An Evaluation of the Northway Emergency Telephone System

RONALD W. TWEEDIE, Associate Transportation Analyst, and
JOHN E. TAYLOR, Senior Transportation Analyst, Subdivision of Transportation Planning and Programming, New York State Department of Public Works

•THE need to provide for the safety and convenience of disabled motorists on limited-access highways is receiving considerable attention from state and federal highway agencies. This emphasis is certainly warranted when one considers that 85 percent of the planned 41,000-mile Interstate Highway System lies in rural areas, many of which are remote, sparsely populated, and completely lacking in motorist services. In event of accident, illness, or vehicle failure, the motorist is almost entirely dependent upon assistance from another passing motorist. Quite often the delay while waiting for service is unreasonably long and may, in the event of a severe injury, result in a loss of life.

Emergency communication systems are not new; however, they have generally been limited to urban areas. The purpose of this paper is threefold: (a) to describe the physical and operational characteristics of an emergency telephone system on a rural interstate highway, (b) to report and analyze data obtained from the system, and (c) to outline and recommend continuing research in several related areas.

DESCRIPTION OF SYSTEM

New York State's Adirondack Northway (I-87), when completed, will form an important 178-mile link in the Interstate System between the eastern United States and Canada. From its southern connection with the New York Thruway at Albany, the Northway carries traffic from the New York metropolitan area to the Adirondack Mountains and other upstate recreational areas. It is the primary route between New York City and major Canadian cities such as Montreal and Quebec City (Fig. 1).

The Northway Emergency Telephone System (NETS) has been in operation on the southerly 55 miles of the highway since January 7, 1966, and consists of 222 free telephones spaced at ½-mile intervals on both sides of the facility (Fig. 2).

The call box (Fig. 3) is a standard telephone housing mounted on a treated cedar pole. The box has been coated with reflectorized yellow paint to improve nighttime visibility. The vertical number on the right identifies the location of the box. Immediately above the number are the instructions for using the phone, and on the left is the familiar icebreaker handle which opens the box. The phones are located just off the right shoulder of the highway approximately 12 feet from the edge of the pavement. This gives the motorist ample space to pull his vehicle completely off the pavement while using the phone (Fig. 4). Phones on the northbound side are located directly opposite those on the southbound side to discourage any motorist on foot from crossing the highway.

Each phone is connected by underground cable to the nearest of three State Police substations, permitting the motorist to explain the exact nature of his call to a police officer. The officer is immediately able to supply information or dispatch appropriate assistance. The system is composed of 12 individual circuits and includes a continuous test of circuit continuity for rapid detection of line failure. The phones are distributed among the three substations as follows: Loudonville, 36; Malta, 98; South Glens Falls, 88.

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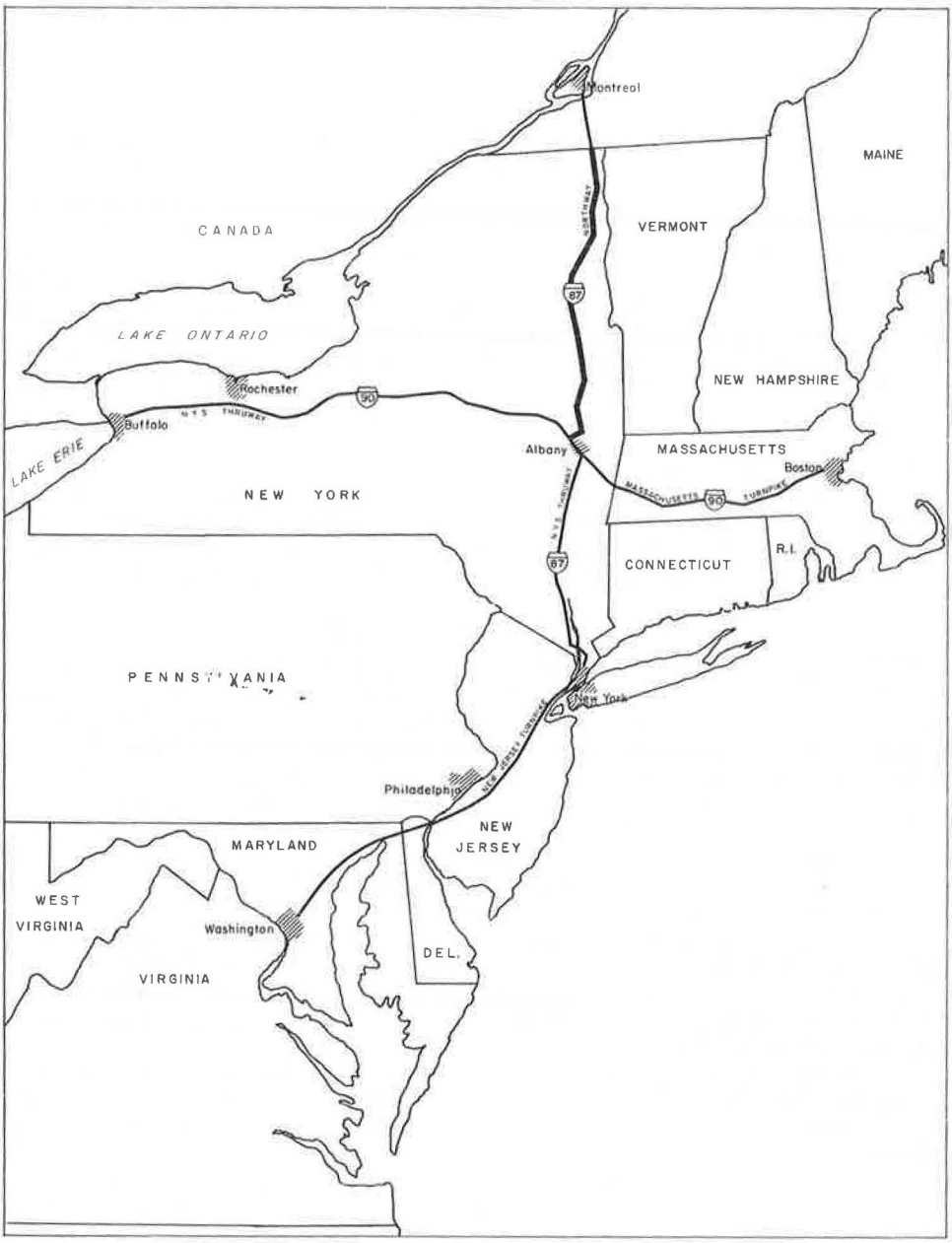

Figure 1. Regional setting of Northway.

Figure 2. Sign on Northway indicating spacing of telephones.

Figure 3. Call box of the emergency telephone system.

Figure 4. Location of call box in relation to roadway.

The telephone equipment is owned and maintained by a private utility company. The initial nonrecurring installation charge was approximately $950 per instrument. The monthly rental rate is about $15 per phone and includes repairs or replacement of material and equipment. Experience during the first year of operation should determine the future maintenance cost.

All incoming calls are recorded and coded by the State Police on the NETS log sheet which was developed by the Department of Public Works to facilitate electronic data processing. At the end of each month, these forms are transmitted to the Department of Public Works for additional coding and keypunching. A computer program has been developed which produces monthly and cumulative summaries of call information as well as a complete listing of data pertaining to each call.

PRELIMINARY RESULTS AND ANALYSIS

An analysis of the number and type of calls received during the first 10 months of operation indicates that the telephone system is providing a needed service to motorists; nearly 4000 calls had been received since January 7, 1966. Moreover, the system was immediately accepted by the motorists as a means for obtaining aid in that they made over 300 calls during the first month of operation. The monthly variation in the frequency of calls is shown in Figure 5. (January is from the 7th through the 31st.)

The sharpest increase in call activity occurred during June, July, and August when more than 40 percent of the calls were received. The number of calls ranged from a high of 660 in July to a low of 228 in October.

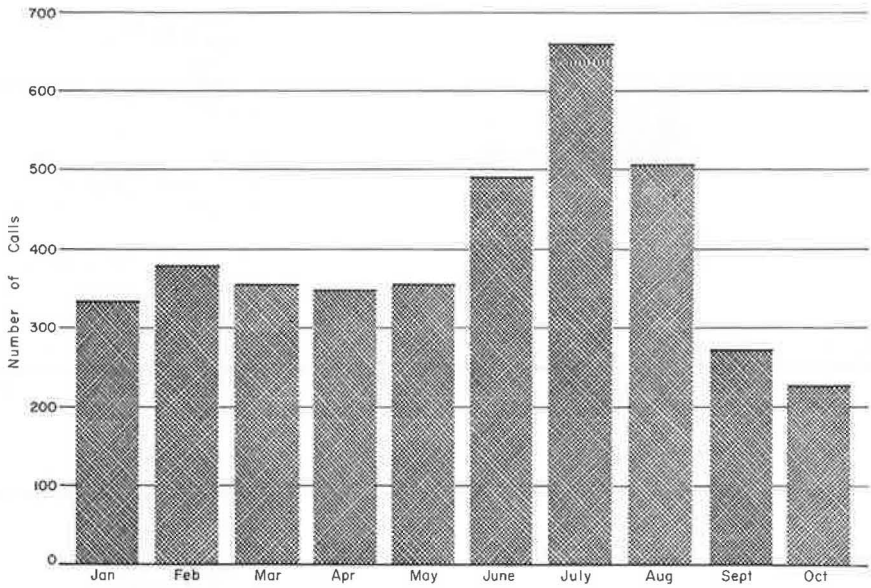

Figure 5. Monthly call frequency.

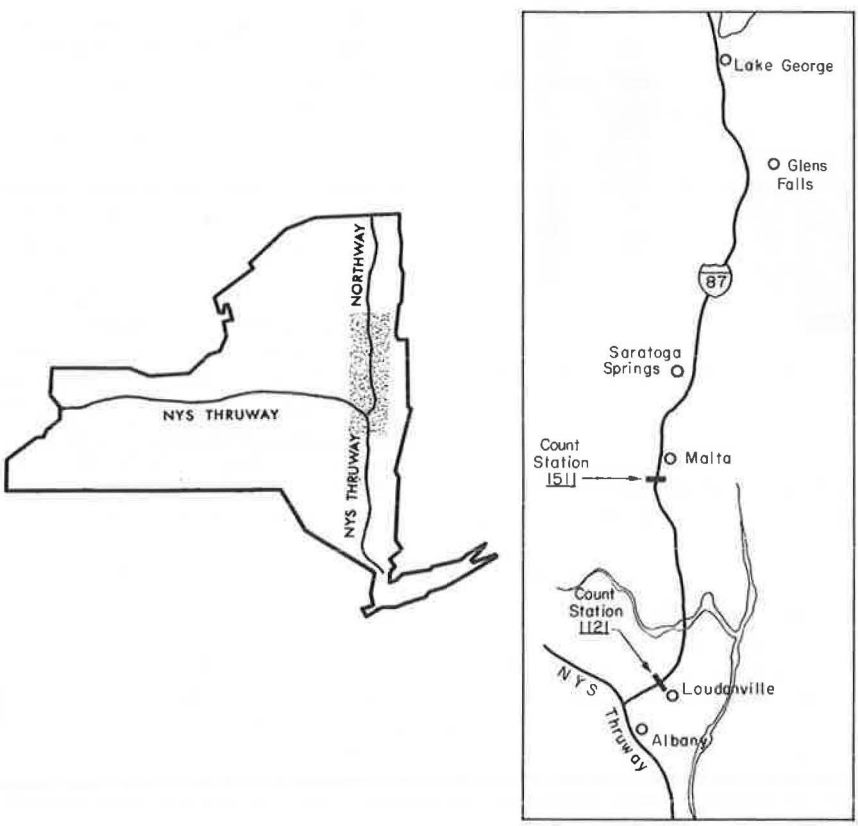

Figure 6. Location of the Northway Emergency Telephone System.

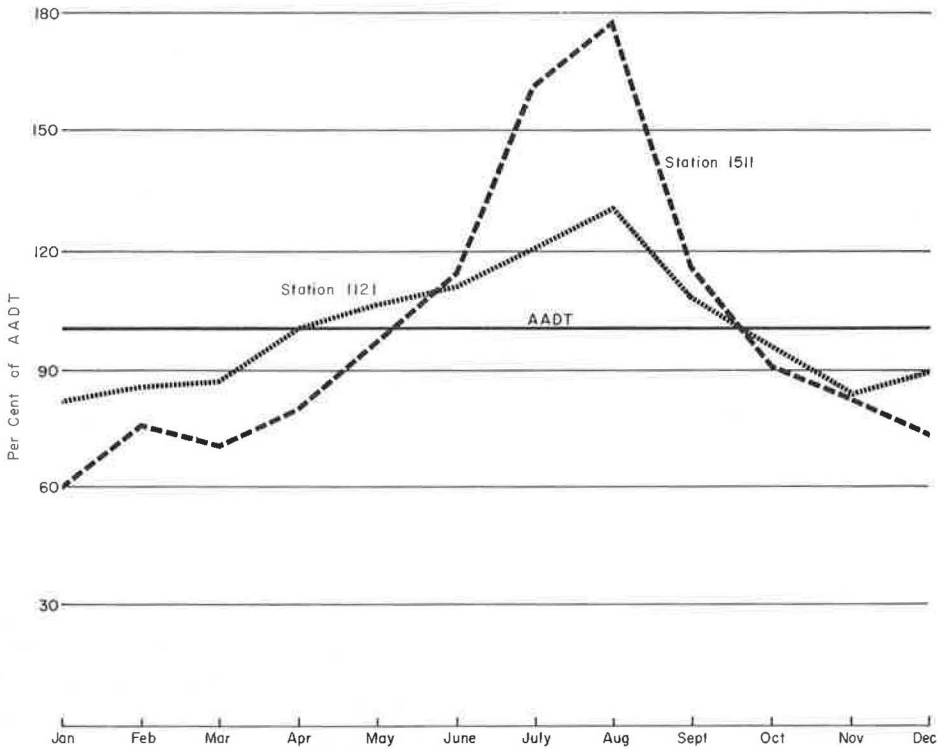

Figure 7. Annual traffic pattern.

The preliminary analysis of NETS usage has dealt primarily with the relationship between call activity and traffic volume. The data sources for traffic volume are two continuous count stations located on the Northway as shown in Figure 6. The lower station (1121) is located in the Loudonville section just north of the interchange with the New York State Thruway. This station is classified in the New York State traffic counting program as representing an urban route with some recreational characteristics. The section of the Northway represented by this station carries heavy commuter traffic between Albany and suburbs to the north. Beyond the suburbs, the area served by the Northway is characterized by many recreational and resort areas such as the famed Saratoga Race Track and the Adirondack State Park. The upper continuous count station (1511) is located within the Malta section and is classified as representing a recreation facility.

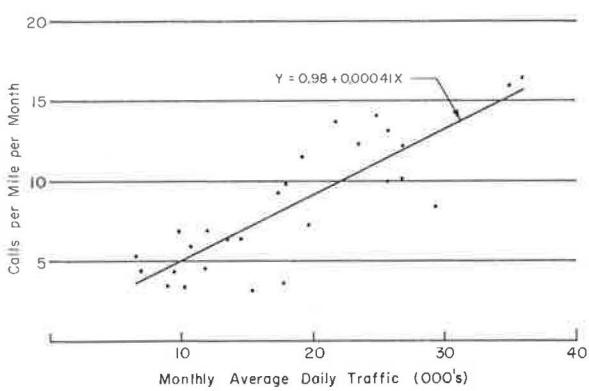

Figure 8. Relation between calls and monthly traffic volume.

Figure 7 illustrates the monthly variation in traffic volume as a percentage of AADT for each station. Station 1511 has the familiar summer peak associated with a recreational route. Station 1121 also has a summer peak, but it is much less pronounced.

The relationship between call activity and traffic volume was investigated through regression analysis.

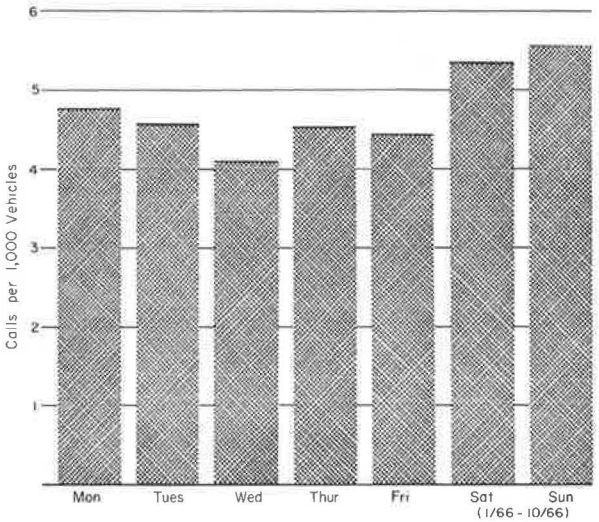

Figure 9. Calls per thousand vehicles by day (Loudonville count station 1121).

The number of calls per roadway mile each month was compared with the monthly average daily traffic; the results are shown in Figure 8. The correlation coefficient of 0.84 indicates the importance of the relationship between traffic volume and the number of calls. As volume increases, the number of calls can also be expected to increase.

The calling rate is expressed as the average number of calls per thousand vehicles. It is based on the actual count of the number of vehicles passing a continuous count station and not on vehicle-miles of travel. While vehicle-miles of travel can be determined for the entire length of the Northway, it is difficult to assign specific amounts to segments of the facility from which calls are received. On the other hand, the calls received from the telephones in the vicinity of the continuous count station can be meaningfully and more accurately related to the number of vehicles passing that station. The following discussion of the calling rate, therefore, pertains to calls received from the Loudonville reporting section and to traffic volumes recorded at the continuous count station located in that section.

The daily calling rate (Fig. 9) varies little during weekdays; however, the weekend rate is considerably higher. The weekend average of 5.46 calls per thousand vehicles is 22 percent greater than the weekday average of 4.48.

Figure 10 shows the hourly variation in the calling rate. The mean hourly calling rate for the Loudonville section of the Northway is 4.66 calls per thousand vehicles passing count station 1121. As shown in the figure, the rate varies from a high of 10.7 between 4:00 and 5:00 a.m. to a low of 2.7 between 9:00 and 10:00 p.m. Of particular interest is the fact that the calling rate between midnight and 7:00 a.m. consistently

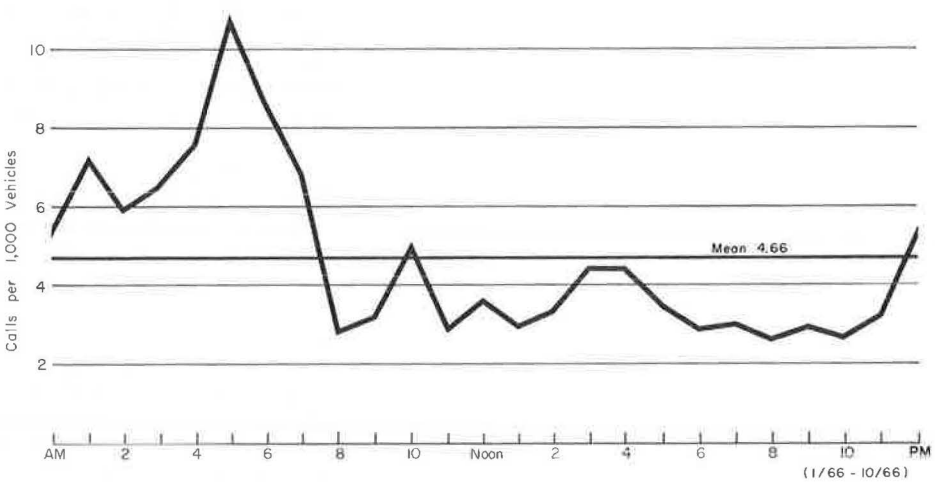

Figure 10. Calls per thousand vehicles by hour (Loudonville count station 1121).

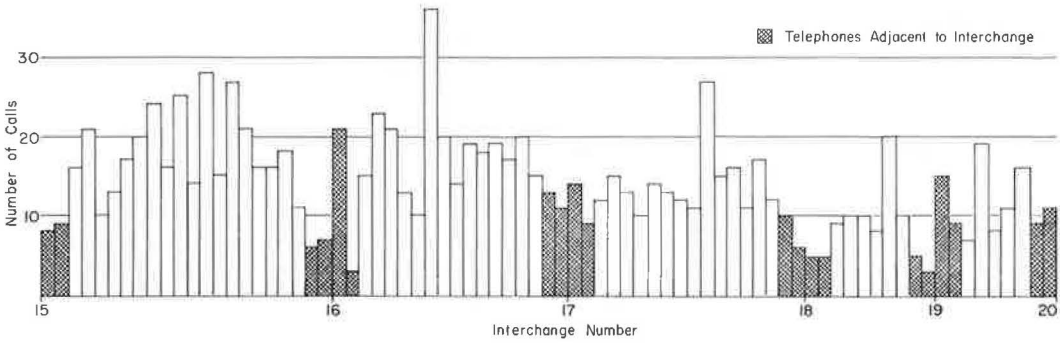

Figure 11. Number of calls by box number sequence between interchanges.

exceeds the mean, while it is generally less than the mean during the remainder of the day. Perhaps this reflects the motorist's reluctance to leave a rural facility at night in search of fuel, repairs, or other assistance.

Individual telephone use has varied considerably, ranging from a low of one to a high of 62 calls during the first 10 months of operation. A pattern was observed (Fig. 11) showing that telephones between interchange areas experienced much more frequent use than those located within or near interchanges. (The telephones within the limits of each interchange were used an average of only 12.5 times as compared to the overall average use of 18.) This suggests that a motorist experiencing difficulty in the immediate area of an interchange will most often attempt to exit and locate a service station himself.

The number of calls per million vehicles-miles of travel for each of the three reporting stations did not vary substantially from the overall average of 15.1. Values of 16.2, 13.5 and 15.6 were observed for Loudonville, Malta, and South Glens Falls, respectively.

Passenger car drivers were responsible for 77 percent of the calls, while the 714 calls from truckers represent an additional 21 percent of telephone use. Motorcyclists and bus drivers accounted for the remaining 2 percent. It is particularly interesting that while trucks represent 11 percent of the traffic volume, they account for 21 percent of the calls. Practically all truck calls requested vehicular service. This fact underscores the value of an emergency communication system to the efficient transportation of goods.

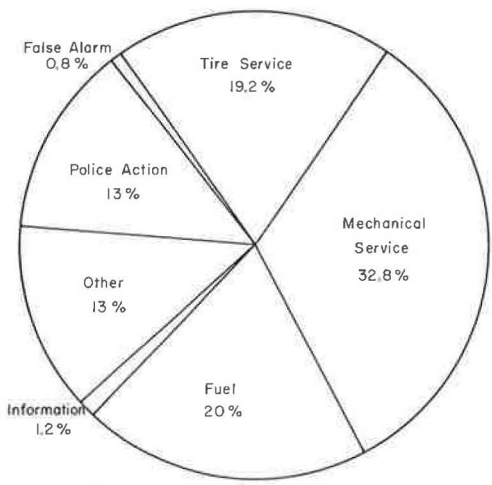

Figure 12. Percent of calls by type of assistance needed.

All incoming calls were classified by type of assistance requested (Fig. 12). Vehicle services, for which more than three-fourths of the calls were made, include requests for gas and tire and mechanical repairs. Police action calls were made primarily to report motor vehicle accidents and traffic violators, the latter including several drivers traveling the wrong way. False alarms amounted to less than 1 percent of the total calls.

AREAS OF FURTHER STUDY

Prior to the collection and preliminary analysis of the NETS data, little, if any, information was available concerning the use of an emergency telephone system on

a limited-access rural highway. While a few basic relationships have become evident from this study, several factors remain to be investigated before sound policies or warrants can be established for expanding similar installations to other rural highways on the Interstate System. Several areas where additional research is needed are described in the following. Some of these will be investigated as part of a continuation of the present study.

Factors Affecting Use

To provide the best service available for any customer in a competitive market, a service agency must know its customers. This fact is doubly important on the Northway because we are dealing with emergency services. A close analysis of the type of service requested reveals a great deal about the disabled motorist. For example, 20 percent of the time he needs only fuel in order to resume his journey.

As was shown in Figure 9, the calling rate on the average weekend is more than 20 percent higher than it is on the average weekday. This suggests that the Monday-to-Friday commuter has a different impact on phone use than the social-recreational traveler on Saturday or Sunday.

There are several factors which may contribute to the use of an emergency telephone. These include the purpose of the trip, the length of the trip on the Northway, the drivers' familiarity with the area, the vehicle type, the day of the week, and the hour of the day. To obtain data on trip characteristics, a screenline inventory is planned. The data from this inventory will be compared with data obtained from the motorists using the telephones. These comparisons will reveal the differences, if any, between the trip characteristics of travelers who use the telephones and those of all the travelers on the Northway. The Northway is an excellent laboratory for this research not only because of the heavy influence of the tourist during the summer but also because of the variation in the degree of development adjacent to the facility.

Physical Features

As might be expected, a few operational difficulties have emerged since the system was installed. A motorist stopping along the shoulder is sometimes unable to see a call box in either direction and often starts for the more distant phone. This problem is intensified at night, and at least one motorist walked nearly a half mile, unaware that another call box was located only a few feet away in the opposite direction. Further, it is often difficult for the nighttime user to identify the number of the box from which he is calling. Some modification of the present system is contemplated to eliminate these undesirable features.

The decision to space the Northway telephones at one-half mile was subjective and may not represent the ideal distance between instruments on any emergency communication system. The spacing between adjacent phones, not necessarily constant, might be based on the ability of the potential user to locate and identify a telephone from any point along the roadway. Identification may thus be a function of horizontal and/or vertical curvature, as well as a function of the level of signing effort. Many areas of the country experience extreme climatic conditions and, while this criterion suggests a maximum spacing, it might be modified by the ability of the user to get to the instrument under adverse weather conditions.

Benefits

Today the highway administrator is more than ever aware of the increasing competition for the dollar invested in transportation systems. To advocate an emergency communication system as extensive as NETS, he must have a firm evaluation of the benefits attainable. The benefits of an emergency communication system may be expressed in terms of time savings, service, safety, and security (1). It may be difficult to attach a dollar value to each benefit; however, the utility of each item can be examined. Time savings credited to an emergency communication system in an urban area might be considerable, since a disabled vehicle often creates congestion and delays

to other motorists using the facility. Motorists on rural highways, however, seldom experience the congestion normally associated with urban routes; thus a rural communication system results in time savings only for the disabled motorist. It is unlikely that savings in driver time alone will completely offset the cost of a communication system. Time savings do, however, constitute an important part of the total benefit to the motorist.

Time savings can also be evaluated in a slightly different context. Prior to the installation of the Northway Emergency Telephone System, a portion of the New York State Troopers' day was spent assisting disabled motorists. While this service can never be completely eliminated, a reduction in stopped time of the patrol vehicle has been observed. This saving results in increased surveillance time, thus offering better service to the motorist.

Attention has been given nationally to establishment of emergency aid stations so as to reduce the time lag between a motor vehicle accident injury and the arrival of competent medical assistance. It is realistic to assume that an emergency communication system may be instrumental in reducing the discomfort and suffering which result from accident injuries on the facility. Installation of an emergency communication system nationally may eliminate or reduce the need for aid stations.

An emergency communication network can also be utilized as an early warning system to alert the police of the existence of a hazardous condition. This can take the form of a traffic violator such as a wrong-way driver, or an actual roadway hazard such as pavement icing or a foreign object in the road. The element of security is perhaps the most difficult to evaluate. It may be expressed in terms of the value of knowing that prompt assistance is readily available in event of an emergency. The importance of this knowledge to the motorist in his decision to select one route over another is a subject for further investigation.

SUMMARY

The Adirondack Northway presents a unique opportunity to study the operation of an emergency telephone system under a variety of conditions. Experience thus far indicates that NETS has been well accepted by the traveling public and is providing a much-needed service. Of course, there remain many unanswered questions concerning emergency communication systems. However, New York State has taken the initiative in establishing a complete system on an Interstate highway. It is anticipated that the evaluation of this system over the next few years will be a significant contribution to the field of emergency communications.

REFERENCE

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