

Air quality and urban planning: towards an integrative approach

G. Knaap ^a and T.J. Kim ^b

^a Gerrit Knaap is associate professor of Urban Planning at the University of Illinois at Urbana-Champaign, Visiting Fellow at the Center for Urban Policy and the Environment at Indiana University and Senior Research Fellow at the American Planning Association

^b T. John Kim is professor of Urban Planning and civil Engineering at the University of Illinois at Urbana-Champaign.

AIR QUALITY AND LAND USE PLANNING: TOWARDS AN INTEGRATIVE APPROACH

Integrated environmental management (IEM) is a concept that now holds great currency at the national, state, and local levels. Although definitions vary, IEM is generally considered to convey an interorganizational, coordinated approach to environmental management that takes into account social, political, economic, and institutional human actions in a particular environmental system (Margerum and Born 1995). At the federal level the U.S. Environmental Protection Agency, the Forest Service, and the Bureau of Land Management have recently launched 'ecosystem' approaches to carrying out their mandates. And at the state level, new institutional relationships have been formed to address land and water resource management. According to the Director of the Wisconsin Department of Natural Resources, a multi disciplinary, integrated approach to environmental stewardship may represent the most important scientifically and philosophically based management principle yet developed (Besadny, 1991, as quoted in

Born and Sonzogni 1995).

Despite its growing popularity, IEM as an approach to managing urban air quality is relatively new. Until recently, U.S. air policy has focused on technological approaches to emissions reductions rather than on the interrelationships between urban land use, transportation, and air quality. In recent years, however, that has changed. Since the passage of the Clean Air Act Amendments (CAAA) of 1990 and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, U.S. policy makers have increasingly viewed transportation and land use as integral issues in the management of urban air quality.

In this paper we discuss integrated land use approaches to urban air management. We begin with a review the CAA and ISTEA focusing on air quality standards and land use and transportation planning as approaches to air quality management. Next we describe policy instruments that can be used to implement such an approach and obstacles to successful implementation. These obstacles include the limitations of urban reconfiguration as an approach to air quality management, institutional impediments to the transmission of policy from the federal to the local level, and market resistance to policy implementation. We conclude with suggestions for further research and institutional development.

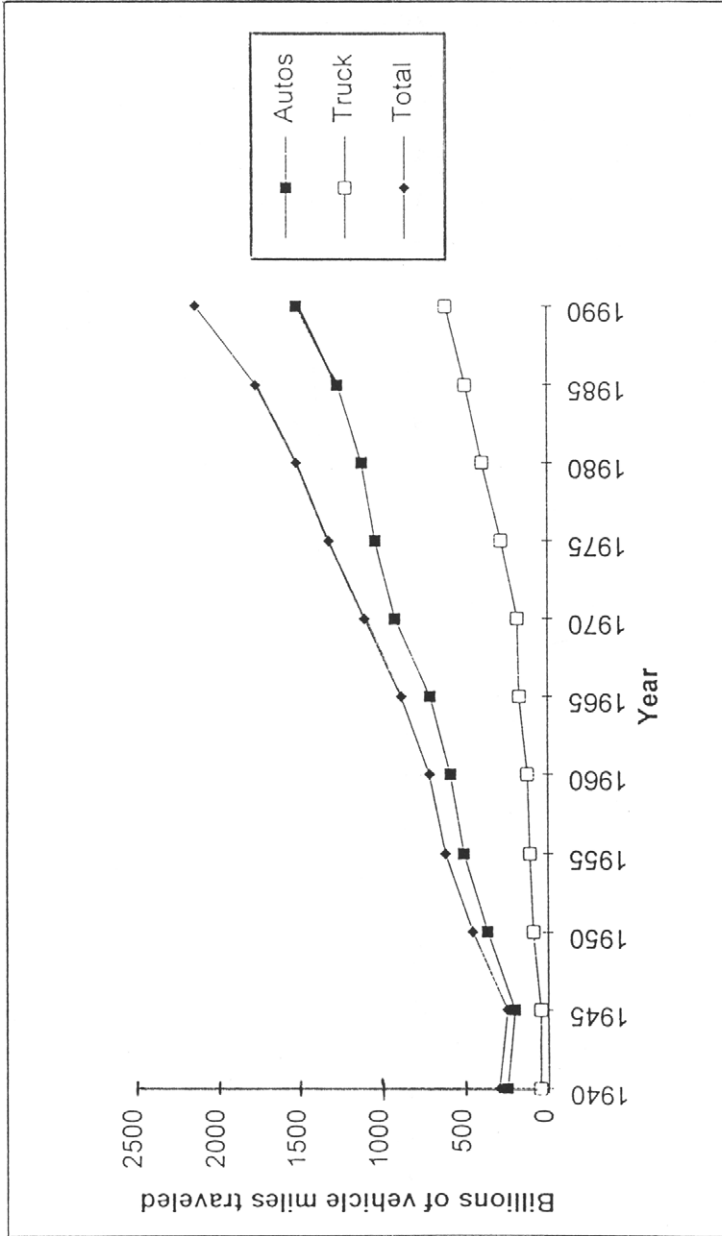
1. THE CLEAN AIR ACT AMENDMENTS AND THE INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT

The 1990 CAAA and the 1991 ISTEA provide the institutional foundation for an integrated approach to air quality management. In brief, the CAAA sets new standards for air quality, offers guidelines for meeting those standards, and authorizes incentives and sanctions the EPA can use to motivate states that fail to meet federal standards. ISTEA delegates responsibility for transportation planning to states and metropolitan planning organizations (MPO's), requires states and MPO's to develop short- and long-term integrated transportation plans, and requires such plans to further the goals of the CAAA.

1.1. Transportation and Land Use Implications of the CAAA

Under the 1970 and 1977 amendments to the original 1955 Clean Air Act, states were required to prepare state implementation plans (SIPs) to meet and maintain national ambient air quality standards (NAAQS). Although the 1955 act and the 1963 amendments did not mandate transportation planning, the 1970 amendments gave states the authority to adopt transportation control measures and the 1977 amendments explicitly encouraged greater integration of transportation and air quality management (Garrett and Wachs 1996). These amendments also enabled the EPA to impose a federal air quality plan or to withhold federal highway funds if air quality standards were not met by 1987. By 1987, however, few urban areas had met the standards, despite continuing reductions in emissions from cleaner cars and fuels, federal limits on fuel volatility, and unusually favorable weather patterns. The failure to meet these standards, in part, stemmed from continuing increases in vehicle miles traveled (VHT). (See Figure 1.)

Figure 1. Growth in Vehicle-Miles Traveled (VMT) in the U.S.



Source: Federal Highway Administration, Highway Statistics, Summary to 1985, and 1991.

The 1990 CAAA further altered the relationship between air quality management and transportation planning. Besides establishing longer, more realistic schedules for meeting air quality standards, the amendments included a classification system for metropolitan areas, based on the degree to which metropolitan areas were in compliance with national air quality standards. Metropolitan areas with the most serious air quality problems, for example, had to develop the most comprehensive strategies for reducing growth in VMT's. In addition, the CAAA identifies transportation control measures (TCM's) that states can use in their SIP's. These include public transit options, high-occupancy vehicle lanes, employer-based transportation programs, trip reduction ordinances, traffic flow improvements, mandatory no driving days, and gasoline rationing.¹ (See Table 1.)

The CAAA also contained new provisions for conformity.² These provisions made it the affirmative responsibility of the Federal agency supporting an action to ensure that its activities conform to an approved or promulgated air quality implementation plan (Shrouds 1995, p.200). Most pertinently, transportation plans and programs pursuant to Title 23, US Code or the Urban Mass Transportation Act, as amended, have to conform with the mobile source emission reduction targets in the SIP. The effect of these conformity requirements is that federal funds for transportation improvement projects will only be available for those projects that conform with the purpose of the state SIP--reducing the severity and number of NAAQS violations and the attainment of the standards. These requirements significantly altered the scope of metropolitan transportation plans. Whereas transportation plans have traditionally focused on accessibility and congestion mitigation, plans developed after the CAAA must also consider the effects of plans on VMT and the contribution of VMT's to air quality.

¹ Transportation control measures include both incentives and regulatory controls. For more on TCM's, see Shrouds (1995).

² For more on conformity, see Shrouds (1992)

Table 1. TCM's Listed in the 1990 Clean Air Act Amendment

| |
|---|
| <ul style="list-style-type: none"> ▶ Programs for improved public transit ▶ Restriction of construction of certain lanes or roads for use by buses of HOV's ▶ Employer-based transportation management programs, including incentives ▶ Trip reduction ordinances ▶ Traffic flow improvement programs that achieve emissions reductions ▶ Fringe and corridor parking facilities serving HOV's and transit ▶ Programs to limit or restrict vehicle use downtown or in other areas of emission concentration, particularly during peaks ▶ HOV/ridesharing service program ▶ Time or place restrictions of road surfaces or area to bikes and pedestrians ▶ Bike storage, lanes and other facilities, public and private ▶ Programs to control extended vehicle idling ▶ Programs to reduce extreme cold start emissions ▶ Employer-sponsored programs to permit flexible work schedules ▶ Localities' SOV trip reduction planning and development programs for special events and major activity centers, including shopping centers ▶ Pedestrian and non-motorized transport facility construction and reconstruction ▶ Programs for voluntary removal of pre-1980 vehicles |
|---|

1.2. The Air Quality Implications of ISTEA

The passage of ISTEA marked the beginning of a new era of transportation planning in the United States. The planning provisions of ISTEA require MPO's, in cooperation with state and local transit operators, to develop both a long-term regional transportation plan (RTP) and a short-term transportation improvement program (TIP) that includes projects consistent with the RTP. Fifteen factors must be addressed in preparing these plans. (See Table 2.) The RTP must accommodate transportation demands for 20 years. To serve as an implementation vehicle for the RTP, the TIP sets project funding priorities for three years and must be updated every two years. In addition ISTEA requires states to prepare a statewide RTP and TIP. As a part of the statewide plan, each state must develop traffic congestion management systems for all areas with a population greater than 200,000, known as transportation management areas (TMA's). All transportation plans and

programs within a TMA must be prepared and implemented by the MPO with local transit operators. Newly designated MPO's must include officials of major local transit agencies and state and local elected officials. The planning process must be certified at least every three years by the U.S. Department of Transportation (DOT).³

Table 2.

THE PLANNING FACTORS TO BE CONSIDERED IN THE METROPOLITAN PLAN

1. Preserve and enhance *existing transportation systems*
2. Conserve *energy*
3. Relieve and prevent *congestion*
4. Integrate transportation policies with *land use* and development policies (demand management, growth management, APFO)
5. Fund "*enhancements*"
6. Include *all transportation projects* (not just federally funded ones)
7. Make major connections (*connectivities*) with:
 - ▶ international borders
 - ▶ ports and airports
 - ▶ freight routes to modes
 - ▶ intermodal facilities
 - ▶ recreational, historic and military destinations
8. Ensure *connectivity* of metro and non-metro roads
9. Meet the needs identified through *management systems* prepared by SDOT's and MPO's
10. Preserve *right-of-way* for future projects
11. Provide for the efficient movement of *freight*
12. Use *life-cycle costing* analysis of proposed investments (and prepare major multimodel investment analysis: other modes treated like transit 'alternatives analysis' to facilitate comparative analysis across modes)
13. Transportation *impact analyses*: social, economic and environmental (include linkages between housing, jobs and transportation)
14. Enhance *transit services*
15. Enhance *transit security*

³ For an analysis of the certification process see U.S. GAO (1996).

ISTEA enhances the role of MPO's and elevates the role of air quality as a transportation planning goal. For TMA's that contain non-attainment areas for ozone and carbon monoxide, all highway projects that increase highway capacity must be addressed in the congestion management plan. Funding for projects that contribute to NAAQS attainment is provided by the Act's Congestion Mitigation and Air Quality Improvement (CMAQ) program. To further enhance their flexibility, ISTEA provides funding for projects that include wetland mitigation banking, brownfield cleanup, intelligent transit, research and planning, congestion pricing, habitat mitigation and banking, highway runoff mitigation, pedestrian greenways, and bicycle programs.

Combined, the CAAA and ISTEA provide the institutional framework for a new era in land use, transportation, and air quality planning and management. The CAAA contains specific standards, deadlines, and sanctions. Metropolitan areas that do not meet these standards must take actions to reduce VMT's through transportation planning. Transportation plans must be developed by MPO's in cooperation with state and local transportation agencies and governments, certified by the DOT, and conform with SIPs submitted to the EPA.

2. LAND USE AND TRANSPORTATION PLANNING

Concern for air quality in land use planning is not new. For many years a fundamental concern of land use planners has been the separation of uses to minimize nuisances. Evidence that air pollution represents such a nuisance has been confirmed by research demonstrating that air pollution significantly reduces land values (Knaap 1997). Recognition of the relationship between transportation and land use is also not new. For decades, transportation planners have followed the 4-step process illustrated in Figure 2.

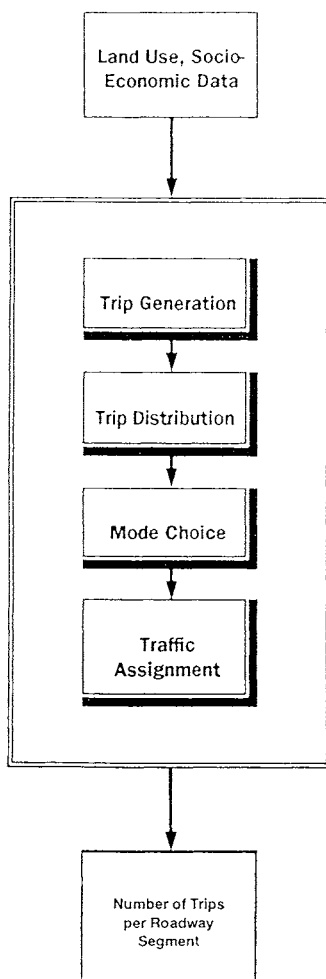


Figure 2.

In this process, land use is taken as given and the transportation system is designed to accommodate transportation demands from one location to another.

Recently, however, land use has been viewed as less of a given and more as a factor determined in part by transportation policy (Moore and Thorsness 1994). The notion that transportation systems affect land use, however, is also not new. Quoting the comments of Charles Gordon at the 1939 National Conference on Planning, Segoe (1941, P.244-5) writes: "From the planners point of view, it is important to stress the fact that the influence of transportation is such that it directly affects the nature and direction of

urban growth and development. It is not only an important urban facility to be planned, but is in itself a tool of planning. ... through the planning of transportation the planner may exercise a direct and potent influence upon the other physical aspects of urban development."

What is relatively new, and what has been highlighted by the CAAA and ISTEA, is the notion that transportation and land use planning can serve to further air quality goals. Financed in part by federal grants, new models have been developed that include feedbacks from transportation policy to land use. These models incorporate the complex dynamic interrelationships among land use, transportation, and air quality. What's more, these models provide the foundation for land use planning as an approach towards meeting national air quality standards. (See Figures 3 and 4.)

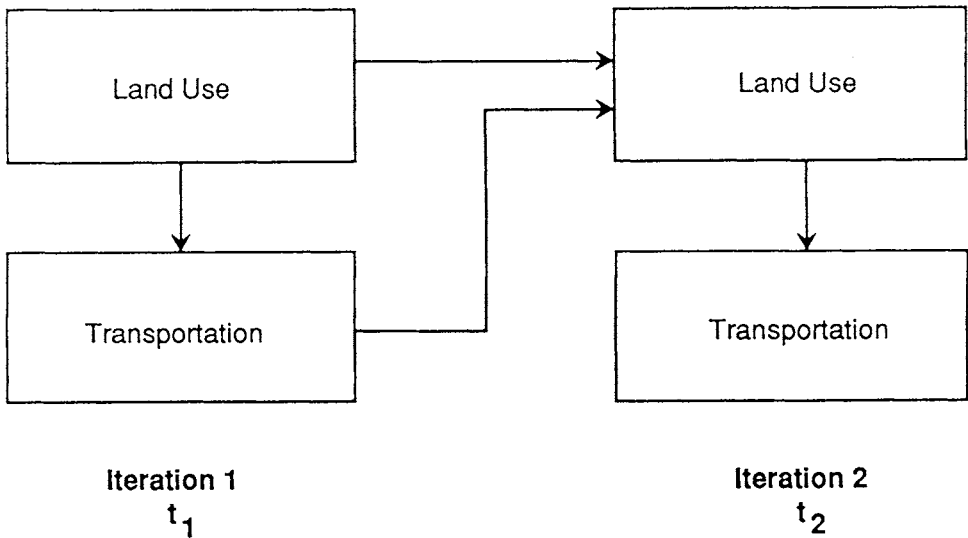


Figure 3. Iterative Land use / Transportation Analysis

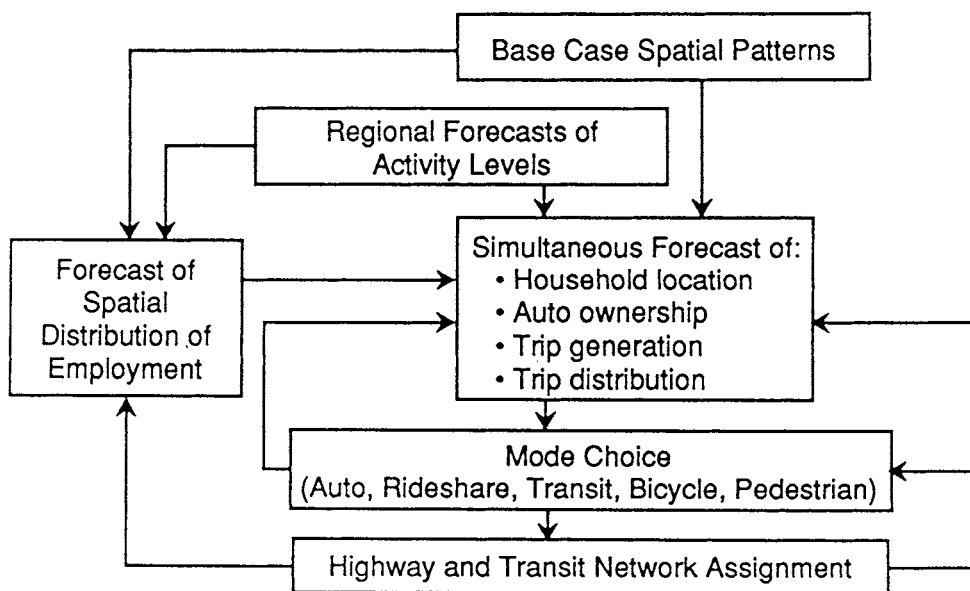


Figure 4. Simulation of Land use / Transportation Interaction

3. LAND USE POLICY INSTRUMENTS FOR AIR QUALITY MANAGEMENT

Like transportation plans, land use plans have little impact without implementation vehicles. Transportation plans are implemented primarily through direct investments in public transportation infrastructure. Because most urban land is privately owned, however, land use plans must be implemented indirectly using a variety of policy instruments. Land use policy instruments that can be used by local governments to further air quality goals include urban growth boundaries, zoning, parking regulations, design review, jobs-housing balance programs, property taxes, impact fees, and public expenditure programs.

3.1. Urban Growth Boundaries

Urban growth boundaries (UGB's) are policy instruments used for a variety of purposes

that include urban spatial containment, increasing urban densities, guiding the extension of urban infrastructure, and increasing certainty in the regulatory environment--all of which could serve to improve air quality. Urban containment could lead to shorter trip lengths. Increasing urban density could encourage transit as a modal choice. Guiding the extension of urban infrastructure could lead to better integrated urban transportation systems. And increasing certainty in the regulatory environment could guide private investments toward transit-complementary uses. In the Portland, Oregon, metropolitan area, for example, UGB's are being used to contain urban sprawl, facilitate transit ridership, reduce automobile trip lengths, and enhance urban air quality. (See Figure 5.) The efficacy of UGB's as tools towards these ends, however, remains unproven, and requires considerable cooperation among local governments within a metropolitan area. Further, to have significant impacts on the density and spatial extent of the metropolitan area, UGB's are likely to raise land and housing prices. Whether UGB's can withstand the political pressures created by rising land and housing prices remains to be seen.

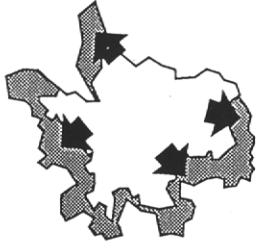


METRO

Region 2040 at a glance...

Figure 5.

CONCEPT A



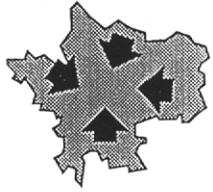
What we did:

- ▶ **Urban Form:** Significant expansion of the UGB. New growth at urban edge develops mostly in the form of housing.
- ▶ **Major Roads:** 10,190 lane-miles.
- ▶ **Transit:** 12,322 daily service-hours.

What happened:

- ▶ **Congestion:** Worst of the three growth concepts, with nearly 12% of roadways having significant peak-hour congestion.
- ▶ **Transit ridership:** 372,390 daily riders.
- ▶ **Trip length:** Total vehicle miles traveled (VMT) more than double 1990 levels; VMT per capita would increase 5.2% over 1990.

CONCEPT B




What we did:

- ▶ **Urban Form:** No expansion of the UGB; growth accommodated through development of existing land and infill.
- ▶ **Major Roads:** 9,820 lane-miles.
- ▶ **Transit:** 13,192 daily service-hours.

What happened:

- ▶ **Congestion:** Slightly less than Concept A, with significant congestion on more than 11% of major roadways
- ▶ **Transit ridership:** Highest of the three concepts, with 527,758 daily riders.
- ▶ **Trip length:** Greatest reduction in VMT per capita, dropping 12.4% from 1990.

CONCEPT C



What we did:

- ▶ **Urban Form:** Slight expansion of the UGB, with growth encouraged in regional centers and neighboring cities.
- ▶ **Major Roads:** 10,327 lane-miles.
- ▶ **Transit:** 12,553 daily service-hours.

What happened:

- ▶ **Congestion:** Least of the three concepts, with slightly over 8% of roadways having significant peak-hour congestion.
- ▶ **Transit ridership:** 437,178 daily riders.
- ▶ **Trip length:** Slight reduction in VMT per capita, with a decrease of 3.8% over 1990.

*Population and employment were held constant among the growth concepts, with an assumption of 2.67 million residents and 1.63 million jobs.

3.2. Zoning

Zoning is perhaps the most widely used instrument to control the type and intensity of urban land uses. Most often, zoning has been used to separate uses and to limit residential density, which increases trip lengths and encourages automobile use. Relaxing such zoning constraints might have the opposite effects. Under the label the 'new urbanism' plans for entire cities have been developed that include regional town centers, local town centers, and transit focused neighborhood centers (Katz 1994). New comprehensive plans for the cities of Portland and Seattle, for example, rely extensively on mixed use and transit focused zoning. (See Figure 6.)

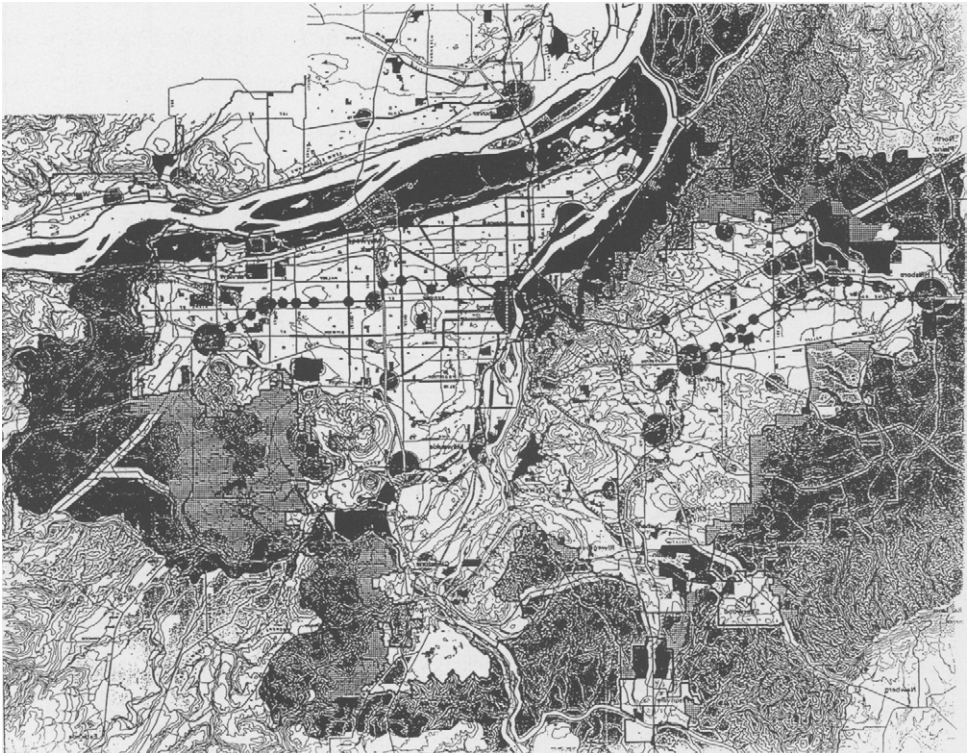


Figure 6.

Proponents of the new urbanism argue that mixed use zoning can reduce automobile travel (Bartholomew 1995, Morris 1997). These proponents claims, for example, that zoning which allows vertical separation of retail and residential uses in the same building, can reduce home-based travel; zoning that allows banks, day care, restaurants, and dry cleaning near suburban employment centers can reduce work-based travel; and zoning that requires transit-supportive uses in transit station areas encourages transit use. Finally, proponents argue, zoning that permits high residential densities enables public transit routes to serve a larger number of points, can lower the per-person cost of ridership, and can increase the frequency of service. Research has shown, for example, that feeder bus service is viable at a density of seven units per acre and a high-frequency bus service is viable at 15 units per acre, yet current zoning regulations typically limit residential densities below five units per acre (Morris 1997).

The extent to which traditional zoning regulations limit densities and separate uses, however, remains a matter of dispute. Although early studies found that allowable use and density zoning affected land values and thus, by inference, lowered density and separated uses, more recent studies have found that zoning tends to follow that market and that actual development densities fall short of zoned densities (Knaap 1997). These results cast doubt on the extent to which land uses would change if zoning constraints were removed. Further, the extent to which mixed use zoning results in a mixture of land uses remains untested.

3.3. Parking Regulations

Parking is an inherent by-product of automobile transportation and a large consumer of urban space; parking regulations thus have a potentially significant influence on transportation mode choice and the spatial structure of urban areas. To encourage walking, bicycling, and transit ridership, parking regulations can be used to alter the location, supply, and design of parking space (Morris 1997). Parking space located between buildings and a public street, for example, give automobile users greater building access than pedestrians. To encourage pedestrian travel, parking could be prohibited between buildings and the street, building set backs could be limited, and parking could be located behind buildings. (See Figure 7.). Parking regulations that

require excessive parking supplies for commercial or residential development lower the overall density of development, facilitate automobile use, and can create large spaces that impede pedestrian and bicycle travel. To counter these effects, communities can lower minimum parking requirements or impose parking space maximums. Finally, parking regulations can be used to alter the design of parking lots. Design requirements might include buffering and interior landscaping, retail uses on the lower levels of parking structures, and dedicated spaces for bicycles.

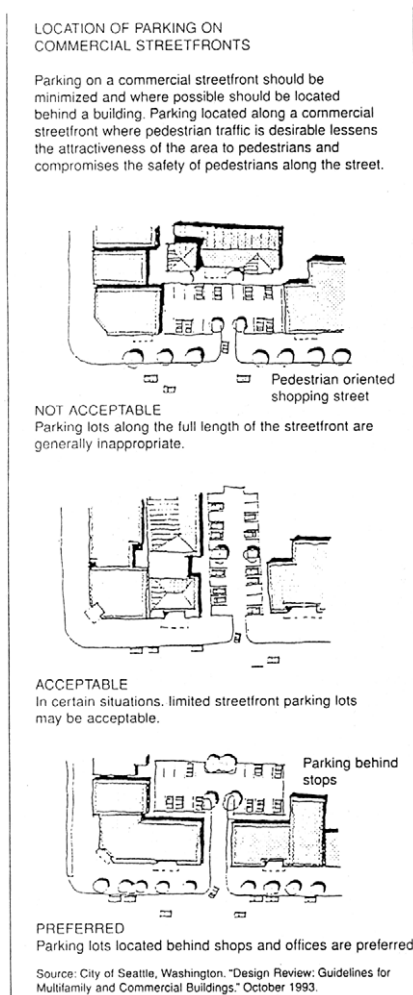


Figure 7. Parking lot guidelines

3.4. Design Review

In recent years, urban designers have designed transit-oriented developments (TOD) that maximize transit friendliness (Calthrope 1993). Such TOD's incorporate mixed land uses, high density residential development, and street patterns that facilitate public transit use. (See Figure 8.)

Transit-oriented development, such as this community designed by Peter Calthrope Associates, is one component of the IUTRAQ alternative to a bypass freeway west of Portland. Such site plans could generate significantly fewer auto trips than conventional development.

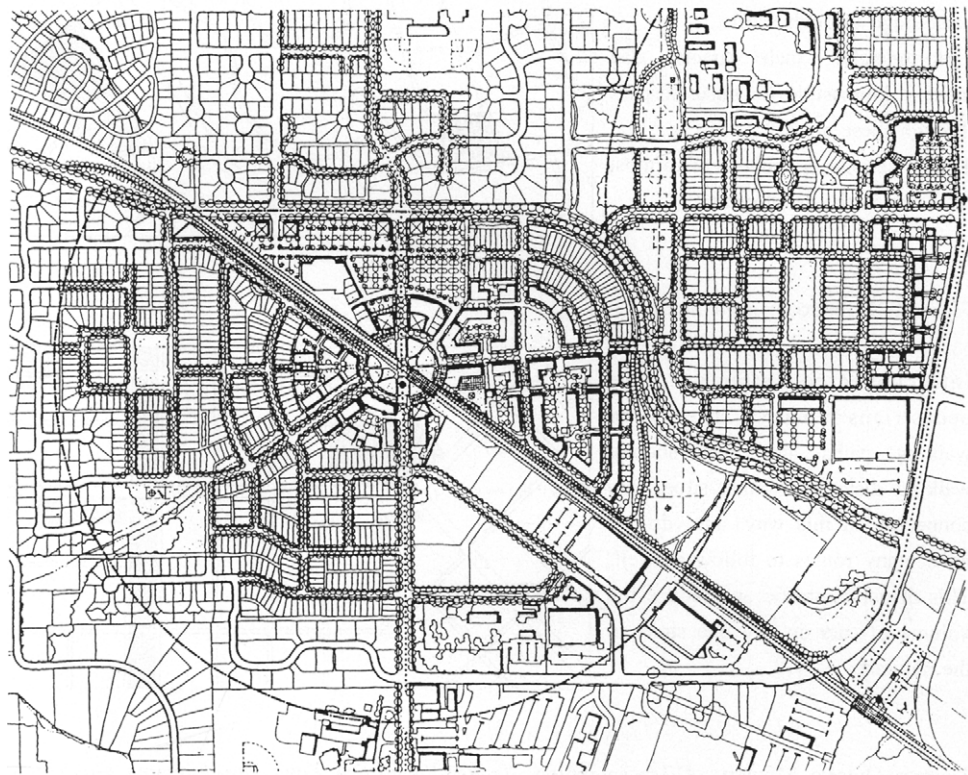


Figure 8.

The market for TOD's in the United States remains largely untested, but new developments could become marginally more transit friendly--perhaps through design review. Design review is a process through which a proposed development or subdivision must pass before receiving a building permit or subdivision approval. Design reviews could be conducted, for example, to assure that subdivisions and developments provide a continuous, direct and convenient transportation linkages; provide a pedestrian-friendly environment; offer interesting and attractive spaces; and conserve open spaces for public use (Morris 1997). (See Figure 9.)

Figure 9.A. Disconnected Streets

Recent practice has emphasized discontinuous streets, such as loops and cul-de sacs, in order to discourage through traffic. Unfortunately, such streets also make it impossible for buses to pass through these areas. Transit service is convenient to most residents in the development.

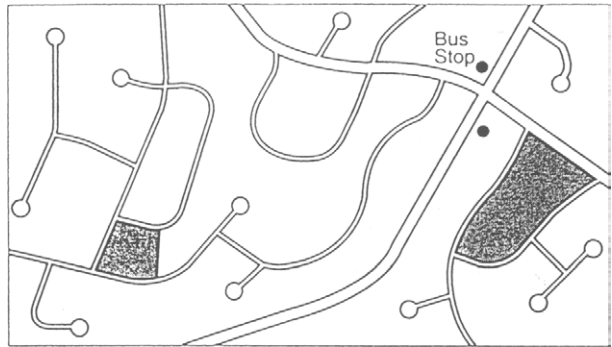
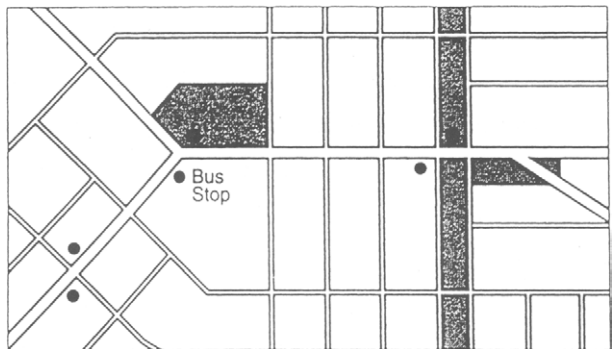


Figure 9.B. Interconnected Streets

Interconnected streets gives pedestrians many alternative walking paths and help shorten walking distances. When streets are connected in this way, auto drivers have many routes to follow as well. This disperses traffic and reduce the volume of cars on any one street in the network.



Source: Ontario Ministry of Transportation, *Transit-Supportive Land Use Planning Guidelines*, April 1992.

3.5. Jobs-Housing Balance

The separation of jobs from residences has created what some call a jobs-housing imbalance. This imbalance, according to this perspective, causes excessive commuting between job rich and housing rich communities. Evidence of a jobs-housing imbalance in the Chicago and San Francisco metropolitan areas is offered by Cervaro (1989, 1996). To correct the imbalance Cervaro (1989) offers a number of policy alternatives, including growth phasing (in which building permits are regulated to assure a balance of jobs and housing units), office-housing linkages (which require office developers to provide or fund housing construction), jobs-housing negotiations in the development review process, and state and regional housing allocation programs.

The role of public policy in balancing jobs and housing among communities, however, remains highly disputed. Gordon and Richardson (1988), for example, argue that journey-to-work trips represent a minority of VMT, especially during peak-hour travel, and that jobs-housing imbalances are self correcting as jobs follow housing to the suburbs. Further, Moore and Thorsnes (1994, P.108) claim policies relating to a jobs-housing balance will get lip service but, for lack of an ability to define, implement, or enforce them, little more. At best, concerns about having housing near employment opportunities will manifest themselves as mixed-use zoning or performance standards, which could be more sensible than numerical quotas for a specific mix of jobs and residences. Finally, after reexamining the issue in the San Francisco area, Cervaro (1996, P. 508) concludes: "To the degree that it exists, any problem of jobs-housing imbalance is fundamentally one of barriers to the production of suitable housing in job-rich cities and subregions Thus, one of the many policy challenges to planners in coming years will be to break down barriers to residential mobility, such as NIMBY resistance, large-lot zoning, and other exclusionary policies."

3.6. Tax Abatement, Impact Fees, and Public Expenditures

Tax abatement and public expenditures have long been popular policy instruments used to influence private investment and urban form. The widespread use of impact fees is relatively new. Traffic impact fees are a potentially effective tool for shaping urban developments and transportation choices (Morris 1997). By assessing traffic impact fees,

local governments can force developers to bear the costs they impose on the transportation system. When properly assessed, such fees can foster a more efficient and equitable system of infrastructure finance. What's more, by assessing such fees based on the extent of traffic impacts, such fees will automatically encourage a more transit-friendly mix, density, and design of urban development. (See Table 3.)

Table 3.

| TRAFFIC IMPACT FEE REDUCTION INCENTIVES | |
|---|---------------|
| Action | TIF Reduction |
| Development within the Transit Overlay District* | 2% |
| Construction of on-site but off road internal walk/bike network | 12% |
| Construction of direct walkway connections to the nearest arterial for non-abutting development | 3% |
| Commercial development which would be occupied by an employer subject to and complying with, section | 4% |
| Direct walk/bikeway connection to destination activity (such as a commercial/retail facility, park or school) if residential development or to origin activity (such as a residential area) if commercial/retail facility | 2% |
| Installation of on-site sheltered bus-stop (with current of planned service or bus stop within 1/4 mile of site with adequate walkways if approved by C-TRAN) | 1% |
| Installation of one secure bike parking space per 10 vehicular parking stalls | 1% |
| Connection to existing or future regional bike trail (either 1% directly, or by existing, safe access) | 1% |
| Voluntary compliance with Commute Trip Reduction Ordinance by non-regulated employers | 5% |
| Designation of 10 percent of all non-residential parking as carpool/vanpool parking facilities if located in a manner maximizing accessibility subject to ADA requirements** | 1% |
| Total if all strategies were implemented | 22% |
| * Automatic reduction for developing within Transit Overlay District and compliance with the provisions of this Ordinance. | |
| ** Requires regular maintenance. | |

Tax abatement and public expenditures have often been used to foster economic development, though often for dubious reasons. Such instruments could also be used, however, to further air-quality management goals. In the Portland metropolitan area, for example, financial incentives are now used to encourage transit-supportive land use development in light-rail station areas. In such station areas, developers are offered tax incentives and public subsidies if their proposed development meets certain transit-oriented criteria. Tri-Met, the operator of the metropolitan transit system, has also published ads in periodicals such as *Urban Land* to attract the attention of appropriate developers.

4. DILEMMAS IN PLANNING FOR AIR QUALITY

Although a variety of land use policy instruments have been developed and are now being used to further air quality goals, dilemmas remain. These include the uncertain influence of land use on air quality, institutional impediments to policy transmission, and market resistance to plan implementation.

4.1. The Influence of Land Use on Air Quality

Despite the growing popularity of land use planning as an approach to air quality improvement, the influence of land use change on air quality remains in considerable doubt. To address this question, transportation planning models have been developed to incorporate the interrelationship between land use and transportation and the effects of transportation choices on ambient air quality. To date, however, such models have produced mixed results. Preliminary results from an ongoing research project in the Portland, Oregon, metropolitan area, led by 1000 Friends of Oregon, suggest that transit-oriented land use development can lower automobile ownership rates, encourage walking, biking and transit ridership, reduce VMT, and by implication, improve urban air quality (Bartholomew 1995). Although the projected changes in transportation patterns are not dramatic, they are expected to increase over time. The results of this work has been examined by the Oregon Department of Transportation as one of five alternatives to

a proposed freeway in an environmental impact statement. In a less well known study, Scheuernstuhl and May (1992) examined the relationship between land use and air quality in the Denver metropolitan area. Although they found that increased densities led to increase public transit ridership, they concluded that land use change had little or no effect on air quality except perhaps over a very long period.

4.2. Institutional Impediments to Policy Transmission

The CAAA and ISTEA provide the foundation for a land use approach to air quality management. The CAA sets national air quality standards and requires states to consider transportation and land use approaches for meeting those standards. ISTEA requires states to prepare integrated transportation plans and requires that those plans conform with CAAA implementation plans. Most importantly, federal legislation includes financial support to prepare and implement such plans.

Federal legislation also establishes institutional linkages from the state to the metropolitan level. ISTEA requires all states to prepare statewide transportation plans and to designate MPO's to prepare metropolitan plans that conform with the statewide plans. Therefore, because MPO's are creations of the state without home rule powers, there is both an institutional and procedural link between state and metropolitan transportation planning.

Within most metropolitan areas, however, the institutional linkages between MPO's and local governments are relatively weak. Although MPO's were required to maintain the 3-C (comprehensive, continuous, and cooperative) planning process, the extent of coordination between MPO's and local governments varies widely. In Chicago, for example, the MPO is the Chicago Area Transportation Study, with complex links to local governments. (See Figure 10.) In many metropolitan areas, the MPO is a Council of Government, a voluntary association of local governments with no statutory power. In Portland, the MPO is Metro, a regional government with a directly-elected board and statutory authority to require local land use plans to conform with metropolitan plans. In Portland, therefore, it is likely that regional land use approaches to air quality problems

can be successfully transmitted to local governments.⁴ In other metropolitan areas, the likelihood is considerably less.

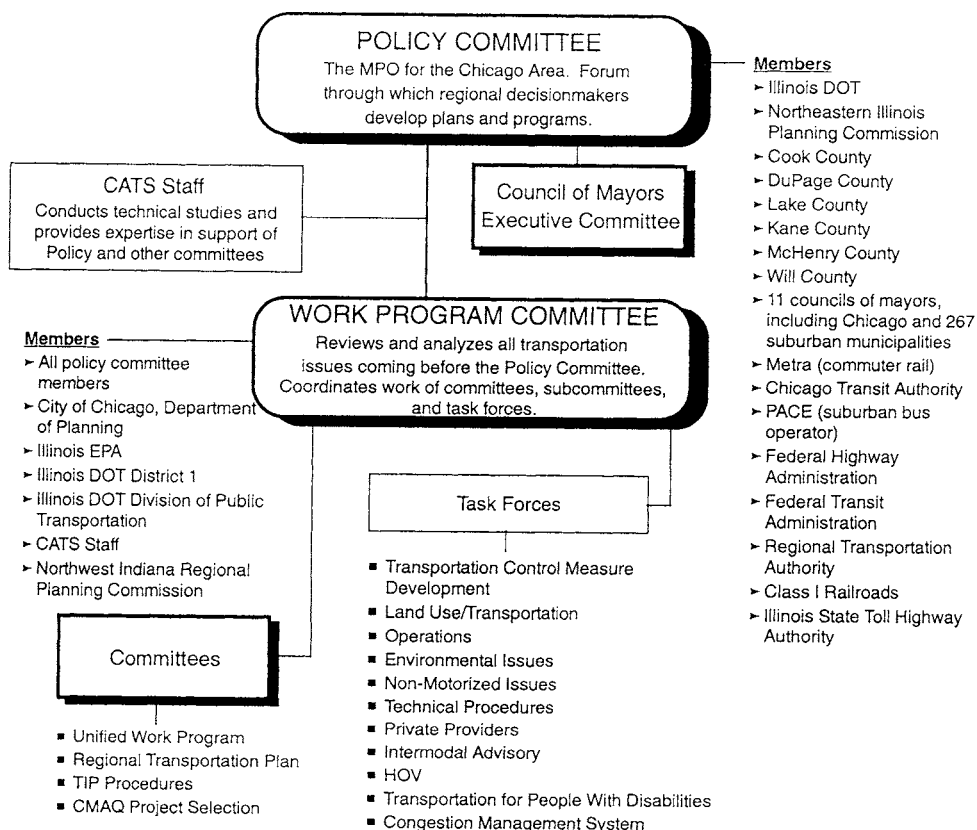


Figure 10. Organization and Membership of the Chicago Area Transportation Study (CATS)

⁴ The transmission of metropolitan land use policies to local governments in Oregon is strengthened by the statewide land use program. See Knaap and Nelsen (1992).

4.3. Market Response to Land Use Instruments

Finally, even if all local government adopt land use plans designed to further air quality goals, the influence of land use policy instruments remain in doubt. Gordon and Richardson (1997), for example, argue that U.S. metropolitan areas would have looked much the same without the construction of the interstate highway system. Further, the influence of urban growth boundaries, zoning, design review, parking regulations, and jobs-balance strategies on land use and transportation patterns remain untested and highly disputed. Even supporters of land use approaches to transportation and air quality problems acknowledge that no single land use instrument is likely to have much effect, and that only when multiple instruments are use in a complementary and coordinated fashion are significant changes likely to occur (Moore and Thorsnes 1994). Clearly what is needed is empirical research on how land markets respond to transportation-oriented land use instruments, and how transportation behavior and air quality respond to land use change. Fortunately, significant research on both of these issues is now underway.⁵

5. SUMMARY AND CONCLUSIONS

Despite its uncertain efficacy, land use planning to address transportation and air quality problems has been institutionalized as a national policy approach. The mandates imposed and the funds made available by the CAAA and ISTEA assure that such an approach will receive considerable attention by local governments over the next few years as well. To implement such an approach a variety of policy instruments are available, some new and some old but redirected. The efficacy of these policy instruments, however, remains in dispute and will probably remain so for years if not decades. In light of this uncertainty, therefore, it seems inappropriate for the federal government to prescribe specific policy approaches or instruments. Land use and transportation policy choices

⁵ One example of a research project designed to address these issues is underway at the University of Illinois. Titled "Does Planning Matter" this project uses dynamic geographic information systems to monitor the land development process in metropolitan Portland Oregon and to analyze the efficacy of land use policy instruments. See Ding, Hopkins and Knaap (1997).

involve difficult value-laden choices on which the residents of different metropolitan areas might strongly disagree. Over the next several years, therefore, mandates for compliance with national standards should remain, but local experimentation with alternative policy instruments should be allowed to continue. Only through continued policy experimentation, empirical research, and institutional development can a nation learn what contributions integrated land use, transportation, and air quality management can make toward air quality improvement, and what sacrifices must be made to achieve such a result.

REFERENCES

1. Bartholomew, K.A., 1995, A Tale of Two Cities, *Transportation*, 22: 273-93.
2. Born, S.M. and W.C. Sonzogni, 1995, Integrated Environmental Management: Strengthening the Conceptualization, *Environmental Management*, 19,2: 167-81.
3. Calthorpe, P., 1993, *The Next American Metropolis--Ecology, Community, and the American Dream*, New York, NY: Princeton Architectural Press.
4. Cervaro, R., 1996, Jobs-Housing Balance Revisited: Trends and Impacts in the San Francisco Bay Area, *Journal of the American Planning Association*, 62,4: 492-511.
5. Cervaro, R., 1989, Jobs-Housing Balancing and Regional Mobility, *Journal of the American Planning Association*, 55,2: 136-50.
6. Ding, C., L. Hopkins, and G. Knaap, 1997, Does Planning Matter? Visual Examination of Urban Development Events, *Landlines*, 9,1: 4-5.
7. Environmental Planning and Economics, Inc, 1992, *Clearing the AIR, Choosing the Future: Reducing Highway Vehicle Emissions in the Chicago Ozone Non-attainment Area*, Final Report, Springfield, IL: the Illinois Department of Energy and Natural Resources Office of Research and Planning.
8. Ewing, R., 1997, Is Los Angeles-style Sprawl Desirable?, *Journal of the American Planning Association*, 63,1: 107-26.
9. Garrett, M. and M. Wachs, 1996, *Transportation Planning on Trail: The Clean Air Act and Travel Forecasting*, Thousand Oaks, CA: Sage.
10. Gordon, P. And H.W. Richardson, 1997, Are Compact Cities a Desirable Planning Goal?, *Journal of the American Planning Association*, 63,1: 95-106.
11. Gordon, P., A. Kumar, and H.W. Richardson, 1988, *Beyond the Journey to Work*,

- Transportation Research-A, 22,6: 419-26.
12. Katz, P., 1994, *The New Urbanism--Toward an Architecture of Community*, New York, NY: McGraw Hill.
 13. Kessler, J. and W. Schroeer, 1995, *Meeting Mobility and Air Quality Goals: Strategies that Work*, Transportation, 22: 241-272.
 14. Knaap, G.J., 1997, *The Determinants of Metropolitan Land Values: Implications for Regional Planning*, unpublished working paper, Department of Urban and Regional Planning, University of Illinois.
 15. Knaap, G.J. and A.C. Nelson, 1992, *The Regulated Landscape: Lessons on State Land Use Planning from Oregon*, Cambridge, MA: Lincoln Institute of Land Use Policy.
 16. Lyons, W. M., 1995, *Policy Innovations of the US Intermodal Surface Transportation Efficiency Act and the Clean Air Act Amendments*, Transportation, 22: 217-40.
 17. Moore, T. and P. Thorsness, 1994, *The Transportation/ Land Use Connection*, PAS report # 448/339, Chicago, IL: American planning Association.
 18. Morris, M., 1996, *Creating Transit-Supportive Land-Use Regulations*, PAS report # 468, Chicago, IL: American Planning Association.
 19. Scheuernstuhl, G.J. and J.H. May, 1992, *Land Use, Transportation, and Air Quality Relationship*, in R.L. Wayson, ed., *Transportation Planning and Air Quality*, p. 90-99, New York, NY: American Society of Civil Engineers.
 20. Shrouds, J.M., 1992, *Transportation Planning Requirements of the Federal Clean Air Act: A highway Perspective*, in R.L. Wayson, ed., *Transportation Planning and Air Quality*, p. 14-29, New York, NY: American Society of Civil Engineers
 21. Shrouds, J.M., *Challenges and Opportunities for Transportation: Implementation of the Clean Art Act Amendments of 1990 and The Intermodal Surface Transportation Efficiency Act of 1991*, Transportation, 22: 193-215.
 22. United States Advisory Commission on Intergovernmental Relations, 1995, *MPO Capacity; Improving the Capacity of metropolitan Planning Organizations to Help Implement National Transportation Policies*, Washington, DC: ACIR.
 23. United States General Accounting Office, 1996, *Urban Transportation: Metropolitan Planning Organizations' Efforts to Meet Federal Planning Requirements*, GAO/RCED-96-200, Washington, DC: USGAO.