A PARADIGM FOR ADDRESSING CHANGE IN THE TRANSPORTATION ENVIRONMENT

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At a meeting of the Research and Technology Coordinating Committee (RTCC), during a discussion about strategic issues facing highway transportation and highway research and development, Tom Deen made an impromptu presentation that has since come to be known as the "Deen Paradigm." The RTCC is a National Research Council study committee organized by the Transportation Research Board to provide the Federal Highway Administration with an ongoing and independent assessment of its research, development, and technology efforts. The committee was wrestling with a wide range of potential research topics, attempting to focus on specific issues that can benefit from research and development by FHWA, and trying to decide on which research issues this committee could focus with the most benefit. Tom Deen helped by articulating a model of the broader environment in which decisions about the future of transportation are made. Since that time he has discussed the concept in several other forums; however, the committee has urged him to seek wider dissemination for comment. Thereupon, he and Bob Skinner prepared the following paper for publication in *TR News*. Reader comments are invited.

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As a society, we are more likely to make modest changes in the way we do business than we are to make wholesale, radical changes. Similarly, changes in transportation services, facilities, policies, and even research activities tend to be made incrementally. On its face, this incremental approach has some compelling advantages: it addresses real transportation needs; minimizes technical risk; is usually politically feasible; and if successful, the payoffs are immediate.

But incremental approaches to transportation change also present risks. Environmental groups have long argued that our nation's current approach to transportation is unsustainable in the long run, and they regard "more of the same" policies as shortsighted if not irresponsible. Increasingly, mainstream transportation professionals share these views. An increasing number of experts believe that, barring a major technological breakthrough, an automobile-dominated, petroleum-dependent transport system will be unable to address the critical environmental and energy problems that face the United States (and the rest of the world), such as global warming, air quality, and dependence on foreign oil.

Although agreement may be reached on the dangers posed by current approaches to transportation, there are no signs of a consensus on the transportation policies that are needed to achieve "sustainable" transportation,[1] nor are there any indications that the nation is prepared to make alternative lifestyle choices implied by such policies. Nevertheless, addressing the environmental and energy imperatives faced by the nation has become the transcending issue of U.S. transportation, and a critical national debate is unfolding about transportation policy in the context of the environment, life-style, and economic growth.[2]

This debate colors transportation decision making at almost every level as incremental, evolutionary approaches to change clash with calls for more radical, environmentally driven approaches. Indeed the relevancy of "incrementalism" can be challenged (and sometimes is) for everything from national transportation policies to minor highway improvements

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[1] No consensus exists about what constitutes "sustainable" transportation, and indeed this is a topic worthy of study. For the purposes of this paper, sustainable transportation means a transportation system and a process for modifying or adapting the system that can accommodate expected population changes, growth in economic activity, and changes in resource availability, and meet environmental standards indefinitely.

[2] Transportation is not the only area in which current practice, conditions, and systems appear unsustainable in the long term. For example, the 1992 Earth Summit in Rio de Janeiro concluded that, at a global level, current rates of population growth and resource depletion (e.g., species, rain forests, top soil) are unsustainable.

to further pavement research because we seem unable to place the debate in context with decision making at these different levels. Often the debate is necessary and constructive, but increasingly it unnecessarily impedes decision making about actions that will at least produce benefits in the short run and have little long-term consequence on whether the nation develops a sustainable transportation system.

The model or paradigm, which is described as follows, is an attempt to characterize the way transportation changes are made normally and in times of crisis. It provides some context for understanding differing approaches to change and the concept of sustainable transportation. In addition, if the paradigm is accepted, it could improve the quality of the dialogue among parties on all sides of the issue, lead to some conclusions about transportation policy, and suggest useful directions for research.

The Paradigm

The paradigm is predicated on two key assumptions. First, no technological breakthrough will occur that significantly alters the role transportation plays in the environmental and energy problems previously mentioned. Second, an array of modest, incremental changes to the transportation system currently under way (e.g., expanded transit services, more high-occupancy vehicle lanes, transportation demand management measures, curtailment of highway capacity improvements, and so on) will be insufficient by themselves to achieve a sustainable transportation system.

The paradigm is best explained with the aid of a graphic (see Figure 1). Point *A* represents the present with its current "enabling" environment for transportation policy, which includes existing institutions, statutes, regulations, financial resources, and public attitudes. In this environment, there is an unresolved conflict among values (e.g., transportation, environment, life-style), and neither the political nor public will exists to support policies, regardless of their environmental benefits, that involve significant sacrifice or depart radically from the status quo.

Point *B* represents a future point in time with a transportation policy and a transportation system that is the result of a series of incremental changes to policies that existed at Point *A*. Compared with today, the transportation system at Point *B* will be less polluting and more energy efficient, but not to the extent that the system is sustainable in the long run. Without changes in the enabling environment, the transportation system would continue down the path of incremental change (line *A–B* extended); but at Point B a new enabling environment develops that forces a directional shift to a path of more far-reaching policy change (represented by Line *B–C*).

A new enabling environment might result from a crisis situation reminiscent of the 1973 oil embargo during which energy conservation measures that were previously politically infeasible and not seriously analyzed were quickly adopted. Potentially, some future disruption of energy supplies or a serious environmental health threat that is strongly linked to transportation might galvanize public opinion in ways that dramatically alter the enabling environment for transportation policy and make revolutionary changes to the transportation system (for example, widespread congestion pricing for highways) politically feasible.

Point *C* represents a potential future with a "sustainable" transportation system in place. Point *C* cannot be reached by a direct path from *A* to *C* because the current enabling environment (the enabling environment of Point *A*) is not conducive to making the significant changes in transportation policies needed to reach Point *C*.

In summary, *A–B* is the only path currently available. In the future we may be able to change course to *B–C*—indeed we may have to change to *B–C*—but such a course change will not be possible until a new enabling environment for transportation policy emerges.

This does not suggest that planners and policy makers should not be pressing for actions that push Point *B* as far toward sustainability as possible (toward the right on the chart). Even though such actions will not provide enough change to reach Point *C*, they do help, and could reduce or delay environmental difficulties until technology provides better answers, or reduce the prospect of causing irreversible environmental damage.

Implications of the Paradigm

The paradigm has a number of implications for transportation generally, some of which are briefly noted below:

- Regardless of our preferences, the nation's transportation system and the underlying policies that shape it will change only incrementally until there is a fundamental change in the enabling environment for transportation policy.
- Changes to the enabling environment will be crisis driven, either in response to a single major crisis or a series of lesser crises. Either way, the timing will be unpredictable. On the one hand, the longer it takes, the more difficult it may be to modify travel and lifestyle habits in ways that rapidly move toward sustainable transportation. On the other hand, the longer a crisis can be postponed, the more time is available to search for technology breakthroughs.
- Given that we do not know if and when we will depart from the path of incremental change, policies and procedures that are oriented to making the best of the situation are still necessary, even though they are arguably suboptimal. At issue is the degree to which they can be compatible with a long-term vision of sustainable transportation, what compatibility tests should be applied, and how much public support will exist for proactive policies that push the envelope of accepted practice.
- A change in the enabling environment generated by crisis will relax barriers to change and will be accompanied by public demands for immediate action. At such a time, good and bad ideas that offer remedies for the crisis at hand will be advanced and can be implemented. Unless solid analysis is available to distinguish between the two, both might be imple-

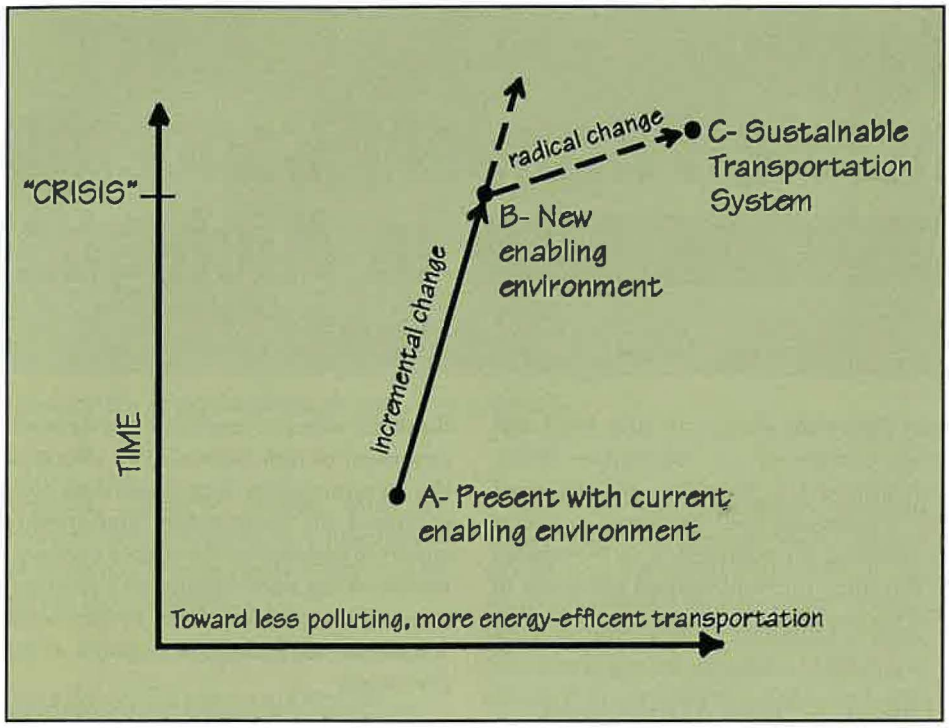

FIGURE 1 "Deen Paradigm."

mented, and unnecessary and inadvertent damage might be done to particular sectors of the population or the economy.

• Regardless of how it is now defined, our views about what constitutes sustainable transportation will change over time, reflecting changes in technology, resource availability, and new knowledge about the environmental impacts of transportation.

Implications for Research

The paradigm also has some implications that specifically apply to transportation research:

• Only research can provide the menu of actions, complete with reliable impact assessments, that are needed to push the envelope in the current enabling environment and embark on a radically different direction if a crisis-driven change in the enabling environment occurs.

• This type of research might best be characterized as contingency planning. Because timing of a change in the enabling environment is uncertain and a technology breakthrough is always possible, the payoffs of research are highly uncertain. Research about far-reaching road-pricing schemes, for example, might have enormous payoffs in crisis conditions, but negligible payoffs if the crisis never develops.

• Research may also have a role in examining (and even predicting) the conditions that could lead to crisis and assessing their likelihood. Research also may be helpful to transportation agencies if they actively promote gradual changes to the operating environment (for example, understanding the public objections to different versions of congestion pricing).

• Defining and assessing the meaning of "sustainable" transportation is itself a researchable topic.

• Much of the research aimed at incremental improvements to transportation systems will still have significant value, if successful, even if the nation embarks on a path to radically restructure the management and operation of its transportation systems. For example, regardless of which path is followed, existing highways will be a major component of the future transport system, and new products and procedures that lower the cost of maintaining highways and bridges will still be valuable.

• Goals (or objectives or balance) of transportation research programs should recognize the need for "contingency" research along with the research that seeks incremental solutions to existing problems.[3]

Conclusion

A substantial part of the debate about transportation policy today tends to focus on how to balance our desire for mobility (broadly defined) and our desire for sustainable development. Proponents of each goal often have difficulty in communicating with each other about appropriate transportation initiatives. This simple paradigm seems to be useful in developing consensus on action because it demonstrates that there is a reasonable place for actions that reduce costs and improve transportation performance today, while at the same time moving toward sustainability with as much firmness and resolution as the enabling environment permits. It also argues for research that will provide a menu of appropriate, well-studied choices when and if the enabling environment changes in the face of some future crisis.

[3] There are some nomenclature problems here—some intelligent vehicle-highway systems (IVHS) research might be characterized as seeking revolutionary changes in the highway system, but such research might still be considered "incremental" in the sense used here.