

**BACKGROUND INFORMATION
FOR LAND USE SIP POLICY**

FINAL REPORT

Prepared for:

U.S. Environmental Protection Agency
Office of Mobile Sources
Transportation and Market Incentives Group

Contract Number 68-C7-0051
Work Assignment Number 0-09

September 30, 1998

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Prepared by:

Jack Faucett Associates
under subcontract to
Sierra Research

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NOTICE - This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis using data which are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments which may form the basis for a final EPA decision, position, or regulatory action.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	
. i	
1 INTRODUCTION	1
1.1 Purpose	1
1.2 Related Developments	2
1.3 Report Organization	2
2 LITERATURE REVIEW	4
2.1 Complementary EPA Work Efforts	4
2.2 Identification of Sustainable Land Use Policies	9
2.3 Other Relevant Literature	11
3 SURVEY METHODOLOGY	14
4 SURVEY FINDINGS	17
4.1 Examples of Land Use Measures in Air Quality Plans	17
4.2 Related Land Use Measures That Are Not Included in Air Quality Plans	25
4.3 Land Use Policies Incorporated Into Transportation Demand Forecasts	28
5 SUGGESTIONS FOR EPA'S ROLE FROM INTERVIEWS	32
5.1 Air Agency Perspective	32
5.2 MPO/COG Perspective	35
6 ANALYSIS OF FINDINGS	37
6.1 Barriers to Effective Land Use Policy	37
6.2 Barriers to Forecasting Air Quality Impacts of Land Use Policies	39
7 DIRECTIONS FOR FUTURE EFFORTS	42
7.1 Helping Metropolitan Areas Take Credit for Existing Land Use Policies	42
7.2 Promoting Adoption of Sustainable Land Use Policies	43
ACKNOWLEDGMENTS	46
APPENDIX A: List of Survey Contacts	47
APPENDIX B: Interview Discussion Questions	52

EXECUTIVE SUMMARY

Purpose

This report summarizes work done in support of the U.S. EPA Office of Mobile Sources Transportation and Market Incentive Group's efforts to reduce mobile source air pollution by providing tools to quantify, recognize, and where appropriate, credit sustainable land use and transportation practices. A number of recent and ongoing research projects have been exploring the land use/air quality linkages, focusing on topics such as the true impact of land use on air quality and improving analytical techniques for modeling these linkages. The purpose of this study was to determine whether or not air quality agencies are taking credit for land use control measures in their state implementation plans (SIP) and to determine what activities EPA might undertake to both quantify the air quality benefits of sustainable land use policies and to enable air quality agencies to take credit for these measures in SIPs.

Methodology

The primary methodology for conducting the study was to survey air quality agencies at the state and regional level and to survey metropolitan planning organizations (MPO) responsible for developing regional transportation plans and conducting conformity determinations. Prior to conducting the survey, a literature review was conducted. The purpose of the literature review was to identify the types of land use policies that are believed to have beneficial air quality impacts, the analytical issues that have arisen when considering the air quality (or emissions) benefits of these policies, and the communities around the country that are adopting and evaluating the impacts of these policies.

Twenty-seven metropolitan areas that are classified as non-attainment or maintenance areas for either ozone or carbon monoxide were surveyed. The areas are listed in Table ES-1. The survey methodology used a prescribed set of interview guidelines to engage participants in a discussion of the major issues. Interviews were conducted with EPA regional office contacts, state air quality officials, regional air quality officials, MPO staff, and several state and municipal planning officials. Air agency personnel were asked questions about land use control measures in air quality plans and about barriers to the adoption of such measures. MPO personnel were asked questions about how land use policies are taken into account in the travel demand modeling and transportation planning process. All interviewees were asked to suggest local, regional, or state land use policies that might have an effect on vehicle use and emissions. All were also asked to give their opinion as to what, if anything, EPA could do to better promote sustainable land use practices.

Key Findings

The key findings of the study fall into five major categories: 1) current state of practice of land use and air quality planning, 2) analytical methods issues and barriers, 3) barriers to adopting

Table ES-1: Metropolitan Areas Selected for Interviews

EPA Region	State	Metropolitan Area	Non-Attainment/Maintenance Status	
			Ozone	CO
1	ME	Portland	Moderate	
1	MA	Boston	Serious	Not Classified (P)
1	NH	Portsmouth	Serious	
1	RI	Providence (all RI)	Serious	
1	NY	Albany	Marginal	
1	NY/NJ/CN	New York City	Severe	Moderate
3	DC	Washington DC	Serious	
3	MD	Baltimore	Severe	
3	PA	Philadelphia	Severe	
4	NC	Raleigh/Durham	Maintenance	
4	GA	Atlanta	Serious	
5	IL	Chicago	Severe	
6	TX	Houston	Moderate	
6	TX	Dallas	Severe	
8	CO	Denver	Transitional	Serious
8	CO	Fort Collins		Moderate 1
8	UT	Salt Lake City	Maintenance	Not Classified
9	AZ	Phoenix	Serious	Serious
9	CA	South Coast (LA Area)	Extreme	Serious
9	CA	Sacramento	Severe	Moderate 1
9	CA	San Diego	Serious	Moderate 1
9	CA	San Joaquin Valley	Serious	Moderate 1 & 2 (P)
9	CA	San Francisco Bay	Non-attainment	Moderate 1
9	CA	Monterey Bay	Maintenance	
9	CA	Ventura County	Severe	
10	OR	Portland	Maintenance	
10	WA	Seattle	Maintenance	

(P): a portion of the ozone non-attainment area is in non-attainment for CO.

Ozone and CO non-attainment area may not be contiguous.

This list does not reflect the May 27, 1998 revocation of the 1-hour ozone standard for some counties

land use measures in SIPs, 4) region-wide land use planning issues and barriers, and 5) issues and barriers affecting local implementation of sustainable land use measures.

State of Practice

Table ES-2 provides a summary listing of the metropolitan areas that were surveyed that have identified land use related control measures in an air quality plan (either a federal SIP submittal or a state required plan). Table ES-3 provides a summary listing of areas that have programs to encourage alternative land use policies but who are not incorporating these programs into their SIPs. The following key findings were observed with respect to the state of current practice in land use and air quality planning.

- Nine of the metropolitan areas surveyed for this study have identified land use related control measures in an air quality plan. One of these has quantified emission reduction benefits in a federally required SIP.
- There are generally two ways that metropolitan areas may include sustainable land use policies in their air quality plans: 1) by incorporating these measures into the land use forecasts reflected in their travel demand models for regional transportation planning purposes and thus implicitly considering impacts in their SIP emission baseline, or 2) identifying an alternative land use strategy as compared to what is reflected in the regional transportation plan and conducting an independent evaluation of the emission reduction benefits of the alternative strategy as an explicit control measure.
- All metropolitan areas consider future land uses as part of their travel demand modeling process. This usually consists of allocating region-wide population and employment growth forecasts to the local (city) and traffic analysis zone (zone) level and then reflecting this allocation in the travel demand model inputs in terms of socio-economic/demographic data. More sophisticated travel demand models include other land use variables (such as access to transit or pedestrian environment factors) in their mode choice components. The Clean Air Act Amendments require SIPs to use the travel forecasts produced by these travel demand models, incorporating reasonable assumptions about future land use, population, and employment growth, although the specific impacts of these assumptions on travel behavior are often poorly characterized with existing models.
- EPA is supporting efforts to enable more sustainable land use practices in several ways. EPA is working with US DOT as part of the new *Transportation and Community and System Preservation Pilot Program*. The core goal of this program is to create a funding source for states, MPOs or local governments that want to do a better job coordinating their land use and transportation planning. Another way is through the pilot *Air Brownfields* program in Baltimore, Chicago, and Dallas. This program is working to identify a method to quantify the emission benefits of brownfields redevelopment that would enable EPA to eventually offer limited SIP credit for these activities.

Table ES-2: Land Use Measures in Air Quality Plans

Metro Area	Land Use Measure in:		Quantified	Programs
	Federal SIP	State AQ Plan		
San Francisco	No	Yes	Yes	Promote Transit-Oriented Development Promote Local Pedestrian Policies
Sacramento	Yes	Yes	Yes	Combination transportation and land use TCM
Monterey Bay	No	Yes	No	Livable Communities
South Coast (LA)	No	Yes *	No	New and Existing Development Standards
Ventura County	Yes	Yes	No	Congestion Management Program -- jobs/housing balance -- impact of land use decisions
Portland, OR	Yes	n/a	No	Urban Growth Boundary Regional Functional Plan -- local accommodation of housing and employment -- regional parking policy -- no large retail in industrial areas policy
Baltimore	Yes	n/a	No	Smart Growth Initiatives
San Diego	No	Yes	No	Indirect Source Program
New Jersey	Yes	n/a	No	State growth management

* Measure was included in 1994 Plan, then removed from 1997 Plan.

Table ES-3: Land Use Measures Not in Air Quality Plans

Metro Area	Program
Ventura County	Livable Communities -- encourage local gov'ts to revise plans to promote compact, mixed use development, ped-friendly design, transit-oriented design, etc.
San Diego	Regional Growth Management Strategy -- focus new development around rail stations
Denver	Vision 2020 -- more compact growth, preservation of open space, etc.
Fort Collins	City Plan -- comprehensive plan requires UGB, contiguous new development, etc.
Seattle	State Growth Management Act -- local governments must identify growth areas
South Coast (LA)	Clean Air Communities -- revise state environmental review to encourage design factors that reduce emissions

Analytical Methods Issues and Barriers

If metropolitan areas were to incorporate land use measures into SIPs, there are some serious analytical issues and barriers that need to be addressed given the capabilities of current travel demand and emissions models. There are no simple methodologies to quantify the emissions impacts of land use policies.

- Given that the emissions impacts of land use measures can be expressed in SIPs either implicitly (through the emission baseline) or explicitly, it is critical that the potential benefits of these measures not be double counted. The Clean Air Act states that the preparation of the SIP and subsequent revisions must be coordinated with a continuing, cooperative, and comprehensive transportation planning process as required under Section 134 Title 23 U.S.C. This planning process requires the transportation plan to take into account and be consistent with land use plans in the metropolitan area. To the extent that the provisions of these plans can be expressed as inputs to prescribed travel demand models, land use policies should already be accounted for in the SIP emission baseline. However, the impacts of some land use policies may not be captured in the prescribed travel demand models and these may be identified as control measures and their emission impacts quantified with off-model analyses
- Modeling of land use measures is an emerging area, with few standard protocols. State-of-the-art forecasting practices are being developed that can account for coarse, large-scale land use policies designed to discourage sprawl and protect open space -- policies like urban growth boundaries, adequate public facilities ordinances, transfer of development rights, etc. Some models attempt to account for smaller-scale or micro-scale land use policies designed to encourage alternative travel modes, policies like requirements for pedestrian- and bike-friendly design elements, higher density zoning around transit facilities, fine-grained mixed-use zoning, etc.

- EPA is supporting improvements to these analytical methods by funding efforts to better incorporate both regional and micro-scale land use factors in regional travel demand models.

Barriers to SIP Adoption

- Two-thirds of the survey respondents felt that EPA guidance on the expected emission reduction benefits of land use measures would be helpful, but few feel that this alone would be sufficient to motivate them to take credit for these policies in their SIP. Many respondents believe that the potential emission reduction benefits are small, that they are difficult to commit to in SIPs, and that their benefits are too far in the future for the attainment schedules required in SIPs. Nonetheless, many areas support these measures for reasons other than air quality benefits. Planners in the areas considering land use measures feel that air quality benefits provide additional justification for the adoption of these measures.
- In areas where regional agencies have no jurisdiction over local land use decisions, the regional agencies are concerned about committing to emission reductions from policies that must be adopted through local government action.
- A number of respondents, particularly MPO planners, believe that it may not be possible to credibly quantify the benefits of sustainable land use policies using existing travel demand models.

Region-Wide Land Use Planning Coordination Issues and Barriers

Land use policies that get adopted by isolated local governments may have little or no impact on regional vehicle use or emissions. Regional growth is often fixed so that growth controls in one part of the region may simply force growth to occur in other parts of the region that have not adopted growth management policies. In such instances there may be no regional emissions reductions. Therefore, regional coordination of land use planning is important if air quality benefits are to be realized.

- Jurisdiction over land use policy is granted to cities and counties by state governments. Regional land use planning is the exception and not the rule throughout the U.S. This tradition of local control over land use decisions is deeply ingrained in our political and legal system.
- State or metropolitan growth management programs are likely to be more successful in rapidly growing areas concerned about the effects of future growth on quality of life. In slow growing communities, competition among cities for growth (and associated tax revenues) is often too great to make regional growth management politically feasible.
- There may be conflicting objectives in the encouragement of regional sustainable land use policies. For example, regional policies to preserve open space or protect certain natural resources may preclude the development of shopping and employment centers near existing residential areas. These policies may actually contribute to increased VMT and emissions.

- Many of the cumulative impacts of uncontrolled sprawl development are felt most intensely by inner-ring suburbs and urban core areas, yet controls must be put in place in the outermost suburbs where unmanaged growth is occurring. While development may have locally beneficial impacts for these outer suburbs, their actions may have negative impacts on the region as a whole.
- There are relatively few areas that have voluntary regional land use policies where we can assess the impact of encouraging local adoption of land use controls and how effective these controls are at shaping local development practices.

Issues and Barriers Affecting Local Implementation of Sustainable Land Use Measures

- Areas generally lack an understanding of the positive fiscal benefits of compact, contiguous development. Local government land use policies are often shaped by fiscal concerns. Commercial development and low density (high value) residential development is often seen as a mechanism to increase the local tax base

Directions for Future Efforts

In exploring ways that EPA can be effective in enabling sustainable land use planning as part of the air quality planning process, it is useful to classify metropolitan areas into two types: those that have adopted some sustainable land use policies but need help taking credit for them, and those that have not yet adopted any meaningful land use policies.

Helping Metropolitan Areas Take Credit for Existing Land Use Policies

More research is needed to determine how effective state, regional, and local land use policies are, and methods are needed to predict the development impacts of different land use policies based on the characteristics of communities that adopt these policies.

- Current travel demand models need to be improved so that they can better account for the travel behavior impacts of region-wide land use policies. This will allow for more reliable accounting of sustainable land use policies in emission baselines and the regional transportation planning process.
- New analytical techniques are needed to account for the travel behavior impacts of micro-scale changes in land use and design features.
- More research is needed to understand the nature of actual emissions impacts resulting from different land use policies and urban form. This will provide regions that pursue alternative land use strategies greater confidence that these measures actually result in cleaner air.

Promoting Adoption of Sustainable Land Use Policies

- The potential benefits of sustainable land use policies seem to be acknowledged by many planners for a variety of reasons beyond their air quality benefits. These planners believe that EPA can be helpful in promoting the policies by identifying and publicizing relevant

examples of sustainable land use practices that could serve as models for other communities that are investigating these options.

- Since jurisdiction for land use control lies at the local level, regional and state air quality and transportation planners need to be able to gain consensus of local governments in order to implement regional land use programs. EPA could play a useful role by identifying or developing model processes for achieving consensus among local governments on regional land use policies and priorities.
- EPA and FHWA should investigate ways to use the existing metropolitan growth forecasting process as a forum for pursuing regional land use goals and strategies. In the current process, local governments are already involved in dialogue and negotiation with the regional planning agencies (MPOs and COGs) with respect to how best to allocate regional growth forecasts in consideration of local land use policies. This process could be taken a step further by engaging local governments in a collective process to achieve consensus on regional land use policies.
- In order to overcome local resistance to growth management, EPA could provide information to local governments about the fiscal benefits of compact, sustainable development.
- EPA should investigate the possibility of allowing local governments to offer adoption of sustainable land use policies as an alternative to project deletion in cases of non-conforming TIPs.
- EPA could promote efforts to modify and streamline existing environmental review processes (e.g., NEPA environmental impact statements) in ways that could recognize the adoption of sustainable development practices.

1 INTRODUCTION

1.1 Purpose

This report summarizes work done in support of the U.S. EPA Office of Mobile Sources Transportation and Market Incentive Group's efforts to reduce mobile source air pollution by providing tools to quantify, recognize, and where appropriate, credit sustainable land use and transportation practices. The work focuses on the ways that land use policies and patterns are accounted for in State Implementation Plans (SIPs) and in regional transportation planning analyses (e.g. regional transportation plans, transportation improvement programs, and conformity determinations). The study also identifies analytical and institutional barriers that impede air quality agencies from more explicitly accounting for air quality benefits of alternative land use patterns and policies in air quality plans. Information was collected primarily through interviews with air quality agencies, metropolitan planning organizations (MPOs), and councils of government (COGs), and through a review of various plans and reports produced by these agencies. Additional information was collected through interviews with selected state and local government officials, and through other literature.

EPA has traditionally sought to reduce mobile source emissions through technology and tailpipe controls, and these efforts have produced significant benefits. As automobile use continues to rise, however, it is becoming recognized that technological improvements may not be enough. Vehicle miles traveled (VMT) has been increasing well ahead of population growth. A number of factors have contributed to this rise, including more women entering the workforce, rising incomes and vehicle ownership rates, as well as recent development practices. Suburban growth patterns that segregate residential, shopping and employment centers force people to make longer and more frequent automobile trips. These segregated land uses are usually developed at densities that do not support transit service. New developments are designed in ways that make travel by walking, bicycle or transit unpleasant or impossible. Many local governments have taken steps to promote more sustainable development practices. EPA has recognized that one of the potential benefits of these policies is a reduction in vehicle use and vehicle emissions. Where they can be shown to be reducing mobile source emissions, EPA wishes to grant SIP credit for sustainable land use policies. This requires a better understanding of how land use is currently incorporated into transportation and air quality plans.

Land use policies could be accounted for in air quality plans in two general ways. A policy or set of policies could be identified explicitly as a transportation control measure (TCM) in a SIP or other air quality plan. The air agency commits to implement the policy, and calculates the resulting reduction in mobile source emissions. A policy could also be incorporated into the land use forecasting process that underlies travel demand forecasts. A SIP begins with a baseline forecast of emissions, from which control measure reductions are subtracted. This baseline is developed by forecasting future land use and travel patterns. If these forecasts fully account for the land use policies, then vehicle emissions in the baseline have already been reduced

accordingly. This could be considered implicit SIP credit. This study will explore both of these methods for incorporating land use policies.

1.2 Related Developments

Three recent developments have highlighted the need for a better understanding of the ways that transportation and air quality planning is accounting for land use policies.

EPA Voluntary Mobile Source Emissions Reduction Programs

In October 1997, EPA issued a new policy designed to allow SIP credit for Voluntary Mobile Source Emissions Reduction Programs (VMEPs). A number of states and local agencies have adopted innovative measures to reduce mobile source emissions by encouraging voluntary actions by the public. These measures include economic and market-based incentive programs, transportation control measures, trip reduction programs, ozone action programs, and targeted public outreach. These types of measures can also include state and regional growth management strategies that encourage local governments to adopt land use policies that reduce automobile use.

Growing body of literature documenting the impact of land use patterns on travel behavior

There is a rich and growing body of literature on the land use / transportation relationship. Land use patterns affect travel behavior, and transportation investments affect development patterns. These relationships are complex, and it is often difficult to isolate the effect of specific variables. But a number of careful empirical studies have shown that factors such as density, land use mixing, design elements, and transit access are related to vehicle use. At the same time, more powerful computers are making it possible to simulate the travel and emissions impacts of different land use scenarios for an entire region. These advances suggest that we may now be able to estimate the impacts of particular land use policies on travel and vehicle emissions.

Growing interest in regional and state growth management

There is a growing interest at all levels of government in examining and addressing the consequences of unconstrained urban growth. As people look to the future and see increasing congestion, worsening air quality, and the continuing loss of open space and agricultural lands, a number of states and regions have taken action. Many metropolitan areas are in the process of developing a long-range vision for themselves, and trying to put policies in place to reach that vision. Several states have adopted growth management or "smart growth" policies intended to limit unwanted sprawl development. These policies, when they take effect, may give urban areas a better tool to reduce the environmental impacts of automobile use.

1.3 Report Organization

This report is organized into seven chapters. After this Introduction, Chapter 2 describes the literature review performed for the study, including reviews of several complementary EPA work efforts. Chapter 3 describes the methodology behind the survey process. Chapter 4 presents the main findings from the survey. Chapter 5 contains suggestions given in the

interviews for ways that EPA could help to promote sustainable land use practices. Chapter 6 is a synthesis and analysis of the survey findings. And Chapter 7 discusses some possible next steps. A full list of survey contacts is included as Appendix A and an outline of the interview questions is included as Appendix B.

2 LITERATURE REVIEW

Although literature review was not the primary purpose of this work, a number of on-going and recent work efforts are closely related to the study. Documents from these efforts were reviewed in order to gain a better understanding of the work context and to make the most efficient use of the interview phase.

2.1 Complementary EPA Work Efforts

There are several other recent and on-going EPA research efforts that complement this study. They are briefly described below.

The Effects of Urban Form on Travel and Emissions: A Review and Synthesis of the Literature.

This is an ongoing contract with Apogee/Hagler Bailly under EPA's Office of Policy (OP). The draft report offers a thorough summary of recent research on the effect of land use on travel behavior.¹ Studies fall into two general categories. Empirical studies compare data collected from actual communities and try to distinguish how various land use factors lead to different travel patterns. Simulation studies use computer models to examine the impact of hypothetical land use patterns on travel and emissions.

The report concludes that changes in land use can reduce region-wide vehicle use and emissions over a period of several decades. Using simulation models, several studies have convincingly shown that modifying future development patterns in ways that make them less dependent on automobile use will reduce VMT and emissions. The reduction in emissions comes from shorter trip lengths and shifts to transit, bicycling and walking modes. While computer modeling has improved greatly in recent years, it is still subject to some serious limitations. Zonal size generally precludes modeling the impact of micro-scale design features, for example.

The report documents how numerous empirical studies have shown relationships between specific land use factors and components of travel demand. For example, compact clusters of mixed-use development are correlated with reduced trip lengths. Similarly, higher density communities of mixed land use are associated with higher shares of travel by transit, bicycling and walking. The report acknowledges the methodological flaws that limit the conclusions that can be drawn from empirical studies. Some, for example, do not control for factors like income when comparing neighborhoods. A more fundamental flaw is the fact that cross-sectional studies, by nature, cannot establish causality. Cross-sectional studies are those that compare two or more different places at the same point in time. They can show a correlation between certain land use factors and lower automobile use, but they cannot say that these same factors will *cause*

¹ *The Effects of Urban Form on Travel and Emissions: A Review and Synthesis of the Literature, Draft Report*, prepared by Apogee/Hagler Bailly for the EPA Urban and Economic Development Division, April 17, 1998.

lower auto use in new communities. Nonetheless, most experts in the field accept that there is at least some causal relationship between land use patterns and travel behavior.

A Methodology to Establish SIP Creditability of Infill Development

This is an ongoing contract with Apogee/Hagler Bailly and Criterion under EPA's Office of Policy (OP). Preliminary work performed is described in a draft report.² This study uses regional travel demand modeling to compare the travel and emissions impacts between a hypothetical development located on an infill site and on a greenfield site. Models were run for three case studies, in San Diego, California, Montgomery County, Maryland, and West Palm Beach, Florida. Each case study consisted of modeling a hypothetical large development as if it were located on an actual infill site, and then modeling the same development as if it were on an actual greenfield site. The development size remains the same in both locations, but the density and street patterns are consistent with the surrounding urban form at each location. In each case, the MPO travel demand model was used to simulate the travel impacts of the development. Environmental impacts (including NO_x and CO₂ emissions) and energy use were estimated using a GIS-based model called INDEX.

All three case studies show that locating the development on the infill site results in lower vehicle use and lower vehicle emissions. VMT per capita at the infill sites was roughly half that at the greenfield sites. NO_x emissions were 27 percent to 42 percent lower at the infill sites, even though congestion at one infill site was higher than the greenfield site. It should be noted that the INDEX model uses simplified per-mile and per-trip emissions factors, not the standard vehicle emissions models. Further work is continuing under this contract. The same simulation methodology will be used in different cities to determine how emissions reductions vary with development size and composition.

Evaluation of Modeling Tools for Assessing Land Use Policies and Strategies

This complementary effort was done for the EPA Transportation and Market Incentives Group by Systems Application International (SAI).³ Their final report was issued in August 1997. The work was intended to assess how regional land use forecasting models are able to incorporate specific land use policies. The report evaluates three commercial land use models: DRAM/EMPAL, MEPLAN and TRANUS. Each model was evaluated in terms of how well it could account for policies designed to 1) increase development densities, 2) increase land use mixing, and 3) modify design elements and infrastructure to encourage alternative travel modes. The specific policies used to achieve these goals were summarized as zoning, monetary incentives (such as subsidies to developers to build in targeted areas), and non-monetary incentives (such as reduced parking requirements).

² *The Transportation and Environmental Impacts of Infill versus Greenfield Development: A Comparative Case Study Analysis, Review Draft*, Criterion, Inc. and Apogee Research, December 17, 1997.

³ *Evaluation of Modeling Tools for Assessing Land Use Policies and Strategies*, prepared by Arlene S. Rosenbaum and Brett E. Koenig of Systems Applications International, for the EPA Office of Mobile Sources, August 1997.

The study concludes that DRAM/EMPAL, because it does not easily represent costs, cannot model the impact of any of the three types of policies. MEPLAN and TRANUS do include representations of development costs, and therefore can at least partially model zoning policies as well as monetary and non-monetary incentives. The report points out that all the models are seriously constrained by zonal size, however. They are usually run using zones the size of several census tracts, or a single census tract at the smallest. As a typical urban census tract is roughly one square mile, a model built on zones of this size could possibly detect an increase in density within a half-mile of a transit station or transit corridor. It could not detect smaller-scale land use changes. If the zonal system uses aggregations of census tracts, even transit station-area densities could not be resolved.

Transportation Impacts of Micro Scale Urban Design Elements: Data Collection and Modeling Needs

This 1998 joint DOT (FHWA)/EPA (OMS and OP) funded project will bring together current knowledge and recent research concerning the ability to appropriately reflect the transportation impacts of various micro-scale urban design elements (e.g., sidewalk width, building setback, street grid type, etc.). The schedule calls for a final report by January 1, 1999 from the contractor conducting the study, Parsons Brinckerhoff. The report will explain procedures to estimate how land use development strategies and site design elements affect travel behavior and will give examples from selected MPO experience. Particularly useful for MPOs will be a product which will relate specific urban design changes to auto ownership, trip generation (or tour or activity generation), and mode choice for use in current travel demand models.

Air Quality Impacts of Regional Land Use Policies

This 1998 joint OP/OMS-funded grant to Robert Johnston at the University of California, Davis will produce a document for policy makers at the national, state, and metropolitan levels that illustrates the air quality benefits or deficits of regional policy scenarios that affect land use development patterns. Policies that affect land use directly, such as removing density caps on zoning around rail stations, and indirectly, such as travel pricing or transit investment will be simulated. A suite of models is under development which utilizes earlier work done in the Sacramento metropolitan area. Numerous scenarios will be evaluated and compared to the expected baseline out to the year 2015. Scenarios having strong effects on region wide accessibility and affecting demand for travel or land significantly (e.g., new road capacity, major region wide transit capacity expansion, or strong travel and parking pricing policies) will be evaluated. In addition, plans call for evaluation of scenarios that include land market pricing corrections, such as incentives for infill development, and land development fees for raw land projects at the urban edge and beyond.

The simulations of land use, transit, and travel pricing scenarios for the Sacramento region using the regional MPO's travel demand model are complete. Part two of the project is underway. This will evaluate the best two or three scenarios, using two urban models that represent land development and travel, Meplan and an improved Transus. A final report is expected in late 1998. These results will give differences that take into account land use pricing and give indications of

the magnitude of land use price differentials for the various outcomes. Results will be compared to the less resource intensive modeling technique previously used.

Other Existing Federal Programs

A number of other federal government programs also support the efforts to promote sustainable land use practices. Several of these are described below.

EPA facilitates the *Smart Growth Network*, a broad coalition of developers, planners, educational institutions, public agencies, community activists and environmentalists. The aim is to promote metropolitan development that minimizes air and water pollution, strengthens local economies, preserves community character, and protects open space. The network provides practitioners a way to share examples of successful development and the lessons learned in implementing smart growth policies or techniques. The Smart Growth Network website provides examples of many smart growth practices and tools to aid smart growth advocates (www.smartgrowth.org).

Transportation Partners is a cooperative program of the EPA. The program works with citizen groups, local governments, businesses and associations to develop transportation choices and practical solutions to improve mobility, efficiency, quality of life and the environment, while reducing vehicle miles traveled. EPA teams with nongovernmental organizations who provide technical and strategic expertise for innovative community actions.

Section 1221 of the recently reauthorized federal surface transportation funding program (TEA21) provides USDOT with \$120 million over 6 years that can be granted to state, local and regional agencies that partner with non-profits, private sector interests and each other to bring together transportation and land use decisions. This new program is known as *The Transportation and Community and System Preservation Pilot Program*.

US DOT is in the early stages of designing an implementation strategy for this program. The core goal is to create a funding source for states, MPOs or local governments that want to do a better job coordinating their land use and transportation planning. Federal funds could pay to develop, assess and implement alternative investment and growth scenarios. In addition to funds for planning, US DOT is authorized to make "implementation grants" where plans have advanced far enough, and to fund cross cutting research.

The U.S. Dept. of Housing & Urban Development's (HUD) coordinates the *National Partners in Home Ownership Program*. Numerous organizations are involved in carrying out HUD's National Home Ownership Strategy, which calls attention to Sustainable Development. Home Ownership Zones support rebuilding and revitalizing old neighborhoods with New Urbanism principles. Included in this program is support of location efficient mortgages, which would reward purchasers of homes in areas that are less dependent on automobile travel.

The *Location Efficient Mortgage (LEM)* is an innovative mortgage product that will be offered in Chicago to low-and moderate-income borrowers who are interested in living in urban areas

served by public transportation systems. The Federal National Mortgage Corporation ("Fannie Mae") has agreed to initiate a \$100 million market test of the LEM in Chicago. The current time schedule calls for a roll-out of the product by four Chicago mortgage lenders in 1998. A working team from Fannie Mae and the LEM Partnership is now developing underwriting standards and a marketing plan for the test of the LEM in Chicago. EPA is funding the evaluation of the air quality impacts through a cooperative agreement with the Center for Neighborhood Technology. The EPA funding will be used to develop a methodology to quantify air quality impacts and explore SIP credit via the new voluntary measures policy.

The EPA *Brownfields Assessment Demonstration Pilots* provide money to states, cities, towns, counties, and tribes to facilitate cleaning up sites contaminated with hazardous substances and returning them to productive use. Pilot funding is used to test redevelopment models, direct special efforts toward removing regulatory barriers, and facilitate coordinated site assessment, environmental cleanup and redevelopment efforts at the federal, state, and local levels.

EPA (OAR, OSWER, and OP) is also working with the U.S. Conference of Mayors (USCM) and the Department of Commerce's Economic Development Agency (EDA) on a pilot *Air Brownfields* program in Baltimore, Chicago, and Dallas to identify a method to quantify the emission benefits of brownfields redevelopment that would enable EPA to eventually offer limited SIP credit for these activities.

EPA's *Transportation Air Quality (TRAQ) Center* provides state and local air quality regulators and transportation planners with access to critical information regarding opportunities, grant funding sources, useful contact names, and technical assistance. More information about the Center's activities can be obtained on the World Wide Web (<http://www.epa.gov/oms/transp.htm>).

The Center of Excellence for Sustainable Development helps communities design and implement innovative strategies that enhance the local economy as well as the local environment and quality of life. Created by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, the Center of Excellence can:

- Define what sustainable development is and how it can apply to you;
- Show how sustainable development is being practiced by other urban and rural communities across the nation;
- Provide communities with a "tool kit" of sustainable information including manuals, workbooks, data bases, case studies and model codes and ordinances;
- Help communities identify public and private sources of technical and financial assistance to carry out their programs;
- Provide communities with information about the public participation processes other communities have found work best in planning and implementing sustainable development; and
- Develop a menu of energy efficiency and renewable energy programs that fit the unique needs of each community.

More information about the Center can be obtained from their web site (<http://www.sustainable.doe.gov/>).

The *Travel Model Improvement Program (TMIP)* is a multi-year, multi-agency program to develop new travel demand modeling procedures that accurately and reliably forecast travel for a broad range of modes, policy actions and operational conditions. To remedy current model deficiencies, the Department of Transportation (including the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the Office of the Assistant Secretary for Transportation Policy) and the U.S. Environmental Protection Agency (U.S. EPA) have initiated the Travel Model Improvement Program to enhance current models and develop new procedures. Texas Transportation Institute (TTI), under contract to FHWA, is responsible for overall program support and outreach efforts.

The objectives of the Program are: 1) To increase the policy sensitivity of existing travel forecasting procedures and their ability to respond to emerging issues including environmental concerns, growth management, and changes in personal and household activity patterns, along with the traditional transportation issues; 2) To redesign the travel forecasting process to reflect today's traveler behavior, to respond to greater information needs placed on the forecasting process, and to take advantage of changes in data collection technology; and 3) To make travel forecasting model results more useful for decision makers. The models developed in this program will determine the effects of transportation improvements on congestion, air quality, and land development.

2.2 Identification of Sustainable Land Use Policies

Literature was also reviewed in order to identify all the land use policies that might be relevant to this study. Knowing and understanding these policies was useful in helping to identify them during interviews. There are several recent documents that provide useful summaries of regional and local land use policies. These documents include the following: *Evaluation of Modeling Tools for Assessing Land Use Policies and Strategies*, Systems Applications International, 1997; *Transportation-Related Land Use Strategies to Minimize Motor Vehicle Emissions: An Indirect Source Research Study*, California Air Resources Board, 1995; *Improving Air Quality Through Local Plans and Programs: A Guidebook for City and County Governments*, Association of Bay Area Governments, 1994; and *A Manual of Regional Transportation Modeling Practice for Air Quality Analysis*, Greig Harvey and Elizabeth Deakin, July 1993. The list of policies below was developed largely from these documents.

Regional sustainable land use policies

The following are examples of land use policies that would typically be adopted at a regional or sub-regional level. They generally work to promote orderly, contiguous development at the urban edge. They discourage "leap-frog" development -- isolated residential sub-divisions located beyond the urban edge and beyond existing service areas, bypassing undeveloped lands.

While they still require local implementation, they often must be coordinated at the regional or state level to be effective. These policies include:

- Urban limit lines and development reserves.
- Mandatory consistency between local land use plans and local and regional transportation plans.
- Requirements for the provision of adequate public facilities concurrent with development.
- Mandatory city, county and regional balancing of job growth with the housing development, priced and located to match the need and incomes of the work force.
- Regional tax and expenditure policies that promote infill development.

Local sustainable land use policies

Most land use policies are local government policies, since that is the level at which most land use decisions are made. These policies can be grouped as supporting three main objectives: increase density, increase land use mixing, and incorporate design elements that encourage alternative modes.

Objective: Focused higher density development

Policies:

- Allow transfer of unused development density capacity in outlying areas to permit development density above maximum limits near central areas and transit.
- Allowing increased density for residential, retail, and employment generated uses in central areas and around transit.
- Setting minimum densities for residential, retail, and employment generating uses in central areas and around transit.
- Requiring no net decrease in residential density for redevelopment.
- Stating densities in terms of square feet of land use per dwelling unit, rather than minimum lot size, to encourage clustering.
- Granting incentives (e.g., reduced parking requirements, accelerated permit processing, infrastructure upgrades) for development that focuses on existing urban areas and infill.
- Adjusting development impact fee structures or giving tax breaks to encourage infill and increased density development near transit and activity centers, and to discourage outlying development.

Objective: Mixed-use zones

Policies:

- Allowing mixed use in places now prohibited.

- Requiring mixed uses, with specified percentages of residential, public and commercial uses in target areas.
- Using fine-grained zoning to achieve mixed use while insuring residential zones are buffered from heavy industrial zones with light industrial and commercial zones.
- Using mixed-use overlay zoning to add a second use to an area that is primarily in another use, e.g., commercial corridors along major arterials in a primarily residential area.
- Granting incentives (e.g., reduced parking requirements, accelerated permit processing, infrastructure upgrades) for development that locates transit- or pedestrian-oriented amenities, like housing or child care, near commercial uses.
- Adjusting development impact fee structures or giving tax breaks to encourage mixed use.

Objective: Design elements that encourage pedestrian, bicycle, transit and ridesharing activity.
Policies:

- Requiring connected, narrower streets with trees and sidewalks in new development.
- Requiring bicycle lanes and transit stops on larger streets in new development.
- Requiring traffic-calming devices in new development.
- Reducing requirements for setbacks and minimum lot sizes to create a stronger connection between buildings and sidewalks.
- Requiring signs, lighting, landscaping, etc that is oriented toward pedestrians in target areas.
- Reducing minimum parking requirements near transit hubs and for projects providing features that encourage pedestrian, bicycle, and transit activity.
- Setting parking maximums in transit- and pedestrian-oriented areas.
- Requiring preferential parking for carpools.

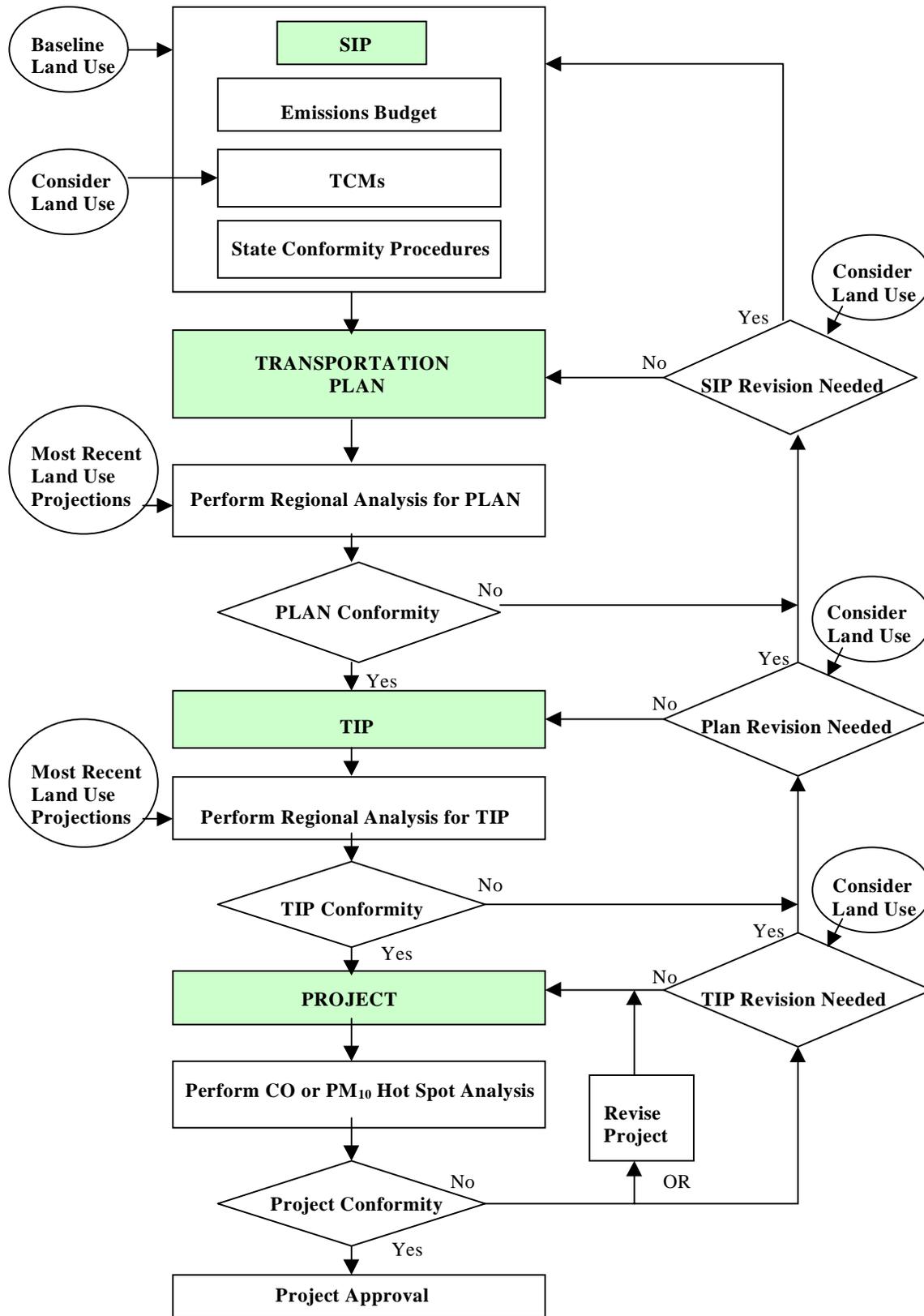
2.3 Other Relevant Literature

Literature was reviewed to gain a better understanding of current land use and transportation demand modeling techniques. A compendium of several recent studies of land use modeling was recently released as part of the Travel Model Improvement Program.⁴ Two good summaries of transportation modeling practice are *A Manual of Regional Transportation Modeling Practice for Air Quality Analysis*, Greig Harvey and Elizabeth Deakin, July 1993, and *Inside the Black Box: Making Transportation Models Work For Livable Communities*, Edward Beimborn and Rob Kennedy, 1996.

⁴ *A Technical Review of Urban Land Use -- Transportation Models as Tools for Evaluating Vehicle Travel Reduction Strategies*, July 1995, by Frank Southworth, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory; *Land Use and Travel Survey Data: A Survey of the Metropolitan Planning Organizations of the 35 Largest U.S. Metropolitan Areas*, October 1995, Chris Porter, Laura Melendy, And Elizabeth Deakin, Institute of Urban And Regional Development, University of California, Berkeley.

Other documents were reviewed to gain a better understanding of the SIP development and RTP/TIP conformity processes, and how land use considerations can affect them. The flowchart in Figure 2-1 provides an overview of these processes.

Figure 2-1: Potential Land Use Considerations in the SIP and Conformity Process



3 SURVEY METHODOLOGY

The primary intent of this study was to interview state and regional agencies that are involved in land use, transportation and air quality planning. Interviews were focused on three types of agencies: air quality agencies, metropolitan planning organizations, and councils of government. Air quality agencies are responsible for development of the SIP. In most states, this agency is a division within the state environmental department, though a few states, such as California and Washington, have regional air agencies. MPOs are required under federal law to prepare both a 20-year Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP). The RTP is a long-range planning document that establishes goals and priorities for the region's transportation system, while the TIP is generally a three-to five-year programming document that identifies precisely how funds will be spent on transportation projects. COGs serve as a regional forum for local governments and perform demographic, employment and land use forecasting for the region. Often, the COG and the MPO are the same agency.

The interviews were limited to agencies in metropolitan areas that are classified as non-attainment or maintenance areas for either ozone or carbon monoxide. Twenty-seven metropolitan areas were selected for interviews. These areas are listed in Table 3-1 along with their non-attainment or maintenance status. The study focused primarily on metropolitan areas in EPA Regions 1, 3, 8, 9 and 10, although several metro areas in Regions 2, 4, 5 and 6 were added to the interview list. Thus, the interviews were not conducted across a full cross-section of U.S. metropolitan areas, but rather focused on the East Coast and Western states. Also, by limiting the interviews to non-attainment and maintenance areas, several metropolitan areas known to have innovative land use policies were not included.

Many of the metropolitan areas chosen for interviews are located in California. This was done in part because many cities in California have poor air quality, but also because state air quality laws allow more flexibility in the adoption of the sorts of land use measures relevant to this study. The California Clean Air Act of 1988 established state ambient air quality standards that are more strict than federal standards. Regions that cannot comply with the standards are required to reduce pollutant emissions by five percent per year, or take all feasible measures to achieve emission reductions. This requirement has led several regions to consider land use related control measures, at least in their state-mandated air quality management plans.

A total of 76 interviews were conducted for the study. This included 29 air agency personnel, 43 MPO or COG personnel, and four others working for a state or local government. A full list of interviewees and their position and agency is included as Appendix A. Of the air agency personnel, nine were in management positions and 20 were staff planners, scientists, or analysts. Of the MPO/COG personnel, eleven were in management positions and 32 were staff planners.

Table 3-1: Metropolitan Areas Selected for Interviews

EPA Region	State	Metropolitan Area	Non-Attainment/Maintenance Status	
			Ozone	CO
1	ME	Portland	Moderate	
1	MA	Boston	Serious	Not Classified (P)
1	NH	Portsmouth	Serious	
1	RI	Providence (all RI)	Serious	
1	NY	Albany	Marginal	
1	NY/NJ/CN	New York City	Severe	Moderate
3	DC	Washington DC	Serious	
3	MD	Baltimore	Severe	
3	PA	Philadelphia	Severe	
4	NC	Raleigh/Durham	Maintenance	
4	GA	Atlanta	Serious	
5	IL	Chicago	Severe	
6	TX	Houston	Moderate	
6	TX	Dallas	Severe	
8	CO	Denver	Transitional	Serious
8	CO	Fort Collins		Moderate 1
8	UT	Salt Lake City	Maintenance	Not Classified
9	AZ	Phoenix	Serious	Serious
9	CA	South Coast (LA Area)	Extreme	Serious
9	CA	Sacramento	Severe	Moderate 1
9	CA	San Diego	Serious	Moderate 1
9	CA	San Joaquin Valley	Serious	Moderate 1 & 2 (P)
9	CA	San Francisco Bay	Non-attainment	Moderate 1
9	CA	Monterey Bay	Maintenance	
9	CA	Ventura County	Severe	
10	OR	Portland	Maintenance	
10	WA	Seattle	Maintenance	

(P): a portion of the ozone non-attainment area is in non-attainment for CO.

Ozone and CO non-attainment area may not be contiguous.

This list does not reflect the May 27, 1998 revocation of the 1-hour ozone standard for some counties

All interviews were conducted by telephone. A list of discussion points was used to guide each interview, and these are included as Appendix B. Questions differed somewhat depending on the agency and the responsibilities of the interviewee. Air agency personnel were asked

questions about land use control measures in air quality plans and barriers to the adoption of such measures. MPO and COG personnel were asked questions about population and employment growth forecasting methods, travel demand modeling methods, and how land use policies affect these procedures. All interviewees were asked to suggest local, regional or state land use policies that might have an effect on vehicle use and emissions. And all were asked to give their opinion as to what, if anything, EPA could do to better encourage sustainable land use practices.

4 SURVEY FINDINGS

The results of the survey are presented below. First, examples of land use measures that are included in air quality plans are presented. These include measures in SIPs as well as measures that only appear in state mandated plans. This section is followed by a discussion of related land use measures that are not included in air quality plans. Finally, the chapter concludes with a discussion of how land use policies are being incorporated into transportation demand forecasts.

The survey results reveal certain patterns that reflect the different types of land use responsibilities that each level of government has. State governments tend to influence land use decisions through the development of planning guidelines, enabling regional growth management planning processes, and providing funding for innovative planning. The State of Maryland's Smart Growth initiative is one of the most comprehensive examples of a state program. State infrastructure funding and economic development, housing, and other community development funding is limited to designated growth areas. In Washington, a state growth management act was passed that requires cities and counties to designate urban growth boundaries. Regional government agencies, such as MPOs, councils of government (COGs), and regional air quality agencies generally have no direct control or jurisdiction with respect to land use policy. Regional programs, in most cases, are focused on issuing planning guidance, establishing regional goals through consensus processes, and conducting outreach and education programs aimed at influencing local land use planning. Local governments have the greatest direct control over land use decisions and the widest variety of programs and policies can be found at this level of government. Actions include growth management programs as part of city general plan elements, adoption of zoning ordinances, development review processes, and other local ordinances. Examples of each of these types of policies and the roles that different levels of government play in implementing them are presented in the following sections.

4.1 Examples of Land Use Measures in Air Quality Plans

Nine of the 27 metropolitan areas surveyed have identified land use related control measures in an air quality plan -- two in a federal SIP submittal, five in a state-required plan, and two in both. Table 4-1 summarizes these measures. Two of these metropolitan areas have quantified the emissions reduction benefits from a land use control measure and take credit for these benefits explicitly -- the San Francisco Bay Area and the Sacramento Metropolitan Area.

The remaining seven do not quantify any emissions reduction. In interviews with air agencies, several reasons were cited for not quantifying any reduction. Some agencies felt confident that the measure was reducing emissions, but did not take SIP credit because they did not need the credit. Others felt that they did not have the technical ability to quantify a reduction. Still others indicated that the measures were included in a SIP or air quality plan more to highlight the policies, and that the measures were not necessarily having any impact.

Table 4-1: Land Use Measures in Air Quality Plans

Metro Area	Land Use Measure in:		Quantified	Programs
	Federal SIP	State AQ Plan		
San Francisco	No	Yes	Yes	Promote Transit-Oriented Development Promote Local Pedestrian Policies
Sacramento	Yes	Yes	Yes	Combination transportation and land use TCM
Monterey Bay	No	Yes	No	Livable Communities
South Coast (LA)	No	Yes *	No	New and Existing Development Standards
Ventura County	Yes	Yes	No	Congestion Management Program -- jobs/housing balance -- impact of land use decisions
Portland, OR	Yes	n/a	No	Urban Growth Boundary Regional Functional Plan -- local accommodation of housing and employment -- regional parking policy -- no large retail in industrial areas policy
Baltimore	Yes	n/a	No	Smart Growth Initiatives
San Diego	No	Yes	No	Indirect Source Program
New Jersey	Yes	n/a	No	State growth management

* Measure was included in 1994 Plan, then removed from 1997 Plan.

San Francisco Bay Area

The Bay Area's 1997 *Clean Air Plan* includes two Transportation Control Measures (TCMs) related to land use, and another related to traffic calming.⁵ Because the area was in attainment both for ozone and carbon monoxide in 1997, it was not required to develop a SIP. (The area was redesignated to ozone non-attainment earlier this year.) The area was in ozone non-attainment by California state air quality standards, and therefore required to submit an air quality plan to the state. The specific control measures are described below.

⁵ *Bay Area '97 Clean Air Plan, Volume 1 and Appendix E*, Bay Area Air Quality Management District, December 17, 1997.

TCM #15: "Local Clean Air Plans, Policies and Programs"

This measure will "Encourage cities and counties to incorporate air quality beneficial policies and programs into local planning and development activities, with a particular focus on subdivision, zoning and site design measures that reduce the number and length of single-occupant automobile trips." It also commits to "Develop subregional planning pilot projects", "Provide technical assistance to local government agencies", and "Publicize noteworthy examples of local clear air plans, policies and programs, as well as endorse noteworthy development projects." This measure was first included in an earlier *Clean Air Plan*.

The benefits of the measure were calculated by assuming that a greater portion of housing growth in the region would occur near rail transit stations. The specific quantification of emissions reduction was based on a 1991 study by Greig Harvey and Elizabeth Deakin.⁶ The following assumptions were made:

- Each of 75 rail stations in the region will receive 200 additional dwelling units.
- Each additional unit will shift 0.5 trips per day to transit mode (based on 1981 household survey data for households within 0.5 miles of BART, the regional rail system).
- The result is 7,500 fewer auto trips ($75 \times 200 \times 0.5$) per weekday.
- This trip reduction translates to a 0.05% reduction in VMT, reactive organic gases (ROG) and oxides of nitrogen (NOx).

As a conservative estimate of the emissions reduction, the Air District then took credit for only 20% of this reduction in the *Clean Air Plan*. The resulting emissions reduction is as follows:

- 0.02 tons per day (tpd) ROG and 0.01 tpd NOx by 2005
- 0.01 tpd ROG and 0.01 tpd NOx by 2015

TCM #19: "Pedestrian Travel"

This measure calls for cities and counties to "Review/revise general/specific plan policies to promote development patterns that encourage walking, and circulation policies that emphasize pedestrian travel, and modify zoning ordinances to include pedestrian-friendly design standards", to "Include pedestrian improvements in capital improvements programs", and to "Designate a staff person as a Pedestrian Program Manager." The Air District and the MPO and COG in the area will emphasize pedestrian improvements in outreach to local governments (in part through TCM 15) and will emphasize use of flexible transportation funding under ISTEA to promote pedestrian-related projects.

This measure was added to the *1997 Clean Air Plan*, and did not appear in earlier plans. Quantification for the emissions reduction was based on the USDOT 1994 National Bicycling and Walking Study and on the California Energy Commission's 1996 *Energy Aware Planning Guide*. The following assumptions were made:

- 10% of vehicle trips under 0.5 mile would shift to non-motorized modes by 2015.

⁶ Harvey, Greig and Elizabeth Deakin, *Transportation Control Measures for the San Francisco Bay Area: Analyses of Effectiveness and Costs*, prepared for the Bay Area Air Quality Management District, July 1991.

- 1% of vehicle trips between 0.5 and 1 mile would shift to non-motorized modes by 2015.

The resulting decrease in vehicle trips would produce the following emissions reduction:

- 0.71 tpd ROG and 0.84 tpd NO_x by 2005
- 0.72 tpd ROG and 1.59 tpd NO_x by 2015

TCM #20: "Promote Traffic Calming Measures"

A third TCM included in the 1997 *Clean Air Plan* takes credit for promoting traffic calming measures.⁷ This measure calls for cities and counties to "Include traffic calming strategies in the transportation and land use elements of general and specific plans," and "Include traffic calming strategies in capital improvement programs."

Quantification of the emission reduction was based on professional judgement by Air District staff, as there is little research on the emission impact of traffic calming. The following assumptions were made:

- Streets are repaved every 20 years, and calming is implemented on one in five streets upon repaving. So in a single year, 1% of streets receive traffic calming.
- Traffic calming only affects speeds under 48 mph.
- Thus, traffic calming is implemented on 1% of VMT under 48 mph annually.
- Traffic calming reduces emissions by 10%.

The emissions reduction was calculated to be:

- 0.54 tpd ROG and 0.84 tpd NO_x by 2005
- 0.54 tpd ROG and 1.59 tpd NO_x by 2015

Sacramento Area

The 1994 Sacramento Area Ozone SIP includes general land use-related TCMs, along with traditional TCMs.⁸ The land use measures are included to take credit for policies in the Sacramento County General Plan that are intended to reduce vehicle emissions. One of these county policies, AQ-15, requires that new developments include mitigation measures to achieve a 15% reduction in vehicle emissions.

⁷ While traffic calming is not a land use measure, it is often considered with other livable communities programs as a tool to discourage automobile use.

⁸ *Sacramento Area Regional Ozone Attainment Plan*, Sacramento Metropolitan Air Quality Management District, November 15, 1994.

The Sacramento Air District has written a draft model ordinance to provide guidance to the county and cities that are implementing such an indirect source review program.⁹ The ordinance would use a point system to ensure that new developments achieve the 15% reduction. To date, they have not been successful in getting local governments to adopt this ordinance. The county has taken some other steps to reduce the emissions impacts associated with new development, including modified zoning ordinances to promote greater mixed use development around transit stations.

The ozone SIP identifies a 1 ton per day reduction in both NO_x and ROG from the full set of TCMs, including the land use measures. This amount was based on professional judgement by the Air District. They are monitoring the emissions reductions resulting from these TCMs, and feels their reduction estimate continues to be accurate.

Monterey Bay Area

The 1997 *Air Quality Management Plan* for the Monterey Bay Area includes a TCM entitled "Livable Communities."¹⁰ The plan satisfies the California Clean Air Act; the Federal Maintenance Plan does not include this TCM. The TCM recognizes the adoption in 1995 of a Livable Communities Initiative by the region's MPO. The Initiative establishes regional policies to promote mixed land uses, promote transit-supportive density and zoning for new development, provide pedestrian/bike circulation and access, provide transit access, and promote pedestrian friendly design.

Air agency staff did not feel that the benefits of the measure were quantifiable. The measure was included in the plan for two reasons. First, it helps to establish the Livable Communities program as a long range planning goal for local governments. Second, inclusion of the program makes bicycle and pedestrian projects eligible for a particular state funding source that is dedicated to air quality beneficial transportation projects.

South Coast (Los Angeles Metropolitan Area)

The South Coast Air District's 1994 *Air Quality Management Plan* (AQMP) included two contingency control measures that would have required standards for new and existing development in an effort to reduce vehicle emissions.¹¹ The measures were not quantified and were never implemented, and were dropped from the 1997 *Plan*. Both control measures, CTY-08 "New Development" and CTY-09 "Existing Development", list examples of standards that should be considered by developers, including pedestrian-friendly design, interior walkways and bike paths, locating child care facilities in close proximity to transit facilities, and reduced

⁹ *Indirect Source Review Program, Implementation Guidelines*, Sacramento Metropolitan Air Quality Management District, February 1995.

¹⁰ *1997 Air Quality Management Plan*, Monterey Bay Unified Air Pollution Control District, December 1997.

¹¹ *1994 Air Quality Management Plan, Appendix IV-H: Contingency Measures*, South Coast Air Quality Management District, September 1994.

parking requirements. According to the Air District, intense opposition from the building industry precluded any implementation of the measures and led to their later removal.

The draft 1997 AQMP contained a control measure entitled "Clean Air Communities Program." This program was dropped from the final AQMP, and is described in the next section of this report.

Ventura County

The Ventura County *Air Quality Management Plan* contains a TCM entitled "Land Use Strategy."¹² The *Plan* serves as the SIP for the region as well as satisfying California Clean Air Act requirements. The Land Use Strategy TCM is based on the state-required Congestion Management Program. Counties are required to adopt such a program, and to include in it a number of elements. One of these is a transportation demand element that requires improvements in the jobs/housing balance in new large developments. Another element of the program is a procedure to analyze the impacts of local land use decisions on the regional transportation system, and to estimate the costs of mitigating these impacts. Because this program could reduce vehicle emissions through land use controls, the Air District has included it in their air quality plan. However, the Congestion Management Program does not give the county any new land use authority; rather, it is intended to highlight the impacts of land use on transportation and relies on local government participation for enforcement. The Air District felt that it was too difficult to quantify the benefits of this program.

Portland, Oregon Metropolitan Area

The Maintenance Plan SIP for the Portland, Oregon region identifies several land use TCMs.¹³ These measures were developed as part of the Portland Metro Council's (Metro) long range plan, called the *Metro 2040 Growth Concept*. The Metro Council is unique in the U.S. in that it has some legal authority over local government land use planning. The implementing mechanisms for the 2040 Growth Concept place several land use requirements on local governments, and it is these requirements that are identified in the SIP. They are as follows:

- *Requirements for Housing and Employment Accommodation* (Title 1 of the Regional Functional Plan Requirements). The requirement sets minimum densities for various land use categories, and requires that cities and counties accommodate the target household and employment growth determined by METRO, the regional government. It is intended to increase densities in areas well-served by transit, accommodating regional growth without the need for Urban Growth Boundary expansion.

¹² *Draft Ventura County 1995 Air Quality Management Plan Revision*, Ventura County Air Pollution Control District, July 1995 and *Ventura County 1994 Air Quality Management Plan, Appendix R-94: Transportation Control Measure Documentation*.

¹³ *Portland Area Ozone Redesignation Request/Maintenance Plan*, Oregon Department of Environmental Quality, July 12, 1996.

- *Regional Parking Policy* (Title 2 of the Regional Functional Plan Requirements). This requires cities and counties to reduce their minimum parking requirements to established ratios, and sets maximum allowable parking ratios.
- *Retail in Employment and Industrial Areas* (Title 4 of the Regional Functional Plan Requirements). This policy prohibits large retail facilities (over 60,000 sq. ft.) in designated Industrial Areas. It is intended to limit new "big box" retail in areas that are not well-served by non-auto modes.
- *Urban Growth Boundary*. The regional Urban Growth Boundary establishes a 20-year limit for new development and must be incorporated into local general plans.

The state has included these measures in the Ozone Maintenance Plan because they felt that the conformity process requires their identification to ensure that they are funded and implemented in a timely manner. They did not attempt to quantify an emissions reduction from the measures in the Maintenance Plan in part because no further reductions were needed. The air agency also felt that quantifying each measure individually would not capture some of the synergistic benefits of all the measures.

In part because it does have some regional land use authority, several highly-regarded studies have been conducted in the Portland area that analyze the effects of urban form on transportation and vehicle emissions.¹⁴ The LUTRAQ (*Making the Land Use, Transportation, Air Quality Connection*) project, led by a statewide non-profit group, used advanced modeling techniques to analyze alternatives to a proposed highway bypass project. The LUTRAQ alternative consisted of more compact development, more pedestrian- and bike-friendly site design, and greater access to transit, without highway expansion. The alternative was shown to reduce future VMT, emissions and congestion in Washington County, as compared to the highway alternative. Metro has also simulated the impacts of alternative development scenarios for the entire region as part of the *Metro 2040 Growth Concept* development. More compact land use scenarios were shown to result in lower VMT and vehicle emissions than the unconstrained base case.

Baltimore Metropolitan Area

The Phase II Attainment Plan for the Baltimore Region identifies several "non-traditional approaches to ozone control."¹⁵ One of these is the State of Maryland's Smart Growth initiatives. The Smart Growth legislation, adopted by the state in 1997, limits most state infrastructure funding and economic development, housing and other program monies to those places local governments determine as growth areas. The law is intended to ensure that the state will not facilitate development in areas where it is not desired by local governments. While growth areas are determined by local governments, they must be areas with existing water and sewer systems. The Smart Growth initiatives are not quantified in the Attainment Plan because

¹⁴ The studies are summarized in *The Effects of Urban Form on Travel and Emissions: A Review and Synthesis of the Literature, Draft Report*, 1998.

¹⁵ *Phase II Attainment Plan for the Baltimore Region and Cecil County*, Maryland Department of Environment, 1998.

the Smart Growth programs have not yet had any significant impact and, therefore, it was not considered possible to quantify travel and emissions reductions.

Part of the Smart Growth legislative package is a program called "Live Near Your Work." The program, run by the State Office of Planning, provides monetary incentives for people to buy a house near their workplace. The state will contribute \$1000 toward the closing costs of such a home purchase, to be matched by \$1000 from the employer and \$1000 from the city. Anyone buying a home that is walk- or transit-accessible to their workplace can apply for the grant, provided that their employer has agreed to participate. The state recruits employers to participate; as of early 1998, there were 24 employers enrolled, mostly large ones. The initial state budget for the program was \$300,000. The program is listed in the 1998 conformity determination document of the Baltimore region MPO.¹⁶ The emissions impacts of the program were not considered to be large enough to quantify at this time.

San Diego Metropolitan Area

The San Diego air quality plan identifies an Indirect Source Program as a control measure.¹⁷ The measure is not included in the region's SIP submittal, and its emission benefits are not quantified. The measure calls for the regional air agency to "help municipalities reduce vehicle trips through land use and transportation infrastructure design." The agency has issued a comprehensive guidance document that provides land use strategies for reducing auto use.¹⁸ Intended for local governments, developers and citizens groups, the document identifies 37 design strategies, discusses their impacts, and provides numerous examples of their implementation.

New Jersey

The Ozone SIP for Northern New Jersey identifies state land use initiatives as a transportation control measure.¹⁹ The State Planning Office is implementing a set of programs promoted by the governor intended to preserve open space and reduce sprawl development patterns. The state anticipates that the initiative will reduce vehicle emissions due to reduced trip lengths or shifts to non-motorized modes of travel. They did not quantify the emissions benefits from this initiative in the SIP, but are currently attempting to do so.

4.2 Related Land Use Measures That Are Not Included in Air Quality Plans

The interview surveys revealed six state, regional and local land use policies that could

¹⁶ *Conformity Determination of the 1994 Baltimore Region Transportation Plan and 1999-2003 Transportation Improvement Program*, Baltimore Metropolitan Council, July 1998.

¹⁷ *1998 Triennial Regional Air Quality Strategy Revision for the San Diego Air Basin*, San Diego Air Pollution Control District, June 1998.

¹⁸ *Tools for Reducing Vehicle Trips Through Land Use Design: Increasing Bicycling, Walking, and Transit Use in the San Diego Region*, San Diego Air Pollution Control District, January 1998.

¹⁹ *Phase II Ozone SIP Submittal*, State of New Jersey Department of Environmental Protection, June 30, 1998.

potentially reduce future mobile source emissions, but are not currently identified in any air quality plan. These policies include regional growth management policies, urban growth boundaries, local livable communities programs, and clean air communities programs. There are many such policies in place or under development across the country, and the examples described below are not intended to be a comprehensive list. Table 4-2 summarizes the policies that are currently in place.

Table 4-2: Land Use Measures Not in Air Quality Plans

Metro Area	Program
Ventura County	Livable Communities -- encourage local gov'ts to revise plans to promote compact, mixed use development, ped-friendly design, transit-oriented design, etc.
San Diego	Regional Growth Management Strategy -- focus new development around rail stations
Denver	Vision 2020 -- more compact growth, preservation of open space, etc.
Fort Collins	City Plan -- comprehensive plan requires UGB, contiguous new development, etc.
Seattle	State Growth Management Act -- local governments must identify growth areas
South Coast (LA)	Clean Air Communities -- revise state environmental review to encourage design factors that reduce emissions

Ventura County Livable Communities Program

The Ventura Council of Governments (VCOG), in the Los Angeles metropolitan area, has adopted a set of principles intended to reduce VMT and has incorporated these into a Livable Communities Program.²⁰ The program calls for greater jobs/housing balance, pedestrian-oriented development, transit-oriented development, mixed-use development, housing diversity, higher density development, infill development, and neighborhood centers. Implementation relies on local governments to amend general plans and design guidelines in support of the program. Several cities in the county have general plans that encourage pedestrian-oriented, mixed use downtowns, including Moorpark and Fillmore. And two large proposed developments will incorporate many of the livable communities principles. But VCOG has not been very successful yet in getting other local governments to amend their policies in support of the program, in part because local government revenue needs encourage competition among cities for commercial developers.

San Diego Regional Growth Management Strategy

The San Diego Association of Governments (SANDAG) has adopted a *Growth Management Strategy* to serve as policy guidance to local governments. One element of the *Strategy* is the *Land Use Distribution Element*, which calls for accommodating forecast population growth

²⁰ *Livable Communities Program -- Executive Summary*. Ventura Council of Governments, 1997.

while improving congestion and air quality.²¹ New development is to be focused around rail transit stations and bus corridors, and should incorporate design characteristics that encourage transit, walking and bicycling trips. In addition, new housing should be accommodated in existing employment areas that currently lack housing. The Strategy is to be implemented by local cities and San Diego County through their general or community plans. Participation by local governments is voluntary.

While many cities have not yet incorporated the *Strategy* policies, the City of Chula Vista is one example that has. The City requires that an "Air Quality Improvement Plan" be submitted by developers of any large project, and that the plan demonstrate how the project will minimize air quality impacts. The City has issued a design element checklist as guidance for developers preparing these plans. The checklist includes specific planning benchmarks in the areas of connectivity of street design, higher housing and employment densities near transit, land use mixing, site design with bicycle and pedestrian orientation, and reduced commercial parking.

Denver Area Metro Vision 2020

The Denver Regional Council of Government (DRCOG) adopted a long-range comprehensive plan in 1997 called the *Metro Vision 2020 Plan*.²² The *Plan's* elements include growth, open space, transportation, and air and water quality. The *Plan* was developed upon the analysis of four different future land use scenarios for the region.²³ One scenario featured a continuation along the current trends of low density, dispersed development. The other three offered different alternatives of more compact future development. Regional models were used to analyze the four land use scenarios in terms of their impact on travel and emissions. The results were mixed, in part because of the limitations of the models used. The Dispersed alternative produced the highest VMT and NOx emissions, but also the lowest emissions of volatile organic compounds (VOC). This somewhat anomalous result was due to the different effects of average speed on different pollutant emissions, and to problems with the models.

The scenario adopted as the *Vision 2020 Plan* is a hybrid of two of the compact scenarios. It identifies a target metropolitan area that occupies a land area roughly seven percent smaller than resulting from current trends. To achieve this more compact form, the Council has adopted a flexible urban growth boundary. The *Plan* clearly states that the growth boundary relies on voluntary local government implementation; there is no regional government mandate to implement the plan. It is too early to determine how much local government participation will occur.

Fort Collins City Plan

²¹ *Land Use Distribution Element of the Regional Growth Management Strategy*, San Diego Association of Governments, February 1995.

²² *Metro Vision 2020 Plan*, Denver Regional Council of Governments, July 1997.

²³ See *Metro Vision 2020: A Framework for the Denver Metropolitan Region*, Denver Regional Council of Governments, November 1995.

The City of Fort Collins adopted last year a progressive comprehensive plan called *City Plan*.²⁴ Fort Collins is a fast-growing community, surrounded by large areas of undeveloped land, and thus has the opportunity to significantly shape its future urban form. The *City Plan* identifies several land use policies intended to promote reduced vehicle use, many of which have been implemented through changes in the municipal codes. One of these policies is an Urban Growth Area boundary. Another is intended to discourage "leapfrog" growth by requiring that new development be contiguous with existing development, and that city roads and utilities not be extended to development outside of designated areas. Several other policies give priority to infill development over new growth development. Design-related policies are included for each neighborhood type. All new neighborhoods are required to include such elements as street connectivity, pedestrian amenities and traffic calming, while gated-street entries are prohibited.

The Fort Collins *City Plan* applies only to land within the city boundaries. The City is working with the county and other nearby cities to promote a regional approach to new development that is consistent with their *City Plan*. It is not yet clear how much regional cooperation they will be able to attain.

Seattle -- Washington State Growth Management Act

The State of Washington adopted the Growth Management Act in 1990.²⁵ It requires that cities and counties designate urban growth areas, and outside of these areas no urban growth should occur. Areas that can adequately be served by existing public facilities and services should be given priority as growth areas, before other areas. Critical agricultural and other natural resource lands must be designated and protected in local plans. Growth Management Hearings Boards have been established to make decisions regarding local plan conformity to the Act.

The long-range plan for the Seattle Area, *Vision 2020*, includes regional strategies to (1) identify and maintain urban growth areas, (2) support compact communities, and (3) focus growth in centers.²⁶ However, the Growth Management Act maintains nearly all local government authority over land use decisions. The Act was established primarily to preserve open space and natural resource lands, and to discourage inefficient extension of public services. It was not specifically intended to reduce vehicle use, and according to regional agency planners, it is not yet evident what effect, if any, the Act is having on growth patterns and vehicle use.

South Coast Clean Air Communities Program

The South Coast Air District has considered an alternative approach to reducing the mobile source emissions from new development through the environmental impact review process. Both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) require that projects be reviewed for their environmental impacts, including air quality, and that significant impacts be mitigated. Currently, the CEQA Handbook used by the

²⁴ *City Plan: Fort Collins, Colorado Comprehensive Plan*, City of Fort Collins, 1997.

²⁵ "State of Washington's Growth Management Act and Related Laws - 1997 Update," Revised Code of Washington.

²⁶ *Vision 2020: 1995 Update*, Puget Sound Regional Council, 1995.

Air District identifies fixed thresholds of emissions for the significance determination. All projects that are found to produce emissions over the threshold are considered significant. As a result, almost all medium and large projects are found to be significant, and then must undergo a much more extensive review process. The CEQA process does nothing to reward large projects that incorporate elements designed to reduce emissions. Small projects that may produce higher emission per capita or square foot are found to be not significant, yet their cumulative impact can be more than a single large project.

To address this discrepancy, the Air District has proposed to amend its CEQA Handbook.²⁷ Under the change, medium and large projects that incorporate air quality beneficial elements could gain "not significant" status for regional air quality. The emissions from a proposed project would be calculated on a per capita or square foot basis. If the emissions are lower than a similar project that lacks clean air design attributes, then the project would be designated Clean Air Community status and would be deemed to be not significant for regional air quality purposes. Alternatively, because it is often difficult to estimate the emissions resulting from a new development, Clean Air Community status could also be granted to those projects that incorporate specific mitigation measures. The Air District originally considered including in these mitigation measures land use elements that could reduce vehicle use. Under strong interest group opposition, however, land use is no longer included as a possible mitigation measure. The specific mitigation measures are still being determined, but will most likely be limited to construction practices and building technological improvements.

4.3 Land Use Policies Incorporated Into Transportation Demand Forecasts

As mentioned in Chapter 1, metropolitan areas could also "take credit" for certain land use policies by incorporating them into forecasts of regional transportation demand. Emissions forecasts are based on forecasts of travel patterns, which in turn are based on the forecast location of households and jobs. Local or regional land use policies could alter the location and design of housing and employment growth, and could potentially reduce future emissions. In order for this to occur, land use forecasts would have to reflect the policies. In interviews with MPO and COG planners, questions were asked to determine if and how land use policies are reflected in the forecasting process.

Current Forecasting Practice

Nearly every metropolitan area starts with fixed regional population and employment growth totals. These forecasts are often done by the state, though they may be done by the metropolitan COG itself. The MPO/COG then allocates the growth to the local level, and ultimately to the zonal level. This allocation process, often called "land use forecasting," may be done in a variety of ways, though there are basically two approaches. One approach is to use a computer model. The most common model used is DRAM/EMPAL, though other commercial models are used as well, and some metropolitan areas develop their own customized models. These models use mathematical equations to predict the location of future jobs and households based largely on

²⁷ *Implementing The Clean Air Communities Initiative In The South Coast Air Basin*, Submitted to the CEQA Air Quality Handbook Revision Working Group, May 27, 1998.

past trends and available land. The amount of available land is generally determined by local government plans.

The second approach is to negotiate an allocation of growth with local governments, based on their general plans. Because general plans can often be more of an ideal future vision than a realistic forecast, there is always a process of negotiation between the regional agency and the local governments. Typically, local plans call for more employment growth and less population growth than is realistic. The regional agency and the local governments reach an agreement for growth allocation that is consistent with the regional growth control totals. Three examples of the land use forecasting process are described below:

- In the Dallas metropolitan area, a combination of computer models and local government input is used to produce forecasts. Regional growth totals are allocated to 300 districts using DRAM/EMPAL, based on economic "demand" for employment. Once the district-level growth forecasts are adopted, DRAM/EMPAL is used to allocate growth to the zonal (TAZ) level, based on available land and past trends. Local governments are then free to shift their portion of the growth between zones within the city, though they cannot change the total growth for the city without approval from the advisory committee.
- In the San Francisco Bay area, the POLIS model is used to forecast household and employment growth. Regional growth totals are first allocated 119 districts, and then down to 1200 census tracts. The Association of Bay Area Governments conducts a continuous survey of local government growth and development policies. Both the district allocation and the tract sub-allocation are constrained by the land use patterns reflected in these policies.
- The Washington DC Area Council of Governments (MetroWash COG) allocates regional growth forecasts using a negotiated process. COG officials meet with local government planners and compare the local growth projections (as identified in general plans) with historical trends. If local projections seem unrealistic given past trends and current market forces, the parties come to some agreement on an alternative set of population and employment growth forecasts.

However growth allocations are done, local government plans and policies are nearly always taken into account. If a local government adopts policies that call for restrictions on new low density greenfield development and more infill development, then the forecast growth in that city would be allocated to reflect this, provided it was considered realistic by the COG. If the local policies adopted allow less growth in general, then the city would be allocated a smaller share of regional growth. Other neighboring cities, or the unincorporated portions of the county, would be allocated this growth instead.

Even in cases where cities play a large role in the zonal growth allocation, the forecasts must still be approved by the MPO/COG. The conformity process requires that travel demand forecasts be based on the best available land use assumptions. MPO/COG planners may require cities to revise their growth allocation if it is grossly inconsistent with past trends. Metropolitan-level

planners are often somewhat skeptical of local government "growth management policies," particularly if it looks to be defying market trends.

Accounting for land use policies

The important question to ask is: How well do land use and transportation forecasting procedures account for land use policies? The SAI report describes the limitations of commercial models in incorporating land use policies.²⁸ The local government review and modification of forecasts may allow for better reflection of policies. Indeed, in interviews with MPOs/COGs, most planners seemed confident that their forecasts would reflect growth management policies if such policies were adopted. However, they point out that the impact of land use policies would probably not be evident for several decades. Furthermore, land use forecasters rely heavily on past trends. Since nearly all strong growth management policies have taken shape in the past ten years, there is little evidence of their impact, and therefore little for COGs to use in determining what is a realistic local forecast.

As described in the SAI report, the nature of the forecasting process is inherently limited by zone size. The smallest unit of analysis is the TAZ, which is typically the size of one or several census tracts. Policies that result in a shift in growth from one TAZ to another could be accounted for in the forecasting process. But many of the policies listed in Section 2.2 would merely result in rearranging and modifying growth within a zone, and would not be accounted for.

Even if land use forecasting was improved and zone size made smaller, transportation models have limitations that prevent full accounting for land use policies. Many models don't even incorporate land use as a model variable. When land use is included, it is generally only represented by the population or employment density within a zone. The benefits of land use mixing may not be fully represented because trips must be classified into one of a limited number of trip purposes. The poor representation of trip chaining also tends to neglect mixed use benefits. Land use variables are often not included in mode choice models, though they have a major impact on bicycling and walking travel.

A few metropolitan areas have improved their travel demand models so that they better account for small-scale land use and design elements. Portland, Oregon and Sacramento have included a variable in their mode choice models to account for differences in pedestrian amenities. A panel of experts scores each zone in terms of its pedestrian-friendliness. By including this Pedestrian Environmental Factor (PEF) as a mode choice variable, small-scale design attributes that encourage walking (and biking) can be shown to reduce vehicle use. Most metro areas, however, do not include such variables in their models.

In summary, the forecasting practices used to determine the baseline emissions for a region could account for coarse, large-scale land use policies designed to discourage sprawl and protect open space -- policies like urban growth boundaries, adequate public facilities ordinances, transfer of development rights, etc. They could not very well account for smaller-scale or micro-scale land use policies designed to encourage alternative travel modes, policies like

²⁸ *Evaluation of Modeling Tools for Assessing Land Use Policies and Strategies*, 1997.

requirements for pedestrian- and bike-friendly design elements, higher density zoning around transit facilities, fine-grained mixed-use zoning, etc.

5 SUGGESTIONS FOR EPA'S ROLE FROM INTERVIEWS

All air agency and MPO/COG personnel interviewed were asked to give their opinion regarding a possible role for EPA in promoting land use policies that reduce vehicle use. As expected, the air agencies had a better understanding of EPA's current role in the process, and were able to give more specific suggestions. MPO/COG personnel tended to be more doubtful about EPA's ability to influence land use policy.

5.1 Air Agency Perspective

Twenty-nine air agency personnel were asked if there was anything they thought EPA could do to promote land use policies that reduce vehicle use, and whether EPA guidance on the expected emissions reduction benefits of such policies would be helpful to promote them. Two-thirds of the respondents felt that some form of EPA guidance or information sharing would be helpful. Of these, roughly half said that the quantification of expected benefits would be useful, while the other half felt that EPA's role should be limited to distributing of examples of other land use control measures around the country. Only one air agency said that they would actually use EPA guidance to quantify a land use measure in a SIP. Most said that quantification of land use measure benefits would be useful simply because it would lend weight to proponents of such policies.

Table 5-1: Summary of Air Agency Responses

EPA Guidance Helpful	64% of total
. . . By Quantifying Benefits	27% of total
. . . By Sharing Information	36% of total
EPA Guidance Not Helpful	36% of total

Air agency interviews included nine managers and 20 staff members. Managers appear to be somewhat more positive about an EPA role than air agency staff, although there was not a large difference between the two groups. Nearly 75 percent of the managers felt that EPA could help them promote sustainable land use. Staff members were more split, with 57 percent seeing a useful role for EPA. Of the 64 percent that do see a useful role for EPA, managers tended to prefer information sharing and staff tended to prefer actual quantification of benefits.

EPA guidance won't lead to SIP inclusion of land use measures

Based on the interviews, it appears that EPA guidance on the quantification of emissions benefits of land use policies would not motivate many more metropolitan areas to take credit for these policies. The few that have already quantified the benefits generally feel that they can do so without EPA direction. Those that include unquantified land use measures in air quality plans have done so primarily to promote the policies, and generally aren't looking for emissions credits from them. Others don't plan to adopt any land use measures soon because they know that they can't commit to any kind of land use control.

"We think we can quantify the measures ourselves and take credit for them, without EPA's help."

"We would probably not take SIP credit for measure, since we don't need it."

"EPA's efforts would not help us with SIP adoption. Even if it's a voluntary measure, you've got to commit to do something, and we're not going to commit to land use control."

Those that see a useful role for EPA

The general consensus among air agencies is that EPA, by identifying the benefits of sustainable land use policies, will add support to the policies in regional and local debates, or will at least foster debate that is not currently occurring. Roughly 27 percent felt that EPA should try to clearly quantify the emissions benefits that could be expected from various land use measures, because the lack of credible quantification is hindering adoption of these measures. Another suggestion was that if SIP credit were allowed for land use policies, the air agency would have an easier time getting funding to study the travel and emissions impacts of different developments.

"EPA guidance would be a big help. I can't say if we would actually adopt land use related voluntary control measures. But at the moment, there's uncertainty as to whether they actually produce any benefit."

"We need documentable evidence of the impact of land use policies to fight the building industry. As long as we can't show a nexus between these policies and emissions reductions, we're not going to be able to adopt anything."

"EPA guidance on the benefits of land use policies would be really helpful to us. I must fight for support for TCMs when we're considering all kinds of measures, and if you can't quantify a reduction in emissions, it's hard to make the pitch for them."

"We have some developments in the region that follow these kinds of policies, but we don't have the funding to study their impact. If EPA gave us reason to study them, it would be easier to get funding for it."

Others felt that by quantifying benefits, EPA could strengthen the hand of local advocates who are pushing for these types of policies.

"Quantifying the benefits of land use measures gives them more weight and credibility in the public eye, and makes it easier for the agency to push for them. We may not adopt a land use TCM, but by having the option out there, people start to think about the trade-offs between that and other measures."

"If EPA offered some guidance on quantifying land use TCM benefits, it would be a useful tool for activists opposed to new sprawl developments."

"Quantification of benefits by EPA would be very helpful. These measures are controversial, and spelling out the benefits in a document would strengthen the hand of the proponents."

Another 36 percent feel that it's not really possible to credibly quantify the benefits at this stage, and that EPA could be most useful by simply publicizing relevant examples. This would provide models to local governments that are concerned about vehicle use and emissions. Several agencies also suggested that what they need is a model for how to achieve consensus among local governments in the region.

"EPA could help by making information available on the impact of land use policies, and what has been done elsewhere. Cities and MPOs are looking to the state air quality division for guidance, but we don't have much experience with or knowledge of land use."

"We need a model for how to bring together a fractured region. The inner cities are suffering from congestion and air quality problems, while the outer cities are scrambling for growth. We need to reach a regional consensus."

Those that do not see a useful role for EPA

The other 36 percent of respondents felt that EPA does not have a useful role in the promotion of land use policies. Various reasons were given for this answer. Some said that their air quality problems were simply not bad enough to warrant consideration of any additional control measures, so EPA's efforts would not be useful to them. Similarly, others felt that they would only adopt a new control measure if it was mandated, and were not interested in any voluntary measures. One respondent noted that there was little interest in growth management because the area was not growing very rapidly. Another expressed concern that any design requirements would be abused by developers. Still another felt that land use measures were simply not quantifiable, and promoting them through the air quality process was not worthwhile.

"There's no incentive here to adopt any additional control measures. We're in attainment and getting better."

"Control measures aren't promoted unless there's a requirement. We won't adopt anything that's voluntary."

"There's not much growth in the state, and not much interest in growth management, so I don't think there's much chance of an emissions benefit."

"You need to think carefully about how land use policies might get used and abused. For example, if you simply require bike paths and transit stops, you'll get master plan developers building far on the urban edge with these window dressings that no one uses. What you really need are regional/state policies that require infill development before leapfrog development."

"The long term solution to our transportation and air quality problems must come from land use ultimately. But these types of land use TCMs aren't quantifiable, and aren't comparable with other traditional TCMs. EPA is wasting their time trying to do it."

5.2 MPO/COG Perspective

Forty-three MPO and COG personnel were interviewed, including 11 managers and 32 staff. Compared to air agency personnel, they tended to be more pessimistic about the possibility of EPA helping to promote air quality-beneficial land use measures. This is not surprising as many of them struggle daily with the complexities of modeling travel behavior and they are well aware of the uncertainties involved. Two-thirds said that they did not think EPA guidance would be useful in promoting land use policies.

Table 5-2: Summary of MPO/COG Responses

EPA Guidance Helpful	33% of total
EPA Guidance Not Helpful	67% of total

Like air agencies, MPO and COG managers tended to be more positive about a useful role for EPA in promoting sustainable land use. About half of the managers interviewed said that EPA could be helpful, while only about 20 percent of the staff agreed with this.

Those that do not see a useful role for EPA

Many MPO and COG interviewees seemed resigned to the fact that there was no way to influence local government land use decisions. Some added that monetary incentives were the only way to get local governments to respond. Others felt that trying to quantify emissions

benefits from land use policies was simply futile.

"There's not a lot EPA can do, as local governments make the land use decisions. No local governments care about regional VMT."

"It's going to be the region and state that take the lead in promoting more sustainable land use patterns, not EPA."

"People aren't very interested in air quality in the region. The only way EPA could make a difference is to make some money available."

"Dollars drive everyone's actions; you need grant funds to get people's attention."

"Taking SIP credit for land use policies is really stretching the modeling capability. You're already putting a lot of pressure on these models to forecast travel demand, and they're built on a shaky foundation. Any SIP benefit would be small, and very uncertain, so there's little point in pursuing it."

Those that see a useful role for EPA

The other one-third of MPO and COG interviewees did feel that EPA could play a useful role. Not surprisingly, these tended to be in rapidly growing areas in the western U.S. Some of these felt that the federal government needs to more actively advocate land use controls as a way to address our traffic and air quality problems. Others identified the need for better evaluation of the impacts of various land use policies currently in place.

"Constant pressure is needed to keep emissions, sprawl and other environmental issues in the land use / transportation planning process. EPA's help in applying this pressure would be useful."

"EPA's help would be appreciated. They need to promote the fact that you can get a lot more VMT and emissions reductions from land use planning than from, say, transit improvements."

"There's a need for some demonstrated impacts of land use policies. Right now there's no consensus on the effects. People need to agree on the range of impact you can expect."

"EPA could be most helpful by distributing information to metropolitan areas. We need to see documentation of the quantification of benefits from alternative land use scenarios in other regions. And we need to see documentation of some real-world successes, too. We need to see if these state growth management policies are working."

6 ANALYSIS OF FINDINGS

The interviews and document review conducted for this study suggest that there is a growing potential for promoting sustainable land use practices through the air quality planning process, but significant barriers still remain. A number of institutional barriers hinder the adoption of effective land use policies and the state, regional and local levels. At the same time, analytical barriers make it difficult to predict how these policies will improve air quality.

6.1 Barriers to Effective Land Use Policy

Despite the recent interest in sustainable land use, there are very few policies currently in place in this country that are having an impact on the development practice status quo. The few recent success stories suggest that to be effective, sustainable land use policies need both regional coordination and substantial local government participation.

Barriers to region-wide coordination

Air quality is a regional problem, and many of the policies to reduce vehicle emissions need to be coordinated at the metropolitan or state level. Several factors stand in the way of metropolitan land use policies.

- State or metropolitan growth management programs are less feasible in areas that are not growing rapidly. Growth management inherently involves restrictions on or modifications to new development. In cities that are experiencing little or no net growth, these policies will be politically difficult to adopt, and would have little impact anyway. It is not surprising that much of the current discussion surrounding growth management is occurring in fast-growing Western states.
- Local governments retain nearly full control over land use decisions within their borders. The federal government requires the formation of MPOs, but metropolitan agencies exist essentially to serve member local governments. A regional agency cannot enforce any sort of regional land use policy unless such powers are granted to it by the state. Portland, Oregon's Metro gained a share of land use authority through state legislation and a voter referendum. Similar state action is needed before other regional agencies can implement Metro-style policies.
- Related to the last point, many areas of the county share a strong, almost reverential tradition of local government land use control. This tradition has been reinforced by federal law and state laws.²⁹ In these areas, any transference of some land use power to a regional agency is highly unlikely at this time.

²⁹ The 1990 Clean Air Act Amendments specifically states: "Nothing in this chapter constitutes an infringement on the existing authority of counties and cities to plan or control land use, and nothing in this chapter provides or transfers authority over such land use." (42 U.S.C. Sec. 7431) The State of California has similar statutory restrictions on the authority of air agencies over land use.

- Because regional land use policies may increase the costs of new development, the construction industry and real estate interests have mounted campaigns to prevent their adoption. Even in metro areas that have succeeded in adopting growth management policies, regional planners often describe a considerable negotiation and compromise process with the building interests. In the Los Angeles region, vociferous opposition by the Building Industry Association (BIA) to land use-related measures in air quality plans led to removal of the measures. The industry has even commissioned a study that refutes many of the claims of the air quality benefits of land use policies.³⁰

Barriers to local implementation

Metropolitan growth management policies, if they are adopted, usually must be implemented through the voluntary participation of local governments. Achieving this participation, particularly from the fastest growing exurban communities, has been very difficult.

- Local government development policies are often shaped by fiscal needs. Many local governments find themselves cash-strapped as they are charged with greater responsibilities while voter initiatives have limited their ability to raise revenue through taxation. New commercial development, particularly large retail outlets, can offer cities badly needed sales tax revenue. As neighboring cities compete for new projects, exacting developer concessions, like design elements to encourage non-auto travel, can be impossible. Similarly, cities will find it hard to require developers of new residential subdivisions to incorporate mixed land uses, multi-family units, bike and pedestrian paths, etc., that might raise developer costs. Local governments may not recognize that compact, contiguous development can produce fiscal benefits in terms of lower infrastructure and service provision costs.
- Many of the impacts of uncontrolled sprawl development are not felt by far-flung suburban communities, or at least are not viewed as symptoms of their growth patterns. Most local governments don't care about regional VMT, and don't see regional emissions as a problem that they can affect.
- Though some cities and counties do adopt growth management policies, it usually comes in response to a period of rapid growth. Public consciousness is raised only after congestion gets bad and open space disappears, and by that time opportunities to shape new growth in the city are limited. Rarely are growth issues considered in the early stages of development. Some reactionary local government policies (slow-growth initiatives, growth moratoria) may actually encourage sprawl and automobile use by forcing new development farther out.

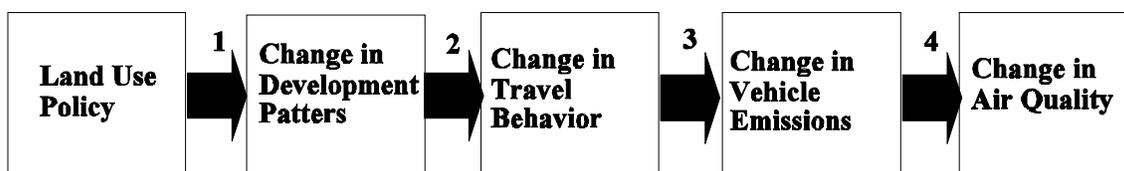
6.2 Barriers to Forecasting Air Quality Impacts of Land Use Policies

³⁰ *Livable Communities and Air Quality: An Examination of Linkages and Their Impacts on the Construction Industry*. Construction Industry Air Quality Coalition, Diamond Bar, CA, October 1997.

Land use policies are only indirectly related to emissions and air quality. In order to forecast the impact of land use policies on air quality, a series of key relationships must be understood. A simplified diagram of these relationships is presented in Figure 6-1.

Figure 6-1 Key Relationships Between Land Use, Transportation, and Air Quality

There are a number of analytical barriers to predicting how each of these relationships will behave. As the uncertainties involved at each stage will be carried on to the next stage of



analysis, reliable forecasts of the emissions or air quality benefits from land use policies can be very difficult to obtain. Some of the barriers that exist in forecasting each relationship are discussed below

1 — Impact of land use policy on development patterns

Taking credit for land use policies will require estimates of how the policies will change future development patterns. This relationship is probably the least understood of the four above. Most land use policies of the type identified in this study have appeared only in the last ten years, and thus have had little impact to this point. Several factors make it difficult to forecast the impacts:

- Local government participation in a voluntary regional policy is often uncertain. Local governments may support vague, visionary principles regarding future growth patterns, but may not be willing to amend their plans and policies in accordance with the principles. In the Denver region, for example, the recently adopted *Metro Vision 2020 Plan* calls for local government to facilitate future growth in a more compact manner. Local government participated in crafting the plan, but nothing in it requires them to change their current development patterns. Taking emissions credit for this plan would require making assumptions about future local government actions.
- Many growth management policies will only have an impact over a long term. An urban growth boundary, for example, may lead to infill or higher density development only when available greenfield lands become scarce. Even then, it will take time for the cumulative impact of multiple projects to significantly alter the dominant urban form. Several of the planners surveyed suggested that land use policies might not have a noticeable impact for several decades. Unless an area has a long attainment planning horizon, land use measures may not have quantifiable impacts within the air quality planning time-frame.

- The development process is complex and governed by market forces that lie beyond the realm of policy. In general, land use policies work only by prohibiting certain actions -- they cannot require new construction. If a market downturn removes the incentive for developers to build, land use policies become irrelevant. Similarly, consumer preferences can change market demand and developer incentives. These forces can be notoriously fickle and make predicting land use policy impacts difficult.

2 — Impact of development patterns on travel behavior

Although this relationship has been the subject of extensive research, there are still uncertainties with respect to how local land use changes will affect region-wide travel.

- Land use policies that get adopted by isolated local governments will have little or no impact on regional vehicle use or emissions. The analogy often used is squeezing a balloon: regional growth can be assumed to be fixed, so restrictions in one area merely cause more growth in another. While local policies can clearly reduce local vehicle use, these policies may have no effect or even the opposite effect on other parts of the region.
- Regional land use policies that are primarily intended to preserve open space or protect certain natural resources may not reduce vehicle use. Open space preservation policies could have the effect of discouraging new suburban employment and shopping centers from locating near residential zones, and could increase trip lengths. Similarly, a ring of open space could lead to new development much farther out than would otherwise occur, and potentially lengthen trips.
- The travel benefits of specific land use and design elements may only occur when they are used as a package with other elements. In isolation, specific land use elements may have no discernable impact on travel.
- Many other factors affect travel behavior, factors that may swamp the impact of land use. Because of this, it will be difficult to develop rule-of-thumb estimates of expected emissions reductions from specific land use policies without consideration of a host of characteristics of the area in which the policies are applied.

3 — Impact of travel behavior on vehicle emissions

Vehicle emissions are affected by vehicle miles of travel (VMT), number of starts, and operating speed. A reduction in vehicle use generally means lower VMT and/or fewer trips, both of which will reduce vehicle emissions. However, the impact of vehicle operating speed on emissions is more complex. Most vehicles emit more pollutants per mile at low speeds (under 25 mph) and at high speeds (over 50 mph). Land use policies that lead to significantly higher levels of congestion could reduce average speeds to the point where emissions increase. This could offset some of the benefits of decreased VMT and trips. Very few studies have considered how land use changes might affect emissions through speed changes. EPA is in the process of revising speed correction factors for use in MOBILE6. Conclusions about the

relationships between land use, travel behavior, and emissions reached with current emission models may prove erroneous when the new speed-emissions relationships are taken into account.

4 — Impact of vehicle emissions on air quality

The impact of vehicle emissions on urban air quality was not the focus of this study. However, it is important to point out that lower region-wide emissions does not automatically result in better regional air quality. The urban airshed models that forecast regional air quality account for the location, as well as the magnitude, of emissions. It is possible that land use policies could reduce region-wide vehicle emissions, but concentrate them in a smaller area and thus create higher pollutant levels.

Implicit SIP credit versus explicit SIP credit

In addition to the analytical barriers described above, it is important to recognize that some larger-scale local and regional land use policies will be accounted for in the land use and transportation demand forecasting process. Thus, any reduction in vehicle use and emissions from these policies would be incorporated into the forecasts, and the area would be taking implicit SIP credit for the policies. If a metropolitan area identifies a land use policy as an explicit control measure, it must be assumed that the policy is not being accounted for in the land use forecasting process. Otherwise, the benefits will be double-counted. However, it is difficult to identify which particular policies are accounted for in the models, and to what extent.

7 DIRECTIONS FOR FUTURE EFFORTS

One clear conclusion from this study is that there is no easy way to promote sustainable land use practices through the air quality planning process. There are technical limitations to our ability to characterize the land use, transportation and air quality relationships. The development process is subject to market forces that are difficult to predict. And the relationships between government levels and agencies is complex. It is important to think carefully about where EPA can influence current processes and how much it can influence them. To do this, it is useful to classify metropolitan areas into two types: those that have adopted some sustainable land use policies but need help taking credit for them, and those that have not yet adopted any meaningful land use policies.

7.1 Helping Metropolitan Areas Take Credit for Existing Land Use Policies

In metropolitan areas that have some kind of sustainable land use policies in place (adopted at the local, regional or state level), EPA guidance may help them take credit for the policies. In general, these areas are not currently taking implicit or explicit credit for the policies because they are not able to show their benefits. Some other areas may have ineffectual policies in place but don't take credit for them because they are not having any impact. These areas really fall into the second type above: those that have not yet adopted any meaningful land use policies. For those that do have effective policies in place, there are three general areas where EPA has an opportunity for influence.

Improve ways to assess the effectiveness of land use policies at achieving land use change.

While great strides have been made in determining the impact of urban form on travel patterns, we have a poor understanding of what it takes to achieve changes in urban form. Part of the reason for this is that most of the land use policies mentioned in this study have appeared only within the last decade. Very few of them have had a discernable impact at this point. EPA could help by supporting more research focused on the complex process of urban development. Specifically:

- Research is needed to understand how well existing state and regional growth management policies work. If we can characterize a region in terms of its governmental structure, economic forces, demographics, etc., can we predict how well a particular policy will work? How much local government participation can be expected in a particular region, under a particular policy? How much local government participation is needed in the region to have significant impacts on regional land use and travel?
- Research is needed to understand the effectiveness of local government land use policies. Under what circumstances are local government land use policies effective? What types of incentives can change developer practices? What kinds developer practices are most effective at reducing vehicle use?

If metropolitan areas can assess how their policies are going to affect land use, they may be able

to take credit for the impact of the land use changes on travel and emissions. Credit could be taken through an implicit SIP baseline assumption or an explicit control measure. It is important here to reiterate that those land use changes that can be accounted for in travel demand models cannot be included in the SIP as a control measure. By law, the SIP baseline must be built on the best available land use forecast. If the metro area expects that a land use change will occur, the MPO must incorporate the change in the model as best as possible. Only those changes that cannot be incorporated into the models can be explicit SIP control measures.

Improve ways to account for land use changes in forecasting models.

Improvements to land use and travel demand forecasting procedures will allow regions to take implicit credit for some land use changes that reduce vehicle use. Our current models do not account for land use changes very well. More powerful computers and better model formulation will likely do much to improve models in coming years. The work currently being performed under the Travel Model Improvement Program (TMIP) could even revolutionize transportation models and allow simulation at the micro-scale level. Data sources will always be a constraint, however. We need better ways to quantify land use than household demographics and employment figures. Efforts to include model variables such as the Pedestrian Environmental Factors are a step in the right direction. EPA could continue to support efforts to improve the ways that urban form is quantified and incorporated into travel models.

Improve ways to estimate the impact of land use changes off-model

Even with model improvements, it is clear that land use elements will not be fully accounted for in travel forecasting practices for some time. Micro-scale changes in land use and design features are too small to be represented in regional models. For these type of changes, EPA can help air agencies estimate an emissions impact. While it is not possible to develop simple rules of thumb to allow estimation of regional emissions reductions, publicizing examples of land use measures and quantification efforts can help air agencies make their own best estimates.

7.2 Promoting Adoption of Sustainable Land Use Policies

Most metropolitan areas are not yet at the stage of quantifying land use policy impacts. Indeed, there are probably very few sustainable land use policies in place in this country that are having a significant impact. There are opportunities for EPA to promote sustainable land use policies at the state and regional level, local level and project level.

Provide tools to aid state and regional growth management efforts

A few states and metropolitan areas have managed to bring together local governments and reach some consensus on future growth patterns. This is often a very difficult task, as growing cities on the urban edge have very different priorities than older inner cities. A number of regions are looking for a paradigm for how to bring together balkanized local governments. EPA could do more to foster regional cooperation in these areas. There is a need for better documentation of existing examples of state and regions that have been able to agree on a future vision and taken steps to achieve it.

The metropolitan growth forecasting process provides a forum at which the MPO/COG and local governments discuss land use changes and the policies that affect it. Currently, most metropolitan agencies use this forum to temper unrealistic local forecasts, relying heavily on past trends. Metropolitan areas that develop a normative vision of future land use could use the existing forums to foster cooperation on how to reach this vision. EPA could have a role in facilitating this process.

EPA could also help to promote the adoption of sustainable land use policies at the regional level by publicizing efforts to quantify their benefits. Many regional agencies are looking for better proof that higher densities, greater land use mixing, and certain design elements can reduce vehicle travel and emissions, proof for themselves and for opponents of the policies.

Provide local government incentives

Local governments that allow sprawling development patterns do so because they feel it is in their best interest. EPA could play a role in helping to show local governments the consequences of unsustainable development. Compact, higher density development can make good fiscal sense for cities and counties if it lowers the costs of extending streets, sewer systems, and other service provision. Many more cities are embracing livable communities as a way to revitalize retail areas. Local governments need examples and studies that can show how it is in their best interest to direct new development into more sustainable patterns.

Some local governments will need better incentives than fiscal or aesthetic arguments. The RTP/TIP process could provide an opportunity for promoting sustainable land use. A few metro areas may be forced to consider land use measures to show RTP conformity. EPA could aid these areas by showing how land use has reduced emissions forecasts through regional computer modeling.

Interviews suggest that the regional emissions benefits from enforceable land use measures would be quite small. And once conformity is attained, the incentive to consider land use controls is lost. Some have suggested modifying the conformity process so that metropolitan areas have incentives to go below attainment levels. This could help to maintain any momentum toward considering land use policy for its emissions benefits.

Another opportunity to influence local government development policy could arise through conformity determinations for the TIP or specific projects. Once the mobile source emissions budget is fixed for a region, emissions from the short-term TIP must be shown not to exceed the budget. It has been suggested that regions allow more innovative ways of trading emissions credits. Local governments that find their transportation improvements blocked because of non-conformity might be allowed to adopt land use policies as a concession. EPA could help to facilitate these sorts of exchanges.

Publicizing examples of local sustainable land use policies and efforts to quantify their benefits will help promote the policies at local levels. EPA could lend support to local governments that are considering such policies, and to local advocates.

Provide developer incentives

EPA could also take steps to promote more sustainable land use practices at the project level. Developers are inherently risk-averse, and established site design features are difficult to change. However, there are many examples where developers have incorporated changes into site plans that reduce auto-dependency at little or no additional cost. Some have even suggested that more sustainable urban design practices could even save developers money. At least one city is using a GIS model to try to show developers how they can reduce their costs and promote alternative travel modes. EPA is already facilitating the exchange of this kind of information through its Smart Growth Network. There may be more that EPA could do to promote sustainable land use directly to developers.

The environmental review process offers an opportunity to promote project-level land use and site design features that reduce vehicle use. As our understanding of the impact of land use on travel improves, there may be ways to require incorporation of mitigation measures that reduce vehicle emissions. EPA could promote efforts, such as those in the South Coast Air District, to modifying the environmental review process in ways that could at least reward good development practices. One immediate opportunity to modify environmental review procedures may be presented by the streamlining provisions of TEA 21. These provisions require the Secretary of Transportation to establish a coordinated environmental review process for the DOT and to work with other Federal agencies to ensure that major highway and transit projects are advanced according to cooperatively determined time frames. One option that might be pursued under these provisions would be to grant expedited reviews to any projects that demonstrate that sustainable land use and site design practices have been incorporated in the project.

ACKNOWLEDGMENTS

Project Coordinator

James Carpenter, EPA Office of Mobile Sources

EPA Regional Contacts

Region 1: Donald Cooke, Linda Marinelli, Jeff Butensky

Region 2: John Walsh

Region 3: Paul Wentworth

Region 4: Kelly Sheckler

Region 5: Patricia Morris

Region 6: John Behnam

Region 7: Chris Hess

Region 8: Scott Lee, Jeff Houk

Region 9: Mark Brucker, Karina O'Connor

Region 10: Wayne Elson, Polly Hunter

Report Reviewers

EPA Office of Mobile Sources: Lucie Audette, Stephanie Alston, Kathryn Sargeant

EPA Office of Policy: Geoff Anderson, Brett VanAkkeren, Robert Noland

APPENDIX A: List of Survey Contacts

EPA Region 1

Portland, ME

Ron Severance, Mobile Sources Manager, Bureau of Air Quality, Maine Department of Environmental Protection

John Duncan, Executive Director, Portland MPO

Steve Lowe, Resource Systems Group, consultant to Portland MPO

Boston, MA

Christine Kirby, Branch Chief for Transportation Management Programs, Bureau of Waste Prevention, Massachusetts Department of Environmental Protection

Carl Quackenbush, Deputy Director, Central Transportation Planning Staff of Boston MPO

Portsmouth, NH

Kent Finemore, Technical Services Administrator, Air Resources Division, New Hampshire Department of Environmental Services

Kathy Brockett, staff, Air Resources Division, New Hampshire Department of Environmental Services

Steve Burns, Director, Sea Coast MPO and Stafford Regional Planning Council

Providence, RI

Barbara Morin, Supervising Environmental Scientist, Bureau of Environmental Protecting, Rhode Island Department of Environmental Management

Ralph Rizzo, Rhode Island Office of the Federal Highway Administration

John Brownell, planner, Rhode Island Statewide Planning Program

EPA Region 2

New York Metropolitan Area

Bob Stern, planner, New Jersey Department of Environmental Protection

Bruce Benton, planner, New Jersey Department of Environmental Protection

Julia Zhou, planner, New Jersey Transportation Planning Authority

Kuo-Ann Chiao, Manager, Systems Planning/Models Bureau, New York Metropolitan Transportation Council

Albany, NY

Chris O'Neill, Senior Transportation Planner, Capital District Transportation Committee

EPA Region 3

Washington, DC

Tom Blue, planner, Virginia Department of Environmental Quality

Ron Kirby, Director of Transportation Planning, Metropolitan Washington COG

Baltimore, MD

Diane Franks, Planning Division Chief, Air Management Administration, Maryland Department of Environment

Charles Baber, planner, Baltimore Metropolitan Council

Chris Wells, Maryland Office of Planning

Philadelphia, PA

Arlene Shulman, Section Chief, Mobile Sources, Pennsylvania Department of Environmental Protection

Ron Roggenburk, Manager, Office of Air Quality Planning, Delaware Valley Regional Planning Commission

Barry Seymour, Assistant Executive Director for Regional Planning, Delaware Valley Regional Planning Commission

EPA Region 4

Atlanta, GA

Marlin Godschalk, Manager, Mobile and Area Source Program, Georgia Environmental Protection Division

Eric Pihl, planner, Atlanta Regional Council

Bart Lewis, planner, Atlanta Regional Council

Raleigh, NC

Shelia Holman, Attainment Planning Supervisor, Division of Air Quality, North Carolina Department of Environment and Natural Resources

Scott Lane, Administrator, Capital Area MPO

EPA Region 5

Chicago, IL

Carol Brown, staff, City of Chicago, Department of Environment

Carl Welzenbach, planner, Chicago Area Transportation Study

Dean England, Deputy for Development, Chicago Area Transportation Study

Max Dieber, Director of Research Services, Northern Illinois Planning Commission

EPA Region 6

Texas

Catherine Stephens, staff, Air Quality Planning and Assessment Division, Texas Natural Resources Conservation Commission

Kim Hearndon, staff, Air Quality Planning and Assessment Division, Texas Natural Resources Conservation Commission

Dallas, TX

Lyssa Jenkins, planner, North Central Texas COG

Houston, TX

Chris Van Slyke, planner, Houston Galveston Area Council

Marilee Martin, planner, Houston Galveston Area Council

EPA Region 8

Denver, CO

Mike Silverstein, Planning/Grants Specialist, Air Pollution Control Division, Colorado Department of Public Health and Environment

Chris Primas, planner, Denver Regional COG

Jeff Romine, planner, Denver Regional COG

Fort Collins, CO

John Daggett, Senior Transportation Planner, North Front Range Transportation and Air Quality Planning Council

Susan Gordon, staff, Natural Resource Department, City of Fort Collins

Salt Lake City, CO

Colleen Delaney, Environmental Scientist, Division of Air Quality, Utah Department of Environmental Quality

Name unknown, Wasach Front Regional Council

EPA Region 9

Phoenix, AZ

Joe Gibbs, Environmental Program Specialist, Air Quality Division, Arizona Department of Environmental Quality

Cathy Arthur, contract consultant, Maricopa Association of Governments

South Coast (LA metropolitan region)

Laki Tisopulos, planning manager, South Coast Air Quality Management District

Connie Day, planner, South Coast Air Quality Management District

Steve Smith, planner, South Coast Air Quality Management District

Mike Armstrong, Senior Planner, Southern California Association of Governments

Simon Choy, planner, Southern California Association of Governments

Sacramento, CA

Ron Maertz, Transportation Programs Manager, Mobile Source Division, Sacramento

Metropolitan Air Quality Management District

Gordon Gary, Transportation Analyst Manager, Sacramento Area Council of Governments

San Diego, CA

Andy Hamilton, Air Quality Specialist, San Diego Air Pollution Control District

George Franck, Senior Transportation Planner, San Diego Association of Governments

Paul Kavanaugh, Senior Planner, San Diego Association of Governments

Jeff Taymen, Senior Planner, San Diego Association of Governments

San Joaquin Valley, CA

Katie Bearden, planner, San Joaquin Valley Unified Air Pollution Control District

Mike Bitner, Senior Transportation Planner, Fresno COG

Kathy Chung, Planning Coordinator, Fresno COG

San Francisco, CA

David Marshall, planner, Bay Area Air Quality Management District

Jennifer Dill, planner, Bay Area Air Quality Management District

Brian Kirking, planner, Association of Bay Area Governments

Chuck Purvis, Senior Transportation Planner/Analyst, Metropolitan Transportation Commission

Monterey Bay, CA

Janet Brennan, Senior Planner, Monterey Bay Unified Air Pollution Control District

Todd Muck, Associate Planner, Association of Monterey Bay Area Governments

Ventura County, CA

Ben Cacatian, Air Quality Specialist, Ventura County Air Pollution Control District

Carl Morehouse, Senior Planner, Ventura County

Gene Kjellborg, Senior Planner, Ventura County

EPA Region 10

Portland, OR

Dave Nordberg, State Implementation Plan Coordinator, Oregon Department of Environmental
Quality

Annette Liebe, planner, Oregon Department of Environmental Quality

Scott Higgens, planner, METRO

Barbara Linssen, planner, METRO

Seattle, WA

Brian O'Sullivan, Growth Management Planner, Puget Sound Air Pollution Control District

Larry Blaine, Senior Planner, Puget Sound Regional Council
Paul Carr, Washington Department of Ecology

APPENDIX B: Interview Discussion Questions

Air District Personnel

Have you ever considered including any land use measures in your SIP? (explicitly)
If no, why were they not included? If yes, how were the emissions benefits quantified?

Are there local governments in your region (or the state government) that have adopted land use policies that could reduce vehicle emissions? What are they?

Do you know if there are any land use assumptions made in the baseline run of a regional transportation demand model that might produce lower VMT? What are they?

What could the Federal Government do to encourage land use policies that reduce emissions?

Have you considered any of the EPA's Voluntary Mobile Source Programs? If the EPA identified tools to quantify the emissions benefits of voluntary land use policies, would you consider such a control measure?

Is there anyone else you would recommended that I speak to in your region?

MPO Transportation Modelers

How do you develop your baseline land use scenario? Does it incorporate any land use policies that might reduce VMT, trips and/or emissions?

Have you modeled alternate land use scenarios with the regional transportation model? Did this include modeling the impact on vehicle emissions? What were the results?

Are there local or regional land use policies in place that are designed to reduce auto use, sprawl, emissions, etc.? Are these policies incorporated into your land use forecasting process for your RTP/TIP?

Do you think that your modeling capability could quantify a reduction in VMT and/or emissions due to sustainable land use policies -- policies such as commitments by local governments to zone for higher densities, zone for transit-oriented development or require site design that is ped/bike friendly?

If the regional models show the RTP/TIP to be out of conformity, is there a process by which land use assumptions can be modified to reduce emissions from the "build" scenario?

What could the Federal Government do to encourage land use policies that reduce emissions?

Do you think it would be useful for the EPA to allow more flexibility in the adoption of voluntary control measures that encourage VMT-reducing or trip-reducing land use policies?

Is there anyone else you would recommended that I speak to in your region?

COG socio-economic forecasters

How do you forecast land use? Or how do you allocate growth forecasts to the zonal level? Do you use a commercial model?

How are local General Plans and land use policies reflected in the regional socio-economic forecasts?

Are there any local land use policies designed to reduce vehicle travel that are reflected in the regional socio-economic forecasts?

Do you think your land use forecasting process would account for sustainable land use policies -- policies such as commitments by local governments to zone for higher densities, zone for transit-oriented development or require site design that is ped/bike friendly?

What could the Federal Government do to encourage land use policies that reduce emissions?

Do you think it would be useful for the EPA to allow more flexibility in the adoption of voluntary control measures that encourage VMT-reducing or trip-reducing land use policies?

Is there anyone else you would recommended that I speak to in your region?