system and environmental objectives. An obvious indicator of such conflicts is the continuing debate regarding the relation between new automobile emission and fuel economy standards. A more basic conflict is that between encouraging the development of more efficient automobiles on one hand and attempting to foster shifts to more efficient modes on the other. Reducing the marginal costs of driving the automobile is not totally in concert with efforts for reducing the demands on the nation's overloaded transportation system and reducing the pollution associated with those demands. Not all measures for increasing operating efficiency are inconsistent with other social objectives. Lower speed limits not only decrease fuel consumption rates but also serve to reduce travel demands and automobile-related pollution.

In any event, it would make little sense from a national viewpoint to impede the development of more efficient automobiles as a means for increasing the cost of automobile travel. Such a strategy would artificially punish those travelers for whom the private automobile is the only transport mode. The use of economic disincentives that can be targeted at those who have other travel options would be a more equitable, effective approach not only for conserving fuel but also for achieving other transportation goals.

Discouraging Use of Private Automobiles

Clearly, discouraging automobile use is the most effective way to reduce traffic congestion, automobile-related air pollution, and energy consumption. However, unless applied with extreme care, this measure conflicts with a basic goal of our society: providing mobility for people and commerce.

A strong case can be made for meaningful disincentives if alternatives to single-occupant automobile travel are available and the public costs of providing for such travel are not prohibitive. Most people are familiar with the concept of marginal cost pricing and recognize that forever building new transportation systems to accommodate peak vehicle demands is a luxury we can no longer afford.

Out-of-pocket marginal costs make up about one-third of the total costs of operating an automobile. Further, the total costs of operating an automobile during peak periods in congested urban areas make up only about one-third of the total economic costs (5). Broader public support for most TSM initiatives should be achievable if the public is given a clear understanding of the three available options: (a) enormous expenditures for expanding the transportation systems, (b) long periods of widespread congestion, or (c) implementation of effective transportation system management measures, including carefully developed and justified disincentives. Transportation analysts must not only design effective, equitable, and appropriate disincentives but also present the costs and benefits of such measures in such a way that decision makers and travelers can fully weigh the advantages and the disadvantages of instituting such measures.

SUMMARY

A wide range of effective actions can be taken to reduce energy consumption in the transportation sector. Many of the important decisions necessary to implement such actions can be made only at the state and local levels. Since nearly all of these actions will contribute to solving other pressing national concerns (such as our reduced ability to build new transportation facilities and unacceptable pollution levels), these actions will have the support, financial or otherwise, of DOT, EPA, and FEA. The real work, however, will have to be done not at the federal level but at the state, regional, and local levels. The energy problem is national in scope and its effects are important to each level of government; dealing with it, therefore, will require the involvement of all levels.

FEA realizes that some of these options have important social and economic implications. Therefore, it supports further study and phased implementation. However, as we study and debate and postpone decisions, we should be aware that we are using up our cheap oil. A cheap, clean, infinite source of energy is not going to be available when we run out or when the next embargo hits. The question is, Do we have the wisdom and the will to act now or will we allow events to act for us?

REFERENCES

1. Guidelines to Reduce Energy Consumption Through Transportation Actions. Alan M. Voorhees and Associates, Inc., May 1974; Urban Mass Transportation Administration.
2. Joint Strategies for Urban Transportation, Air Quality and Energy Conservation. Interplan Corp., 1975; Urban Mass Transportation Administration; U.S. Environmental Protection Agency.
3. Frank W. Davis, Jr. Regulatory Barriers to Innovation and the Knoxville Experience. TRB, Special Rept., forthcoming.
4. The Potential for Transit as an Energy Saving Option. R. H. Pratt Associates, Inc., March 1976; Federal Energy Administration.
5. Douglas B. Lee, Jr. Costs of Urban and Suburban Passenger Transportation Modes. Institute of Urban and Regional Research, April 1975.

PACKAGING TRANSPORTATION ELEMENTS TO MEET ENVIRONMENTAL OBJECTIVES

Joel L. Horowitz
U.S. Environmental Protection Agency

Controversy over the relation between air quality requirements and urban transportation planning appears to center around two basic issues. The first is whether the implementation of transportation measures that improve air quality is consistent with the achievement of other transportation objectives. The second concerns the changes in the planning process needed to accommodate air quality requirements. This paper outlines the basic elements of a potential resolution of these issues. The transportation measures that have been proposed to improve air quality are virtually identical to the measures now being proposed to achieve a wide variety of other transportation objectives. However, the various measures are

not necessarily equally effective in improving air quality and achieving other objectives. Thus, the process of selecting transportation measures for implementation often will involve making trade-offs between air quality objectives and other objectives. The need for such trade-offs is recognized by the Environmental Protection Agency, and the changes in the transportation planning process needed to enable the trade-offs to be made are consistent with current planning trends. However, three problem areas may require further attention in the future: encouraging the implementation of innovative demand-management approaches, developing procedures for mediating disputes between EPA and state and local agencies over the rate at which transportation change should take place, and preventing the planning process from becoming overly cumbersome.

Air pollution control is unique among federal environmental programs affecting urban transportation in that it attempts to influence the outcomes of the urban transportation planning process as well as the mechanics of the process. Specifically, one of the objectives of this program is to ensure that urban areas develop and implement transportation options that are consistent with federally established air quality standards.

The concern of the air program with the outcomes of the planning process became controversial when the Environmental Protection Agency (EPA) announced in 1973 that drastic traffic curtailments would be needed in several large cities to achieve the air quality standards within the time periods prescribed by law. It is now clear that EPA will not require cities to implement such traffic curtailments. However, the controversy over the relation between air quality requirements and urban transportation has continued, despite the removal of its initial cause. This continuing controversy appears to be centered around two basic issues. The first is whether the implementation of transportation measures needed to achieve air quality goals is consistent with the achievement of other transportation objectives. The second concerns the nature and extent of the changes in urban transportation planning and decision-making processes needed to accommodate the federal government's responsibility to ensure that the outcomes of these processes are consistent with air quality requirements.

Although these issues are likely to remain troublesome for the foreseeable future, the basic elements of a potential resolution are becoming increasingly apparent. The transportation measures that have been proposed to improve air quality and the measures being proposed to achieve a wide variety of other objectives, such as reduced congestion, reduced reliance on capital-intensive projects, and energy conservation, are virtually identical (1, 2, 3, 4, 5). However, the various measures are not necessarily equally effective in achieving improved air quality and other objectives. Thus, trade-offs between air quality objectives and other objectives often will have to be made during the process of selecting measures for implementation. The need for such trade-offs now is recognized by EPA, and changes in urban transportation planning and decision-making processes that will enable these trade-offs to be made within the framework of federal environmental law are beginning to take place. These changes are consistent with the current movement toward multiobjective, multimodal transportation planning, increased interagency coordination and public participation, increased emphasis on short-range transportation options, and a closer connection between planning and implementation (5, 6, 7).

ROLE OF TRANSPORTATION SYSTEM MANAGEMENT IN CONTROLLING AIR POLLUTION

The Clean Air Act Amendments of 1970 directed EPA to establish national ambient air quality standards whose attainment would protect the public health and welfare from the adverse effects of major air pollutants. The pollutants for which health-based air quality standards now exist include carbon monoxide and photochemical oxidants, whose presence in urban air is primarily attributable to emissions of carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NO_x) by motor vehicles. The areas in which one or more of these air quality standards are exceeded include most large cities in the United States and contain approximately two-thirds of the nation's population. The automobile is the source of roughly 70 percent of the CO, 50 percent of the HC, and 30 percent of the NO_x emitted in urban areas. Other transportation sources are responsible for approximately 20 percent of CO, HC, and NO_x emissions in these areas.

Because of the importance of motor vehicles relative to other sources of CO, HC, and NO_x, the reduction of motor vehicle emissions is a major objective of programs to improve air quality. The principal means of achieving this objective is the control of emissions from new vehicles. New automobiles, for example, have been subject to increasingly stringent emission standards since 1966 in California and 1968 nationally. As a result, new automobiles now emit roughly 20 percent as much CO and HC as pre-1968 automobiles. Further reductions in new automobile emissions will be achieved in future years as the emission standards become more stringent.

Despite these emission reductions, controls of new motor vehicle emissions are not by themselves sufficient to achieve CO and oxidant standards in all places. Therefore, the Clean Air Act requires states to develop and implement plans to control emissions from existing sources and certain types of new sources as needed to attain and maintain the air quality standards within their boundaries. If a state fails to develop an adequate plan, EPA is required to promulgate a plan or portion of a plan that satisfies the provisions of the Clean Air Act.

In many large cities, the current and projected future magnitudes of motor vehicle emissions are such that the CO or oxidant air quality standards cannot be attained and maintained through the control of emissions from new motor vehicles and from nonvehicular sources alone. In effect, the transportation systems of these cities are major emission sources that, like other major sources, must be controlled if the air quality standards are to be achieved. Emissions from urban transportation systems can be reduced by improving traffic flows and reducing traffic volumes. The measures through which these objectives might be achieved include virtually all of the ones currently encompassed by the term "transportation system management" (1, 2, 8). The Clean Air Act refers to transportation system management measures as "transportation controls" and requires their inclusion in state implementation plans as necessary to ensure the attainment and maintenance of the air quality standards.

IDENTIFYING TRANSPORTATION SYSTEM MANAGEMENT MEASURES THAT ADDRESS SPECIFIC AIR QUALITY NEEDS

A variety of urban problems, including air pollution, congestion, and high levels of energy consumption, are related to excessive traffic volumes or poor traffic flow conditions and can be alleviated to a greater or lesser extent by reducing traffic volumes and improving traffic flow. Thus, transportation system management measures that benefit one of these problem areas are likely to benefit the others as well. However, air pollution, congestion, and excessive energy consumption are different things, and they have, to some extent, different

physical remedies. Consequently, the transportation measures that might be selected if, for example, congestion relief is the principal policy objective are not necessarily identical to the measures that might be chosen if air pollution control or energy conservation were the principal objective (9).

Excessive CO concentrations occur mainly in areas of high traffic density, such as the central business districts of large cities. Excessive CO frequently is associated with congestion, and measures that reduce congestion also tend to reduce CO. However, CO tends to be a problem during more hours of the day than congestion. Whereas severe congestion normally occurs only during peak periods, excessive CO concentrations typically occur as violations of the 8-h CO air quality standard, meaning that the CO concentration averaged for an 8-h period is too high.

Controlling CO therefore involves reducing CO emissions during an 8-h period. Although peak-period congestion relief is likely to help reduce 8-h CO concentrations, it cannot be assumed that peak-period congestion controls alone necessarily will achieve the reductions in CO concentrations needed to achieve the CO air quality standard. Peak-period traffic typically accounts for only a third of total traffic in an 8-h period that includes a peak. Thus, traffic engineering improvements and reductions in peak-period traffic sufficient to eliminate congestion may not produce reductions in 8-h CO emissions that are large enough to achieve the CO air quality standard (9). Moreover, the principal effect of some peak-period traffic management measures is to encourage the substitution of off-peak-period travel for peak-period travel. This causes CO emissions during peak periods to be replaced by CO emissions during off-peak periods. Owing to improved traffic flow conditions, the resulting increase in off-peak emissions may be less than the decrease in peak-period emissions. Even so, the change in 8-h CO concentrations may be negligible.

The foregoing considerations suggest several ways in which transportation system management measures that are oriented toward CO control may differ from measures whose principal objective is to reduce peak-period congestion. Measures whose main effect is peak spreading may be relatively ineffective for CO control. Traffic engineering measures that improve traffic flow during peak periods are likely to help in reducing CO concentrations, provided that they do not significantly increase traffic volumes, as are measures designed to alter peak-period mode choice. The latter class of measures includes peak-period transit improvements, car-pooling incentives, and pricing or restraint programs whose periods of operation are sufficiently long to discourage peak spreading. However, to achieve the 8-h CO air quality standard, the various peak-period measures may have to be supplemented with measures that reduce off-peak traffic. The supplementary measures could include improvements in off-peak transit service, including the use of paratransit, and the extension of pricing or restraint programs into the off-peak period. Finally, all-day automobile-free zones are a highly effective means of controlling CO in small areas.

Oxidant, unlike CO, is not emitted directly by motor vehicles or any other emission source. Rather, it is the product of atmospheric chemical reactions involving HC and NO_x, both of which are emitted by motor vehicles among other sources. The chemical reactions that produce oxidant require at least 3 h to take place and, under appropriate conditions, may continue for several days. During this period the atmosphere is being mixed by winds and is receiving new injections of pollutants. Consequently, excessive oxidant concentrations tend to occur over entire metropolitan regions rather than in small geographical subareas. Moreover, oxidant is caused by total HC and NO_x emissions within a region rather than emissions in certain subareas or at certain times of day.

The geographical extent of high oxidant concentrations makes oxidant control a significantly different problem from the problems of controlling congestion and CO, both of which tend to be restricted to distinct corridors or subareas. To significantly reduce the contribution of the transportation system to excessive oxidant concentrations requires the achievement of motor vehicle emission reductions, and particularly HC emission reductions, that are significant on a systemwide scale. Thus, transportation system management measures to control oxidant should be oriented toward reducing total regional traffic. Measures that affect only peak-period travel to congested areas and even measures that achieve moderate reductions in total daily traffic in these areas, as CO control measures might do, are likely to have relatively minor effects on oxidant. Similarly, measures whose principal effect is to alter the temporal distribution of travel or the choice of travel routes are unlikely to have significant effects on oxidant (9).

The transportation system management measures that are most appropriate for the control of oxidant are ones that can be applied over large geographical areas. These include transit improvements, particularly for suburban and circumferential travelers, areawide car-pooling incentives, and pricing techniques such as parking taxes, vehicle metering, and HC emission taxes. Gasoline taxes also might be an effective approach to controlling oxidant, at least in the short run, provided they are sufficiently high. In the long run, however, gasoline taxes tend to encourage the replacement of vehicles with poor fuel economy by vehicles with good fuel economy. The resulting improvements in fuel economy would reduce the effects of the gasoline tax on the cost of travel, thus reducing the effects of the tax on traffic volumes and on HC emissions.

Energy consumption by motor vehicles, like oxidant, is a consequence of total regional travel. Thus, with two possible exceptions, measures that are effective in reducing the contribution of the transportation system to excessive oxidant conentrations also are likely to be effective in reducing energy consumption by motor vehicles. Conversely, measures that are ineffective for controlling oxidant are likely also to be ineffective for reducing energy consumption. The two possible exceptions are the HC tax and the gasoline tax. The effects of the HC tax on the cost of travel are likely to decrease over time as old vehicles with high emissions are replaced by new vehicles with lower emissions. Accordingly, the effects of an HC tax on traffic volumes and energy consumption are likely to decrease over time. On the other hand, it is likely that the long-run price elasticity of demand for gasoline is greater than the short-run elasticity. Thus, the beneficial effects of a gasoline tax on energy consumption are likely to increase over time, although the effects of the tax on emissions may decrease.

INTEGRATING AIR QUALITY CONSIDERATIONS INTO THE TRANSPORTATION PLANNING AND DECISION-MAKING PROCESS

Because the transportation system management measures needed to achieve air quality objectives are not necessarily identical to the measures needed to achieve other objectives, it cannot be assumed that transportation policies designed to meet these other objectives

automatically will satisfy air quality needs as well. Rather, air quality must become an explicit factor in the transportation planning process that, along with other factors, affects the design and selection of transportation policies and measures. Moreover, means must be developed for making trade-offs between air quality objectives and other objectives when the measures needed to achieve these various objectives do not coincide.

The procedures for integrating air quality considerations into the planning process, especially the procedures for making trade-offs, must be consistent with the federal government's substantive concern with the air quality impacts of the transportation plans, programs, and projects that result from the planning process. The Clean Air Act requires the air quality standards to be achieved and, in addition, specifies that they must be achieved "as expeditiously as practicable." Moreover, Federal Highway Administration regulations implementing section 109j of the Federal-Aid Highway Act require annual determinations by the policy boards of metropolitan planning organizations (MPOs) that the transportation plans and programs of these agencies are consistent with the state implementation plans. Thus, achievement of the air quality standards is not an objective that planners and policy makers can accept or reject as they see fit. Indeed, the term "as expeditiously as practicable" implies that air quality improvement must be included among the highest priority transportation objectives. This does not mean that air quality must be the dominant objective or that measures that have severe adverse effects in other respects must be implemented solely because they improve air quality. However, it does suggest that other objectives may, on occasion, have to be compromised or delayed for air quality reasons.

Fortunately, the characteristics of a planning process that adequately incorporates air quality considerations are consistent with process changes that are already taking place for reasons that include but are by no means restricted to air quality requirements. These characteristics include

1. Regional coordination of transportation system management planning as well as planning for major capital improvements,
2. Increased involvement of transportation agencies in air quality planning,
3. Increased coordination among transportation agencies and other agencies,
4. Increased emphasis of transportation system management measures,
5. Alternatives analysis and trade-off identification,
6. Flexible planning approaches and incremental implementation, and
7. Increased involvement of elected officials and the public in the planning process.

The transportation planning process must include a strong element of regional coordination to enable it to deal satisfactorily with air quality issues. The need for regional coordination is most apparent when oxidant, a regional pollutant, must be controlled, but it is also present in the case of CO control. Although excessive CO concentrations tend to be restricted to distinct corridors and subareas, uncoordinated efforts to reduce CO concentrations in each area individually are likely to shift CO problems from one area to another and fail to take advantage of complementary efforts in different areas.

A logical agency for effecting the necessary regional coordination is, of course, the MPO. In the past, transportation measures to improve air quality frequently have been developed in isolation from the process through which other transportation actions are planned and programmed. As a result, the air quality measures often have been infeasible, have been in conflict with other transportation actions and objectives, or otherwise could not be implemented. The involvement of the MPO and, through it, other transportation agencies in developing transportation measures to improve air quality will enable transportation decisions concerning air quality and decisions about other transportation objectives to be made together, thus making it possible for coincidences and conflicts among objectives to be identified, trade-offs to be made where necessary, and advantage to be taken of coincidences between air quality objectives and other transportation objectives. In discharging its regional coordination responsibilities, the MPO should ensure that

1. Air quality requirements receive appropriate consideration at all stages of the transportation planning process;
2. All participants in the process understand how air quality requirements affect their respective areas of responsibility;
3. Air quality implications of the transportation options under consideration at various stages of the planning process are evaluated early enough to affect the selection of options for inclusion in plans and programs; and
4. Transportation plans and programs developed through the planning process are consistent with air quality requirements.

In addition, the MPO can serve as a forum for making trade-offs among air quality objectives and other objectives when conflicts arise.

Although transportation agencies should have the primary responsibility for developing transportation measures for improving air quality, coordination between transportation agencies and agencies with nontransportation responsibilities is necessary. State or local air quality agencies, for example, may be able to provide data and skills relevant to air quality analyses that are not otherwise available to transportation agencies. More important, air quality agencies are responsible for controlling stationary-source emissions of some of the same pollutants that motor vehicles emit, and decisions must be made as to how emission reductions will be allocated among the two types of emission sources. Coordination also is necessary with land use, water quality, and housing agencies, all of which affect the transportation system and its emissions through their influence on land use.

The requirement of the Clean Air Act that the air quality standards be achieved as expeditiously as practicable implies that the transportation planning process should include a strong short-range programming activity and that air quality improvement should be a high-priority objective of this activity. This does not necessarily mean that the air quality standards will be achieved quickly or that long-range measures may not be needed. However, it does suggest that steady progress toward meeting the air quality standards should be made, starting now. The principal means whereby such steady progress can be made is through the implementation of appropriate selections of transportation system management measures. Transportation organizations should make systematic and continuing efforts to identify, develop, and implement transportation system management options, including innovative ones, that appear capable of reducing the emissions of transportation systems.

The development of both short-range options and the longer range elements of the transportation plan should include analysis of the likely impacts on air quality and other factors of a range of alternative courses of action (10). The alternatives selected for analysis should be sufficiently different in their impacts to provide a real choice and should be defined and analyzed in a way that illustrates the complementarities and trade-offs among objectives. One of the uses of the results of the analysis should be to assist decision makers in determining which course of action enables the air quality standards to be met as expeditiously as practicable. This determination can be made only if information is available on what would be gained or lost by reducing emissions more or less rapidly. The necessary information, insofar as it is available, should be developed during the analysis of alternatives.

Even the best analysis of alternatives is unlikely to develop information that is as complete or precise as would ideally be desired. Available analytical techniques are imprecise, and there has been too little experience with many of the most promising transportation system management options to enable their impacts to be forecast with confidence. The planning process and the transportation implementation process both should contain sufficient flexibility to accommodate the resulting uncertainties. Untried measures should be implemented on a small scale and their effects carefully monitored. Depending on the outcome of the monitoring, the measures can be modified, expanded in their application, or withdrawn. Contingency plans can be prepared so that progress toward achieving transportation objectives does not halt if one or more innovative measures fail to produce the hoped-for results.

Finally, it is necessary to increase the involvement of elected officials and the public in the transportation planning process. Heretofore, transportation planning, particularly transportation planning for air quality improvement, has taken place in relative isolation from elected decision makers and the public. In consequence, the resulting plans could not and have not represented commitments to implementation. Indeed, they sometimes have represented attempts to avoid commitments and to keep all options open. Implementation commitments have tended to develop on a project-by-project basis during long periods of time with the result that implemented projects and planned ones often have had little in common. However, under the Clean Air Act, transportation plans and programs to improve air quality must include commitments to implementation. These commitments need not extend to all elements of what might be a 20-year plan, and they do not require the continuation of measures that prove unsuccessful. But assurance is needed that the near-term elements of transportation programs will be implemented and that the policies contained in the plans and programs will be carried out until such time as experience or changed conditions may require their modification. The necessary commitments can be obtained only if those who can make or impede them, including elected officials and the public, are involved in the planning process earlier and more systematically than often has been the case in the past.

The participation of elected officials and the public in the planning process should be oriented toward achieving the public acceptance, budgetary commitments, and legal authority needed to implement the near-term measures and longer range policies contained in the resulting plans and programs. Insofar as possible, public acceptance, budgetary commitments, and legal authority should be developed during the planning process rather than through subsequent efforts of the planners to "sell" the plan to elected officials and the public. Thus, the participation of elected officials and the public in the process must involve more than exchanges of information and ideas; it must be a decision-making activity designed to produce plans and programs that are ready for implementation.

UNRESOLVED ISSUES

The achievement of substantial improvements in the efficiency and reductions in the emissions of urban transportation systems is likely to require the implementation of some of the more innovative approaches to managing travel demand. There has been little experience with most demand management measures, and their effects are not well understood. Thus, there is a risk entailed in implementing the measures: They may prove to be socially costly and fail to produce the expected benefits. Understandably, elected officials and the public are reluctant to implement risky and potentially disruptive transportation measures. However, the innovative demand management measures cannot be obtained unless the measures are implemented on at least an experimental basis. Thus, it is necessary to consider how the barriers to implementation created by risk might be overcome.

A policy of fully involving elected officials and the public in the process of planning innovative demand-management measures, gradually implementing the measures, carefully monitoring their effects, and modifying or withdrawing the measures as necessary should help to overcome reluctance to implement the measures. However, other risk-reduction policies also may be needed. For example, it may be necessary to develop procedures for compensating persons who are adversely affected by innovative attempts to manage travel demand. It also may be necessary to wait. The public may not yet perceive its transportation problems as being sufficiently severe or the traditional transportation measures as being sufficiently ineffective to justify the risks associated with innovative demand-management approaches.

The determination of whether the air quality standards are being met as expeditiously as practicable is another potential source of difficulty. This determination requires a value judgment. Different individuals may disagree over what is the proper judgment, even if they agree on the underlying information. In particular, EPA may disagree with state and local officials. The Clean Air Act requires EPA to promulgate a state implementation plan or portion of a plan if it determines that the plan submitted by a state is inadequate to achieve the air quality standards as expeditiously as practicable. However, there is much experience indicating that this is not a satisfactory way of resolving disagreements over transportations plans. An improved planning process that examines a broad range of transportation options should help to minimize disagreements between EPA and state and local officials. Moreover, there is preliminary evidence that informal bargaining may be sufficient to resolve the disagreements that do arise (11). However, it is too early to determine whether the combination of an improved planning process and informal bargaining will be adequate to resolve disagreements between EPA and local authorities or whether the development of more formal mediation procedures will be needed.

Implementation of the planning approaches presented here will significantly increase the complexity of the transportation planning process. More potentially conflicting objectives will have to be considered, more analyses and evaluations will be needed, and more

people and agencies will be involved. This complexity undoubtedly will cause transportation planning to become more expensive, thus necessitating increased federal financial support of planning agencies. More important, the planning process may become so cumbersome that it inhibits the informed, efficient decision making it is supposed to promote. If an overly complex planning process is to be avoided, the people who design, operate, and participate in the process will have to exercise considerable skill and wisdom in balancing the need to maximize information, coordination, and participation against the need to maintain simplicity.

ACKNOWLEDGMENT

The views expressed in this paper are those of the author and are not necessarily endorsed by the Environmental Protection Agency.

REFERENCES

1. Transportation Improvement Program. Federal Register, Sept. 17, 1975, pp. 42976-42984.
2. J. Horowitz and S. Kuhrtz. Transportation Controls to Reduce Automobile Use and Improve Air Quality in Cities: The Need, the Options, and Effects on Urban Activity. U.S. Environmental Protection Agency, Rept. EPA-400/11-74-002, Nov. 1974.
3. Low Cost Urban Transportation Alternatives: A Study of Ways to Increase the Effectiveness of Existing Transportation Facilities. R. H. Pratt Associates, Jan. 1973; U.S. Department of Transportation.
4. C. A. Hedges. Let's Attack the Real Urban Transportation Problem. TRB, Transportation Research Record 519, 1974, pp. 10-25.
5. G. W. Harvey and E. A. Deakin. State and Local Roles in Transportation Control Planning. TRB, Transportation Research Record 599, 1976, pp. 1-6.
6. W. G. Hansen and S. C. Lockwood. Metropolitan Transportation Planning: Process Reform. TRB, Transportation Research Record 582, 1976, pp. 1-13.
7. M. L. Manheim, J. H. Suhrbier, E. D. Bennett, L. A. Neumann, F. C. Colcord, Jr., and A. T. Reno. Transportation Decision-Making: A Guide to Social and Environmental Considerations. NCHRP, Rept. 156, 1975.
8. F. C. Dunbar. Evaluation of the Effectiveness of Pollution Control Strategies on Travel: An Application of Disaggregated Behavioral Demand Models. Transportation Forum, Vol. 16, No. 1, 1975.
9. J. Horowitz. Pricing the Use of the Automobile to Achieve Energy and Environmental Goals: A Comparison of Measures and Effects. TRB, Special Report, forthcoming.
10. G. A. Bonina. Evaluation of Air and Noise Pollution Impacts During the Highway System Planning Stage. TRB, Transportation Research Record 580, 1976, pp. 59-69.
11. E. D. Bennett, G. W. Harvey, A. Rappaport, and M. Bessey. Air Quality Considerations in Transportation Planning: Findings and Recommendations on Transportation Control. Massachusetts Institute of Technology; U.S. Environmental Protection Agency; National Technical Information Service, Springfield, Va., PB 256 424.

ROLE OF THE MPO IN FORMULATING THE TSM ELEMENT

Albert A. Grant
Department of Transportation Planning, Metropolitan Washington Council of Governments

Developing and implementing effective transportation system management elements in urban transportation plans will depend greatly on the ability of the metropolitan planning organization to develop an acceptable institutional framework for cooperation and joint action that does not detract from the basic responsibility and authority of participating local and state agencies. MPOs, particularly those operating within the framework of councils of governments, can play a key role in the further refinement and implementation of TSM elements because of their ability to work with local and state policy and decision makers to achieve consensus in a metropolitan area. Because of their concerns with a wide range of functional and social service goals and needs, MPOs can recommend trade-offs among competing objectives, identify opportunities for applying locally successful TSM measures to other parts of a metropolitan region, and integrate and relate TSM planning to other elements of the areawide transportation planning process.

Regulations promulgated by the U.S. Department of Transportation in September 1975 required the submission by March 30, 1976, of a transportation improvement plan containing transportation system management (TSM) elements. During this 6-month period, metropolitan planning organizations (MPOs) had to develop and gain acceptance of a strategy for action by state and local constituents, many of whom unhappily perceived that the September regulations threatened their prerogatives and authority; carry out the agreed-to strategy; and prepare and submit the TSM element of the plan. Many of these first efforts were hasty and drew criticism for lacking comprehensiveness and not being systematic in the approaches, evaluations, and trade-off analyses.

Although generally valid, these criticisms should be considered within the perspective of institutional relations and concerns and of the time needed to overcome such institutional concerns so that adequate attention can be given to the technical problems and their solutions. The first role of the MPO in TSM planning is to develop a political and institutional strategy and process that will allow all MPO participants at the state and local levels to engage in areawide TSM planning without losing their responsibilities and authority. Implementation of effective TSM plans will depend greatly on the MPO's ability to develop an acceptable institutional framework over time for cooperation and joint action.