

FEATURE ARTICLES



HIGHWAYS AND THE ENVIRONMENT: NEW PROBLEMS AND NEW OPPORTUNITIES

James R. Wright*

At the 1972 Highway Research Board Summer Meeting, recently held in Madison, Wisconsin, Ray Lappegaard, Commissioner of the Minnesota Department of Highways, set forth three challenging environmental goals for state highway organizations (1):

1. Avoid any detrimental effects on the environment;
2. Minimize detrimental effects on the environment where such effects cannot be completely avoided; and
3. Enhance the environment wherever it is possible to do so.

Although such goals have not been enthusiastically adopted by all members of the transportation community, there is a growing sentiment among those involved in transportation operation and development that such environmental goals are both necessary and important and that now it is time to get on with the job of making the goals realities.

POLLUTION CONTROL

Noise, air, and water pollution stand high on the list of problems slated for priority attention. The Federal Highway Administration is currently developing highway noise standards that will apply to federal-aid highway projects for which location approval is requested after December 31, 1972, and also to certain types of federal-aid highway projects submitted prior to that date (2). FHWA guidelines are also being developed on air pollution control to meet the requirement of the 1970 Federal-Aid Highway Act that federal-aid highways be "consistent with any approved plan for the implementation of any ambient air quality standard for any air quality control region..." (3). These implementation plans are being developed on a state-by-state basis, and each plan must be approved by the U. S. Environmental Protection Agency (4).

Highway impact on water quality has numerous facets. Sedimentation of bodies of water resulting from soil erosion during highway construction has

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Some of the 400 registrants line up at the desk to receive program materials and credentials.



The Honorable William D. Dyke, Mayor of Madison, Wisconsin (left), chats with Edward A. Mueller, Florida Department of Transportation, who presided at the first session.



John T. Middleton, Environmental Protection Agency, was the opening speaker at the first general session of the 5th Summer Meeting.



Alan M. Voorhees, Chairman of the Executive Committee of the Highway Research Board, extended a welcome to the delegates on behalf of the Board.



The speaker at the banquet at the 5th Summer Meeting was the Honorable Norman M. Clapp, Secretary of the Wisconsin Department of Transportation. Also at the head table are, from left, W. B. Drake, Kentucky Department of Highways; Richard Golterman, Illinois Department of Transportation; Reverend Michael Trainor; John T. Middleton, Environmental Protection Agency; Ray Lappegaard, Minnesota Department of Highways; and W. N. Carey, Jr., Highway Research Board.

received considerable attention at the federal level. Congress directed in the 1970 Federal-Aid Highway Act that guidelines for minimizing possible soil erosion from highway construction be developed and applied to all federal-aid highway projects (5), and legislation to establish additional controls has been proposed by the President (6).

Another aspect of highway water quality impact is the application of chemical de-icers to highways during snow and ice conditions to maintain bare pavements. The possible adverse effect of these de-icing salts on water quality, vegetation, and animal life has created controversy and litigation in a few northern states. Additional problems of water quality impact may arise from chemical spills, highway water runoff, and highway development effects on local hydrology.

Solving the problems of noise, air, and water pollution will in general not be a simple matter. Although some initial, and in some cases rather complex, techniques have been developed for simulating the potential noise impact of a proposed highway facility (7, 8, 9), for monitoring and modeling its air pollution impact (10, 11), for approximating the movements of salt from highway water runoff (12, 13, 14, 15), and for measuring and modeling the character and movement of suspended sediment (16), these techniques and others will require further evaluation, refinement, and research. In the interim, such techniques can provide valuable tools for environmental assessment and decision-making.

Solutions to specific problems of pollution abatement are in a similar tentative state. Insofar as noise and air pollution are concerned, substantial improvement can be expected from changes and improvements in motor vehicle design. Such changes are now required by federal law for air pollution control (17) and by state law for noise control (18, 19, 20, 21, 22, 23). In addition, a proposed federal law regulating motor vehicle noise has passed one house of Congress and is pending in the other (24).

Even if motor vehicles are "cleaned up" enough to meet federal air pollution emission standards, that will not be sufficient to satisfy national air pollution control health standards in many large urban areas (25, 26). Although research currently under way holds the promise of substantial reductions for some types of vehicle noises, the application of such research will take time. Certain technical barriers also stand in the way of achieving substantial motor vehicle noise reduction for traffic flows moving at freeway speeds (27). In effect, then, improvements in motor vehicle design will not by themselves be sufficient to satisfy federal environmental standards applying to highways. Substantial changes in highway planning, design, and operation will also be required.

A number of possibilities exist for making these changes. Highway noise reductions, for example, can be achieved in some situations by depressing or elevating a particular highway section (2, 8). Because noise attenuates harmlessly with distance, shifting the highway alignment away from noise-sensitive areas where possible is always effective. Banning truck traffic from certain areas or during certain hours will reduce peak noise levels. Roadside barriers have also been used to shield noise-sensitive land uses adjacent to the right-of-way, but there are currently differing opinions on the noise reduction effectiveness of such barriers (9, 28).

Numerous suggestions have been made for ways to reduce urban air pollution through transportation planning and operations. Traffic flow improvements have been proposed as one possibility inasmuch as smoothly flowing traffic emits less carbon monoxide and hydrocarbons (but apparently more oxides of nitrogen) (29). Traffic flow improvements, however, may generate more traffic or longer trips and in the long run have a negative effect (26).

Diversion of substantial numbers of commuters to public transportation by improving the speed and quality of service would reduce the number of vehicular air pollution sources during rush hour. Changes in work schedules on a city-wide basis would also reduce the commuter-generated air pollution peaks by spreading the rush hour (29). To achieve national ambient air quality standards in some cities may require vehicle-restraint programs such as parking taxes, traffic-free zones, and car-pooling tax incentives. It would appear from a current study, however, that, because of the magnitude of the pollution reduction required in some cities, any of the transportation proposals described above that are capable of being introduced in the next few years would have only a modest effect on urban air pollution (26, 30).

Methods for dealing with highway-water quality problems are more readily at hand. The major problem of soil erosion and sedimentation resulting from highway construction can be attacked by limiting the surface area of erodible soil exposed at any given time on a particular project and by rapid seeding and mulching of slopes as soon as construction operations are concluded in a particular area. In some cases, the construction of berms, dikes, dams, sediment basins, and slope drains may also be necessary (31, 32). Several possibilities that exist for reducing the environmental impact of de-icing chemicals include more efficient and conservative spreading of salt and better storage of salt stockpiles (33).

One final word on pollution control. A number of highway departments use pesticides to control roadside insects, weeds, and undesirable plant growth. Since the publication in 1962 of Rachel Carson's book, *The Silent Spring*, detailing the deadly effect of pesticides on certain forms of wildlife, pesticide use has been engulfed in a storm of controversy. The federal government is now considering banning the sale of a number of pesticides (34, 35, 36) because of their adverse effects on the public health, and Congress has before it legislation to strengthen federal control of pesticides (37). These recent developments may lead to changes in methods and requirements for pest management in the highway landscape (38).

HIGHWAYS IN A LIVING ENVIRONMENT

There are effects of a highway on the environment that are not so easily identified or quantified as the effects of the various types of highway-related pollutants discussed above, but they are nonetheless extremely important.

One such effect is the impact of a highway on the living system around it. Such an effect need not necessarily be negative. Wildlife specialists have urged, for example, that roadside maintenance policies be adjusted to encourage the development of wildlife habitat along roadsides (39, 40). Such new habitats are needed at a time when more traditional habitats for certain forms of wildlife are disappearing. On the other hand, highway development can also have a negative impact. Stream channelization, for example, and changes in drainage patterns can adversely affect wildlife in river and floodplain areas (41).

Highways can create opportunities for the enjoyment of the natural environment by providing access to outdoor recreation areas (42, 43, 44). Highways can also provide the opportunity for developing parks and recreational facilities along the right-of-way (45, 46, 47, 48). There are parts of the natural environment, however, where highways are definitely not welcome. Section 4(f) of the Department of Transportation Act of 1966 (49) prohibits the U. S. Department of Transportation from approving

... any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or

received considerable attention at the federal level. Congress directed in the 1970 Federal-Aid Highway Act that guidelines for minimizing possible soil erosion from highway construction be developed and applied to all federal-aid highway projects (5), and legislation to establish additional controls has been proposed by the President (6).

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local significance as determined by the Federal, State or local officials having jurisdiction thereof, or any land from an historic site of national, state, or local significance as so determined by such officials unless (1) there is no feasible and prudent alternative to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreational area, wildlife and waterfowl refuge, or historic site resulting from such use.

As interpreted by the U. S. Supreme Court, section 4(f) prohibits the use of federal funds for the construction of highways through the areas protected by 4(f) except for "the most unusual situations" (*Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 1971). Section 4(f) is apparently a very clear statement of public policy that, as a general rule, highway intrusions into certain areas are simply unacceptable.

Even more subtle than the effect of highways on wildlife and parks is the effect of highways on appearance. If a highway is to be a part of the living environment, it must blend aesthetically with its surroundings.

The concept of highway aesthetics is not new to highway designers. For years it has been studied, discussed, and applied, sometimes successfully and sometimes unsuccessfully. Highway aesthetics depend on multidisciplinary teams of sensitive, competent professionals and on a recognition that aesthetic factors are an integral part of highway development, not something added on. Aesthetic impact pervades most elements of highway development and constitutes an entire subject within itself (50).

One area of highway aesthetics deserves special mention. The Highway Beautification Act of 1965 (51) established a program to provide for the control of outdoor advertising signs and junkyards along federal-aid highways. The Act was largely moribund for lack of funds to carry out the program until the passage of the 1970 Federal-Aid Highway Act in which Congress provided the necessary money (52). Billboard-removal efforts are now in full swing. As of May 6, 1972, all states except one had come into full compliance with the 1965 Act (53). In addition, a special Commission on Highway Beautification composed of 4 Senators, 4 Congressmen, and 3 public members has just completed a study of the beautification program and will soon issue a report of its findings (54).

RESOURCES AND LAND USE

Increasing attention has been focused recently on the fact that the world's available natural resources are finite and that the present level of technological activity may be leading to the consumption of these resources at too rapid a rate. Transportation, as a major consumer of resources, will certainly have a role in this debate. A recent study (55), for example, attempted a rough estimation of the impact that a 25 and a 50 percent diversion of commuter traffic to public transportation would have on pollution and on resources.

Of all natural resources, the limitations on available energy, dramatized in recent years by electrical blackouts and brownouts, seem at the present time to be of greatest concern. Here again, transportation has a major role, accounting for, according to several estimates (56, 57), about one-fourth of the total energy consumption in the United States. There are few final answers to the energy crisis at the present time, but there are many questions. In the years ahead the quantity and the form of energy available for consumption may have a substantial impact on transportation.

Some very definite answers are emerging to the question of the relation of transportation to another resource—land. Various bills (including 5.992) are pending before the Congress that would establish a national policy on land use. In the President's 1972 Environmental Message to the Congress (6) an amend-

ment to the pending national land use policy legislation was proposed that would require states to control the siting of major transportation facilities, such as highways and airports, and to control the use of land around those facilities.

Under the proposed amendment, any state that had not established an acceptable land use program by 1975 would be subject to annual reductions of certain federal funds. Seven percent of the funds allocated under the federal airport development program, the federal-aid highway program, and the land and water conservation fund would be withheld in the first year. An additional 7 percent would be withheld for each additional year that a state was without an approved land use program.

MANAGING AN ENVIRONMENTAL PROGRAM

The challenge that now lies before transportation administrators and planners is to pull together disparate environmental standards, requirements, and research findings into an integrated environmental program. New socio-economic and environmental guidelines now being developed by the Federal Highway Administration as required by Congress in Section 136 of the Federal-Aid Highway Act of 1970 (58) are designed to provide just such an environmental management process.

Under these new guidelines (59), each state highway agency will be required to prepare an action plan, or management process, to meet the requirements of Section 136 that all possible adverse social, economic, and environmental effects of federal-aid highways be fully considered, that the need for transportation facilities and the cost of eliminating or minimizing adverse effects be analyzed, and that the final decision on each project be made in the best overall public interest. The action plan adopted by each state highway agency must provide for early identification of social, economic, and environmental effects and early involvement of other government agencies and the public. It must also provide for a systematic, interdisciplinary approach.

Each state action plan must require the consideration of alternatives throughout the highway planning process. The alternative of no highway construction and the alternative of serving transportation needs by means other than highway construction must be specifically evaluated. Finally, decision-making must be responsive to the technical studies, consideration of alternatives, involvement of the public, and interdisciplinary approach specified by the action plan.

The underlying objective of this action plan or management process approach is to achieve "substantial effective community agreement on a course of action which is feasible, equitable and desirable" (60). It represents a substantially new approach to transportation development. The traditional elements of technical feasibility and economic benefits and costs are still there. The evaluation of the desirability of a proposed transportation project has been broadened to recognize the existence of adverse social, economic, and environmental effects.

But there is more. The process must be equitable. It must recognize that any transportation project involves costs to some and benefits to others. "The principle of equity says that if there are groups which bear costs in order that other interests may benefit, then the interests bearing the costs should be compensated in a way which is acceptable to them" (60). The goal of the process is "substantial effective community agreement on a course of action." That implies public participation, consideration of alternatives, openness, and flexibility. It suggests negotiation and management, not neat formulas or technical determinism.

These are lofty goals. They may not be achievable. They may not work. On the other hand, they may restore an atmosphere of amity and confidence to transportation development.

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NOTE: Copies of papers presented at the HRB Fifth Summer Meeting are not available from the Board. The papers will be published by the Board in a Special Report, and an announcement will appear in HIGHWAY RESEARCH NEWS at the time of publication.

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EMERGENCY LONG-DISTANCE PHONE SYSTEM FOR IOWA MOTORISTS ON TWO-YEAR TRIAL

A new highway emergency long-distance phone system, which went into effect July 1, will enable motorists on any Iowa highway to request emergency assistance for ambulance, medical, fire department, or automotive repair with a minimum of difficulty and time.

The new program, designated HELP, is a cooperative effort by the Iowa State Highway Commission and the Iowa Department of Public Safety.

The HELP system utilizes a single telephone number that may be called, toll free, from anywhere in the state. The number, 800-362-2200, is answered 24 hours a day by the Iowa Highway Patrol in Des Moines. The patrol personnel on duty then contact the appropriate Iowa police radio dispatcher or emergency service to assist the caller.

The HELP system is to be used only for emergencies, such as illness, accidents, fire, or mechanical breakdowns, and not for road or weather condition reports.