**
- **Implementation of Inspection Schemes**
- **...**

**as well as strategic issues
to be considered**

▪
▪
▪

STRATEGIC ISSUES

- **Land Use**
 - Control of physical extent of MCMA
- **National Policy**
 - Decentralization of economic activities on a national scale
- **Change in mix of public transport modes**
- **Economic Growth**
- **Metro Expansion**
- ...

*There is no silver bullet
Need to do “everything”*

MANY PLAYERS & INSTITUTIONAL ISSUES

- **Travelers**
- **Auto Owners**
- **Public Transport Users**
- **Transport Operators**
 - Metro
 - Colectivo Associations (drivers, owners, route associations)
 - Buses
- **Trucking Companies**
- **Inspection Stations**
- **PEMEX**
- **Auto Manufacturers**
- **Industry**
- **Political parties**
- **Government Agencies**
 - DF, EM, Federal Government, SEMARNAT, SCT, PEMEX, CAM, COMETRAVI, SETRAVI (Transport), SMA (Environment), SCT-EM, Secretaria de Ecologia
- **Environmental Stakeholders**

MANAGING A COMPLEX METROPOLITAN SYSTEM

- **Mexico City provides a clear example of how changes in the physical system can impact the types of policy-institutional structures that are needed to manage certain issues.**
- **The urbanized area has progressed beyond the Federal District across state boundaries to the State of Mexico, and more recently, to the State of Hidalgo.**
- **In this manner, *the physical system changes generated a tension across the institutional sphere, which necessitated new institutions* at the metropolitan-level.**

from Sussman, Joseph M. and Rebecca Dodder, "The Concept of a 'CLIOS Analysis' Illustrated by the Mexico City Case", Massachusetts Institute of Technology, Cambridge, MA, November 2002.

SOME CRITICAL FACTORS (I)

- 1. The institutional complexity inherent to the transportation-land use system across the continuously sprawling MCMA;**
- 2. The rapid and intensifying dispersion of activities across the MCMA, resulting in new trip patterns/ interactions among the DF and EM which the current transportation system does not adequately satisfy;**
- 3. Great disparities in infrastructure provision and institutional capacity between the EM and the DF;**
- 4. Great disparities between the EM and DF in terms of trip-making rates of residents, both currently and in the future;**

SOME CRITICAL FACTORS (II)

5. Trends in mode share evolution away from high capacity modes towards low capacity modes (colectivos and autos);
6. The conflict between colectivo and bus viability, driven by the massive growth in colectivos, political clout of their owners/operators, and subsequent difficulty in successfully concessioning out bus services;

SOME CRITICAL FACTORS (III)

- 7. High levels of subsidies for DF-operated public transport modes (Metro, trolleybuses, light rail), and stagnant or declining patronage;**
- 8. Infrastructure-oriented transportation plans, with a supply expansion focus and apparent failure to account for subsequent trip generation and changes in land use, not to mention air pollutant generation.**

POLICY AREAS (TRANSPORTATION)

- **Fleet Composition and Operations/Inspection and Maintenance**
 - Trucks
 - Buses
 - Colectivos
 - Taxis
 - Private Cars
- **Fuels**
 - Composition
- **Public Transportation**
 - Buses
 - Metro
 - Colectivos
 - Intermodalism

POLICY AREAS (TRANSPORTATION)

(CONTINUED)

- **Infrastructure/Technology**
 - Truck bypass
 - Metro expansion
 - Dedicated bus lanes
 - Intelligent Transportation Systems (ITS) pricing
- **Regional Land Use Strategies**
 - Transit-oriented development
 - Redensification
- **Institutions**
 - Transportation and environmental planning
 - Linkages between DF and EM
 - Regulation
 - Regional perspective on land use

PUBLIC TRANSPORTATION

- **Provide choice for mobility**
 - Collectivos, bus, Metro
- **Sensitivity to the public's view of quality transportation service**
- **Incentives for intermodal opportunities**
- **High-tech opportunities**
 - Smart Card, Fare Integration

PUBLIC TRANSPORTATION (2)

- **Ownership structure of operating units is important**
Behavior
- **Security is an issue that needs attention if market share is to be improved**

PUBLIC TRANSPORTATION (3)

- **No major expansion of Metro in recent years**
- **New initiative with Bus Rapid Transit**
 - “Metrobus” – 19 mile route on Insurgentes Avenue
 - Opened in 2004, now has 260,000 riders/day
 - Advanced ITS technologies, exclusive lanes, lower polluting buses
- **Shift toward light rail?**
 - Currently only one light rail line
 - Plans for more?
 - Abandoning the BRT system concept?

Hoy No Circula - Day without a Car

- **Based on license plate number and age of car**
- **Linked to vehicle emissions inspections**
- **Trying to limit daily vehicle circulation and create incentives for newer vehicle purchases to replace older vehicles**
- **Policy possibly backfired (2nd-hand family vehicle)**
- **Creates incentives for corruption (bribes to pass inspection, stealing emissions verification stickers)**

Mexico City's Central Artery

- **High levels of motorization**
- **Pressures for new infrastructure for private autos**
- **The administration's response**
 - “Segundos Pisos” (Second Stories)
 - Construction began in 2003
 - Major interchanges and flyovers between two major urban highways
 - Source of major controversy

SOME ADDITIONAL PERSPECTIVES

FLEET TURNOVER

- **Continue use of vehicle restriction days penalty in inspection programs to enhance fleet turnover**
- **Enforce existing regulations that limit age of high-use vehicles**
 - Taxis
 - Paratransit vehicles
- **Develop incentives to increase fleet turnover taking into account equity issues**
 - Use tax and license fees to encourage fleet turnover

SOME ADDITIONAL PERSPECTIVES INSPECTION & MAINTENANCE

- **The purpose of the vehicle inspection program is to:**
 - Identify high emitting vehicles
 - Cause these vehicles to be:
 - Repaired
 - Scrapped
 - Sold out of the metropolitan area
- **Improve the DF inspection program**
 - Reduce forgeries
 - Target overt audits
 - Establish undercover audits
 - Track fate of failed vehicles

INSPECTION & MAINTENANCE (2)

- **Upgrade the EM inspection program to the standards of the DF program**
 - Until the EM program is equivalent to the DF program, continue to inspect DF vehicles in the DF program
- **Use license plate renewal program to establish a high-quality registration database and link this with the inspection database to enhance compliance**

INSPECTION & MAINTENANCE (3)

- **Establish a remote sensing program to:**
 - Monitor uninspected vehicles driving in the Mexico City Metropolitan Area
 - Target inspection lanes for undercover audit
 - Monitor durability of repairs
- **Use analysis of inspection data to:**
 - Target inspection lanes for overt and undercover audit
 - Identify vehicle models by model year for more frequent or less frequent testing

INSPECTION & MAINTENANCE (4)

- **Failed vehicles should be repaired to fix the underlying cause of malfunction; merely changing the catalyst may have no lasting effect.**

SOME ADDITIONAL PERSPECTIVES NEW VEHICLE AND FUEL STANDARDS

- **Setting vehicle and fuel standards should be a highly integrated process**
- **The pace of investment in low sulfur refining capacity is crucial to success in implementing these standards, but these decisions are controlled by the treasury, not PEMEX**

NEW VEHICLE AND FUEL STANDARDS (2)

- **Dilemma:**

- Differentially priced fuels at different sulfur levels create consumer incentives to purchase fuels that damage the catalyst
- But a single fuel nationwide would increase the refining investment cost substantially, slow the availability of low sulfur fuels and could adversely affect the economy

SOME ADDITIONAL PERSPECTIVES TRUCKS

- **As a major source of PM and NOx emissions, truck pollution is a key priority for emission reductions; but far better basic data about this sector needs to be compiled:**
 - Size and composition of metropolitan area fleet and federal trucks that make through trips
 - Origin and destination studies within the MCMA
 - Emissions inventory
- **Federal emissions regulation of trucks needs to be adjusted to meet the more stringent standards of the MCMA-- a political issue**

TRUCKS (2)

- **Truck retrofit policies and incentives for fleet turnover need to be developed**
- **MCMA should consider a low sulfur diesel fuel/particulate trap program for high-use urban bus and truck fleets**

TRUCKS (3)

- **Trucks are central to the economic life of the MCMA, but new policies should be assessed with the aim of reducing usage to the greatest extent possible:**
 - Truck corridors
 - Central distribution systems
 - By-pass possibilities for through traffic

SOME ADDITIONAL PERSPECTIVES LAND USE

- **Recognize critical linkage of land use, mobility and the environment -- these systems co-evolve**
- **Need to institutionally link transportation, environmental and land-use planning**
- **Opportunities to shape the MCMA**
 - New airport -- siting -- major political issue--currently dormant
 - Metro build-out -- including transit-oriented development

LAND USE (2)

- **Densification through zoning reform**
 - Rigid rules need relaxing
 - Flows of tax revenues to delegaciones
 - Need to keep the city “alive”

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