ing primary importance today as we make the transition from system development to system management. This change has required adaptation of existing planning tools, as with the needs study, and the development of new tools, as in the case of the pavement management program. Existing planning efforts, and the data used in their support, are being put to new uses. For example, our roadway sufficiency rating program was initially devised to measure progress in meeting legislatively mandated equalization of service in the primary road system in all areas of the state. It is a development planning tool. But it has become an invaluable tool in establishing the location and immediacy of pavement rehabilitation needs in an aging system. It joins with our new pavement management tools as part of the kit.

Changes in planning have come about as a result of expansion in scope and shift in program emphasis. The tendency is for products of the planning process to be oriented less to a specific desired end state and more to a series of short-range studies and decisions, efforts that will have the effect of keeping our options open for a future that cannot be predicted with complete certainty. The time frame for much of our planning has become short range.

With increasing comprehensiveness has come the need for an expansion in the data base used in support of transportation planning. In cooperation with FHWA our base of information has increased, particularly with respect to the characteristics of highway use and performance. With continuing advances in computer technology, we have been able to make data more accessible and make more effective use of information from those data. Today we have weigh-in-motion and traffic telemetry systems that tell us more about use of the system, analytical procedures available to us such as the Highway Performance Monitoring System, and perhaps one of the most significant developments in a long time--the new needs study approaches that will rival in usefulness the planning tools we had in the 1960s for traffic forecasting.

In looking back at the evolution of transportation planning, our efforts corresponded pretty well with the decision-making requirements of the times. In that sense we have been successful. However, if we look around, we see examples of problems that might have been avoided through better planning. In fact, many of the problems and issues we currently face might even be blamed on poor planning or a lack of planning. Our current problems and issues should be viewed as a signal of the need to make another adaptation in our transportation planning process.

Response

W. L. GARRISON

We have heard five proud, varied, and candid papers. They are proud papers because there is much to be proud of. The states and the federal government began varieties of highway planning well before World War II and that planning flourished after World War II. With the development of the Interstate system, techniques were rapidly developed or adapted that served well.

These are varied papers because the story is different here and there. We invest in transportation systems to achieve goals; goals from the federal perspective are one thing, and goals are spelled out differently in individual states and regions.

And we have heard candid papers. Not all has gone smoothly. Sometimes rules and regulations have gotten in the way rather than served. Rules and regulations pressed by special interest groups have caused problems. We are fortunate to have speakers who can recognize problems, speakers courageous enough to name causes of problems, and speakers whose institutions have found ways to manage them.

Five proud, varied, candid papers.

REFLECTIONS

In this spirit of doing better in the future, these remarks in response to the papers will begin with what went wrong rather than accomplishments, although the record is 99 percent accomplishment. We will speculate on how we might have avoided getting in trouble. Then we will seek comments that will help us understand what we ought to be doing now.

As the papers do, these comments have a historical orientation.

Making Enemies

My first observation is a simple one. It is that more attention to history would have alerted us to some of the tensions between suppliers of transportation and those who are negatively affected by it. For example, Lord Parnell's Treatise on Roads, written in the first decade in the 1800s, warned highway builders of the dangers of building through cemeteries and parks and a character in John Bunyan's Pilgrim's Progress, written in the late 1600s, longed for places where "there is no rattling with (stage) coaches, nor rumbling with wheels . . . (places where) one may think . . . ."

Early railroads had some problems that sound familiar. The Stockton-Darlington, the world's first railroad, which opened in 1825, was stalled for several years by the Duke of Cleveland because the rail engineers had proposed a route through one of his fox covers. Charles Dickens hated railroads, seeing them as the cause of premature childbirth, a

symbol of power and ruthlessness, and the despoilers of the natural environment.

Later, there was great consternation when the railroads entered the cities, and in many large cities, construction faltered short of serving the center city. In London, for example, railroads were hardly able to penetrate the wealthier parts of the city at all. When they invaded workingmen's neighborhoods, displacement was a bother, and the railroads ended up operating low-fare workingmen's trains, the precursor to the money-losing commuter railroad.

Those fragments illustrate a long-standing conflict between those who build and those who are affected. They remind us that conflicts are not so new, and they tell us that if we had remembered or studied our history, we would have been ready for the revolt of the 1960s, the replay of a well-worn record. We could have avoided making so many enemies.

Inside Enemies

Some of the things we have done have set highway planners and their institutions against each other. Congress saw a danger in 1915 when it said (House Document 1510, Jan. 15, 1915):

> To make State highway commissions or State highway engineers subservient to a Federal bureau would be disastrous. It would stifle initiative, discourage original research, and cause all State highway officials to await the action of federal authority.

And in his book on Telford's system of roadmaking written just over 100 years earlier, MacAdam remarked on the need for a knowledgeable, balanced institutionalized system. MacAdam was a planner and a manager. He sought a rather centralized management system, perhaps suitable for England. (And perhaps illustrating that deep in the heart of every planner lies a dictator.)

Although history should have alerted us, power did move upward in the hierarchical road planning and delivery system, with some of the results that concerned Congress in 1915.

(Those who are keen for road pricing schemes might do well to remember history, too. Eighteenth century tollroad pricing in Britain led to endless debates about what was fair and what wasn't. Indeed, the British Parliament spent more time discussing tolls than it did worrying about the revolt in the colonies--the American Revolution. Debate came to an end when, beginning in Wales and spreading like wildfire, the citizens broke the toll gates and burned down the tollkeeper's houses, a popular revolution known as the petticoat revolution. Perhaps borrowing from Bostonians' dressing as Indians and dumping tea in the harbor, outraged yeomen dressed as housewives to destroy toll collection facilities.)

Making Lots of Friends

As mentioned earlier, the highway program has been 99 percent accomplishment, and that depended on deep public support, lots of friends. Now, we remark on when and how those friends were made.

Think with me about the automobile-highway system. It came into being about 1910 with the innovation of the Model T and efficient ways to produce it. But the system grew from more than an automobile technology revolution. There was also a revolution in highway supply. Organizationally, it involved creation of state highway departments and expansion of the Bureau of Public Roads. There were funding, programming, and construction innovations. Needs studies were developed, an early form of highway planning.

There was an operations revolution too. Some of it was in traffic engineering. In the large, it involved learning to drive vehicles on shared roadways, to substitute automobile travel for travel with other modes, and to do new things with the automobile.

Once the format of the system was established, and people knew about it, the public clamored for its deployment. Individuals were willing to buy cars, pay for roads, and learn to drive and use the system. Road bonds only had to be offered to voters to be passed, automobile shows were the big events of the social season, and automobile clubs and user lobbies enjoyed great popularity. That was the case, say, during the 1920s.

Loss of Broad Public Support

Things are different today, of course. Most say this is because the system is pretty much ubiquitous: roads have been widely improved, 90 percent of the age-eligible population has driver's licenses, and there is 0.8 of an automobile for each member of the population 18 years of age or older. The general public is not clamoring for more, and small special interest groups, be they for or against the system, dominate political debate.

But there is more to it than that.

Think about what it was like in the 1920s to become a user of the system--to buy a car and get a driver's license. One immediately got all the advantages of accessibility that the system offered. An important matter was that the system was getting better every year as roads and vehicles were improved and as places of residence, work, and shopping adjusted to the automobile. To put that in more general terms, the system was increasing its productivity markedly every year. The real cost of the automobile was decreasing and there was more car per car. Highway producers were producing more and better highways for the money expended. The reorganization of production and consumption, automobilization, was proceeding apace.

That is what is missing today--productivity improvements. The real price of the automobile has been flat for about 2 1/2 decades, and we are no longer getting more car per car. Productivity improvements in highway construction have been negative since 1965. The real cost of operating a vehicle has hardly changed since World War II. Furthermore, the structure of production and consumption--the way we work, consume, and play--has been well automobilized for a long time.

That's the fundamental problem of the automobile-highway system and of mass transit, the railroad system, the pipeline system, and the air transportation system as well. They are deployed; technology (hard and soft) is not offering the productivity improvement we enjoyed in the past.

The problem runs deep because our nation's development has ridden on the shoulders of the innovation and deployment of transportation systems. We have been able to increase the gross national product and real incomes because we have had transportation systems that one after another have worked better. Systems are deployed now, they are working very well, but they are not working markedly better year by year.

Improvements in productivity are much discussed, but the kind of productivity that takes center stage focuses on making old systems work a little better. We should be realistic. Much of what today's systems can do for society has already been wrung out of them. We are working against diminishing returns. We ought to be making plans for major renewal of old systems.

Doing Better

The central question for today's planning is thus different in kind from the one that preoccupied us through the deployment of the highway system and the planning toward which we are drifting. That was tactical planning; it dealt with deployment tactics. And we are drifting toward operational planning: given the system, plan its operations.

But to reenergize gains from transportation as we have known them in the past, we have to do much more. We need strategic planning, planning that takes what we have and seeks to build something an order of magnitude more productive out of it. What are the things transportation might be doing in the future? How can we take what we have now and steer in that direction?

Strategic planning looks at opportunities and asks what we might be doing in the future. Transportation has enabled order-of-magnitude improvements in the organization of production and consumption in the past: that is the task. These are some options:

- Change the nation's energy base by decreasing the cost of moving coal from the intermountain west by an order of magnitude.
- Increase the options for improved residential environments by major increases in the ease of commuting.
- Decrease the cost of housing by enabling the shipment of large, heavy loads. That is, make the prefabrication and shipping of housing workable as well as the shipping and relocation of housing already available.

Strategic planning also asks how to build from existing resources--resources of facilities, people, and instructions--and it asks whether there are development pathways along which new goals may be sought. Two problems emerge when this is done. First, one cannot be certain about the development options that will be valued by the public. Second, the resources are not available.

Lessons from history will provide a comment on these problems. In the early days of the automobile, for example, no one could imagine the development options that it would offer. There was no need for it. It was a rich man's toy. Its use promised only modest reductions of manure on city streets. The vehicle was so expensive that few would ever own one; impossible-to-obtain amounts of money would be needed to improve the road system for use by automobiles.

The lesson is that innovation is the mother of necessity, and necessity pushes barriers aside. Strategic planning for transportation should offer options that have the potential of social and economic necessity.

Summing

The papers we have heard today treat the deployment chapter in the story of highway transportation and its planning. We have sought to position that deployment chapter in a larger sweep of history.

The question now is that of the next chapter. The job of operating and maintaining the system is an important one, so a next chapter is an operations planning chapter. We are in for a rough period. The public takes the system as a given and demands that it works well. Yet the outlook for enthusiastic public support for programs is limited, for the system is no longer offering markedly new and better things for people to do.

There is the option for another chapter, a strategic chapter. Strategic planning and thinking would support our finding ways to build from the present system toward one ushering in a new transportation revolution. No one can know exactly what should be done. We need to explore major options for the future.

Would the public support new options? Support for rail transit says yes. Although it is clear that the promise of transit is very limited, the public sees transit as a metaphor for "doing something." The public says to do something that will make a difference.

READING

Reflecting broad public interest, there are many books on the history of the automobile, and I have no favorite. Very little has been written treating how the public learned to make use of the system and how it changed styles of living. Early views are available in M. L. Berger's The Devil Wagon in God's Country: The Automobile and Social Change in Rural America (Archon Books, Hamden, Conn., 1979). The highway part of the story is well told in the FHWA 1976 bicentennial history, America's Highways: 1776-1976.

The early commercial revolution and the prerailroad and canal era of road building are treated in Sidney and Bernice Webb's English Local Government: The Story of the King's Highway (1913). The Webbs tie the need for highways to evolution of local governments and intergovernmental roles, a style of government transferred in part to the United States.

Is there anything new that's worth doing? Norman Bell Geddes had modern freeways in mind when he wrote Magic Motorways in 1940. Jerry D. Ward (and others) made suggestions suiting today's situation in Toward 2000: Opportunities in Transportation Evolution (U.S. Department of Transportation, 1977). I have suggested some options also in Innovation and the Structure of Transportation Activities, in Innovation in Transportation (National Research Council, 1980).