Feature Articles

The Maine Facility

Instrumented 2-lane highway generates continuous information on driver behavior

To the casual motorist driving between Canaan and Newport in rural Maine, the 15-mile stretch of US-2 seems like just another picturesque New England 2-lane highway, complete with the usual bridges, intersections, curves, grades, and railroad crossing.

But beneath the surface is a complex instrumentation system, connected to a computer that is recording information on driver problems in discrimination, judgment, and vehicle control. There are 37 portable vehicle-detection stations; 406 sets, or nodes, of vehicle-sensing loops installed beneath the pavement of the main road, side roads, and driveways; and 5 in-vehicle receiver-display assemblies. Fifteen miles of communication and power cables connect the instruments to a 32K Raytheon 706 computer with a teletype, paper-tape reader, and magnetic-tape reader.

The Federal Highway Administration, the Transportation Systems Center of the U.S. Department of Transportation, and the Maine Department of Transportation are among the groups participating in the management of this system called the Maine Facility.

Public Roads magazine says that rural-road mileage, representing approximately 22 percent of all road mileage, carries 32 percent of all traffic. This traffic is involved in accidents that account for 48 percent of all traffic fatalities, a disproportionate share. On at least 163,000 miles of rural 2-lane highways more than 2,000 vehicles travel each day.

The Maine Facility was created to better define 2-lane rural highway problems and to evaluate possible solutions by static and dynamic control devices to a basic problem: how to improve roadway level of service as reflected by

1

1 The town of Palmyra is one of the sites to be used in a study of methods to improve speed zone compliance.

2 This intersection on the Maine Facility at US-2 and Me-152 will be equipped with flashing lights to determine their effect on traffic, currently hampered by inadequate sight distance.

2

reduced travel times, fewer traffic interruptions, additional freedom to maneuver, increased safety, lower operating costs, and improved driving comfort and convenience—all without incurring the large expenditures needed for major reconstruction and upgrading to divided highways.

Research in this area has been hampered in the past because instrumentation was not readily available to follow or track vehicle movements over long sections of highway. In addition, a system was needed whereby the driver's reaction to possible remedial aids could be recorded. Solutions to some problems appear to require variable messages in the form of either roadside or in-vehicle displays, which necessitate the use of computer and roadside communication techniques.

Equipment at the Maine Facility can monitor traffic data in a very precise manner, communicate with drivers over considerable distances, and evaluate the effectiveness of alternative traffic control remedial aids. The data acquisition system detects vehicles, tracks their positions, and stores the traffic data on magnetic tape for subsequent off-line reduction and evaluation. The system also provides for the transmission of messages to motorists as they travel the instrumented section of highway. The messages can be displayed on the dash panel of specially instrumented vehicles or at the roadside on variable-message signs.

The sensing loops are installed in sets of 4 (called a node) and are configured to permit the determination of vehicle location and direction. Nodes are spaced uniformly 200 feet apart on the main road. Side roads with a flow of 3 vehicles or fewer are not instrumented, but busier side roads have a node placed approximately 150 feet from the centerline of the main road. Other occasional high-flow entries and exits, such as driveways, are instrumented with a 2-sensor node.

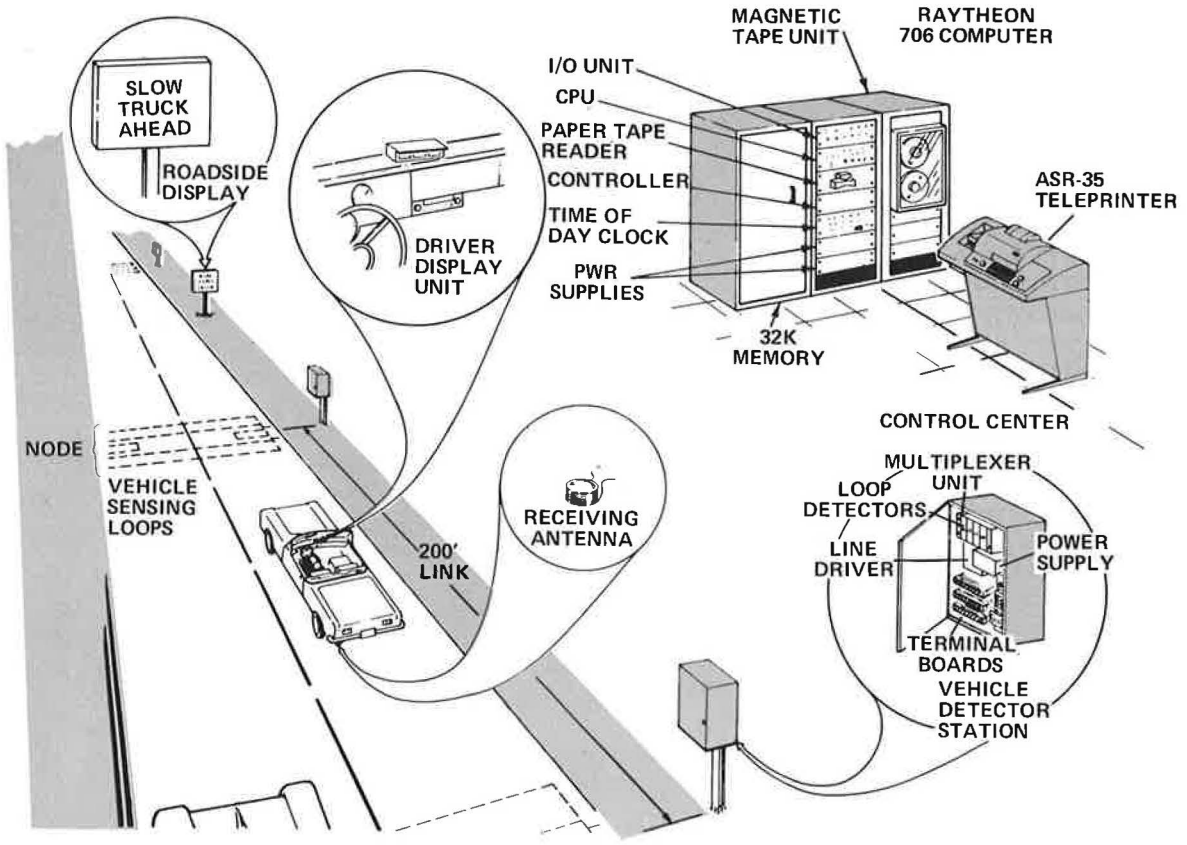
Messages may be transmitted to instrumented vehicles via the detector stations and sensing loops. Roadside display messages are also received at the detector stations and channeled to nearby roadside displays. Eight unique messages can be transmitted to instrumented vehicles, and 256 messages can be displayed at the roadside.

The control center, housing the computer and other facilities for off-line activities, is situated 8.5 miles from the eastern terminus of the 15-mile stretch of instrumented highway.

The northerly location of the facility makes testing possible under all weather conditions. The site is subjected during the average year to 95 inches of snow, 42 inches of rain, 15 snowstorms, 15 days of ground fog, and 15 days of general fog.

Many commercial vehicles travel the highway, which carries an average of 1000 vehicles each day in the win-

In experimentation now under way as part of a National Cooperative Highway Research Program study, data are being collected and analyzed on vehicle operations and conflicts on and adjacent to this narrow bridge on the Maine Facility.



The Maine Facility system.

ter and 4000 each day in the summer. Because it is the most northerly east-west route across Maine, a large number of out-of-state and Canadian vehicles use the highway. Many recreational vehicles use the road during skiing, summer recreational, and fall foliage seasons.

The Maine Facility program for fiscal years 1975 and 1976 includes continuation of several existing research projects and initiation of a number of new projects. Federal Highway Administration research and development funds are being supplemented with funds from the state highway and transportation departments of Maryland, Maine, Ohio, Mississippi, Nebraska, Connecticut, North Dakota, Florida, and Georgia. Other states are invited to participate in the use of the facility on either an individual or a cooperative basis, thereby reducing or eliminating many rural 2-lane safety and operation problems in their own areas. The following 10 research projects are scheduled for fiscal years 1975 and 1976.

Development and evaluation of remedial aids to warn drivers of slowly moving vehicles ahead on a grade

Two-lane rural highways have many sections of steep ascending grade where no passing is permitted. Slowly moving vehicles ascending these grades present a potential hazard to faster moving vehicles overtaking them. The length of queues and the hazards of overtaking may be reduced if approaching drivers are provided with information regarding the queue and possibly an optimum approach speed. Along the selected grade location, data will be collected regarding the initiation, location, and speeds and headways of slowly moving vehicles. An analysis of this information will determine the locations for detecting the slow movement and the locations and messages for the variable-message signs that will be installed and tested.

Evaluation of traffic controls for highway construction and maintenance operations on 2-lane highways

The 1971 Manual on Uniform Traffic Control Devices includes traffic controls for street and highway construction and maintenance operations. This experiment will involve the evaluation of these devices as applied to 2-lane rural highways. The Maine Department of Transportation will cooperate in a series of experiments that will apply the traffic controls as given in the manual to selected construction and maintenance operations on Maine Facility roadway, including pavement, shoulders, ditches, entrances, and intersections.

Measurement of vehicle equivalency and capacity including effects of commercial and recreational vehicles

Of the factors that influence highway capacity and levels of service, probably less is known about the influence of trucks and buses than any other factor. Current criteria are open to serious question not only on an absolute basis but even on a relative basis. Further, no criteria are yet available regarding the influence of recreational vehicles such as campers, house trailers, and mobile homes, which are a rapidly increasing proportion of total traffic. Highway planners, designers, and operating personnel need better information on the effects of trucks, buses, campers, and passenger cars with trailers on traffic flow on both level ground and grades and on both 2-lane and multilane highways. This experiment will deal only with 2-lane highways.

Retention and presentation of highway traffic data collected on the Maine Facility

During the conduct of past, current, and future experiments on the Maine Facility, many data have been, are being, and will be collected. These data, although collected primarily for specific experiments, have value to traffic engineers and highway designers. The effort in this experiment involves the development of formats for data retention and presentation. This will involve a review of data needs of traffic engineers and highway designers in relation to 2-lane rural highways. These needs will be used in developing the data retention format so that at periodic intervals or on request tabulations and analyses may be made to supply these needs.

Development and evaluation of dynamic aids for narrow bridges

This experiment will develop and test dynamic remedial aids to reduce the hazards and vehicle conflicts on narrow bridges. As part of an NCHRP study, data are now being collected and analyzed on vehicle operations and conflicts on and adjacent to a narrow bridge on the Maine

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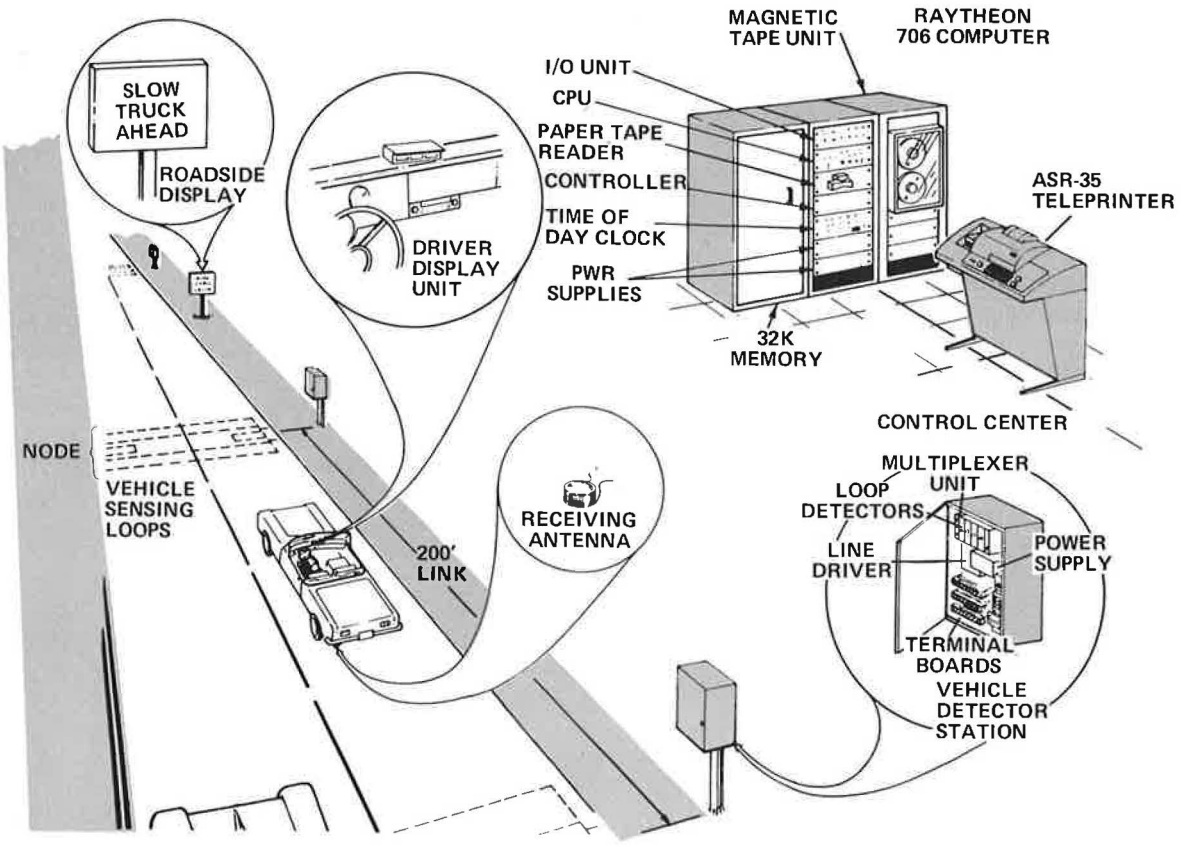

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Facility. Static remedial aids are being developed under this ongoing study. The results of the base-condition study and the testing of the static aids will be used in designing an experiment and data analysis plan for the use of dynamic aids such as variable-message signs and flashing lights to warn drivers in real time of traffic hazards and potential conflicts on or near the bridge and to advise drivers of actions to take to avoid a conflict or accident.

Study of rest area usage

NCHRP Synthesis of Highway Practice 20 gives a number of recommendations regarding needed research concerning the use of rest areas. A rest area for cars and camper vehicles is located adjacent to the Maine Facility control center. This experiment will gather data concerning the use of this rest area including items such as types of traffic, origins and destinations, peak travel periods, and nighttime use. Also included will be a study of advance signing for the rest area and its effect on use. Questionnaires will be developed by the contractor and administered by facility personnel. Overall traffic activity into and out of the area will be measured.

Development and evaluation of remedial aids for intersections with inadequate sight distance

An experiment under a current FHWA contract will evaluate the use of flashing lights at the intersection of US-2 and Me-152 on the Maine Facility and in other locations in the United States. That experiment will study the use of dynamic warning devices at 3 other intersections with US-2 on the Maine Facility, 2 of them T-intersections and 1 a crossroads. Studies will be required to determine the characteristics of existing traffic for use in devising dynamic remedial aids. Subexperiments will be designed to test these aids at the 3 intersections. All information developed under the FHWA contract will be provided to the contractor for use in designing the experiment.

Development and evaluation of transverse lines for traffic control and speed reduction

Transverse lines for traffic control and speed reduction have been used on approaches to toll booths, in gore areas, and in areas where the number of lanes is reduced. This experiment will evaluate a number of transverse line configurations for use on 2-lane highways and intersections with them to warn drivers of the need to reduce speed or stop or otherwise to advise of a potential hazard in association with other appropriate or standard signs and markings.

Study of effects of width of snowplowing on traffic operations

The Maine Facility is subject to a large number of light, medium, and heavy snowfalls each winter. This experiment will involve a study of the effects of various widths of snowplowing on traffic operations. Independent variables will include plowing widths sufficient for traffic movement, plowing the full width of pavement, and plowing shoulders in addition to the pavement. Consideration will be given to the pavement surface condition and to whether the snow on the shoulder has a barrier or curb effect and acts as a desirable or undersirable delineator. All of these variables will be measured, and a plan will be developed to analyze their effects on traffic operations including speed variations and capacity.

Study of effects of adverse visibility and dynamic warnings of limited visibility

Adverse visibility on sections of the Maine Facility occurs with enough frequency to permit the evaluation of fog-detection devices and the evaluation of dynamic warning signs actuated by such equipment. This experiment will involve the selection and recommendation of visibility surveillance devices and their integration with the Maine Facility electronic system for data collection and communication of messages to control roadside dynamic signs based on detected conditions, to warn drivers of the lowered visibility, and to advise of actions to take to avoid the problems that may ensue.