INFORMAL DISCUSSION OF FREEWAY OPERATIONS IN THE UNITED STATES AND OTHER COUNTRIES

The 2 preceding papers in this RECORD summarize the discussion by 2 panels regarding accomplishments in freeway operations. Following this discussion, the panelists were asked questions by those in the audience, and this paper is a transcript of these questions and answers. Members of the panels were Joseph A. Wattleworth, University of Florida; Patrick Athol, Illinois Division of Highways; Donald Cleveland, University of Michigan; Robert S. Foote, The Port of New York Authority; W. R. McCasland, Texas A&M University; William E. Schaefer, California Division of Highways; J. T. Duff, Ministry of Transport, England; M. Frybourg, Ministry of Transport, France; Masaki Koshi, University of Tokyo; Roberto Vacca, Campagnia Generale Automazione, Italy; and R. Lapierre, Institut für Strassenwesen Erd-und Tunnelbau, Germany.

Question

Mr. Foote mentioned that his measurements showed that he was able to increase the output of the tunnel by reducing or by limiting the input. A number of other projects have showed similar results, usually with another result that some queues are formed at the input where the limitation has taken place. This can often produce a certain adverse public reaction. What was the public reaction in this case?

Robert S. Foote

The basic purpose of this tunnel-flow control operation is to increase the amount of throughput. Although it is true that in this operation we do create a delay at the entrance of the tunnel earlier than would otherwise be the case, the net impact is to reduce the overall delay. There are other benefits too: a faster, safer, and smoother trip through the tunnel; fewer disabled vehicles; and less air pollution. This operation is really still on a prototype basis. Not until a later time will we be controlling flow in all tunnels full time. We have been controlling flow periodically on an experimental basis at 1 tube of the Lincoln Tunnel. Bus operators in particular seemed to understand what it is we are trying to do. The control is exercised by a sign that comes on and reads PAUSE HERE—THEN GO, and there is nothing that is very commanding about it. When we first started this control, people did not pay much attention to the sign by itself, so we augmented it with some other devices. During a period of months as we gained experience we found we could discontinue the other devices. People did seem to obey the sign more. They had an appreciation of what we meant by pause. They would just come to a stop for a second or so and then start again. Therefore, people were moving normally into the tunnel in fluid movement. When the sign comes on, generally within 3, 4, or 5 vehicles a driver will pause. Once that happens then usually the succeeding drivers will also pause until the sign is turned off. We have had good public reaction and compliance for the past several years during the extended tests.

Question

I have a 2-part question relating to the impact of ramp metering on local streets. The first part is about cost effectiveness. Mr. Foote mentioned that throughput has

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been increased. What about the urban network where, because of ramp metering, traffic is diverted to local street systems? Here we have additional delay to nonfreeway traffic that uses the local street system because the freeway traffic from one ramp must use the local streets to go to ramp B, C, or D. Has any work been done on the cost effectiveness of this aspect? The second part of my question relates to communicating with the driver. There has been an extensive discussion in the United States and abroad about variable-message signs. In Japan information is given to the motorist at the on-ramp. Do we have these variable-message systems on the local streets to tell motorists how to find the next ramp? Has any work been done on local street communications as part of the process of diverting the traffic from one on-ramp to another?

Patrick Athol

A misleading impression may have been given, and that is that the corridor studies followed the earlier work. Of course, this is merely in terms of instrumentation so that most of the control studies that were undertaken in the early days did attempt to measure the specific problem to which you refer. Benefits really mean network benefits even though the instrumentation was limited to, in most cases, the freeway. What happens, however, is that the diversion through the network in many cases is beyond the ability to measure so that the traffic to which you refer that leaves the entrance ramp and travels through the network is so diffused throughout the network that if often has a very small and not measurable influence on delay to the network. The other problem that ties in with whether we are getting any benefits is that many of the projects that do not involve tunnels are not able always to get improved capacity on the freeway. In other words, in the tunnels where there is congestion there is a lesser flow. On a freeway this is not true. In many cases, one has to actually trade off the level of service on the freeway for this capacity. Essentially what one is doing is setting a level of service criterion for the freeway. Considering that there is a discontinuity of flow, we are getting a sizable improvement in reduced delay on the freeway essentially by striving to stay within the better or higher level of flow situation and avoiding the breakdown. We are getting a major saving on the freeway and a diversion throughout the network. Because of the sizes of the networks we are dealing with, in most cases, it is not possible to measure any increased delay to other vehicles, and so there is a net benefit from the system.

Donald Cleveland

With regard to the second part of the question about information systems, we have been experimenting with a network in Detroit that can be visualized as a ladder with 3 vertical members rather than 2 and with 8 cross pieces equivalent to the 8 ramps that were metered when the Texas Transportation Institute was operating the system. These are major streets in the corridor and have a total length of approximately 6 miles and a width of less than 1 mile, slightly twisted at the middle. As a part of this project to optimize flow through the corridor, we have recently completed some experiments in which the display system exists at 2 levels. With the cooperation of the local highway agencies, we placed more than 100 typical trail-blazer static devices that move traffic toward the northbound Lodge Freeway. At between 20 and 30 key intersections, we have had dynamically operated, simple-to-complex displays during the afternoon peak. These indicated to the motorists which of these binary choices they should follow if they were interested in moving some distance north on the freeway and in optimizing their individual travel time through the network. Wherever we have used a variety of these displays there has been some small (more than 10 percent but less than 40 percent) response to our suggestions. In many cases we have been able to consistently deliver a faster trip to those who have used the network.

Question

In this country we are using changeable-message signs, and apparently they are doing so in Germany and Japan. I wonder whether representatives from these coun-

tries and others would express their opinions concerning the need for international symbolism and the possibility of achieving such on changeable-message signs.

Masaki Koshi

Characters in the Japanese language are quite different from alphabet characters in other languages. We are a member of the international road traffic organization, and we use symbols according to international rules. I am afraid, however, that we cannot use symbols in changeable signs because we want to give as much information as possible to drivers. If we study how the changeable signs affect drivers in selecting the surface street or freeway, we find very little difference in route-selection behavior. If we do not give drivers the cause of the congestion and only tell them CONGESTION AHEAD, they pay no attention to the sign. If we give them ACCIDENT—CONGESTION AHEAD they do not use the freeway. For this reason, I do not think we will be able to use or adapt international sign symbols.

R. Lapierre

In Germany we have developed only changeable signs with speed limit information. These use internationally known symbols, and we have no trouble on our motorways because this is a sign that all drivers know and therefore understand.

J. T. Duff

In England, the indications that we give on our changeable signs are all completely symbolic. We either display a number that gives the advised speed of travel or indicate a symbol showing which lanes are open or closed. We can show a symbol diverting traffic from one lane to another or onto an off-ramp. The all-clear symbol is the international symbol—a circle with a diagonal bar. All signs are in accordance with international standards in Europe.

Roberto Vacca

In Italy, the organization responsible for establishing the national standards for signs is the Ministry of Public Works, and it has not yet determined a national standard for variable-message signs, although one for fixed signs exists. What we have in mind for freeway control systems now under project is to display written signs with a variable message indicating the names of stations between which there is congestion or a total blockage. We would display separately the names of the beginning and the end stations and the cause of the impediment, that is, congestion or total blockage. These signs would be put just before the ramp at the last possible decision point. All the signs that we are thinking of installing are similar to those installed in Chicago; they indicate the ramp situation. Apart from the name of the ramp or the symbol indicating the ramp, it would certainly be appropriate to devise some kind of international symbol for indicating whether access to the ramp is unimpeded, difficult, metered, or impossible. Although international symbols exist for many other traffic situations, a symbol for the state of a ramp does not exist. I think it would be highly appropriate for one to be devised.

Question

What is meant by the optimum flow of traffic? Different studies seem to have adopted different criteria for the optimum flow. It was stated that capacity and safety are optimized although those do not always go together. It was also stated that actually capacity and level of service are traded off. There is also the problem of travel time or delay, and that does not necessarily coincide with maximum capacity. It depends on alternatives available to the traffic that is diverted or slowed down or controlled at one facility. Can panel members give examples of how clearly these criteria have been adopted for their respective work.

W. R. McCasland

This is a very interesting area because I think this points the finger to the decision-maker who is in charge of determining just what a control system will do. In my own experience, I have the responsibility in effect for the decision as to what goals or objectives we should try to achieve on the Gulf Freeway Project. Based on the engineering analyses of the area, it was found that the area did not have suitable alternate routes. There were high demands, and therefore our decision was to do all we could to increase the throughput, if necessary at a reduction in level of service. I know that in other places there are better alternatives for the diversion of traffic, and I would prefer to assign a higher level of service. This is one of the key points in the design of a control system: Establish goals early, have one person in charge of determining what the goals should be in a system, and then find out what other consequences are going to result as a result of achieving these goals.