EXPANDING METROPOLITAN HIGHWAYS

Implications for Air Quality and Energy Use

Special Report 245: Expanding Metropolitan Highways—Implications for Air Quality and Energy Use (price $32.00; $24.00 for TRB affiliates) is available from the Transportation Research Board (see page 64 for ordering information).

To meet the regulatory requirements of the Clean Air Act Amendments of 1990, metropolitan planning organizations, state officials, legislators, and courts with oversight responsibilities are currently being asked to make judgments about the likely effects of highway capacity additions on air quality on the basis of their interpretation of the best available information. The Executive Committee of the Transportation Research Board initiated an 18-month study, the results of which are summarized in TRB Special Report 245, *Expanding Metropolitan Highways—Implications for Air Quality and Energy Use,* to evaluate the scientific evidence about the impacts of highway capacity additions on traffic flow characteristics, travel demand, land use, vehicle emissions, air quality, and energy use in metropolitan areas.

The CAAA and complementary provisions of the Intermodal Surface Transportation Efficiency Act of 1991 introduced new constraints on the transportation sector to help ensure that transportation activities do not delay expeditious attainment of national health standards for air quality. Local jurisdictions that do not meet air quality standards must show that implementation of proposed transportation plans will not lead to new or greater violations or delay the attainment of clean air goals. As a result, projects that expand metropolitan highways—the backbone of traditional transportation programs—have come under intense scrutiny in many areas.

Once believed to always reduce congestion without adversely affecting air quality, projects that expand highway capacity are now being challenged by some analysts and environmental groups because of their potential for stimulating pollution-creating motor vehicle travel and supporting dispersed metropolitan development patterns that foster additional automobile travel. The issue is already at the center of legal challenges or threats of litigation in several metropolitan areas, potentially stalling local highway construction programs.

Energy issues do not convey the same urgency, yet transportation's increasing consumption of the nation's petroleum resources is also of concern. Highway capacity expansions have the potential to induce additional motor vehicle travel and energy use.

These issues are part of a larger debate over the appropriate direction of metropolitan growth and the role of transportation in that process. Many view new highway capacity as essential to the continued economic growth and competitiveness of major metropolitan areas. Others see continued highway expansion as antithetical to a more environmentally oriented and resource-conscious future that stresses the revitalization of older urban and inner suburban neighborhoods and supports transit and other modes of transport such as bicycling and walking.

The TRB study does not resolve the broader debate—which involves value judgments about the relative importance of mobility, economic growth, environmental protection, and energy conservation—but it does review the state of knowledge and the reliability of forecasting tools available to planning agencies to predict the effects of expanding highway capacity on air quality and energy use. Broad-based interest in the study was demonstrated by funding support from agencies and organizations that included the Federal Highway Administration, the American Association of State Highway and Transportation Officials (through the National Cooperative Highway Research Program), and the Environmental Protection Agency.

FINDINGS

After examining the considerable literature on the relationships among transportation investment, travel demand, and land use as well as the current state of the art in modeling emissions, travel demand, and land use, the committee found that the analytical methods in use are inadequate for addressing regulatory requirements. Modeled estimates are imprecise and limited in their account of changes in traffic flow characteristics, trip making, and land use attributable to transportation

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investments. The current EPA regulatory requirements for estimating vehicle emissions demand a level of analytic precision beyond the current state of the art in modeling.

The initial effects on energy use from highway capacity additions can be predicted more reliably than effects on emissions because fuel economy is not as sensitive as emissions to traffic flow conditions, particularly speed variation. However, energy and emissions estimates must both be linked with reliable data on the likely impacts of highway capacity additions on traffic, travel demand, and location decisions. Here, too, the available travel demand and land use models provide imprecise and limited estimates of likely outcomes.

More research and improved models can help narrow the gap between regulatory requirements and analytic capabilities. However, the complex and indirect relationship between highway capacity additions, air quality, and energy use, which is heavily dependent on local conditions, makes it impossible to generalize about the effects of added highway capacity on air quality and energy use, even with improved models.

On the basis of current knowledge, it cannot be said that highway capacity projects are always effective measures for reducing emissions and energy use. Neither can it be said that they necessarily increase emissions and energy use in all cases and under all conditions. Effects are highly dependent on specific circumstances, such as the type of capacity addition, location of the project in the region, extent and duration of preexisting congestion, prevailing atmospheric and topographic conditions, and development potential of the area.

Concluding Observations

Despite the current uncertainties in predicting the effects of expanding highway capacity on air quality and energy use, policy makers and planners must comply with current regulatory requirements and make decisions on the basis of the best available information. The committee evaluated the likely payoffs of pursuing current policies.

In its opinion, the current regulatory focus on curbing growth in motor vehicle travel by limiting highway capacity is at best an indirect approach for achieving emissions reductions from the transportation sector that is likely to have relatively small effects, positive or negative, on metropolitan air quality by the late 20th and early 21st centuries, when the current attainment deadlines must be met. Historically, measures to control travel demand have had limited effects. Major highway capacity additions are likely to have larger effects on travel and to increase emissions in the affected transportation corridors in the long run. However, because of the large investment implicit in current metropolitan spatial patterns, it may be years before changes in land use and related traffic patterns induced by the added capacity make a significant difference in regional emission levels and air quality.

Moreover, curtailing all highway capacity expansion that has any potential for increasing emissions invites competition between environmental and economic concerns. In the past, when environmental goals have conflicted with economic objectives, the response has been to delay or reassess environmental regulations. It is easy to envision these pressures building again. In addition, requiring policy decisions to hinge on uncertain model outputs leaves the entire process vulnerable to error and manipulation.

A more constructive approach in the committee's view is to look for ways to reconcile air quality with economic goals. The committee believes that technology improvements can yield more significant benefits for air quality relative to the current focus on curbing travel growth. Technological

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Committee for Study of Impacts of Highway Capacity Improvements on Air Quality and Energy Consumption

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*Mr. Replogle's dissent from some of the key committee findings is presented in an appendix to the report.

Point of View *continued from page 21*

In any case, the number of lead-acid batteries used in electric vehicles will never approach the 72 million per year placed in today's gasoline vehicles. Lead-acid batteries are widely acknowledged to be nothing more than a short-term bridge to more advanced batteries and advanced nonbattery electric vehicles (such as hybrid and fuel-cell vehicles).

The Carnegie Mellon researchers concluded that "...automobile makers are spending hundreds of millions of dollars on near-term battery technology that is bad for the environment. Instead, resources could be devoted to developing more attractive technologies that will not be available for some years." In fact, automobile makers are spending virtually nothing on near-term battery technology for electric vehicles; most investments in such research and development are being made by unaffiliated battery companies (with the exception of GM's Delco), and at a scale far smaller than the authors imply. Even if automobile makers were spending substantial funds on near-term lead acid batteries, the spin-off benefits for ignition batteries (and other applications) might easily justify the investments.

Most investments by automobile makers in battery research and development, although negligible, already are devoted to advanced batteries. They have paid for about one-fourth of the $160.2 million spent by the U.S. Advanced Battery Consortium since its founding in 1991. Most of the remaining funds came from the U.S. government and electric utility companies.

The central premise of the Carnegie Mellon research—that the analysis of the environmental effects of electric vehicles should be broadened "to consider the life-cycle consequences of producing and reprocessing lead-acid batteries"—is exactly right. However, either they were unaware of or chose not to factor in the findings of many thorough, objective studies on the environmental benefits of electric vehicles. Their findings are flawed and inappropriately narrow to support their broad policy prescriptions.

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advances to vehicles and fuels have substantially reduced vehicle emissions in the past 20 years. Further emission reductions can be achieved from improvements such as preheated catalytic converters, engine power enrichment regulations, use of oxygenated or alternative fuels, and more effective vehicle inspection and maintenance programs. Market solutions also show promise. For example, imposing tolls varied by time of day (i.e., congestion pricing) and collected electronically could help control travel growth on expanded highway links.

In the long run, stronger measures such as pricing motor vehicle travel to more fully reflect the full social costs of highway travel and the introduction of areawide, time-of-day tolls, may be necessary to provide direct incentives for reducing or shifting travel demand in ways that use highway capacity more efficiently and with less damage to the environment. Radical advances in vehicle technology could produce cleaner transportation, substantially reducing the level of vehicle emissions. The feasibility of some of these approaches is untested. In the judgment of the committee, however, as long run alternatives to current policy, they offer better prospects for reconciling economic and environmental interests and making significant improvements in metropolitan air quality and energy conservation.