

Clearing the Air

To Reduce
Automobile
Pollution,
Adjust the Car,
Not the Driver

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So foul a sky clears not without a storm.

—Shakespeare, *King John* (IV:2)

The improvement of air quality in American cities undoubtedly ranks as one of the resounding public policy successes of the postwar era. Yet the widespread perception is that air pollution is getting worse—since major industrial sources of pollution have been stringently controlled, deteriorating air quality therefore must result from increased emissions from the other major source, cars. The increase is usually attributed to growth in automobile ownership and use, since progressively tighter emissions standards have made new cars significantly cleaner.

The U.S. Environmental Protection Agency (EPA)—the federal agency largely responsible for the nation's success in clearing the air—uses this logic in its *Plain English Guide to the Clean Air Act*: “More cars driving more miles . . . is why air pollution from cars has gotten worse even though individual cars produce less pollution than they used to.” Since tailpipe emissions standards have failed to reduce automotive air pollution, the obvious prescription is to control automobile use by

- ◆ Restricting driving, and
- ◆ Fostering development patterns that reduce automobile dependence.

This popular prescription may have many merits, but improving air quality is not one. The diagnosis of automotive air pollution is astonishingly at odds with the facts. Violations of federal standards for three of the four commonplace pollutants from automobiles—airborne lead, nitrous oxide, and carbon monoxide—virtually have disappeared in the past two decades, and violations involving the fourth, ozone, have declined by more than 90 percent.

The typical duration of violations of federal air quality standards also has decreased sharply—yet even this impressive decline may understate the overall reduction in Americans' exposure to harmful pollution levels. Levels of toxic chemicals in the air are declining, and U.S. greenhouse gas emissions, although rising—and apparently a cause of atmospheric warming—are declining in relation to nationwide economic activity.

Credit Where It Is Due

Much of this progress results from reductions in air pollution from automobiles, despite the sustained growth in car ownership and use. Cars were once the dominant source of atmospheric lead, but phasing out lead as a gasoline additive has eliminated this threat to public health. Automobile emissions of carbon monoxide and volatile organic compounds—which react in the atmosphere to form ozone—have decreased by half or more since 1970, mostly as a result of progressively tighter federal tailpipe standards for new cars and federally-mandated changes in gasoline formulation.

The only exception to this remarkable record for car emissions is nitrogen oxide, which forms the pollutant nitrous oxide and also contributes to ozone. Nitrogen oxide emissions from cars have fallen only slightly, although remaining steady or even increasing from other sources. Most toxic chemicals in vehicle exhaust also have declined dramatically, and emissions of carbon dioxide—the main greenhouse gas emitted by passenger vehicles—were falling gradually until the recent U.S. infatuation with behemoth sport utility vehicles.

Refocusing Emissions Standards

Despite this impressive record of air quality improvements and the critical role that cleaner cars have played, reducing air-polluting emissions from

motor vehicles should remain a priority. EPA recently imposed the Tier II emissions standard as well as limits on gasoline sulfur, but making new cars cleaner under laboratory-like test conditions will not solve the problem. The Tier II standard will reduce total emissions from cars only by 5 to 10 percent, even after vehicles meeting the standard constitute a substantial portion of the fleet.

Mandating sales of zero-emission vehicles—in California and several other states—will not work with the current technology. The vehicles are costly to produce; their high prices will slow the retirement of older cars and exacerbate the shift from cars to light trucks. In addition, zero-emission vehicles have a limited range and performance compared with gasoline-powered vehicles.

The key is to reduce automobile emissions under real-world driving conditions. New cars in real-world conditions average four to ten times the emissions recorded under test conditions, depending on the specific pollutant. Reductions in automobile fleet emissions have not kept pace with the reductions for new cars. Some cars now on the road have met less stringent emissions standards; nonetheless, most emission control systems do not perform as well on the road as under the carefully controlled conditions for testing new models.

New cars appear “squeaky clean” on the outdated test cycle, allowing higher emissions under conditions common in real-world driving. Moreover, a small portion of cars on the road (10 to 20 percent, depending on the pollutant measured) have malfunctioning emissions control systems, which can elevate emissions levels drastically.

Closing the Test Gap

The most important step toward closing the gap between test and on-road emissions is to identify and repair vehicles with malfunctioning emission control systems. Malfunctions can be detected either with the dynamometer test—part of the enhanced inspection and maintenance program that EPA has mandated for some cities—or with portable sensing devices, making direct roadside measurements of the exhaust from passing vehicles.

The onboard diagnostic devices installed in new cars alert drivers to malfunctions in the engine control systems and provide repair technicians with data to pinpoint the causes. Encouraging drivers to respond promptly to these warnings might accomplish the same result as subjecting every vehicle and its driver to periodic, time-consuming tests. (Perhaps the car’s radio automatically should play supermarket music until the engine malfunction is repaired!)

Another measure would change emissions testing procedures to require new cars to control emissions more effectively in common real-world

driving situations, such as rapid acceleration, stop-and-go traffic, air conditioner use, and climbing hills. Recent revisions in the test cycle do not take full effect immediately and stop short of mirroring everyday driving conditions and behavior.

Finally, efforts to clean up gasoline already have had heroic success reducing emissions of some pollutants at extremely modest cost. Most of the benefits may be in place already, but further changes in fuel specifications are probably worth pursuing, since they reduce emissions from the entire fleet without having to wait a generation for new cars to replace older ones. Accounting for normal deterioration in emission control system effectiveness, these measures together could eliminate the gap between the test and on-road emissions, guaranteeing a continued decline in total automotive emissions for another two decades.

Addressing Carbon Emissions

Although these measures could reduce on-road emissions of criteria pollutants to the virtually undetectable levels achieved in test conditions, reducing automobile carbon dioxide emissions is another story. This task will require a combination of quantum improvements in vehicle energy efficiency and shifts to fuels with low carbon emissions in relation to their energy content.

The most promising near-term innovations in engine technology are the direct-injection diesel engine and the hybrid drive system. The hybrid drive system uses a small internal-combustion engine to generate electricity that is stored in an onboard battery to power an electric motor (most railroad locomotives use a similar system without the battery).

Fuels with low carbon emissions include diesel fuel made partly from soybean or other vegetable oils (biodiesel) and ethanol distilled from plant material (biomass)—the plants already have absorbed enough carbon dioxide to offset most of that generated by combustion of the fuel.

In the longer run—that is, in terms of decades, not years—near-magical engine technologies like fuel cells may operate on exotic fuels such as hydrogen, drastically reducing carbon emissions. However, the costs may remain prohibitive.

Controls on Automobile Use

Instead of focusing on how to reduce real-world emissions, much of the recent debate has concentrated on how to reduce automobile use, either through

◆ Demand-management strategies—attempting to combine trips in single-occupant cars into trips in carpools; to shift some automobile trips to walking,





bicycling, and transit; and to reduce the length of automobile trips; or

◆ Land-use planning—fostering development patterns that require less driving.

The problem is that extensive travel-demand research and more than two decades of experience with demand management have produced few measures that detectably reduce automobile travel. Even the minute reductions tend to be one-time effects that rapidly erode, with no permanent effect on the rate of travel growth.

The only likely exceptions are strategies that impose significantly higher prices for automobile use or parking, including peak-hour tolls on congested highways and on other facilities that can cause traffic bottlenecks—such as bridges and tunnels—or raising prices for all-day commuter and hourly on-street parking. Although pricing measures are attractive for many reasons besides the potential impact on air quality, their effectiveness is limited, because most automobile travel occurs in relatively uncongested conditions.

In addition, increased pricing remains unpopular among automobile drivers and political officials alike. The limited highway and parking price measures recently adopted in the United States may overcome resistance, but the educational process is likely to be too prolonged to accommodate the ambitious timetables for achieving the air quality standards mandated by federal legislation.

What About Land-Use Planning?

The enthusiasm for land-use planning to change travel behavior and improve air quality is understandable. However, land-use planning will be ineffective in accomplishing either goal for two reasons. First, planning typically has little influence on land-use patterns, and second, the link between changes in land use and changes in travel behavior is weaker than advocates maintain.

The social consensus, the legal and economic foundations, and the political institutions involved in land-use planning tend to be weak and have limited influence. To make matters worse, zoning—the instrument for land-use control—is only crudely suited to guiding development patterns; historically, zoning has promoted the dispersion, the separation of land uses, and the lower densities that land-use control now is trying to remedy.

Finally, property and housing markets play a central role. With the added influence of other public policies, these market forces often overwhelm the intended effects of carefully designed and successfully implemented land-use plans.

Limited Influence

But even if planning could change land use patterns, its influence on travel behavior would be limited because the presumed connection misinterprets the historical process of urban development. Historically, powerful economic and demographic developments—rising incomes, smaller and less traditional households, innovations in production technology, and changes in the products of the U.S. economy—have combined with investments in transportation infrastructure to disperse population and employment within urban areas and to reduce the density of development in progressively more distant suburbs.

The evolving technology (from horse-drawn streetcars to electric rapid transit to highways), historical timing, and geographic orientation of cities' massive investments in transportation facilities—not to mention the systematic underpricing of their use—have been important in shaping the geography of metropolitan development and travel patterns.

The association between today's urban land-use patterns and travel flows revealed in cross-sectional statistical analyses usually is interpreted as evidence that land use determines the geography of travel demand. But the static relationships uncovered in the research oversimplify the complex, dynamic process that simultaneously creates urban development patterns and travel flows; the perceived relationships do not mean that changing land-use patterns will alter travel in predictable ways. Almost invariably analyses find that the location of neighborhoods within metropolitan areas, as well as the economic and demographic characteristics of the households, explains most of the association between development characteristics and residents' travel behavior.

Achievable Goals

Careful research generally has identified only residual effects of land-use characteristics on travel behavior and usually finds that these effects—such as residential density—become significant only at extremes rarely approached in the United States. As compelling as the logic relating land-use patterns to travel behavior seems, the evidence remains mostly unpersuasive. (In contrast with land-use planning, transportation planning has the potential to influence travel behavior in significant and desirable ways.)

Nonetheless, most American cities need more effective and thoughtful land-use planning. But the case for planning rests on achieving rational land-use patterns and hospitable urban designs, not on reducing automobile travel—not necessarily a desirable goal—nor on improving air quality and forestalling climate change.

Resources

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