TRANSPORTATION RESEARCH RECORD

487

Formerly issued as Highway Research Record

Crime and Vandalism In Public Transportation

5 reports prepared for the 53rd Annual Meeting of the Highway Research Board

subject areas

81 urban transportation administration
82 urban community values

TRB

TRANSPORTATION RESEARCH BOARD

NATIONAL RESEARCH COUNCIL

Washington, D. C., 1974

NOTICE

These papers report research work of the authors that was done at institutions named by the authors. The papers were offered to the Transportation Research Board of the National Research Council for publication and are published here in the interest of the dissemination of information from research, one of the major functions of the Transportation Research Board.

Before publication, each paper was reviewed by members of the TRB committee named as its sponsor and accepted as objective, useful, and suitable for publication by the National Research Council. The members of the review committee were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the subject concerned.

Responsibility for the publication of these reports rests with the sponsoring committee. However, the opinions and conclusions expressed in the reports are those of the individual authors and not necessarily those of the sponsoring committee, the Transportation Research Board, or the National Research Council.

Each report is reviewed and processed according to the procedures established and monitored by the Report Review Committee of the National Academy of Sciences. Distribution of the report is approved by the President of the Academy upon satisfactory completion of the review process.

The National Research Council is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering, serving government and other organizations. The Transportation Research Board evolved from the 54-year-old Highway Research Board. The TRB incorporates all former HRB activities but also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

TRR 487
ISBN 0-309-02273-8
LC Cat. Card No. 74-10127
Price: $2.00

CONTENTS

FOREWORD

Crime and vandalism on public transit are detrimental to ridership regardless of whether they have been experienced firsthand or vicariously by the patrons. Although there is much published material on crime and delinquency in general, there is a dearth of material related directly to crime and vandalism on urban transportation systems. The five papers in this RECORD report on recent research on this subject.

Shellow, Romualdi, and Bartel report on research they conducted using 18 months of verified crime reports from one city's police department files on bus and rapid transit robbery, battery, assault, and crime against persons. An important part of their study includes an assessment of the public's attitude toward the transit system as related to the perceived level of crime and the general level of security. The authors describe a surveillance system that provides direct response to crime patterns and greater assurance of the security of the general public.

Sinha and Roemer describe the study they conducted on personal security in buses for a bus route in Milwaukee. On-bus and corridor questionnaire surveys were taken to give an indication of respondents' views about personal security and other transit service characteristics. The researchers conclude that the problem of personal security is less important than service factors such as frequency of service, fare level, and travel time.

Three papers are by Thrasher and Schnell. The first paper reports on findings of six studies on whether fear of crime and vandalism on transit systems affects individual decisions to use public transportation. The authors found that knowledge of incidence of crime on transit and the costs of transit vandalism are not well developed. In their second paper they report on their research that attempts to quantify the extent and seriousness of crime and vandalism on urban transportation systems. The study included data from 37 U.S. transit systems. The research team developed a transit exposure index to compute the risk of being involved in a criminal incident when riding on public transit. They conclude that crime on transit systems may be proportionately more serious than has been generally credited. The last paper summarizes the findings of a research study of crime, vandalism, and passenger security on urban transit systems. The paper covers the means of controlling the problem through use of several approaches, including special vandal-proof materials, procedures and tactics to protect passengers, involvement of the community in anti-crime measures, and methods to cultivate good relationships with the police, the courts, and the media.

CRIME IN RAPID TRANSIT SYSTEMS: AN ANALYSIS AND A RECOMMENDED SECURITY AND SURVEILLANCE SYSTEM

Robert Shellow, James P. Romualdi, and Eugene W. Bartel,
Carnegie-Mellon University

This study is directed toward identifying the influence that crime has on transit ridership and toward developing measures for increasing patron and system security on a major transit network. Because of the preponderance of crime and harassment on rapid transit as opposed to surface transit, recommendations are directed toward test demonstrations on the rapid transit segment of the system. All suggested improvements are based on systematic analyses of transit crime patterns, ridership trends, a survey of public perception of transit crime, present security measures, and general operating procedures. Profiles of transit crime are derived from an 18-month series of crime data collected on the system. A crime-ridership index is employed to measure risk to patrons on various parts of the transit system. Present inadequacies in surveillance and response capability of police are described. The question of increasing manned patrols as opposed to substituting electronic or mechanical systems is examined from the viewpoint of assuring patrons of rapid protective response should an emergency arise. A publicly activated closed-circuit television system is offered as one means of addressing the security needs on high-risk portions of the rapid transit network.

•TRANSIT OPERATORS throughout the nation have long recognized the potentially injurious effect that crime has on public confidence in mass transit systems. The presumption is that withdrawal of confidence is accompanied by a withdrawal in patronage as well. With the prospect of rapidly expanding existing systems and the construction of new ones, this issue is increasingly important. This is particularly true for rail rapid transit serving suburban metropolitan areas where the justification of the system will depend, to a large extent, on its ability to draw commuters away from private automobiles. It is the image of these systems that will determine, to a great extent, the outcome of the quest for new riders. Though residents of the inner city are captive to public transit and few possess the means to avoid its use, it is suggested that the appearance of crime may well be at the basis of declining use. Furthermore, there is a growing possibility that potential suburban riders will be disproportionately discouraged from public transit by their anxiety about crime.

Because of their relative collective inexperience with crime, potential suburban riders are more likely to be alarmed by the presence of crime on public transit even if it occurs far from the neighborhoods or routes they frequent. The transit security problem clearly illustrates the interdependence between the lives of city and suburban dwellers. Not only must the burden of crime be lifted from inner-city residents as a matter of public service, but such action is mandatory if suburban patrons are to feel sufficiently secure on public transit to make its use a regular part of their daily lives.

An overall approach to the question of crime on transit systems has three general components:

1. The establishment of the nature and extent of crime on the system and its relation to overall urban crime statistics (as it exists if the transit system is presently operating or as it might be expected for a proposed system),

2. The public's perception of security and the extent to which it will affect riderships (this is in addition to the inherent responsibility of the operating agency to protect the riding public), and
3. The deployment of effective means not only to reduce crime but also to increase the public perception of security and to do both in a cost-effective manner.

In spite of the seriousness of the problem, a surprisingly small amount of work has been reported in this area. A recent study concerned with the renovation of a particular underground rapid transit station indicates the importance of the issue of security (1). A survey of potential and existing users of the single rapid transit station analyzed clearly pinpointed security as the most preferred kind of improvement. But, in general, studies to establish the effect of key variables in the choice of transit mode invariably ignore security, despite its apparent importance for non-work-related trips. For example, one of the most comprehensive attitudinal surveys attempting to quantify and rank transit system attributes does not explicitly deal with security (2).

In recognition of the need to pursue studies in this area, the Transportation Research Institute at Carnegie-Mellon University began a team effort to structure the transit crime problem and define criteria against which proposed security or surveillance measures could be tested (3, 4). Subsequently, the Transportation Research Institute and the Urban Systems Institute of Carnegie-Mellon University undertook to collect, analyze, and interpret data pertaining to crime, public attitudes, and system operation for a large urban rapid transit system. The study, supported by the Urban Mass Transportation Administration, also designed a pilot security and surveillance system that was responsive to the actual and perceived security problem.

This paper presents the principal findings and recommendations of the study in the belief that the crime characteristics and recommended security system are indicative of characteristics and solutions that are appropriate to other existing or proposed systems. However, specific data and even reference to the city in question are omitted for two reasons: First, there is a natural sensitivity on the part of any urban area to overly publicized data on crime or detailed analyses of the effectiveness of various components of its security system, and second, there is no evidence that the details of crime and its distribution are representative of anything but the city in question. Thus, it is only the general characteristics and conclusions that might have application to other areas.

DESCRIPTION OF DATA-GATHERING PROCESS

The city in question operates a rapid transit system with some portions elevated, others at grade, and a few miles in tunnels. A surface bus system is also operated. Protection is provided by the regular city police force and a special transit unit (transit police). In addition to detailing all transit operations regarding station and route ridership figures and trends for different times of the day, week, month, and season, 18 months of verified police crime reports were analyzed.

Public attitudes toward the transit system were also surveyed, particularly with regard to perception of the level of crime occurring on the transit system and the general security of the facilities. Some 45 potential questions were asked in a telephone interview of 1,556 persons.

STUDY FINDINGS

Ridership

The ridership trends for the system studied are rather typical of major urban areas. Ridership on the total transit system dropped 22 percent from 1962 to 1972, while per capita automobile registration increased over 20 percent in the same decade. Ridership originating on the bus system fell four times as far as that originating on rapid transit.

Gradually during the decade riders shifted their use from evening peak and off-peak hours to the 9:00 a.m. and 3:00 p.m. period (Fig. 1). Most of the reduction occurred in the 3:00 p.m. to midnight interval. It is not coincidental that this later afternoon,

evening, and nighttime decline in use is correlated with both the incidence of serious crime and the public's perception of unsafe periods.

Crime on the System

During the 18-month study period, analyses of verified police reports clearly portray that (a) most crimes occur on the rapid transit system and (b) robbery is the crime of greatest frequency. About 75 percent of all crime occurred on rapid transit lines, mostly on elevated station platforms. Three out of four crimes were robberies, occurring at times when there is a drop in use and when patrons tend to be isolated or share the facilities with few other people. Thus, over two-thirds of the robberies occurred between 6:00 p.m. and midnight. Assault and battery, on the other hand, was more likely to occur when the system is congested. Almost half were found in the 4:00 to 10:00 p.m. period, with a peak during the 5:00 to 6:00 p.m. rush hour when the jostling of passengers entering or leaving trains is common. The hourly pattern for robberies continued into the weekend evenings of Friday and Saturday, although there is something of a shift in the robbery peak to the after-midnight hours (Figs. 2 and 3).

Simply reporting the volume of crime occurring on rapid transit or bus, in different months, days, or hours, could be somewhat misleading because of the variation in ridership during these periods. However, by dividing the reported incidents during a particular period by the ridership during the same period, a crime-ridership index was obtained that is a more accurate measure of the risk exposure. Thus, as shown in Figure 4, the risk index for rapid transit is compared to that for bus over the days of the week. The weekend increase in risk is readily apparent. Overall, risk on rapid transit was markedly higher than on the bus system. Figure 5 shows the indexes by hour of the day and underscores the high risk associated with the late evening and early morning off-peak hours.

Perhaps the most instructive of all findings relates to the geographic distribution of crime on the system throughout the city. A mapping of stations with high crime-ridership indexes closely overlapped areas of high unemployment as well as police districts experiencing high crime rates. In looking at the residences of apprehended offenders in relation to the site of their crime, it became clear that criminal predators tended to work in territory that was familiar to them and were not likely to use public transit as a means for extending their territory beyond their own neighborhood or as a means of escape.

Over 75 percent of all crimes on the rapid transit system were committed on station premises, and over two-thirds occurred on platforms. Less than 33 percent of all robberies occurred on trains, whereas a slightly greater proportion of batteries and almost half of all crimes against persons were committed on rapid transit vehicles.

The Public's View of the System

Because a major objective of the study was an assessment of the public's attitude toward transit service, and especially transit crime, an attempt was made to determine the extent to which an individual's perception of the incidence of transit crime was realistic and how this perception affected ridership behavior. Accordingly, the public attitude survey served to determine habits of use, perception of service, assessment of crime, and preferred security measures.

Of those responding, 95 percent had used rapid transit at one time or another, 75 percent within the last year.

The survey indicated a pervasive lack of public confidence in transit security. Furthermore, this perception of insecurity has significantly affected ridership. About one-fifth of those who do not use transit and 16 percent of rapid-transit-only riders cited the lack of security from harassment and crime while riding or waiting for the bus as reasons for not using the bus system. But when it came to rapid transit, itself, 25 percent of those who do not use it and 30 percent of bus-only riders cited lack of security for not riding trains.

Both bus and train users agreed that the entire transit system was especially unsafe at night. Nine out of ten would not use either system after 9:00 p.m.; almost none would

Figure 1. Rapid transit and bus ridership distribution (by time interval) for 1955 and 1970.

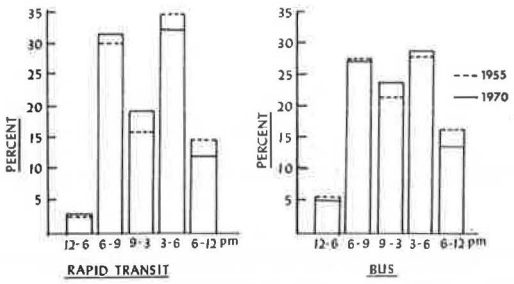


Figure 2. Assault and battery reports (by time period).

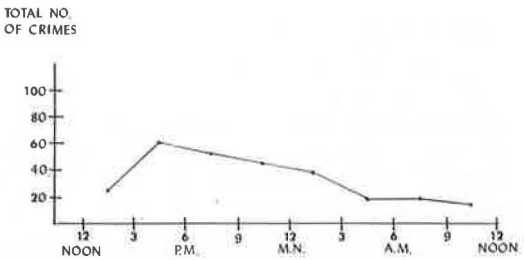


Figure 3. Robbery reports (by time period).

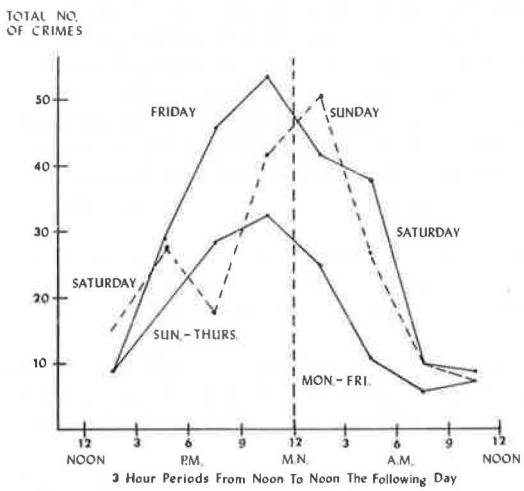


Figure 4. Rapid transit and bus crime-ridership indexes (by day of the week).

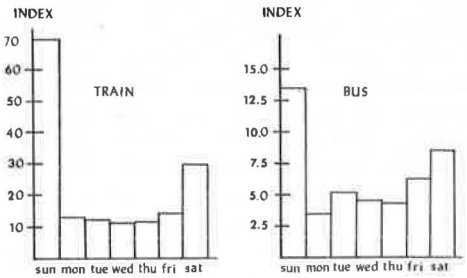
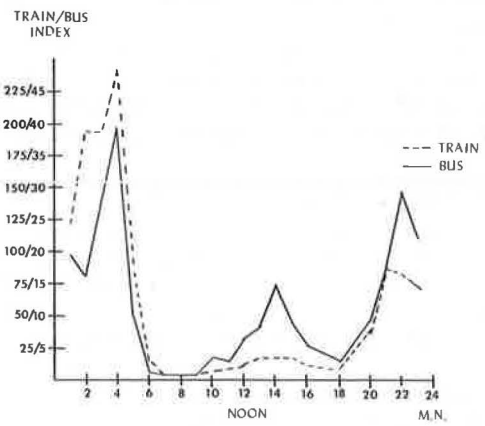


Figure 5. Rapid transit and bus crime-ridership indexes (by hour of the day).



after midnight. Lack of security was cited by 84 percent of the bus users and 89 percent of the rapid transit users as a reason for not riding after 9:00 p.m.

When asked to rate various features of the transit system, over half of the train riders rated safety from harassment and crime while riding or waiting for trains as fair to very poor.

A sizable percentage of the riders in one survey (8 percent) had been victims of crime. Within the victim group, about half experienced theft, a fourth robbery, and another fourth assault and battery.

To determine under what conditions perceived insecurity was highest, riders were asked to rank nine conditions associated with using transit facilities. Out of nine possible locations, the stairs, rampways, and tunnels of the train system were ranked least secure, followed closely by station platforms and trains in motion. Riders felt most secure while riding the bus, while going from their home to the bus or rapid transit stop, and while waiting at the bus stop (in decreasing order).

Subsequently, respondents were asked to rank which security measures in their estimation would give them the greatest reassurance. Most felt that the best promise of improvement in security lay in the deployment of more police (including K-9 patrols) to the station platforms and on trains or in the knowledge that quick assistance could be obtained in any emergency.

Calculating Risks on the System

But is public transit truly a "crime-ridden" environment? There is no simple or direct way by which risk of victimization on a transit system can be calculated.

To compare crime risk on rapid transit with that associated with living in a neighborhood and using the city streets requires that street crime be expressed as an index of crimes per million entries onto the public streets. Inasmuch as this is not presently feasible, we chose to measure rapid transit crime in terms of incidence per 100,000 riders because city crime is expressed in rates per 100,000 community residents. Such rates can be grossly approximated for transit crime for each 100,000 occupants of the "rapid transit community." For our purposes, this community was considered to consist of those persons 16 years and older who used rapid transit daily. The fact that the rapid transit community is less stable than a city, that some people use rapid transit far more than others, and that we have no idea of the extent to which occasional users contributed to our victim lists only invites caution in the use of such comparative figures.

Robbery was used as the "bellwether" crime that it properly is. The non-transit robbery rate for police precincts analyzed is an average of 954 robberies per 100,000 residents for 1971. By using a series of calculations, it can be estimated that there are approximately 228,000 persons, 16 years and older, on the rapid transit system each weekday. If indeed this group is the rapid transit community, it probably accounts for the greater part of the system's 135,000,000 rapid transit rides annually. Based on robbery data for rapid transit victims 16 years and older, this population experiences a robbery victimization rate of 332 per 100,000 persons (about one-third of the rate for the rest of the city, although somewhat greater than the national average of 187 per 100,000 as computed by the Federal Bureau of Investigation).

These calculations, taken with the average crime-ridership index of seven occurrences of serious crime per every 1,000,000 entries onto the rapid transit system, should be far from cause for alarm. Even the risk factor of 91 per 1,000,000 for the most dangerous part of the network might be seen as favorable odds by most prudent patrons.

Paradox of Reality Versus Perception

Why then is there the mounting concern over transit crime? Why does it persist as an issue? The most we can say is that, in this instance, appearances are more important than reality. With heightened national awareness of crime, particularly stranger-to-stranger crime, the public is likely to be highly sensitized to each oc-

currence even before it is reported. Anticipation itself quite likely adds to the impact of each publicized transit crime, especially if crime occurs in space where people may feel trapped.

This is the paradox that is so central to any consideration of mass transit security. It is not the reality of crime on the system that makes the difference, but how it is differentially perceived. Furthermore, the general public expresses considerable concern over crime on the system even though this concern appears to be out of reasonable proportion to the occurrence of criminal events. Indeed, as has been pointed out by Bard (5) in a study relating to sense of security in public housing projects: "A general sense of security in a community is not derivative of crime statistics alone. There is mounting evidence that citizens feel secure when there is the conviction that government is responsive to their needs."

Summary of Findings

1. On the basis of a series of crime profiles, crime appeared to be disproportionately located along the rapid transit portion of the public transit system.
2. When expressed in terms of the crime-ridership index, the patterns of transit crime closely corresponded to high-crime and high-unemployment areas of the city.
3. Robbery on isolated, elevated platforms during off-hours at these high-risk locales outranked all other crimes at other times elsewhere throughout the system.
4. Police response capability was severely hampered by gaps in the communications-response network on which unit dispatch is based. Indeed, it was found that a major communication gap existed between the victim or witness of a crime and police headquarters.
5. A crime on public transit (especially on rapid transit) was perceived to be a serious problem by a significant number of survey respondents, despite the fact that the robbery victimization rate on transit properties was estimated at one-third of that for the rest of the city. This finding confirms the hypothesis that perceived security is at least as important as the reality of crime on public transit.

A REFINED STATEMENT OF THE PROBLEM

Two central questions remain: How can the public's perception of security on transit systems be improved, and how can the actual number of crime incidents be reduced? If we literally accept the preference of survey respondents for security improvements, we would recommend a sizable increase in police-patrol at stations and on trains. But relying totally on the use of manpower for surveillance is of questionable cost-effectiveness in deterring crime. Few on-view crimes were reported by police during this study except for special decoy operations. Although police perform an extremely important role in the overall provision of protective services, it is our contention that, because few crimes develop within the police officer's sight, his role is mainly a response function rather than one of surveillance. This is not to say that patrols do not deter crime, but rather that good response capability is apparently more cost-effective than routine patrol and surveillance. The permanent positioning of patrolmen on a station platform appears to be an effective (although costly) method of deterring crime at the site; however, it is probably limited to that site alone. The long rampways, numerous stairways, and obstructed sight lines of many rapid transit stations seriously erode the ability of a small number of officers to provide effective surveillance. Furthermore, the effectiveness of allocating men to fixed posts for up to 8-hour tours is constrained by the effects of physiological fatigue and exposure to the elements during inclement weather.

Another look at what survey respondents think will increase their sense of security suggests that there is a central theme underlying their views: assurance that assistance can be rapidly obtained. Any public transit system that could convince patrons of this fact (with or without the continuous physical presence of police officers) is likely to meet this need.

A REVIEW OF POSSIBLE REMEDIES

Various electronic devices appear to have attributes that could provide the needed assurance. However, most currently available security devices are the type designed for areas or facilities closed to the general public. As a result, these devices provide no assistance in distinguishing between the criminal and the law-abiding citizen in a 24-hour facility such as a transit system. In the following sections, some potential transit security devices are described briefly along with their shortcomings. A total system is then proposed that minimizes these shortcomings and provides direct response to the crime patterns and perceived security needs revealed by this study.

Simple Alarms

The simple alarm devices available are quite limited in their scope and only serve to draw local attention and increase the awareness of onlookers in the surrounding area.

Alarms may be effective in satisfying the public concern for personal security; however, they have definite drawbacks that restrict their potential usefulness in a public area. Prominent among these are the following:

1. Witnesses may refrain from using the alarm for fear of drawing the offender's attention to themselves, and they may not wish to become obviously involved;
2. The loud noise produced by the alarm may cause the offender to become agitated and harm the victim more seriously than he originally intended;
3. The exact location of the alarm is not always easily discernible, particularly when there are similar alarms in the surrounding areas;
4. The inability to distinguish between valid and false alarms could possibly overtax the response capability of the police; and
5. Because the witness or victim cannot relay information, details regarding the occurrence are not available to the police until they arrive at the scene.

Although the use of emergency telephones in public areas can reliably reduce the time lag between the crime occurrence and police notification, the system also has drawbacks: (a) the need to know and dial the police number, (b) the need to verbally identify the location, and (c) the improper use of the phones by the public for private calls or false reports. Some of these problems may be overcome by using a system in which the caller need not dial nor identify his location. In one, the caller lifts the receiver, which activates an alarm at the security console. The caller's phone is self-locating. Although it helps to reduce apprehension about security by providing a system the public can activate, this more complex system still has limitations:

1. The false-alarm problem is prevalent. In one university employing this approach, 70 percent of all alarm calls proved to be false.
2. Details regarding an occurrence or ongoing events are not necessarily available to the police, who must, therefore, approach the location without knowing the nature of the situation.
3. The telephone receiver must be replaced to stop the alarm. Even in known false-alarm cases, an officer must be sent to the location to replace the receiver. The receivers can also become a target for vandalism.
4. Witnesses may feel that the actions necessary to use the telephone would be such as to attract the offender's attention and thereby involve themselves more than they are willing to be involved. For this reason, they may not use the telephone.

Continuous Closed-Circuit Television Monitoring

Continuous, closed-circuit television (CCTV) surveillance of the transit stations could provide authorities with visual information regarding all events taking place within the area covered by the cameras. TV coverage could greatly reduce false alarms by permitting only monitor operators to make alarm judgments and could provide police with reliable information about the situation they will be entering. Automatic video taping also can provide details about the incident, offender, and victim that could aid in the arrest. In the public's opinion, continuous TV coverage may be viewed

as a welcome increase in security or as creating an unappealing "Big Brother" climate. Public reaction is uncertain but probably is dependent on the usefulness of the TV component in producing a prompt police response. Continuous TV monitoring, however, has the following limitations:

1. Persons viewing continuous monitors are subject to fatigue and therefore may not be alert enough to detect a crime in progress;
2. Considerable manpower is necessary to provide surveillance of all stations continuously and completely;
3. The citizen does not actively participate in his own protection and cannot easily communicate the specifics of his problem to the monitor operator; and
4. Observers may be unable to gain a detailed and accurate description of events and offenders from a momentary TV picture.

Assessment of Alerting Devices

In reviewing the various electronic and mechanical devices that could conceivably provide assurances of security in rapid transit, we made the following assessment: Alarm systems are plagued by false alarms and lack of information from the incident scene; phone systems are also subject to false alarms and vandalism, with only verbal information available from the scene; and standard CCTV systems are hampered by the monitor operator's viewing fatigue, and they do not provide verbal communications with the viewed area. Although they could possibly have a favorable effect on the public's perception of security, none of the available electronic countermeasures can effectively meet all the problems encountered in a publicly accessible area. What is needed is a system that will

1. Permit a witness or victim to notify the police quickly, efficiently, and, in some cases, inconspicuously, thereby increasing the public's perception of security as well as actual security;
2. Provide the police with a reliable description of the offense, the offender, and the existing situation before the police arrive on the scene;
3. Reduce the number of false alarms and amount of vandalism so that police can devote more time to legitimate calls; and
4. Minimize increments in manpower costs necessary to effectively accomplish these objectives.

Although available electronic systems do not meet these needs individually, a combination of them holds considerable promise, providing "off-the-shelf" components are employed.

PROPOSAL FOR AN INTEGRATED TELEVIEW ALERT SYSTEM

The combination of the alarm, telephone, and CCTV system into a publicly activated operating unit has, to our knowledge, not been attempted before. Such a coordinated system, which we term the teleview alert (TVA) system, would provide the public with an emergency phone and alarm system for quick and efficient communication with the authorities in the event of trouble. Television coverage would provide the police with a method for determining the legitimacy of the alarm and, by video taping, with a reference for describing the events and the offender. By linking the alarm system with the television so that the appropriate television cameras and recorders come on automatically only when an alarm is activated, the fatigue problems and manpower requirements associated with other systems of full-time surveillance are eliminated.

The proposed TVA system holds promise in that it reduces false alarms, provides critical surveillance information, and allows the public to quickly notify the authorities of the problem. The TVA system combines the communication capability of an emergency phone and alarm system with the surveillance coverage of a CCTV system.

The crime profiles emerging from this study indicate that the typical victim is usually isolated and waiting on a station platform, most often between 7:00 p.m. and 2:00 a.m. The offender, after committing the crime, typically leaves the system as

quickly as possible by the nearest exit. Apprehension rates are highest (about 65 percent overall) if the police can respond to the offense scene in less than 5 minutes. Principal security coverage should be enforced during the period from 7:00 p.m. to 2:00 a.m.

Components of the TVA System

Movable Gates or Barriers—Movable barriers would be used during periods of low ridership to restrict the publicly accessible platform area to that space necessary for a reduced train length. These gates, as shown in Figure 6, should be attractive, transparent, and effective as deterrents to prevent passengers from penetrating the unused portions of the platform.

The restricted platform [90 to 115 ft (27 to 35 m) long] can be effectively covered by only four television cameras, instead of several times the number required to survey the total platform [500 to 600 ft (152 to 183 m) long]. Robbery with assault often occurs under conditions of low passenger density, which is typical of many long platforms at night. The limited platform area would force the waiting passengers to gather in a small area, simultaneously making them potential witnesses and reducing the area to be patrolled by police.

Emergency Phones—Installation of an emergency phone system (Fig. 7) would provide the public with a direct voice link with the authorities and eliminate a major communication gap that presently exists in transit systems. The phones would enhance the public's perception of security measures and reassure patrons that they can contact the authorities whenever they need assistance. Two phone units are located on a typical island platform, one near the stair or exit ramp, and one about two-thirds of the distance to the remote barrier. (A split platform should have four phones.) These phones are essential to the primary operations of the TVA system. Well-marked boxes will contain a standard receiver handset with an armored cable and a pushbutton activator. The caller must lift the receiver, then momentarily depress the pushbutton activator. This will initiate the call and trigger the TVA system. The central monitor observer can reset the phone even if the receiver has been left dangling by a vandal or an excited victim. In fact, he can reset the system to be otherwise operational, even if the receiver has been torn off by a criminal. The user will not be required to dial or state his location; the system will be self-locating.

Closed-Circuit Television Cameras—CCTV cameras would provide the base for effective operation of the system. They would give the authorities essential visual verification of any alarm condition so that false alarms could be screened out and the appropriate response initiated.

Four cameras at the platform level will, in the case of an island, provide overlapping coverage of the open section. Where there are side platforms, overlapping is accomplished by two cameras per platform. An additional camera will be located at the turnstile and will be used to discern actions occurring on the platform whenever the system is activated. A trained monitor observer will, based on actions observed, make a decision regarding the response of the police or other emergency service or identify a false alarm.

All the cameras should be pointed away from the platform exit, which is located at one end of the platform portion under surveillance. All cameras would provide a uniform direction reference, offering a face-on picture of an offender leaving the area. The additional camera in the turnstile area would be used to provide a more detailed facial picture of any offender as he exits, and would also cover the agent's booth, turnstiles, and change and token vending machines.

All five camera signals should be transmitted to the monitor location at one time. This enables the monitor observer to make a decision based on a complete station picture and not on a single area, which may or may not contain the crime scene. The five TV pictures will provide the observer with coverage of station areas where, according to crime statistics, about 80 to 85 percent of all recorded station crimes occur.

TVA Bars—The teleview alert bars (Fig. 8) will be the primary public activators, in addition to the emergency telephones, for the TVA system. They should be freely

Figure 6. Artist's concept of transparent platform barrier in (a) non-deployed and (b) deployed position.

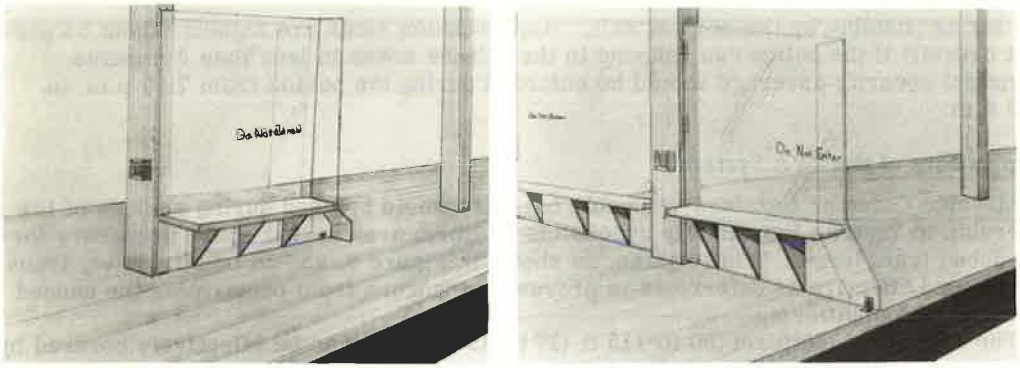


Figure 7. Artist's concept of emergency telephone, internal view.

Figure 8. Artist's concept of TVA bar with activation indicator lamp.

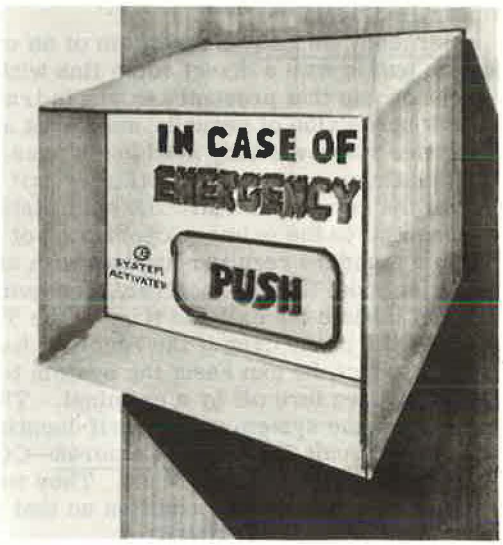
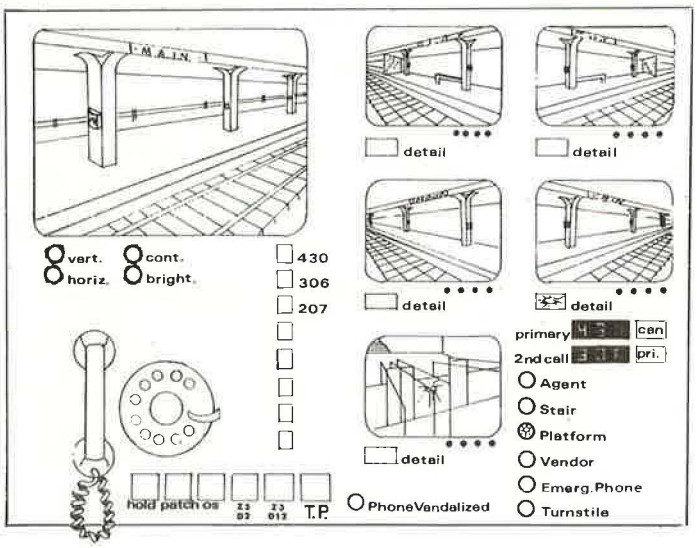


Figure 9. Artist's concept of TVA central monitor main display model.



accessible to the patrons, preferably placed every 20 to 30 ft (6 to 9 m) on the open section of the platform area, some in the stairwells or ramps, and at least one within the turnstile area. All bars, except those in the stairway and ramps, would be within range of the television cameras. These activating devices should require a deliberate action on the part of the user. To avoid alarming an offender, an inconspicuous action such as pushing a lever is preferable. A small signal light on the unit would indicate to the user that contact had been made. Once the bar is depressed or a phone removed from its hook, the unit would become permanently activated until remotely reset by the central monitor operator. A station agent's foot switch would also serve as a TVA bar.

Monitoring Equipment—At the central monitor's console six monitor screens are provided: five 9-in. (23-cm) screens and a large 17-in. (43-cm) high-resolution screen (Fig. 9). The five smaller screens simultaneously display all views of any one station, which are always in the same relationship to one another. Four monitors cover the platform, the fifth covers the exit turnstile, and the sixth provides a detailed view of whichever scene the observer chooses. The observer may call up views of any station as part of routine surveillance, but a station in alert would assume priority, and views of that station would be presented automatically, overriding his manual selection.

Five stop-action video tape recorders with time and date generators automatically record the five camera views at the alert scene. They also may be manually activated in a routine surveillance procedure. Capability is provided to transmit any one of the five signals back to the station agent's console for use in identifying offenders. This information would be available for later prosecution.

The central monitor observer has extensive telephone communication capability, which connects him with police dispatchers, traffic supervisors, station agents, and victims or witnesses on the platform.

Indicator lights advise the operator of which station is on alert and locate the alert within the station (platform, stair, agent, vending machine, turnstile, or emergency telephone). The monitor observer is also advised if an alarm at a second station has been activated, although the likelihood of this occurring is remote. The original alert station controls the monitor console until the monitor observer either cancels its alarm (resets the emergency sensors) or moves it to a secondary (hold) position, at which time the waiting station is automatically presented to the monitoring console.

Public-Address Systems—Public-address systems have already demonstrated their utility in notifying waiting patrons of scheduling problems. Such systems may also function as security devices when they are used in conjunction with TV coverage. Persons viewing the TV monitors could use the public-address system to talk with and reassure passengers in the waiting areas. Verbal warnings directed at vandals or pranksters might deter them from perpetrating their acts.

CONCLUSIONS

The thrust of this study was the analysis and evaluation of existing and perceived crime on the rapid transit system of a major metropolitan area. Although not intended to represent transit systems in all cities, the findings suggest conclusions that are sufficiently basic to transit development programs everywhere and that should be given serious consideration in the improvement of existing systems or in the design of new ones. Of particular importance is the observation that, although the crime index on rapid transit systems may well be less than that on city streets (at least in the city studied), the public's impression of crime on the system is what is important and may well underlie a reluctance to use the system, particularly during off-peak hours.

We feel it is a paradox that, with so much attention given to riders' preference for transit-service characteristics and with much concern over those attributes of service that contribute to modal split, very little attention has been given to real and perceived security. Yet, on the basis of these study findings, security looms as a major deterrent to choice riders in off-peak hours.

The TVA system described in this paper is based on the most accurate data we have on transit crime and public attitudes toward it. Most of the criteria for an effective link between the public and security forces are met in such a way as to heighten the

public's perception of security. The total cost for such a security system appears relatively small when it is compared to the construction and operating expenses of a rapid transit system. This cost compares favorably to the heavy costs incurred when manned patrol is relied on exclusively.

REFERENCES

1. Broad and Columbia Subway Development Study: Final Report. Broad and Columbia Subway Study Group. Prepared for U.S. Department of Transportation, Assistant Secretary for Environment and Urban Systems, Aug. 1971.
2. Nash, A. N., and Hille, S. S. Public Attitudes Toward Transport Modes: A Summary of Two Pilot Studies. Highway Research Record 233, 1968, pp. 33-46.
3. Williams, E. M., et al. Control of Mass Transit Vandalism and Other Crime. Prepared for Fifth International Conference on Urban Transportation, Pittsburgh, Sept. 8-10, 1971
4. Williams, E. M., and Shellow, R. A Systematic Approach to Mass Transit Security. Presented at University Research and Training Program, Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C., June 1-2, 1972.
5. Bard, M. The Unique Potentials of the Police in Interpersonal Conflict Management. International Journal of Group Tensions (in press).

PERSONAL SECURITY IN BUSES AND ITS EFFECTS ON RIDERSHIP IN MILWAUKEE

Kumares C. Sinha, Department of Civil Engineering, Marquette University; and
Forrest P. Roemer, Bureau of Engineering, City of Milwaukee

This paper deals with the problem of personal security on bus transit vehicles and its effects on transit ridership. A survey was conducted in Milwaukee along a transit route that has a high degree of transit crime and vandalism. The route chosen traversed a cross section of land uses and neighborhoods of widely different socioeconomic levels. A sample of bus riders and a group of randomly selected households along the chosen corridor were asked to complete questionnaires. The survey results give an indication of the relationship between and the relative degrees of passenger perceptions of destructive and personally hostile acts as well as the actual occurrence of such acts. The survey results are analyzed according to the respondents' rates of use of transit service as well as their ages and sexes. The responses are evaluated separately for crime and vandalism. The responses about personal security are further examined in relation to the various service characteristics. The survey results are also analyzed according to the land use and socioeconomic characteristics of the identified zones. It is determined that the degree to which transit crime and vandalism affects transit patronage is related to land use and socioeconomic characteristics of the neighborhoods, but the problem of personal security is less important than such service factors as frequency of service, convenience of routes, fare level, and travel time.

•MILWAUKEE, like many metropolitan areas, is experiencing on-bus crime and vandalism. In 1971, the total reported incidents on buses on all routes of the Milwaukee transit system was about 1,700. The monetary loss associated with physical damage due to vandalism has been estimated at $70,000 for that year. Although this monetary loss is not significant in terms of total expenses of about $19 million, it is necessary to examine whether on-bus crime and vandalism do significantly affect transit ridership. If the extent and nature of the effects of on-bus crime and vandalism can be ascertained, proper measures can then be taken to alleviate this problem. Accordingly, a study was undertaken, under the sponsorship of the Urban Mass Transportation Administration and the American Transit Association, to investigate the effects of on-bus crime and vandalism on transit patronage in the Milwaukee area. For the purpose of the study a transit route with high incidence of crime and vandalism was chosen for both an on-bus survey of the riders and a survey among the residents along the route. The questionnaire survey was to obtain information concerning the effects of experience and of beliefs on both users and non-users of the bus route. The survey also attempted to determine user and non-user perception of crime and vandalism on buses. Survey results were analyzed according to the socioeconomic characteristics of the respondents' residence zone. The survey questionnaire was prepared as an attitudinal survey, and the questions related to personal security were accompanied by several other questions regarding service characteristics of the bus route. This indirect form was chosen to minimize any bias that might result if respondents were directly asked questions related to crime and vandalism. Although the survey conducted was only along one route of the transit system, the results obtained provide important and valid information about the overall problem of on-bus crime and vandalism.

SURVEY ROUTE

The route for the survey had to have a history of vandalism that was above average for routes in the transit system and had to traverse a cross section of land uses and serve neighborhoods of different socioeconomic backgrounds. A bus route that runs mostly along Burleigh Street was chosen for the final survey. It is an east-west route approximately 9 miles (14.5 km) long and is located about 1 mile (1.6 km) north of the center of the city. When all the reported incidents of vandalism on the 47 routes in the transit system are considered, the Burleigh Street line ranked seventh, with 85 reported incidents of vandalism in 1971.

The Burleigh Street route serves a variety of travel generators and basic land uses. At the western end of the route are a large industrial manufacturer, a large warehouse and retail outlet that has its own internal bus service, a regional shopping center, two junior high schools, and a large hospital. General development along the route varies from upper-income residential on the western end to middle-income, racially integrated, mixed residential, commercial-professional in the midwestern section to low-income, predominantly Black in the mideastern section to mixed residential, commercial-light manufacturing in the eastern section.

Before the actual survey was undertaken, a pretest was conducted to test the questionnaire, its acceptance, and the technique of administering the survey. The pretest survey was done along Capitol Drive. This route was chosen because of its similarity to the Burleigh Street route. A location map indicating the final and pretest survey routes is shown in Figure 1.

ZONE CHARACTERISTICS

For the analysis of the results the overall transit route was divided into four zones on the basis of housing value, stability of the neighborhood, and land use. Figure 2 shows the geographic delineation of the zones used in the study.

Zone 1 extended from North 76th Street to the west end of the route at North 121st Street. This segment of the route is composed of high-income, stable residential areas in the east to central section and large retail and industrial development on the west. Traffic generators served by the bus in Zone 1 are Wilbur Wright Junior High School, which has a predominantly White enrollment; Mount Mary College, an all-girl liberal arts school; the Mayfair Shopping Center, which is regional in scope; a Penney's warehouse and retail outlet; and a major manufacturing plant, the Briggs and Stratton Corporation.

Zone 2 extends from North Sherman Boulevard to North 76th Street. This part of the route is composed of middle-income residential development of stable character. St. Joseph's Hospital is a major traffic generator located in this zone.

Zone 3 extends from West Hopkins Street to North Sherman Boulevard. The Burleigh Street bus serves Peckham Junior High School, which has a predominantly Black enrollment. This section of the route is a primarily Black, low-income residential area that has some small commercial development.

Zone 4 extends from West Humboldt to West Hopkins Street. This segment of the route is predominantly Black, low-income residential with some light manufacturing on the eastern end.

The socioeconomic characteristics of the four zones were obtained from the 1970 census data and are given in Table 1.

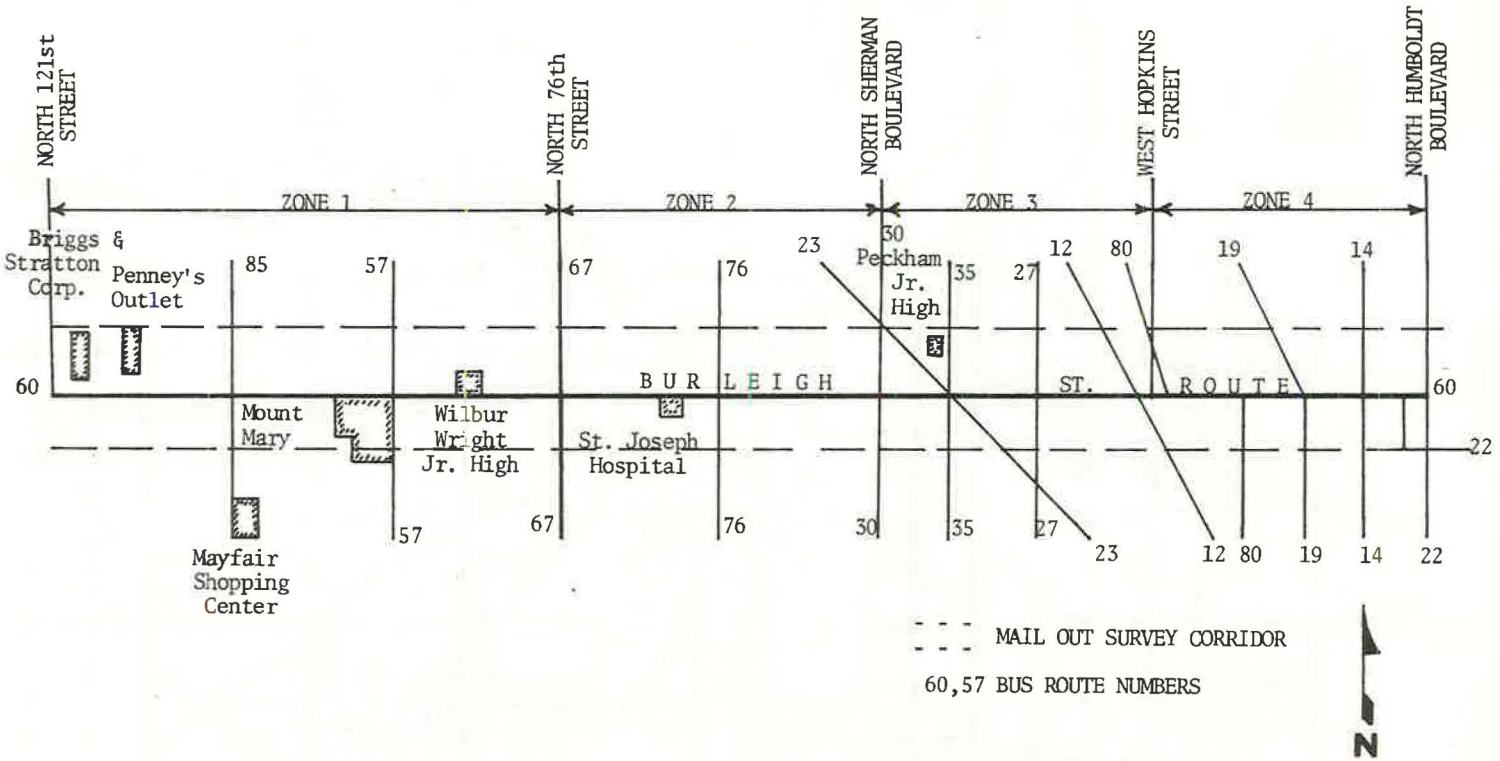
FINAL SURVEY

The final survey was conducted in April 1972. A total of 539 questionnaires were returned in the on-bus survey, of which 408 were used after screening out the incomplete returns. Of these, 141 were returned by the mail-back option. The predominant reasons for using this option were a need for reading glasses, inability to write on the bus, and insufficient time because of a short ride.

The corrider survey was restricted to a corridor 4 blocks wide, centered on Burleigh Street (Fig. 2). The list of properties to which questionnaires were to be mailed was pre-

Figure 1. Location map of survey routes.

Figure 2. Final survey route and mail-out survey corridor.



pared by selecting addresses from the Milwaukee City Directory. Properties excluded from this list were those where city directory entries showed a commercial or industrial building, a professional office, a vacant property, or no return, which indicated no information was given to the canvassers for city directory information. A total of 1,000 questionnaires were mailed out; this yielded 227 usable returns. A copy of the corridor survey questionnaire, which was basically the same as the on-bus survey questionnaire, is shown in Figure 3.

SURVEY RESULTS

User and Non-User Groupings

Responses to the on-bus and corridor survey questionnaires were grouped into user and non-user categories according to the respondent's frequency of riding the bus and by zones into which the survey corridor had been divided. This permitted investigation in greater depth of various reactions of transit patronage to crime, vandalism, and service characteristics.

Question 1 on the on-bus survey questionnaire contained the choices: frequently (six or more one-way trips a week), occasionally (one to five one-way trips a week) and seldom (few times a year). The responses to these choices were 259 frequently, 88 occasionally, and 37 seldom. The corridor survey questionnaire contained the additional choice never. The corridor survey responses to the choices to Question 1 were 63 frequently, 53 occasionally, 28 never, and 80 seldom. The respondents who checked frequently and occasionally were placed in the user group, and those who checked seldom and never were placed in the non-user group. This pairing classified 347 riders in the user group and only 37 riders in the non-user group for the on-bus survey. The corridor survey responses, influenced to a much lesser degree by peak-hour riders, yielded 116 users and 108 non-users.

Personal Security in Relation to Other Service Characteristics

Personal security as well as other service characteristics was ranked on the basis of the frequency of response to Question 5 of the on-bus and corridor surveys. The outcome of this ranking is given in Table 2.

Personal security ranked no better than sixth and fifth among the designated service characteristics for the on-bus and corridor surveys respectively. These results give evidence that personal security is of less concern to passengers than certain service characteristics, and, consequently, an increase in personal security on the Burleigh Street bus would probably have a smaller impact on improving patronage than would shorter bus headways and more bus routes.

Effects of On-Bus Crime

An evaluation of the overall effect of on-bus crime and vandalism on transit patronage was done through a statistical contingency test using the chi-square statistic and on the basis of the samples that reported having experience and no experience. The samples were obtained by abstracting the responses to combinations of Questions 4 and 9 of the corridor survey. Question 4 asked respondents to check whether their use of the Burleigh Street bus had decreased, remained the same, or increased. Question 9 asked what their experience with robbery and assault on the bus had been. The respondents' answers to each of these questions were grouped as given in Table 3.

Because the value of $\chi^2_{0.01}$ with 2 degrees of freedom exceeds the computed value of χ^2, the null hypothesis is accepted that the proportion of respondents in different categories of transit patronage does not significantly vary with the experience of on-bus crime. Therefore, at a 0.01 level of significance, transit passenger experience with on-bus crime does not have an appreciable numerical impact on transit usage. These results can be explained by realizing that crime on the Burleigh Street bus is a rare occurrence and that the long-term behavior of people is not significantly affected by a rare experience. If the survey had been taken immediately after an incident of crime, it could be expected that the responses would indicate an effect on transit patronage as a short-term phenomenon.

Figure 3. Corridor survey questionnaire.

Marquette University
Department of Civil Engineering

The results of this survey will be used to improve the bus service on Burleigh Street and bus service in general. Do your best to answer all the questions.

1. I use the Burleigh Street bus: (Please check one)
   _____ frequently (6 or more one-way trips a week)
   _____ occasionally (1 to 5 one-way trips a week)
   _____ never
   _____ seldom (few times a year)

2. My usual type of transportation is: (Please check one)
   _____ auto (as driver)
   _____ auto (as passenger)
   _____ another bus
   _____ walking
   _____ taxi
   _____ bicycle
   _____ other (Please name it)
   _____ Burleigh St. bus

IF MY USUAL TYPE OF TRANSPORTATION IS NOT A BUS

3. If my usual type of transportation was not available, I: (Please check one)
   _____ would ride the Burleigh St. bus
   _____ would not take the Burleigh St. bus

IF I WOULD NOT TAKE THE BURLEIGH ST. BUS

3a. I would not take the Burleigh St. bus because:
   _____ transit route is not convenient
   _____ schedule is not convenient
   _____ prefer other method of travel
   _____ service not satisfactory

4. In recent years my usage of the Burleigh St. bus has generally: (Please check one)
   _____ decreased a lot
   _____ decreased a little
   _____ remained the same
   _____ increased a little
   _____ increased a lot

5. If I were to take a Burleigh St. bus, the following points about the service would be most important to me: (Please check four)
   _____ a. fare level
   _____ b. frequency of service
   _____ c. comfortable ride
   _____ d. accommodating driver
   _____ e. clean, nice-looking buses
   _____ f. travel time
   _____ g. personal safety
   _____ h. convenience of routes

6. I believe the following points of the Burleigh St. bus service are:

fare level	_____ satisfactory	_____ poor	_____ don't know
frequency	_____ satisfactory	_____ poor	_____ don't know
personal safety	_____ satisfactory	_____ poor	_____ don't know
convenient routes	_____ satisfactory	_____ poor	_____ don't know
comfortable ride	_____ satisfactory	_____ poor	_____ don't know
accommodating driver	_____ satisfactory	_____ poor	_____ don't know
clean,nice-looking buses	_____ satisfactory	_____ poor	_____ don't know
travel time	_____ satisfactory	_____ poor	_____ don't know

7. The two most important reasons why I might use the Burleigh St. bus are:
   _____ a. work
   _____ b. shopping
   _____ c. social
   _____ d. recreation
   _____ e. personal business
   _____ f. school

8. I have seen the following activity on the Burleigh St. buses:

		(once or twice a year)	(once or twice a month)	(once or twice a week)
pushing and shoving	___never	___seldom	___occasionally	___frequently
obscene language	___never	___seldom	___occasionally	___frequently
smoking	___never	___seldom	___occasionally	___frequently
verbal threats	___never	___seldom	___occasionally	___frequently
vandalism	___never	___seldom	___occasionally	___frequently

9. I have had the following experience with robbery and assault on the Burleigh St. bus:
   _____ been a victim
   _____ witnessed
   _____ read of in papers
   _____ heard of on radio/TV
   _____ heard of from a friend
   _____ no experience

10. There are times I prefer not to take a Burleigh St. bus because of personal security: _____ yes _____ no

    If yes, please check times below:
    _____ 7:00 a.m. - 9:00 a.m.
    _____ 9:00 a.m. - 12:00 noon
    _____ 12:00 noon - 2:00 p.m.
    _____ 2:00 p.m. - 4:00 p.m.
    _____ 4:00 p.m. - 7:00 p.m.
    _____ 7:00 p.m. - 10:00 p.m.
    _____ after 10:00 p.m.

11. If benches were provided at bus stops and shelters at transfer points, I might increase my use of the Burleigh St. bus: (Please check one)
    _____ not at all _____ a little _____ considerably

12. If more frequent bus service was provided on Burleigh Street, I might increase my use of this transit route: (Please check one)
    _____ not at all _____ a little _____ considerably

13. If fares were lowered ten cents on the Burleigh St. bus route, I might increase my use: (Please check one)
    _____ not at all _____ a little _____ considerably

14. If travel times were faster on the Burleigh St. bus, I might increase my use: (Please check one)
    _____ not at all _____ a little _____ considerably

15. I am: _____ female _____ male

16. I am between the ages of: (Please check one)
    _____ 11-15
    _____ 16-19
    _____ 20-24
    _____ 25-34
    _____ 35-44
    _____ 45-54
    _____ 55-64
    _____ over 65

Please return the questionnaire by depositing it in any U.S. mailbox.

Thank you for your time and cooperation.

Table 1. 1970 census data by zone and tract.

Zone	Tract	No. of Blocks	Median Block Values: Total Population	Percent Black	Percent Under 18	Percent 62 and Over	Owner Units	Renter Units	Average Home Value (dollars)
1	57	17	1,266		19.5	21	21	4	23,000
1	903	7	441		40	6	13	8	40,400
1	56	12	892		22.5	20.5	23	3	22,100
1	54	14	1,175		30	12	25.5	4	19,400
1	53	16	1,206		22	22	23	3.5	19,550
1	902	14	641		24.5	8.5	15		39,650
1	55	12	689		22.5	18	19	2	28,900
2	49	15[a]	1,775		22	25	22	25	18,550
2	50	26[a]	2,450		22	24	22	16	18,100
2	58	23	2,511		19	30	24	14	19,600
2	49	16[b]	1,867		17	34	24	20.5	21,600
2	50	17[b]	1,283		15	35	20	11	22,600
3	65	8	1,766	78.5	48.5	7.5	26.5	27.5	10,950
3	64[a]	16	3,551	71.5	46	8	30	30	10,100
3	66	4	443	91	50.5	6	12	23	7,900
3	63	14	1,819	43	43	13.5	19	18.5	11,800
3	64[b]	7	1,314	74	45	8	24	32	11,450
3	48[a]	12	1,403	1	27	24.5	26	14	16,250
3	48[b]	17	1,682	3.5	21.5	25	20	17.5	13,450
4	71	18	2,697		29.5	16	25	28	9,000
4	72	9	1,672	2	24	15	24	23	18,400
4	69	8	840	66.5	44.5	6	9.5	13.5	10,500
4	70	30	5,113	74.5	44.5	9	15	28	9,100
4	67	12	3,025	96	47	7	27	41.5	10,100
4	68	13	1,668	96	44	4	13.5	20	10,450
4	66	31	5,862	95	46.5	6	18	29	9,350

[a]South side of Burleigh Street. [b]North side of Burleigh Street.

Table 2. Ranking of service characteristics by response.

Survey Characteristic	Rank: On-Bus Survey	Rank: Corridor Survey	Total Responses: On-Bus Survey	Total Responses: Corridor Survey
Convenience of routes	1	3	198	127
Frequency of service	2	1	197	177
Travel time	3	4	137	112
Accommodating driver	4	6	128	61
Fare level	5	2	118	132
Personal safety	6	5	103	73
Clean buses	7	7	77	51
Comfortable ride	8	8	70	28

Table 3. Effects of on-bus crime and vandalism on patronage.

Subject	Use of Transit (Question 4): Decreased	Same	Increased	Total
Crime experience[a] (Question 9)				
Some	49	71	29	149
None	31	57	20	108
Total	80	128	49	257
Vandalism experience[b] (Question 8)				
Some	149	198	69	416
None	93	223	78	404
Total	242	421	147	820

[a]$\chi^2_{computed} = 0.71$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

[b]$\chi^2_{computed} = 16.18$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

Effects of On-Bus Vandalism

Another set of statistical contingency tests was conducted to evaluate the effects of on-bus vandalism on the Burleigh Street bus. This was accomplished by simultaneously examining the responses to Questions 4 and 8. Question 4, as previously noted, asked respondents about frequency of their use of the bus. Question 8 asked what their experience with vandalism on the bus had been. Acts such as pushing and shoving, obscene language, smoking, and verbal threats were included in the vandalism category because it was believed that transit users react similarily to these types of behavior. The results of this test are given in Table 3.

The tabular value of $\chi^2_{0.01}$ with 2 degrees of freedom is 9.21 and is less than the computed value of $\chi^2 = 16.18$. Therefore, at a 0.01 level of significance, the null hypothesis that the proportion of respondents in the different categories of transit patronage is not significantly affected by on-bus vandalism can be rejected. This result is considered reasonable because the frequent incidence of vandalism gives transit riders a high level of exposure to this lack of regard for personal property and has the effect of posing a threat to personal security. This threat is generally disagreeable to many transit users.

Effect of Beliefs About Crime

The effect of beliefs about crime on the Burleigh Street bus was investigated by applying the contingency test to the responses of users and non-users to Questions 6-3 and 9. Question 6-3 asked respondents to check satisfactory, poor, or don't know according to their belief about personal safety on the bus. Question 9 was used to measure what experience respondents had had with robbery and assault on the bus. Respondents who checked no experience for this question were divided into user and non-user groups and their answers to Question 6-3 were recorded as given in Table 4.

As the computed value of χ^2 exceeds the value of $\chi^2_{0.01}$ with 2 degrees of freedom, it can be concluded that the responses in the three categories of personal safety on the bus vary significantly between users and non-users who reported having no experience with on-bus crime at a level of significance of 0.01. It is reasoned that the significant variation in the effect of beliefs of crime between users and non-users is because the frequent use of the bus with little or no exposure to on-bus crime reassures the rider about his personal safety. Although the observed cell frequencies are small in some categories of personal safety, it could be expected that a larger sample would only verify the rejection of the null hypothesis. Thus, the effect on patronage of beliefs about on-bus crime is very small because it primarily affects the non-user classification who ride the bus infrequently.

Effects of Beliefs About Vandalism

The effects of beliefs about vandalism on the bus were investigated by applying a contingency test to the responses of users and non-users to Questions 6-3 and 8. Question 6-3, as previously defined, asked respondents to check satisfactory, poor, or don't know according to their belief of personal safety on the bus. Question 8 asked what their experience had been with vandalism and similar antisocial behavior on the bus. Again respondents who checked no experience for this question were divided into user and non-user groups, and their answers to Question 6-3 were recorded as given in Table 4.

The value of χ^2, as computed from the observed and expected cell frequencies, exceeds the tabular value of $\chi^2_{0.01}$ for 2 degrees of freedom. Therefore, it can be assumed that the responses in the three categories of personal safety vary significantly between users and non-users who reported having no experience with on-bus vandalism. It is believed that the large number of responses of peak-hour riders obtained from the on-bus survey influences the decision to reject the null hypothesis; however, again the effect of beliefs about on-bus vandalism is more apparent in the non-user classification. Because people in this classification seldom use the bus, there is little effect on total transit patronage.

Belief About Personal Security by Sex

The individual's attitude in relation to personal safety on the bus according to sex was investigated by applying a contingency test to the responses to Question 6-3 and Question 15 of both surveys. Question 15 asked the persons to indicate their sex. The results of this analysis are given in Table 5.

The computed value of χ^2 for the given sample data is less than the actual value of $\chi^2_{0.01}$ with 2 degrees of freedom. Therefore, the null hypothesis that the proportion of responses in various categories remains the same in both the male and female groups cannot be rejected; the sex of a respondent does not significantly affect the belief about personal security on the bus.

Although the contingency test showed no significant difference in belief about personal security among males and females, a comparison of the responses of females with those of males by zone revealed that in all four zones a greater percentage of the males than females indicated that they believed personal safety on the Burleigh Street bus was poor. For both the female and male groups, the percentage of those who responded poor is higher in Zones 3 and 4 than in Zones 1 and 2. An examination of the zones and census data in Table 1 reveals notable differences in socioeconomic characteristics of Zones 1 and 2 versus Zones 3 and 4.

Belief About Personal Security by Age

The responses to Question 6-3 obtained from both surveys were grouped by age and were considered jointly with the responses to Question 16 to find the variation in belief about personal security on the Burleigh Street bus with respect to the ages of the respondents. The results of this investigation, given in Table 6, indicate that the belief about personal security on buses does vary to some extent with age; a greater percentage of younger respondents tend to believe that personal security on the Burleigh Street bus is satisfactory. However, a contingency test conducted with the two age groups, 54 and less and 55 and above, did not show any significant difference in responses. This result contradicts the common belief that older people are more concerned with personal security on buses.

Belief About Personal Security by Zone

The responses obtained from the corridor survey were grouped by zones to investigate the effects of the variation in socioeconomic characteristics on the belief about personal security. The characteristics of the four zones were as follows:

1. In Zones 1 and 2 there were no Black residents, 23 percent of the residents were under 18, 21.3 percent were 62 years old or older, the median number of renter units per block was 9, and the average home value was $24,450.
2. In Zones 3 and 4, 56.6 percent of the population was Black, 40.1 percent were under 18, 9.4 percent were 62 years old or older, the median number of renter units per block was 25, and the average home was valued at $11,340.

The percentage of Black population in Zones 1 and 2 is less than 1 percent; therefore, a zero was recorded in the census data. Families are considerably younger in Zones 3 and 4 than in Zones 1 and 2. Neighborhoods that contain a larger percentage of older families tend to be more stable. Another indicator of neighborhood permanency is the lower number of renter units in Zones 1 and 2. Owners have less tendency to change location than people who rent. The wide family-income gap is reflected in the average value of dwelling units in Zones 1 and 2, which were appraised at 2.16 times more than units in Zones 3 and 4.

A contingency test was performed on the basis of the responses to Question 6-3 that asked people to indicate their beliefs about personal security on the bus. The responses obtained from the zones were combined into two groups. The results that are given in Table 7, support the conclusion that the proportion of responses in different categories of belief about personal security does not vary between Zones 1 and 2 and Zones 3 and 4 at the level of significance of 0.01. This analysis indicates that there is no substantial

Table 4. Effects of beliefs about crime and vandalism on patronage.

Subject	Personal Safety on Bus (Question 6-3) Satisfactory	Poor	Don't Know	Total
Crime experience[a] (Question 9)				
User	157	8	10	175
Non-user	30	8	26	64
Total	187	16	36	239
Vandalism experience[b] (Question 8)				
User	560	47	27	634
Non-user	145	30	87	262
Total	705	77	114	896

[a] $\chi^2_{computed} = 53.47$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

[b] $\chi^2_{computed} = 151.19$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

Table 5. Belief about personal safety by sex.

Sex of Respondent[a] (Question 15)	Personal Safety on Bus (Question 6-3) Satisfactory	Poor	Don't Know	Total
Female	212	37	35	284
Male	93	29	19	141
Total	305	66	54	425

[a] $\chi^2_{computed} = 4.54$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

Table 6. Belief about personal safety by age.

Age Groups (Question 16), Years	Personal Safety on Bus (Question 6-3) Satisfactory No. of Respondents	Percent	Poor	Don't Know
11-15	18	75	4	2
16-19	56	88	4	4
20-24	46	77	6	8
25-34	34	63	8	12
35-44	29	56	17	6
45-54	68	79	10	8
55-64	42	69	12	7
>65	24	71	5	5

Table 7. Belief about personal safety by zone.

Zone	Personal Safety on Bus[a] (Question 6-3) Satisfactory	Poor	Don't Know	Total
1 and 2	65	17	20	102
3 and 4	33	17	9	59
Total	98	34	29	161

[a] $\chi^2_{computed} = 3.38$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

Table 8. Effect of belief about personal safety on transit use.

Prefer Not to Ride Bus[a] (Question 10), Zones	Personal Safety on Bus[a] (Question 6-3) Satisfactory	Poor	Don't Know	Total
1 and 2	54	32	7	93
3 and 4	26	40	15	81
Total	80	72	22	174

[a] $\chi^2_{computed} = 12.9$; $\chi^2_{0.01} = 9.21$ with 2 degrees of freedom.

Table 9. Perception of on-bus crime.

Crime Experience[a] (Question 9)	Zones 1	2	3	4	Total
Some	51	37	38	28	154
None	29	42	20	26	117
Total	80	79	58	54	271

Table 10. Perception of on-bus vandalism.

Vandalism Experience[a] (Question 8)	Zones 1	2	1 and 2 Combined	Percent	3	4	3 and 4 Combined	Percent	Total
Some	120	119	239	43.6	79	99	178	54	417
None	117	168	285	54.4	82	70	152	46	437
Total	237	287	524		161	169	330		854

[a] $\chi^2_{computed} = 12.88$; $\chi^2_{0.01} = 11.34$ with 3 degrees of freedom.

effect on personal belief about security on buses that results from the variation in socioeconomic characteristics of the residence zone.

Effect of Belief About Personal Security

An investigation of the effect of the belief about personal security on the bus was made by jointly considering the responses to Question 6-3 and Question 10, which asked whether the respondent preferred not to take the Burleigh Street bus at certain times because of personal security. The responses were grouped by zone and are given in Table 8.

The computed value of χ^2 from the contingency table is 12.9 and exceeds the tabular value of $\chi^2_{0.01}$ with 2 degrees of freedom. This indicates that the null hypothesis that there are no significant differences between the proportions in the two zone groupings should be rejected. Although there is no significant difference in the belief about personal security as related to zonal variations in socioeonomic characteristics, there is a significant difference in the effect of the belief about personal security according to socioeconomic characteristics. When the geographic layout of the zones as shown in Figure 2 is considered, it can be stated that, as the central city is approached along the Burleigh Street bus route and socioeconomic characteristics of the abutting neighborhoods decline, transit users are more inclined to restrict their use of the bus because of their belief about personal security.

It cannot be precisely ascertained whether or not the observed effect on use of the Burleigh Street bus is entirely due to the belief about personal security on buses. The information from the questionnaires did not establish that the respondent's fear for his personal security is derived from riding on the bus or going to and from the bus stop.

Perception of On-Bus Crime

An investigation of the individual's perception of on-bus crime was attempted by constructing a contingency table that listed the responses to Question 9 by zone. Those who checked no experience were in the no experience group, and those who checked any other category (victim, witnessed, read in papers, heard on radio or TV, or heard of it from friend) were in the some experience group. The results are given in Table 9.

The contingency test was conducted to test the hypothesis that there is no significant difference between the proportions of perception of crime by zones in the two experience classifications. Because the computed value of χ^2 is 7.07 and is less than the tabular value of $\chi^2_{0.01}$ with 3 degrees of freedom, 11.34, the null hypothesis is accepted, and it is concluded that perception of on-bus crime does not vary significantly between zones for the some experience and no experience classifications. This result can be explained by the fact that on-bus crime is a rare occurrence and the perception of such an event is not affected by socioeconomic characteristics.

Perception of On-Bus Vandalism

Perception of on-bus vandalism was investigated by means of another contingency table. According to their responses to Question 8, those who never observed vandalism were listed in the no experience classification. Respondents who indicated that they had observed some form of vandalism, either seldom, occasionally, or frequently, were grouped in the some experience classification. Table 10 gives the observed cell frequencies.

The results of the contingency test indicate rejection of the null hypothesis that there is no difference between the proportions of perception of vandalism by zone in the some experience and no experience classifications at the 0.01 level of significance. The greater incidence of vandalism in general is believed to be the primary reason for this result. Grouping the observed cell frequencies for Zones 1 and 2 and Zones 3 and 4 yields the results given in Table 10.

The grouping of the observed cell frequencies reveals that a greater percentage of vandalism is experienced in Zones 3 and 4 than in Zones 1 and 2. This reinforces the conclusion reached in the contingency test on the effect of belief about personal security.

namely, that an increase in the observed frequency of vandalism as the central city is approached contributes to an increase in the effect of the belief about a loss of personal security.

COST EFFECTIVENESS OF PREVENTIVE MEASURES

The cost of any program to combat on-bus crime and vandalism should be compared to the savings expected. Justification for undertaking any program that involves the expenditure of money must be established in light of diminishing revenues and the rising costs of operation. Moreover, the inability to quantify precisely the impact of on-bus crime and vandalism on patronage requires that assumptions be made that are based on subjective deduction from known facts.

The effect of on-bus crime, as measured by the reported decrease in patronage, on users who had experienced crime was not significantly greater than on the users who had no experience with crime. Furthermore, the overall decrease in patronage in the user group was almost neutralized by a reported increase in use from other respondents in this group. The net loss of patronage in the user group was thereby largely neutralized. The user group by definition is composed of people who ride the bus on one or more one-way trips a week.

The effect of on-bus crime on the non-user group was a substantial 17 percent. A reported 18.9 percent decrease in the non-user group who had no experience with vandalism aggravated this effect. Because the non-user group only uses the bus a few times a year, one can conclude that the number of annual rides lost is small and that this group is quite likely the most fertile area from which increased patronage will come.

The effect of on-bus vandalism on users who had experienced it was not significantly greater than on the users who had not experienced vandalism. There was a reported net increase in patronage in the user group that overshadowed the decrease in patronage due to vandalism. In the non-user group, the effect of vandalism was significant and was supplemented by a substantial reported loss in patronage.

The estimated financial loss to the Milwaukee and Suburban Transport Corporation in 1971 for repairing the physical damage to buses due to vandalism was $70,000. If a program could be undertaken that would result in the elimination of the losses due to equipment damage from vandalism and also increase the number of paid fares by 1,000 daily on the average throughout the entire system, one could anticipate a yearly increase in income of $253,500. This expected increase in income would amount to somewhat less than $480 per bus for the 530-bus fleet of the transport company. Such a small amount would limit a program to a modest investment in bus appointments with the objective of reducing vandalism. If the expected increase in income was applied selectively to certain routes at certain times of the day and only to certain buses, the expected income could be concentrated at the expense of complicated bus assignments and the reduced possibility of increasing ridership. It appears that the expected monetary benefits alone would not justify a meaningful program; however, social aspects of combating on-bus crime and vandalism could enter into a final decision in any given area.

CONCLUSIONS

The important points of the study on crime and vandalism on the Burleigh Street bus can be summarized as follows:

1. Personal security is not considered by the respondents to be a critical factor among service characteristics of the bus service. It was consistently ranked lower than such factors as frequency of service, fare level, travel time, and convenience of route.
2. The effect of beliefs about on-bus crime and vandalism on transit users and non-users of the Burleigh Street bus route is more important in the reduction of transit passenger use than the effect of experience.
3. On the basis of the collected data, it was observed that the sex of a respondent does not significantly affect the belief about personal safety. However, the belief about

personal security on buses varies to some extent with age; a greater percentage of younger respondents tends to believe that personal security on the bus is satisfactory.

4. Survey results analyzed according to land use and socioeconomic characteristics of zones show that belief about personal security on buses is not affected by the socioeconomic background of the respondents. However, as the central city is approached along the bus route and the socioeconomic characteristics of the abutting neighborhoods decline, transit users are more inclined to restrict their use of the bus because of their beliefs about personal security.

5. The preference for not riding the bus after dark may well be caused by fear of crime and vandalism that may occur while a user is en route to and from the bus.

6. With regard to perception of on-bus crime and vandalism as measured by users who had some experience (personal, hearsay, or radio-TV or newspaper) as opposed to users who had no experience, it was observed that there is no significant difference in the perception of crime by zone. However, there is a significant difference between the proportions of perception of vandalism by zone. The greater incidence of vandalism in general is believed to be the primary reason for this result.

7. The overall problem of on-bus crime and vandalism on the Burleigh Street bus route does not result in loss of a significant amount of transit patronage.

8. More detailed information is needed to derive an appropriate relationship between the effect of on-bus crime and vandalism and passenger use.

ACKNOWLEDGMENT

This study was in part sponsored by a research and training grant from the Urban Mass Transportation Administration of the U.S. Department of Transportation. The survey part of the study was partially supported by the American Transit Association. The cooperation of John B. Schnell and Arthur Smith of the American Transit Association is gratefully acknowledged. The results and views expressed are not necessarily concurred in by any of the sponsoring agencies.

STUDIES OF PUBLIC ATTITUDES TOWARD TRANSIT CRIME AND VANDALISM

Edward J. Thrasher and John B. Schnell, American Transit Association

This paper describes the findings of six studies in five cities on the question of whether fear of transit crime and vandalism affects a person's decisions to use urban transit systems. Although the studies do not give a firm answer, they offer some tentative conclusions: Transit crime and vandalism can exert strong influence on decisions concerning use of urban transit, but there are many variations depending on the volume of crime or vandalism in the area served by a particular route, the transportation alternatives available to passengers, the hours at which they must ride, and other factors. In general, transit crime and vandalism are more likely to influence passenger decisions concerning riding on rapid transit than on buses. Riders are more likely to view with serious concern the potentially menacing aspects of rowdyism such as verbal threats and vandalism than "nuisance" aspects such as the pushing and shoving involved in horseplay. Riders' concern is likely to be more intense when they personally witness crime or serious rowdyism than when they are not personally involved. Those who are reluctant to ride urban transit because of personal security considerations least favor riding after 7:00 p.m. Transit crime and vandalism may have a potential influence on all classes of riders regardless of age or sex, although possibly not in the same degree. It is extremely difficult to establish that a given change in ridership is caused by a single factor such as crime or vandalism. In any situation, there may be a combination of factors that influence ridership and make it all but impossible to determine the degree of influence of any one factor.

• THIS PAPER recounts the findings of six studies on the question of whether fear of transit crime and vandalism affects people's decisions to use urban transit systems. The little that has been published on this topic gives conflicting opinions. For example, Misner and McDonald (1) assert that "There can be no mistake . . . that 'fear of crime' is an important consideration in the decision to use or not to use public transportation systems." A study by ABT Associates (2) states that "among the various factors that determine the choice of mass transportation as one's mode of transportation, personal security is comparatively unimportant, or at least, not as prominent in the mind of users as are other factors more directly related to the operation of the system." A survey of bus users in three cities found that 12 percent of the riding public (3,497 respondents) had been deterred from using urban transit at least once and perhaps more often during a period of approximately 6 months because of concern for crime on buses. Thus, impressions differ as to how important transit crime and vandalism are in influencing public attitudes toward use of urban transit.

Although the studies summarized in this paper do not give a firm answer, they intimate that the influence of transit crime and vandalism varies with local conditions and that, in general, the influence of other factors is stronger than that of transit crime and vandalism on decisions to use mass transit or seek alternate modes of transportation.

The six studies are derived from a project undertaken under the sponsorship of the Urban Mass Transportation Administration (3). Several methodologies were used. In Milwaukee and in Washington, questionnaires were distributed by hand on regular bus

runs. In Baltimore and Cleveland, traffic counts were made following criminal incidents that had occurred on a bus and at a rapid transit station. In Chicago, a marketing study used personal interviews conducted in households, and an accompanying qualitative opinion study used group interviews with small panels of respondents. Another study in Chicago conducted interviews by telephone. Results of the six studies were mutually sustaining on some aspects and were conflicting on others.

The Milwaukee study found no support for a hypothesis that transit crime and vandalism adversely affect ridership on a city bus route. The Washington study, using substantially the same questionnaire, found crime and vandalism to be probable influences on ridership. The Baltimore study found that a slight decrease in ridership following a criminal incident was not necessarily caused by the incident, but the Cleveland study positively attributed a decrease to the criminal incident. The Chicago attitude study found that personal safety is not a major influence on ridership, but a qualitative opinion study found that personal safety is a major influence with at least some of the riders on subway and elevated rapid transit, and the security study conducted by telephone gave support to this finding.

Details of the individual studies follow.

MILWAUKEE STUDY

Milwaukee was selected as the site of one case study because, among other reasons, the Milwaukee and Suburban Transport Company had experienced 1,677 reported incidents of vandalism and crime during 1971, not counting damage to equipment such as slashed seats and broken windows. Bus route 60 was chosen for the test because it serves riders with a wide range of ages, occupations, and racial characteristics in an area that embraces factories, residences, hospitals, shops, and schools. To avoid prejudicing answers, the questionnaire included crime and vandalism with six other factors that have influence on transit patronage. This procedure developed incidental information concerning passenger attitudes toward things other than crime and vandalism, such as frequency of service and fare levels.

A pretest was carried out in December 1971, and some of the questions were reworded on the basis of lessons learned from the preliminary trial. The actual test on route 60 was conducted on April 12, 1972. Approximately 1,000 questionnaires were handed out by researchers who rode seven bus round-trips from 6:34 a.m. to 8:00 p.m., and another 1,000 were sent to selected addresses in the vicinity of route 60 by mail. A total of 370 questionnaires handed out on buses and 279 distributed by mail were returned. Not every question was answered. Findings are grouped under three subheadings: basic parameters, attitudes toward crime and vandalism, and service characteristics.

The pattern that emerged from the responses to basic parameter questions was one of a ridership in which females outnumbered males by more than two to one. Most riders used route 60 to go to work or to go shopping, and most of these were females aged 35 and over. The largest group of riders took the bus before 9:00 a.m., and the second largest took it between 3:00 and 6:00 p.m. This pattern was important in that it corresponded with what was already known about route 60 before the survey began. Although no attempt was made to obtain a random sample of route 60 riders, the correspondence of the pattern to existing knowledge suggested that a sample was obtained of ridership on a typical day that was undistorted by special considerations such as unusual weather, a parade or convention, or other exceptional set of circumstances.

The questions on attitudes toward crime and vandalism, the principal concerns of the study, followed three lines of approach: Two questions noted the frequency with which respondents singled out personal safety from a total of eight factors influencing use of route 60, two other questions probed into respondents' personal experience with crime and vandalism on the route, and a third pair of questions inquired whether there were times of day at which riders preferred not to take the bus because of considerations of personal safety. Responses were punched into cards and tabulated by computer, and attempts were made to cross-link and corroborate the replies to the three approaches through analysis of relationships.

The study sought to test a hypothesis that incidents of transit crime and vandalism adversely influence ridership on route 60. Findings from the first approach indicated that considerations of personal safety do not strongly affect passenger patronage on the route. Findings from the second approach suggested that

1. Riders on route 60 are not strongly concerned about rowdyism (including vandalism),
2. Riders are more concerned about menacing aspects of rowdyism, such as verbal threats and vandalism, than about nuisance aspects such as the pushing and shoving involved in horseplay, and
3. Riders' concern was more likely to be intense when they personally witnessed serious rowdyism than when they were not personally involved.

The third approach disclosed that, when asked directly, patrons said they were influenced by considerations of personal security to a greater degree than appeared in the responses to the other two approaches. This direct response, however, was contradicted to some extent by cross-checks that indicated that passenger decisions and actions were not strongly influenced by such considerations. Those stating they preferred not to take the bus for reasons of personal safety least favored the hours after 7:00 p.m. for ridership.

The aggregate of the three approaches was that the data developed by the survey did not confirm the hypothesis that incidents of transit crime and vandalism have a major influence on ridership of route 60.

The study disclosed findings on service characteristics in addition to those on crime and vandalism. When asked to select the service characteristics they considered most important, respondents chose frequency of service and convenience of routes more often than personal safety. Respondents were also asked to rate eight service characteristics as satisfactory or poor. The characteristics checked satisfactory most often were accomodating driver, comfortable ride, and convenient routes; those checked poor were frequency of service, fare level, and travel time. Finally, respondents were asked whether they would increase their use of route 60 considerably, a little, or not at all if benches were provided at bus stops, if frequency of service were increased, if fares were lowered, or if travel times were speeded up. Nearly 50 percent of 589 respondents thought they would increase their use considerably if fares were lowered; 28 percent answered not at all. The gap was narrower for benches, frequent service, and travel times.

WASHINGTON, D.C., STUDY

The specific purpose of the Washington study was akin to that of the Milwaukee study: to test the hypothesis that transit crime and vandalism adversely influence passenger patronage of one bus route in Washington. The route selected (called route 30 for this paper) runs from the extreme northwest corner to the extreme southeast corner of the city and serves many institutions of secondary and higher education, affluent and low-income residential areas, varied business districts, tourist centers of all kinds, and numerous government office buildings. A pretest was conducted on November 13, 1972, with two 2-man research teams each handing out questionnaires (substantially the same as that used in Milwaukee) on one bus round-trip. The full test was conducted on November 15, 1972, with questionnaires handed out on 21 round-trips from 6:30 a.m. to 10:00 p.m. and also in shopping centers and stores at six locations from northwest to southeast Washington. Unlike Milwaukee, no questionnaires were distributed by mail. A total of 4,037 questionnaires were given out, and total usable responses numbered 2,054 (50.88 percent). Responses were punched into cards and tabulated by the same computer program as in the Milwaukee study. Findings are again grouped under three subheadings: basic parameters, attitudes toward crime and vandalism, and service characteristics.

Basic parameter findings revealed that ridership on route 30 is approximately 60 percent female and 40 percent male; the largest age bracket is 20 to 34 years. The largest group rides between 7:00 and 9:00 a.m., and the next largest group rides be-

tween 4:00 and 7:00 p.m. Work and shopping are the chief reasons given for using route 30. About 63 percent of the respondents said that the bus is their usual means of transportation, and 53 percent said they had no alternative means of transport. In none of these basic parameter findings was there any recognizable discrepancy from facts already known about the route. All indications were that the responses to the questionnaire constituted a representative sample of the typical daily ridership.

As with the Milwaukee study, the questions concerning attitudes toward crime and vandalism followed three lines of approach. The first approach tried to ascertain attitudes indirectly by determining whether respondents considered personal security an important characteristic of service and whether they had a strong opinion about its quality. The second approach probed attitudes by inquiring about personal experience with transit rowdyism (including vandalism) and crime. The third approach endeavored to determine attitudes by asking respondents if there were times at which they preferred not to use route 30 because of personal security considerations.

Findings from the first approach did not indicate respondents' opinions clearly. Respondents indicated that they did not consider personal security very important in comparison to other service characteristics, but approximately 20 percent of the respondents said they considered personal security on the route poor.

The findings from the second approach indicated the probable existence of concern about vandalism and crime on the part of a group of patrons large enough to affect ridership patterns. Small, but not inconsequential, percentages of respondents had witnessed vandalism, verbal threats, or crime, and nearly 4 percent had been victims of robbery or assault on the route. Relatively high percentages of those who had witnessed vandalism thought personal security on the route was poor. Those who rode frequently reported a higher percentage of observance of crime and vandalism than those who used the route less often, and 23 percent of respondents said their patronage had decreased in recent years, although not necessarily as a result of crime and vandalism. In the aggregate, these findings lent support to the hypothesis that transit crime and vandalism adversely affect ridership on route 30.

Findings from the third approach indicated concern about transit crime and vandalism in many passengers. Nearly 30 percent of the respondents said there are times at which they prefer not to ride the bus for reasons of personal security. Comparatively high percentages of these reported personal experience with rowdyism, robbery, or assault. More than 40 percent of the passengers who preferred not to take the bus and 13 percent who had no objection to taking the bus thought personal security on route 30 was poor. The sum of the third approach findings was further support for the hypothesis that transit crime and vandalism adversely affect ridership patterns on route 30. In total, the findings were considered to support the hypothesis.

Findings were developed coincidentally on service characteristics. Respondents selected reliable and on time, frequency of service, and convenient routes as the three most important service characteristics. As satisfactory they most often picked convenient routes, accomodating driver, and comfortable ride, only one of which was among the service characteristics designated most important. Relatively few respondents thought they might increase their patronage if bus shelters, more frequent service, or faster travel times were provided, but approximately 50 percent said they might increase their use considerably if the fare were lowered by 20 cents (base fare at time of survey was 40 cents).

MILWAUKEE VERSUS WASHINGTON

The findings of the Milwaukee study did not support the hypothesis that fear of transit crime and vandalism adversely affects passenger ridership on a given bus route, but those of the Washington study did support it. Whether the implication is that crime and vandalism are not major influences on ridership on all bus routes of Milwaukee but are major influences on all routes of Washington needs further research. Comparable results from surveys on at least one additional route in each city would be needed to confirm this broad assumption. Perhaps the only conclusion that can be drawn from a comparison of the two surveys is that conditions differ from one community to another,

and research is necessary in each instance to determine whether transit crime and vandalism are major factors affecting passenger decisions.

BALTIMORE STUDY

A case study undertaken in Baltimore tried to determine whether a well-publicized criminal incident, an armed robbery of driver and passengers on a Baltimore city bus route, influenced passenger patronage of that route in the short term. The objective of the study was to accumulate empirical evidence toward acceptance or rejection of the general hypothesis of a functional relationship between transit riding patterns and passenger attitudes toward transit crime and vandalism.

The data developed indicated that there was a certain decrease in ridership after the robbery but only of a magnitude attributable to a rational margin of error. The possibilities for error during the study appeared numerous enough to raise serious questions about the validity of the figures and the causes of the decrease in ridership, if indeed there was a decrease. It was concluded that the study did not establish a definite relationship between the robbery and passenger patronage of the route and that, because of many imponderables, it may be unfeasible to reach conclusions in a situation of this type.

The incident occurred on August 2, 1972, on a westbound MTA (Baltimore) route 5 bus. When the driver made a routine stop at 2:20 p.m., four young men boarded, threatened him and the passengers with a revolver and shotgun, and made off with $106 in cash and a check for $161. No one was injured. Four alleged robbers, all under age 20, were apprehended within 30 minutes.

It happened that MTA had conducted a traffic check of route 5 on July 12, 1972, just three weeks prior to the incident. At the request of the research team, MTA conducted a special passenger traffic check on August 9, 1972. The resulting figures were then compared on the presumption that, with the comparison made so promptly, the dominant variable in the daily routine would be the criminal incident. If the comparison disclosed a substantial decrease in ridership, the hypothesis that there is a functional relationship between transit riding patterns and passenger perceptions toward crime would be supported. At the same time, inquiries were made to see whether changes in variables other than the criminal incident could also have affected transit riding patterns.

The traffic checks disclosed a decrease in passenger ridership between August 2 and August 9 that could be accounted for by statistical error and was not necessarily attributable to the criminal incident. To this extent, the hypothesis of a relationship between the criminal incident and transit riding patterns was not confirmed, but questions concerning the accuracy of the traffic check figures, plus the presence of other variables that could have influenced passenger riding patterns to an indeterminable extent, raised doubts that tended to void this tentative finding. Since these independent variables could have influenced passenger ridership patterns both positively and negatively, it was decided that no definite conclusion was possible and that the hypothesis was neither accepted nor rejected.

CLEVELAND STUDY

A study made by the Cleveland Transit System (CTS) found that ridership in rapid transit decreased in the short term following a homicide at a rapid transit station.

CTS attempted to evaluate the effect on ridership of a homicide that occurred at the Superior rapid transit station on Sunday, January 18, 1970. Ridership at Superior and other east side stations of CTS was tabulated for 2 weeks before and 3 weeks after the incident. The findings that follow are from an internal memorandum dated June 19, 1970:

> Total east side ridership compared to the week preceding the homicide was down 4.0% the week in which the homicide occurred; 1.1% the second week; and 1.5% the third week. . . .decreases at Superior Station for each of the three weeks following the homicide were greater than that which occurred at all other east side stations with the exception of East 105th Station for the week ending January 24th. . . .total east side ridership for the first five months of 1970 versus 1969 was down 6.8%. And during this time period, Superior Station registered a decrease of 6.2%–a lower rate of decrease than occurred at 5 out of the remaining 6 east side stations.

> Accordingly, it must be concluded that the homicide did have a short-term effect on ridership at Superior Station. However, shortly thereafter, ridership must have returned to near normalcy based on long-term ridership results at Superior Station compared to the ridership results at the remaining individual east side stations and the combined west side stations for the equivalent long-term period.

Although the memorandum does not say so, presumably the possible presence of other factors (e.g., exceptional weather, mid-year time at schools and universities, changes in fare structure or frequency schedules) that conceivably might have affected ridership following the homicide was considered and discounted. Accordingly, the findings in this CTS study are in sharp contrast with those of the Baltimore study, where it was felt that the decline in ridership following a bus robbery could have been caused by factors other than the incident of transit violence.

CHICAGO STUDIES

A survey of passenger attitudes carried out by a contractual research organization for the Chicago Transportation Authority (CTA) found that personal safety is not a major influence on whether patrons decide to ride. A qualitative opinion survey conducted coincidentally, however, suggested that personal safety is a major influence with at least some riders on subway and elevated rapid transit (El).

For the attitude surveys, which consisted of personal interviews in approximately 200 households, respondents were read six statements pertaining to their experiences with CTA facilities. As each statement was read respondents were asked whether they agreed, disagreed, or neither agreed nor disagreed. For purposes of analysis, the results were "repercentaged" to eliminate the neither agree nor disagree responses. Only one of the six statements had to do with personal security: "There is no reason to be concerned about riding the CTA during the day."

Agreement with the statement varied with frequency of ridership; i.e., the more often a person rode the CTA the more often he agreed with the statement. For frequent riders 75 percent agreed with the statement and 25 percent disagreed; for occasional riders 72 percent agreed, 28 percent disagreed; and for infrequent riders 65 percent agreed, 35 percent disagreed. The remaining five statements dealt with service characteristics such as comfort, convenience of routes, and readily available travel information. Based on percentage of disagreement with the statement, safety during the day ranked fourth in all areas. This ranking, plus the high percentage of agreement with the statement, suggested that personal safety is not an item of great influence on ridership decisions with passengers on the CTA.

The accompanying qualitative study was conducted with four groups of CTA riders and non-riders. Each group consisted of eight to ten non-Black Chicago residents, 20 to 60 years old. All sessions were video tape recorded, but findings were not tabulated. Respondents were encouraged to describe situations in which they had accepted or rejected use of CTA.

Both men and women admitted that they felt fear when traveling in the city, especially in unfamiliar areas, whether using private or public transportation. Many respondents who rode Els and subways said they did so only at rush hours when there was safety in numbers. They felt exposed and alone unless they were surrounded by other passengers. This attitude prevailed before boarding, during the ride, and after getting off, i.e., throughout the whole El or subway experience.

Respondents said that they experienced feelings of anxiety before boarding, particularly at non-peak hours, and that they anticipated and dreaded trouble as they approached the subway platform. Although some of their anxiety lessened after they were on the train, some fear remained because there rarely was a conductor or other authority figure visible as a protector and crime inhibitor. Anxiety resumed when they got off and confronted lonely platforms and the danger of being physically or verbally abused.

Because of these considerations, many respondents perceived subways as more appealing at times when one is physically uncomfortable (crowded, hot, jostled) than when one is psychologically uncomfortable. Thus, some passengers tended to time their rides not for comfort or convenience but for safety. To do this they either post-

poned the trip until peak hours or rode the bus rather than the subway. Buses seemed to be the least anxiety-provoking form of public transportation. On the bus, there was the impression that the driver was there to guard and protect and there was the knowledge that the bus could be stopped anywhere and was more neighborhood-oriented than subways or Els.

Attitude Study Versus Qualitative Study

Whereas the CTA attitude study suggests that personal safety is not a major concern for transit passengers, the CTA qualitative study suggests that personal safety is a prime influence on passengers who ride the El or subway. Whether equal weight should be given the two studies is questionable. The narrow, even biased, scope of the qualitative study is a factor to be considered because the four respondent groups of non-Blacks, each numbering not more than ten, were definitely not a representative sample of CTA ridership. Notwithstanding, the qualitative study offers evidence that personal safety is a major consideration in decisions about riding on urban rapid transit.

CTA Transit Security Study

A survey conducted by telephone in Chicago examined the question, among other things, of the conditions in which the public feels most secure and least secure while using the CTA and of the conditions under which passengers would feel more secure than at present.

Data for the survey were obtained from a questionnaire that was used for 1,586 interviews conducted by telephone with a statistically random sample of all private households in Chicago with telephones. The two (out of 45) questions dealing with passenger security were

1. "While using the CTA, under which conditions do you feel most secure and under which do you feel least secure?" and
2. "Which of the following conditions would make you feel most secure?"

For each of these questions, respondents were asked to select from lists of conditions which were read to them over the telephone.

The conditions in which the respondents felt most secure were while riding the bus, while going from home to bus or El or subway stop, and while riding the El or subway. The conditions in which they felt least secure were while on the stairs, rampway, or tunnel to the El or subway platform; while waiting on the El or subway platform; and while waiting in the El or subway stations.

The three preferred conditions under which respondents believed they would feel more security were if they saw more police officers on El and subway platforms and trains, if they knew quick assistance was available from CTA personnel or the police, and if a policeman and police dog were assigned to each bus or El or subway train during non-rush-hour periods.

These results provide some measure of confirmation for the findings of the qualitative study that personal safety is a major influence on passenger decisions regarding patronage of the El or subway but is less of an influence regarding patronage of buses.

CONCLUSIONS

Despite the areas of disagreement, the following tentative conclusions can be drawn from the six studies:

1. Transit crime and vandalism can exert strong influence on passenger decisions concerning use of urban mass transit, but there are many variations depending on the volume of crime or vandalism in the area served by a particular route, the transportation alternatives available to the passengers, and the hours at which they must ride.
2. In general, and subject to deviations according to local conditions, transit crime and vandalism are more likely to influence passengers riding on rapid transit than on buses.
3. Riders are more likely to view with serious concern the potentially menacing aspects of rowdyism such as verbal threats and vandalism than "nuisance" aspects such

as the pushing and shoving involved in horseplay.

4. Riders' concern is likely to be more intense when they personally witness crime or serious rowdyism than when they are not personally involved.

5. Those who are reluctant to ride urban transit because of personal security considerations least favor riding after 7:00 p.m.

6. On the basis of the six studies, no firm conclusion is possible regarding attitudes toward transit crime and vandalism according to age and sex characteristics. However, findings suggest that transit crime and vandalism have a potential influence on all classes of riders regardless of age or sex, although possibly not in the same degree.

7. It is extremely difficult to establish that a given change in ridership is caused by a single factor such as crime or vandalism. In any situation there may be a combination of factors that influence ridership and make it all but impossible to determine the degree of influence of any one factor.

REFERENCES

1. Misner, G. E., and McDonald, W. F. The Scope of the Crime Problem and Its Resolution. In Reduction of Robberies and Assaults of Bus Drivers, Vol. 2.
2. Qualitative Aspects of Urban Personal Travel Demand. ABT Associates.
3. Vandalism and Passenger Security. Urban Mass Transportation Administration, U.S. Department of Transportation.

SCOPE OF CRIME AND VANDALISM ON URBAN TRANSIT SYSTEMS

Edward J. Thrasher and John B. Schnell, American Transit Association

This paper reports on an attempt to quantify the extent and seriousness of crime and vandalism on urban transit systems. Although many imprecisions in the recording of criminal incidents and the computing of vandalism costs impose limitations on the data, the authors believe that the findings constitute a significant first step toward knowledge of the incidence of transit crime and the monetary costs of transit vandalism. On the basis of data obtained from 37 U.S. transit systems, the total number of criminal incidents on all systems in 1971 is estimated at approximately 33,000 to 39,000. No functional relationships were found between various factors such as total crime indexes and total crime per 100,000 vehicle-miles or 100,000 revenue-passengers. A computed transit exposure index led to the tentative conclusion that the risk of being involved in a criminal incident could be at least twice as great when riding on urban transit vehicles as in nontransit circumstances. If this conclusion is sound, the problem of crime on transit systems may be proportionately more serious than has been generally credited. The total national transit vandalism costs for 1971 are estimated at $7.7 million to $10 million. Direct transit vandalism costs on the average amounted to less than 0.5 percent of operating costs in 1971, but the problem assumes greater dimensions when indirect costs are also considered. Window breakage was the largest component, followed by damage to seats, damage to stationary facilities, and graffiti. National transit system costs of liability claims resulting from incidents of crime and vandalism in 1971 are estimated at $1.85 million to $2.33 million.

• THE TOTAL number of criminal incidents occurring on U.S. urban transit systems in 1971 is estimated approximately at 33,000 to 39,000, according to a study prepared for the Urban Mass Transportation Administration. This compares with a national total of almost 6,000,000 criminal incidents as reported in the seven crime classifications of the Federal Bureau of Investigation Index of Crime.

Before these figures on transit crime can be accepted, however, a number of limitations and imprecisions concerning data on crime in general and on transit system crime in particular must be considered. The authors acknowledge that some of what will be discussed here is open to question. Notwithstanding, to the best of their knowledge, the findings represent the first attempt to quantify the extent and seriousness of the transit crime and vandalism problem.

BACKGROUND

In the autumn of 1970, the Urban Mass Transportation Administrator suggested that a study be undertaken concerning the costs and forms of vandalism on transit systems and the problems pertaining to rowdyism and passenger harassment. The American Transit Association submitted a proposal to UMTA for a study that would attempt to ascertain and categorize the scope and characteristics of the vandalism and passenger security problem, summarize and evaluate types of antivandalism and passenger security procedures and devices, draw conclusions from demonstration projects, and

furnish recommended courses of action to combat the major forms of vandalism and improve passenger security.

The vandalism and passenger security (VAPS) project, as accepted by UMTA, had two major goals: to appraise the national scope of transit crime and vandalism and to explore means of controlling the problems of crime, vandalism, and rowdyism and make specific suggestions on the basis of the research findings. This paper is a distillation of the findings that concern transit crime and vandalism.

A literature search confirmed that, although there is much published material on crime and vandalism in general, there is a dearth of material relating directly to crime and vandalism on urban transit systems. To obtain data, researchers conducted interviews with personnel of transit systems in more than 60 cities of the United States and Canada. Although some of the gaps in the information were filled in by telephone calls, correspondence, and follow-up questionnaires, blank spaces still remain because many systems do not keep records of all the types of data desired. The findings reported in this paper are based on figures obtained from 37 U.S. and 4 Canadian systems that were able to supply responses to most of the categories.

LIMITATIONS OF DATA

Several limitations should be kept in mind when using the data. Although vandalism is a form of crime, in this paper vandalism is differentiated from crime and treated as an aspect of juvenile delinquency because most vandals are juveniles and if arrested are brought before juvenile courts. What constitutes a crime varies from one jurisdiction to another and from one period in time to another. An action can be a felony in one state and merely a misdemeanor, or possibly even quite legal, in another state. Thus, differences in legal concepts can determine whether an act is recorded as an incident of crime, an incident of vandalism, or not recorded at all.

The FBI's standard set of crime classifications defines vandalism as "willful or malicious destruction, injury, disfigurement, or defacement of property without consent of the owner or person having custody or control." An element of judgment enters into identification of an offense as an act of vandalism even with this definition. If a 3-year-old child smashes a bus window, his action is considered irresponsible and is not counted as an act of vandalism, but then one may ask how old the child must be for his act to be counted as willful or malicious destruction. Gray areas of this sort contribute to the uncertainties of crime and vandalism data.

That differences in methods of reporting or changes from one period to another can strongly affect crime statistics is illustrated in the following quotation from the report of the Task Force on Assessment of the President's Commission on Law Enforcement and Administration of Justice:

> Although Chicago, with about 3 million people, has remained a little less than half the size of New York City with 7½ million throughout the period (1935-1966), it was reporting in 1935 about 8 times as many robberies. . . .In 1950 New York discontinued its prior practice of allowing precincts to handle complaints directly and installed a central reporting system. . . .In the first year, robberies rose 400 percent and burglaries 1,300 percent, passing Chicago in volume for both offenses. In 1960 Chicago installed a central complaint bureau of its own, reporting thereafter seven times more robberies than New York. In 1966 New York, which appeared to have had a sharp decline in robberies in the late fifties, again tightened its central controls and found a much higher number of offenses. Based on preliminary reports for 1966, it is now reporting about 40 percent more robberies than Chicago.

The foregoing is to warn the reader that the findings reported are not the last word. Indeed, the authors earnestly hope that data will continue to be gathered in years to come, that some measure of standardization of record-keeping among transit systems will be realized, and that the figures will be refined and rendered more accurate with passage of time. All the same, the data reported provide an important base on which useful statistical information can be accumulated. It is believed that these statistics constitute a significant contribution to knowledge about the incidence of crime and the monetary costs of vandalism to urban transit systems.

FINDINGS

Transit Crime

Statistical tables were compiled for 37 U.S. and 4 Canadian transit systems about the following:

1. Incidents of violent crime, other crime, and total crime in transit systems for 1969, 1970, and 1971 (Table 1);
2. Ratios of transit violent crime and total crime to system vehicle-miles for 1970 and 1971;
3. Ratios of transit violent crime and total crime to vehicle-hours for 1970 and 1971; and
4. Ratios of transit violent crime and total crime to revenue-passengers for 1970 and 1971 (Table 2).

On the basis of ATA estimates, the 1971 figures on vehicle-miles and revenue-passengers for the 37 U.S. systems approximate 60 percent of the vehicle-miles and revenue-passengers for all systems in the United States. System vehicle-miles, vehicle-hours, revenue-passengers, and number of vehicles are given in Table 3. Since these systems constitute a representative sample of most of the largest and some of the smallest transit systems, national crime and vandalism incidents and costs were extrapolated in the study on the hypothesis that the sample also represents 60 percent of the crime and vandalism incidents and costs in the United States. However, such extrapolation from vehicle-miles and revenue-passengers to criminal incidents and vandalism costs is open to challenge.

A total of 20,889 criminal incidents for 1971 was reported by the 37 U.S. transit systems (Table 1). The total of criminal incidents occurring on all U.S. systems for the year was extrapolated by the simple relation that, if total transit system vehicle-miles for 37 systems (B) is determined to be a certain percentage of transit system vehicle-miles for the entire United States (A), then the total of criminal incidents for the 37 systems (Y) is a corresponding percentage of the national total of transit criminal incidents (X), or $B/A = Y/X$. This same simple ratio was used also for revenue-passengers, number of vehicles per system, and vehicle-hours. Information on vehicle-hours was not available in the annual data reported in ATA's Fact Book, and therefore, the figure used was an approximation. It was postulated that, if the four computations yielded roughly similar results, the range could be considered as approximating the total criminal incidents for all U.S. systems. Results of the four computations were as follows:

Basis	Incidents
Revenue-passengers	33,194
Vehicle-miles	36,568
Number of vehicles	39,716
Vehicle-hours	39,011

Accordingly, the total number of criminal incidents occurring on U.S. transit systems in 1971 is estimated at approximately 33,000 to 39,000.

Attempts to determine whether any relationships exist between various possible influences and transit crime and vandalism were universally negative. Scatter diagrams were plotted, but in every instance the wide dispersion of the points indicated an absence of any functional relationship. Figure 1 shows a representative diagram. The diagrams were based on the following combinations of factors:

1. City size and number of incidents of total crime on transit systems in 1971;
2. Total crime indexes and total transit crime per 100,000 vehicle-miles;
3. Total crime indexes and total transit crime per 100,000 revenue-passengers;
4. Vandalism costs and vehicle-miles;
5. Vandalism costs and revenue-passengers;
6. Vandalism costs and vehicle-hours;
7. Vandalism costs and number of vehicles operated;

Table 1. Incidents of transit violent crime and total crime to revenue-passengers, 1969, 1970 and 1971.

System	Violent Crime			Other Crime			Total Crime		
	1969	1970	1971	1969	1970	1971	1969	1970	1971
>1,000,000[a]									
Boston (MBTA)	56	234	168	1,120	1,879	1,966	1,176	2,113	2,134
Chicago (CTA)	1,090	405	714	1,480	1,841	2,410	2,570	2,246	3,123
Cleveland (CTS)	—	36	11	—	79	26	—	115	37
Detroit (DSR)	—	—	—	—	—	—	—	—	—
Los Angeles (SCRTD)	217	45	87	192	765	1,108	409	810	1,195
Montreal (MUCTC)	8	8	14	115	128	178	123	136	192
New York (NYCTA)	381	204	305	8,399	9,921	10,619	8,780	10,125	10,924
New York (PATH)	14	21	22	70	94	68	84	115	90
Philadelphia (PATCO)	0	0	1	—	—	35	—	—	36
Philadelphia (SEPTA)	95	132	102	689	625	325	784	757	427
Toronto (TTC)	8	1	1	375	341	484	383	342	485
250,000-1,000,000									
Albany	—	—	3	—	—	19	—	—	22
Atlanta	—	—	6	—	—	41	—	—	47
Baltimore	—	25	23	—	1,490	860	—	1,515	883
Columbus	0	1	3	18	28	16	18	29	19
D. C. (Metro)	—	—	—	—	—	—	—	—	—
Denver	—	—	0	—	—	54	—	—	54
Ft. Worth	11	16	5	39	41	38	50	57	43
Indianapolis	4	42	21	248	372	249	252	414	270
Milwaukee	46	60	73	190	158	269	236	218	342
New Orleans	154	514	28	120	179	249	274	693	277
Oakland (AC Transit)	—	—	6	—	—	266	—	—	272
Ottawa	1	3	4	9	10	12	10	13	16
Portland	7	4	2	—	—	171	—	—	173
St. Louis	19	16	10	123	140	153	142	156	163
San Antonio	0	0	0	60	71	43	60	71	43
San Diego	0	0	2	50	59	54	50[b]	59	56
Seattle (STS)	—	24	22	—	130	110	—	154	132
Seattle (MTC)	0	0	0	6	6	11	6	6	11
Winnipeg	3	1	1	4	4	4	7	5	5
<250,000									
Ann Arbor, Mich.	—	0	0	—	15	15	—	15	15
Billings, Mont.	0	0	0	5	5	5	5	5	5
Chattanooga, Tenn.	0	1	1	5	5	5	5	6	6
Concord, N. H.	0	0	0	0	0	0	0	0	0
Dayton, Ohio	0	0	7	17	28	60	17	28	67
Everett, Wash.	0	0	0	0	0	0	0	0	0
Lafayette, Ind.	0	0	0	—	—	4	—	—	4
Orlando, Fla.	0	0	0	0	0	0	0	0	0
Pueblo, Colo.	0	0	0	0	0	0	0	0	0
Schenectady, N. Y.	0	0	1	—	9	9	—	9	10
Syracuse, N.Y.	—	—	0	—	—	2	—	—	2
Tacoma, Wash.	2	0	0	10	12	16	12	12	16
1971 total									
All systems			1,643			19,954			21,597
U.S. systems			1,623			19,276			20,899

[a]Including rail cities. [b]Estimate.

Table 2. Ratios of transit violent crime and total crime to revenue-passengers, 1970 and 1971.

System	Violent Crime[a]		Total Crime[a]	
	1970	1971	1970	1971
>1,000,000[b]				
Boston (MBTA)	0.092	0.075	0.832	0.957
Chicago (CTA)	0.103	0.185	0.568	0.809
Cleveland (CTS)	—	0.013	—	0.043
Detroit (DSR)	—	—	—	—
Los Angeles (SCRTD)	0.032	0.061	0.570	0.851
Montreal (MUCTC)	0.003	0.003	0.052	0.070
New York (NYCTA)	0.012	0.019	0.608	0.683
New York (PATH)	0.054	0.056	0.295	0.231
Philadelphia (PATCO)	0	0.011	—	0.382
Philadelphia (SEPTA)	0.069	0.051	0.395	0.215
Toronto (TTC)	0.000	0.000	0.106	0.147
250,000-1,000,000				
Albany	—	0.027	—	0.215
Atlanta	—	0.014	—	0.106
Baltimore	0.026	0.023	1.55	0.876
Columbus	0.004	0.017	0.143	0.109
D.C. (Metro)	—	—	—	—
Denver	—	0	—	0.403
Ft. Worth	0.292	0.106	1.04	0.915
Indianapolis	0.239	0.143	2.35	1.842
Milwaukee	0.095	0.106	0.35	0.500
New Orleans	0.673	0.038	0.908	0.374
Ottawa	0.009	0.011	0.038	0.045
Oakland (AC Transit)	—	0.012	—	0.538
Portland	0.026	0.012	—	1.016
St. Louis	—	0.016	—	0.255
San Antonio	0	0	0.339	0.204
San Diego	0	0.015	0.450	0.420
Seattle (STS)	0.076	0.075	0.485	0.452
Seattle (MTC)	0	0	0.224	0.501
Winnipeg	0.002	0.002	0.009	0.009
<250,000				
Ann Arbor, Mich.	0	0	—	3.070
Billings, Mont.	0	0	—	1.667
Chattanooga, Tenn.	0.034	0.038	0.204	0.228
Concord, N.H.	0	0	0	0
Dayton, Ohio	0	0.075	2.05	0.714
Everett, Wash.	0	0	0	0
Lafayette, Ind.	0	0	0	4.101
Orlando, Fla.	0	0	0	0
Pueblo, Colo.	0	0	0	0
Schenectady, N.Y.	0	0.413	3.818	4.128
Syracuse, N.Y.	—	0	—	0.021
Tacoma, Wash.	0	0	0.194	0.256

[a]Per 100,000 revenue passengers. [b]Including rail cities.

Table 3. Vehicle-miles, vehicle-hours, revenue-passengers, and number of vehicles in transit system, 1971.

System	Vehicle-Miles	Vehicle-Hours	Revenue-Passengers	Vehicles[a]
>1,000,000[b]				
Boston (MBTA)	43,487,462	2,643,073	229,918,049	1,983
Chicago (CTA)	146,267,671	11,169,353	386,158,185	3,824
Cleveland (CTS)	25,449,379	—	85,000,000	1,011
Detroit (DSR)	35,144,977	2,736,722	97,362,318	1,171
Los Angeles (SCRTD)	58,784,000	4,634,000	149,444,000	1,511
Montreal (MUCTC)	64,498,802	5,891,479	274,212,787	2,221
New York (NYCTA)	428,467,769	28,247,612	1,599,641,865	11,270
New York (PATH)	9,674,236	439,712	38,877,360	252
Philadelphia (PATCO)	3,704,823	123,494	9,414,029	75
Philadelphia (SEPTA)	57,589,758	—	198,601,500	2,739
Toronto (TTC)	72,374,255	5,608,722	330,495,450	1,886
250,000-1,000,000				
Albany	4,307,998	434,685	10,212,949	—
Atlanta	19,025,715	1,469,628	44,376,614	504
Baltimore	23,365,293	2,237,593	100,853,864	832
Columbus	7,794,434	643,156	17,374,867	250
D.C. (Metro)	31,830,887	—	101,965,573	1,176
Denver	7,412,075	6,224,443	13,400,000	214
Ft. Worth	3,718,726	331,110	4,701,201	120
Indianapolis	5,798,143	482,184	14,654,958	233
Milwaukee	19,981,612	1,740,148	69,009,345	538
New Orleans	14,294,830	1,438,848	74,004,380	494
Oakland (AC Transit)	25,632,834	1,793,601	50,584,495	721
Ottawa	8,890,022	848,604	35,513,898	323
Portland	11,477,735	724,284	17,032,133	311
St. Louis	21,181,416	1,848,567	64,000,000	963
San Antonio	8,123,809	628,993	21,048,118	261
San Diego	8,126,243	—	13,328,668	228
Seattle (STS)	13,851,952	1,179,451	29,207,562	424
Seattle (MTC)	3,232,135	215,476	2,196,086	115
Winnipeg	14,461,707	1,330,360	58,076,195	484
<250,000				
Ann Arbor, Mich.	387,975	33,600	488,562	26
Billings, Mont.	147,285	12,420	300,000	5
Chattanooga, Tenn.	1,540,761	128,145	2,632,525	81
Concord, N.H.	—	—	—	—
Dayton, Ohio	3,929,328	333,681	9,390,241	185
Everett, Wash.	660,000	38,688	654,000	17
Lafayette, Ind.	329,441	30,419	97,548	21
Orlando, Fla.	1,580,834	131,736	3,416,000	58
Pueblo, Colo.	1,650,000	—	1,231,702	—
Schenectady, N.Y.	952,973	76,522	242,243	—
Syracuse, N.Y.	4,143,216	384,538	9,694,489	192
Tacoma, Washington	3,108,169	245,490	6,253,063	108
Total				
All systems	1,215,380,680	864,805,370	4,159,066,822	36,827
U.S. systems	1,055,155,894	728,013,720[c]	3,460,768,592	31,913[d]

[a]Including nonpassenger vehicles. [b]Including rail cities. [c]32 systems. [d]34 systems.

Figure 1. Total transit crime per 100,000 revenue-passengers compared with total crime index for 1971.

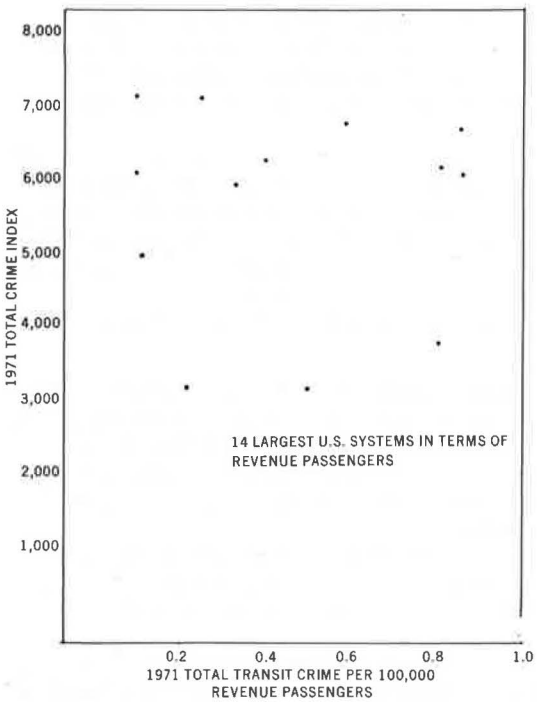


Table 4. Total vandalism costs ($) for 1969, 1970, and 1971.

System	1969	1970	1971
>1,000,000[a]			
Boston (MBTA)	187,100	211,634	257,581
Chicago (CTA)	520,000	593,249	686,496
Cleveland (CTS)	—	60,643	68,250
Detroit (DSR)	40,325	55,819	32,874
Los Angeles (SCRTD)	42,407	49,191	78,000
Montreal (MUCTC)	60,590	74,000	90,700
New York (NYCTA)	1,732,274	2,152,782	2,013,823
New York (PATH)	38,007	34,698	33,535
Philadelphia (PATCO)	—	27,200	19,390
Philadelphia (SEPTA)	669,355	803,977	976,000
Toronto (TTC)	42,179	47,844	42,469
250,000-1,000,000			
Albany	6,600	5,500	4,839
Atlanta	105,000	95,000	90,000
Baltimore	147,994	156,692	190,152
Columbus	5,372	7,847	8,618
D.C. (Metro)	246,000	334,000	289,000
Denver	—	—	22,500
Ft. Worth	11,000	11,000	11,000
Indianapolis	15,837	19,234	22,146
Milwaukee	56,000	62,000	71,000
New Orleans	30,000	30,000	29,808
Oakland (AC Transit)	59,419	63,688	83,219
Ottawa	12,300	14,800	16,300
Portland	3,475	3,350	2,000
St. Louis	112,000	143,000	140,000
San Antonio	26,898	27,039	24,309
San Diego	12,906	15,699	17,214
Seattle (STS)	35,364	29,980	44,060
Seattle (MTC)	400	400	1,800
Winnipeg	5,900	7,780	6,230
<250,000			
Ann Arbor, Mich.	—	600	600
Billings, Mont.	120[b]	125[b]	125[b]
Chattanooga, Tenn.	1,000	1,100	1,100
Concord, N.H.	—	—	—
Dayton, Ohio	2,200	2,400	2,900
Everett, Wash.	100	100	100
Lafayette, Ind.	800	1,000	600
Orlando, Fla.	900	900	1,000
Pueblo, Colo.	—	500	700
Schenectady, N.Y.	—	1,650	1,400
Syracuse, N.Y.	—	22,750	15,500
Tacoma, Wash.	—	15,000	16,500
Total			
All systems			5,413,838
U.S. systems			5,258,139

Note: In 1972, Boston spent $282,189; Chicago, $780,524; and Los Angeles, $134,000 on repairing transit vandalism.

[a]Including rail cities. [b]Estimate.

8. Criminal incidents and vandalism costs per 100,000 revenue-passengers; and
9. Number of incidents of violent or total transit crime and size of transit system, whether measured by vehicle-miles, vehicle-hours, or revenue-passengers.

Thus, these findings show, for example, that the number of criminal incidents on a transit system in a large city may or may not be greater than the number on a transit system in a small city. Likewise, the number of incidents of total crime on transit systems does not necessarily vary either directly or inversely with total crime indexes.

Recognizing that comparing incidence of crime per city population with transit crime per city population could be misleading because city population includes many persons who do not use urban transit, the authors tried to draw a comparison between incidence of crime per population (i.e., crime indexes) and transit crime per number of transit users. A difficulty was to derive an accurate measure of transit users. Total revenue-passengers is obviously not the same thing. A person riding twice a day 300 days a year counts as 600 revenue-passengers, but he is only one user. To avoid this obstacle, an attempt was made to develop an exposure index by the following steps:

1. The number of revenue-passengers of a city system for 1971 was divided by the center-city population to ascertain the average number of trips per person for the year;
2. This figure was multiplied by 15 minutes (estimated to be the duration of the average trip), and the result was divided by the total number of minutes in the year, which yielded the fraction of the total minutes to which the average rider was exposed to possible crime or vandalism (the exposure index);
3. A transit violent crime index was computed by dividing the number of violent crimes reported by the system in 1971 by the center-city population, and a transit total crime index was computed from the number of total crimes reported in the same way; and
4. These transit indexes were divided by the exposure index and the results, transit crime exposure indexes, were compared with the FBI Violent Crime Index and Total Crime Index respectively, for the city (per 100,000 population).

Comparisons of selected major systems disclosed that the computed transit exposure index was greater than the FBI index in 13 out of 14 cases. If there is any validity to the computation, the conclusion is that the risk of being involved in a criminal incident is at least two times greater when riding on most major transit systems than it is in nontransit circumstances. This conclusion is strengthened when one looks at the raw figures on crime. For example, there were 168 incidents of violent crime reported on Massachusetts Bay Transportation Authority (MBTA) transit in 1971 compared with 6,993 incidents of violent crime (2.4 percent) in center-city Boston, according to the FBI's Uniform Crime Reports. That the risk of transit violent crime in Boston is more than twice as great as that of nontransit crime does not appear too farfetched, given the brief exposure of riders to crime on urban transit. The problem of crime on transit systems may be proportionately more grave than has been realized.

Transit Vandalism

Statistical tables were compiled for 37 U.S. and 4 Canadian transit systems about the following:

1. Transit vandalism costs for 1969, 1970, and 1971 (Table 4);
2. Transit system vandalism costs per 100,000 vehicle-miles, 100,000 revenue-passengers, and 10,000 vehicle-hours for 1971 (Table 5);
3. Transit system vandalism costs as a percentage of operating expenses for 1971 (Table 6);
4. Transit system vandalism costs per vehicle for 1971;
5. Transit system total vandalism costs for repairing vehicle windows, damaged seats, stationary facilities, and damage from graffiti for 1971 (Table 7); and
6. Transit system costs for windows, seats, graffiti, and stationary facilities as a percentage of total vandalism costs for 1971.

Table 5. System vandalism costs ($) for vehicle-miles, revenue-passengers, and vehicle-hours in 1971.

System	Per 100,000 Vehicle-Miles	Per 100,000 Revenue-Passengers	Per 10,000 Vehicle-Hours
>1,000,000[a]			
Boston (MBTA)	299.583	58.443	974.551
Chicago (CTA)	302.972	114.759	614.625
Cleveland (CTS)	146.565	43.882	—
Detroit (DSR)	93.54	33.765	120.122
Los Angeles (SCRTD)	132.689	55.554	168.321
Montreal (MUCTC)	91.475	21.517	153.951
New York (NYCTA)	48.79	13.06	712.918
New York (PATH)	346.65	86.30	762.658
Philadelphia (PATCO)	—	—	1,570.117
Philadelphia (SEPTA)	992.150	287.700	—
Toronto (TTC)	58.68	12.85	75.720
250,000-1,000,000			
Albany	112.35	47.39	111.322
Atlanta	473.06	202.81	612.400
Baltimore	613.83	188.54	849.806
Columbus	110.57	49.600	133.995
D.C. (Metro)	907.92	283.43	—
Denver	303.558	167.91	—
Fort Worth	295.86	233.99	332.216
Indianapolis	381.96	151.12	459.285
Milwaukee	355.34	102.89	408.011
New Orleans	208.54	40.26	207.166
Oakland (AC Transit)	324.658	164.515	463.977
Ottawa	183.35	45.90	192.080
Portland	17.43	11.74	27.613
St. Louis	660.97	218.74	757.343
San Antonio	299.26	115.49	386.475
San Diego	211.84	129.15	273.263
Seattle (STS)	318.08	150.85	373.564
Seattle (MTC)	55.690	81.93	83.535
Winnipeg	43.08	10.73	46.829
<250,000			
Ann Arbor, Mich.	154.649	122.809	178.571
Billings, Mont.	—	41.66	
Chattanooga, Tenn.	71.393	41.785	85.840
Concord, N.H.	—	—	—
Dayton, Ohio	73.804	30.883	86.909
Everett, Wash.	—	15.291	—
Lafayette, Ind.	182.13	615.082	197.25
Orlando, Fla.	63.258	238.095	75.909
Pueblo, Colo.	—	56.832	—
Schenectady, N.Y.	146.91	577.932	182.95
Syracuse, N.Y.	374.106	159.885	403.081
Tacoma, Wash.	530.86	263.871	672.125

[a]Including rail cities.

Table 6. Transit system operating expenses and vandalism costs.

System	Operating Expenses ($1,000)	Total Vandalism Costs ($)	Vandalism Costs as Percent of Operating Expense
>1,000,000[a]			
Boston (MBTA)	117,905	257,581	0.219
Chicago (CTA)	211,578	686,496	0.325
Cleveland (CTS)	29,889	68,250	0.228
Detroit (DSR)	45,814	32,874	0.072
Los Angeles (SCRTD)	62,690	78,000	0.124
Montreal (MUCTC)	80,573	90,700	0.113
New York (NYCTA)	672,121	2,013,823	0.300
New York (PATH)	24,927	33,535	0.135
Philadelphia (PATCO)	4,756	19,390	0.408
Philadelphia (SEPTA)	88,994	976,000	1.097
Toronto (TTC)	80,192	42,469	0.053
250,000-1,000,000			
Albany	3,963	4,839	0.122
Atlanta	15,750	90,000	0.571
Baltimore	25,326	190,152	0.751
Columbus	7,227	8,618	0.119
D.C. (Metro)	44,127	289,000	0.655
Denver	6,224	22,500	0.361
Ft. Worth	1,968	11,000	0.559
Indianapolis	5,903	22,146	0.375
Milwaukee	18,458	71,000	0.384
New Orleans	18,774	29,808	0.159
Oakland (AC Transit)	23,368	83,219	0.356
Ottawa	9,323	16,300	0.174
Portland	9,137	2,000	0.022
St. Louis	22,852	140,000	0.612
San Antonio	5,886	24,309	0.413
San Diego	7,516	17,214	0.229
Seattle (STS)	13,455	44,060	0.327
Seattle (MTC)	2,235	1,800	0.080
Winnipeg	15,570	6,230	0.040
<250,000			
Ann Arbor, Mich.	400	600	0.150
Billings, Mont.	50	125	0.250
Chattanooga, Tenn.	1,091	1,100	0.100
Concord, N.H.	—	150	—
Dayton, Ohio	3,705	2,900	0.078
Everett, Wash.	11[b]	100[b]	—
Lafayette, Ind.	155	600	0.387
Orlando, Fla.	1,285	1,000	0.078
Pueblo, Colo.	—	700	—
Schenectady, N.Y.	999	1,400	0.140
Syracuse, N.Y.	4,252	15,500	0.365
Tacoma, Wash.	2,634	16,500	0.624

[a]Including rail cities. [b]For one month.

Table 7. Transit system specific vandalism costs ($).

System	Total Vandalism	Vehicle Window	Damaged Seat	Graffiti	Stationary Facilities
>1,000,000[a]					
Boston (MBTA)	257,581	73,000	14,508	35,863	112,500
Chicago (CTA)	696,496	274,165	176,060	62,600	90,769
Cleveland (CTS)	68,250	35,200	31,000	—	1,500
Detroit (DSR)	32,874	16,720	18,427	—	30
Los Angeles (SCRTD)	78,000	39,000	23,400	7,100	0
Montreal (MUCTC)	90,700	22,300	39,400	8,400	4,900
New York (MYCTA)	2,013,823	230,321	38,925	1,266,488	426,893
New York (PATH)	33,535	5,285	10,250	8,000	10,000
Philadelphia (PATCO)	19,390	7,620	3,073	200	8,400
Philadelphia (SEPTA)	976,000	262,014	155,492	126,475	371,598
Toronto (TTC)	42,469	10,000	14,469	1,000	17,000
250,000-1,000,000					
Albany	4,839	4,539	200	100	0
Atlanta	90,000	28,000	42,000	10,000	—
Baltimore	190,150	146,921	25,018	4,000	—
Columbus	8,618	4,788	3,115	471	140
D.C. (Metro)	289,000	192,000	51,000	26,000	6,000
Denver	22,500	10,000	10,000	2,000	0
Ft. Worth	11,000	3,000	5,000	3,000	—
Indianapolis	22,146	13,000	8,400	500	100
Milwaukee	71,000	32,000	28,000	2,500	1,000
New Orleans	29,808	13,138	10,464	3,103	—
Oakland (AC Transit)					
Ottawa	16,300	4,300	5,000	500	6,500
Portland	2,000	900	1,000	400	0
St. Louis	140,000	110,000	20,000	—	10,000
San Antonio	24,309	16,720	7,173	208	0
San Diego	17,214	9,407	7,565	200	0
Seattle (STS)	44,060	13,425	29,635	500	0
Seattle (MTC)	1,800	500	500	200	200
Winnipeg	6,230	2,500	400	800	2,327
<250,000					
Ann Arbor, Mich.	600	200	300	100	0
Billings, Mont.	125[b]	100[b]	25[b]	0[b]	0[b]
Chattanooga, Tenn.	1,100	500	500	—	—
Concord, N.H.	150	70	50	30	—
Dayton, Ohio	2,900	2,424	276	200	—
Everett, Wash.	100	70	25	5	0
Lafayette, Ind.	600	200	200	100	50
Orlando, Fla.	1,000	600	300	100	—
Pueblo, Colo.	700	300	400	0	0
Schenectady, N.Y.	1,400	1,000	200	200	0
Syracuse, N.Y.	15,500	500	2,500	400	400
Tacoma, Wash.	16,500	4,500	3,300	190	5,180
Total	5,423,988	1,591,227	787,550	1,571,533	1,075,487

[a]Including rail cities. [b]Estimate.

Because few urban transit systems maintain comprehensive records of vandalism costs, few are able to provide breakdowns of material and labor costs for repairs to windows, seats, stationary facilities, and damage from graffiti. This state of affairs exists in many systems because vandalism is not a problem of sufficient magnitude to justify the expense of detailed cost accounting.

Even where detailed records are kept, reports of vandalism costs can vary widely for many reasons. As an example, if two systems sustain the same damage but one repairs it with more durable and costly materials than the other, the difference in repair costs can be incorrectly interpreted as meaning that one suffered greater damage than the other.

The 1971 range of costs for the 37 systems was $100 for Everett, Washington, to approximately $2 million for New York City Transportation Authority (Table 4). At least part of this wide range is attributable to differences in reporting procedures rather than differences in actual incidence of vandalism.

The range still remains wide when costs are computed per 100,000 vehicle-miles, 100,000 revenue-passengers, and 10,000 vehicle-hours (Table 5). For instance, the 1971 range on the basis of 100,000 vehicle-miles is from $17 for Portland, Oregon, to $922 for Philadelphia (SEPTA). Because of the differences in reporting procedures, it is inadvisable to draw any conclusions about efficiency from these figures. The system with fewer criminal incidents and lower vandalism costs is not necessarily more efficient at combating these problems; it may simply have failed to report incidents and costs as accurately as the others.

National transit vandalism costs and national transit criminal incidents were extrapolated the same way. The ratio, $B/A = Y/X$, was also computed based on revenue-passengers, number of vehicles, and vehicle-hours on the assumption that if roughly similar results were obtained the range could be accepted as approximating the total vandalism costs for all U.S. transit systems. The following table gives the range of these computations:

Basis	Vandalism Costs
Vehicle-hours	7,743,837
Revenue-passengers	8,351,550
Vehicle-miles	9,200,500
Number of vehicles	9,994,600

Thus the wide variations in record-keeping among transit systems give an estimated range between $7.7 million and $9.9 million for the national transit bill for vandalism for 1971.

Vandalism costs in terms of percentages of operating expenses for 20 selected systems were mostly less than 0.5 percent (Table 6). Vandalism costs were as much as 1.1 percent of operating costs for only one system (Philadelphia, SEPTA) and possibly this could be attributed to differences in keeping track of vandalism costs. Considering these low percentages, a snap judgment might be that vandalism is not a serious problem, but that would be to ignore indirect costs such as revenues lost while vehicles are being repaired, customers lost to other modes of transportation because of cuts in service, and costs of insurance and legal fees to meet claims against the system for damages. It also ignores social costs such as passenger and employee welfare, customer ill-will caused by having to use dilapidated and disfigured vehicles, and possible injuries to passengers and employees from acts of vandalism such as throwing stones at vehicles. Moreover, the costs of vandalism amount to sizable sums for many systems; for example, NYCTA's vandalism costs for 1971 were in excess of $2.0 million. To conclude that vandalism costs are unimportant because they constitute a low percentage of operating costs would be to overlook their economic and social significance.

Of the 41 systems reporting, 4 of which are Canadian, the largest component of vandalism costs was window breakage for 20 systems; for 12, it was damage to seats; for 6, damage to stationary facilities; and for 1, disfigurement by graffiti. Costs for the remaining 2 systems were evenly split (Table 7).

The study of transit crime and vandalism was only a first step toward analysis of trends. Data were collected for 2 years in most categories and for 3 years in a few,

but 3 years gives little indication of trends. Inconclusive evidence concerning the course of crime and vandalism was obtained by asking transit management personnel for their opinions. When asked, "Has the nature and level of transit crime in your system changed substantially over the last 5 to 10 years?", 17 of 48 answered yes, 11 no, and 20 did not reply. Of the 17 respondents answering yes, 10 said that crime had increased, 4 said that it had decreased, and 3 said that it had gone up and then down. When asked, "Has the nature and level of transit vandalism in your system changed substantially over the last 5 to 10 years?", 21 of 48 answered yes, 10 no, and 17 did not reply. Of the 21 answering yes, 14 said that vandalism had increased, 4 that it had decreased, and 3 that it had gone up and then down. Further research on analysis of trends is needed.

LIABILITY COSTS

Neither the raw figures on vandalism costs of 37 systems nor the extrapolation of national vandalism costs reported earlier included costs of claims filed against transit systems because of incidents of crime and vandalism. Such claims are customarily covered by insurance, but no figures are available on crime-vandalism insurance costs because systems do not specifically earmark insurance for crime and vandalism. Accordingly, the study attempted to calculate costs attributable to crime or vandalism claims and settlements by extrapolating from Chicago Transit Authority (CTA) experience.

During 1971, a total of 1,166 incidents occurred in which foreign objects were thrown through windows of CTA vehicles, resulting in injuries to 420 passengers. A total of 348 claims was presented, of which 138 were settled during 1971. CTA officials estimated that the third-party assault type of incident that might result from crime or vandalism would add approximately 10 to 15 percent more claims and lawsuits to these totals. A third-party assault would occur if a criminal assaulted a bus driver or a transit patron and another passenger or a bystander was injured during the altercation.

CTA experience with crime or vandalism that involved foreign objects thrown through windows, resulting in injuries to passengers, is presented as an annual average based on 1971 and 1972 data.

Item	Foreign Objects	Third-Party Assaults	Total
Incidents	1,166	174	1,340
Injuries to passengers	420	63	483
Claims presented	348	52	400
Lawsuits filed	17	2.5	19.5

Of the 400 claims listed above, CTA experience indicates that two-thirds are eventually settled at an average payment per claim of $300 and an average overhead cost of $113 per claim:

Item	Cost
Settlement costs	$400 \times \frac{2}{3} \times \$300 = \$ 80,000.00$
Overhead costs	$400 \times \frac{2}{3} \times \$113 = \$ 30,133.33$
Total	$110,133.33

Of the 19.5 lawsuits listed above, CTA experience indicates that three-fourths are eventually settled at an average payment per suit of $1,990 and an average overhead cost of $501 per suit:

Item	Cost
Settlement costs	$19.5 \times \frac{3}{4} \times \$1,990 = \$29,103.75$
Overhead costs	$19.5 \times \frac{3}{4} \times \$ 501 = 7,327.12$
Total	$36,430.87

Therefore, the total claims and lawsuits costs for 1971 were $146,564.20.

Based on these estimates of CTA liability costs, the following extrapolation of total transit system liability costs for all U.S. systems was made, where A = CTA revenue-passengers, $386,158,185; B = U.S. revenue-passengers (from ATA Fact Book), $5,497,000,000; Y = CTA liability costs, $146,564; and X = U.S. transit system liability costs. Therefore, if A/B = Y/X, then X = $2,086,350 for revenue-passengers, $2,327,892 for transit vehicles, and $1,849,955 for vehicle-miles. Thus, the range of total liability costs for all U.S. systems in 1971 was from $1,849,955 to $2,327,892.

Data on liability costs were obtained only from CTA. The validity of this estimate would be greatly strengthened if results in the same range were computed from data supplied by additional systems.

STANDARDIZED REPORTING SYSTEM

Earlier, this paper remarked on the wide divergence, from one transit system to another, in the amount of transit crime and vandalism data and the form in which they are recorded. As a step toward standardization of record-keeping, a tentative set of forms was drawn up and submitted to transit personnel of long experience for comment. The following objectives were kept in mind in preparing the forms:

1. To measure the quantity of vandalism, crime, and passenger harassment that occurs on a given transit system from year to year;
2. To measure the quantity of vandalism, crime, and passenger harassment in one transit system as compared with another;
3. To measure the quantity of crime on a given transit system as compared with the quantity of crime in the community served by the system; and
4. To avoid compiling and maintaining records of items with little or no utility to transit systems.

The general industry reaction to these tentative forms was that it is inadvisable for any one agency, such as a research team, to draw up forms that would be used by all systems. The procedure generally favored was to inform the industry of the end result desired and leave it up to each system to compile its own forms.

Specific reactions ranged from criticism that the proposed forms were far too detailed to criticism that the proposed forms were not detailed enough. It was evident that some systems would have difficulty in supplying any of the data, some would have difficulty in supplying part of it, and some would have no difficulty in supplying far more than called for.

Questions were raised concerning the value to the system of some of the suggested items as gauged by the costs of compiling the information. The scale of values varied markedly from system to system.

The objection was raised that, because many transit systems pay drivers extra (frequently at overtime rates) for time spent filling out incident reports, such incentive pay can lead to abuse of the practice of filling out incident reports.

Thus it was apparent that, regardless of how desirable standardization of data may be, many obstacles must be overcome to realize it. The authors believe that standardization of data on transit crime, vandalism, and passenger harassment is an important objective and that efforts should continue toward finding a common denominator that will help the majority of transit systems to compile and maintain basic data and provide for compilation of more elaborate data by those systems that are able and willing to undertake such a task.

SUMMARY REPORT ON VANDALISM AND PASSENGER SECURITY IN THE TRANSIT INDUSTRY

Edward J. Thrasher and John B. Schnell, American Transit Association

This paper summarizes the findings of a study on crime, vandalism, and passenger security on urban transit systems. The study's major goals were to appraise the national scope of transit crime and vandalism and to explore means of controlling the problems and make suggestions on the basis of the research findings. The emphasis in this summary is on means of controlling the problems. Several ideas to control transit crime and vandalism are discussed: the use of materials that are specially fashioned to withstand criminal and vandal acts on transit; procedures and tactics to protect transit passengers, employees, and properties and ways to detect and deter offenders, keep them under surveillance, and apprehend them when necessary; mechanical and electronic devices, as well as features of stationary sites, for assisting police and security forces in their duties; programs for involving the community in formulating anticrime and vandalism measures and programs for maintaining a liaison with educational authorities and personnel; the methodical cultivation of good relations with police, courts, and the media; and the attitudes of the public toward transit crime and vandalism to ascertain whether fear of crime and vandalism influences passenger decisions to use urban transit. Suggestions for further research on transit crime, vandalism, and passenger security are also given.

•IN 1970, the Urban Mass Transportation Administrator wrote to the American Transit Association suggesting that a study be undertaken concerning the cost and forms of vandalism on urban transit systems and the problems pertaining to rowdyism and passenger harassment. As described in another paper (1), UMTA agreed to fund such a project, and the vandalism and passenger security (VAPS) research team presented a draft report for UMTA review in August 1973.

This paper is a summary of the main items in that report. Because the methodologies used in accumulating and interpreting data varied widely, this summary is limited to findings. The VAPS report had two basic goals: to appraise the national scope of transit crime and vandalism and to explore means of controlling the problems of crime, vandalism, and rowdyism and make specific suggestions on the basis of the research findings.

Controlling transit crime and vandalism involves various approaches: resistant materials, deterrence, protection, surveillance, apprehension, dissuasion, community involvement, cooperation with educational authorities, coordination with institutions, and analysis of passenger attitudes. The general opinion among those working to overcome transit crime and vandalism is that none of these approaches can be successful on its own and that the most effective means of combating crime and vandalism is the sustained use of a combination of all approaches. Because of cost considerations, however, the problem becomes one of selecting those approaches that are best suited to local conditions and budgets.

The findings on the scope of transit crime and vandalism (1) and the findings on passenger attitudes toward transit crime and vandalism (2) are presented elsewhere.

VANDAL-RESISTANT MATERIALS

Although the following remarks apply to both rapid transit and bus systems, for convenience, the discussion will speak only of buses.

One way that bus systems can cope with the vandalism problem is to utilize materials in vehicles and stationary sites that resist breakage by vandals. Broken windows, which account for much of the cost, ripped seats, and graffiti are the three main items in bus vandalism costs. Safety glass is customarily used in bus windows, but more systems are trying break-resistant acrylic and polycarbonate plastics.

For systems subjected to only a small amount of vandalism to windows, tempered safety glass is safe, adequate, and low-cost. Acrylic is substantially more break resistant than safety glass, but it is more expensive initially. Polycarbonate has superior break resistance because of its softness and flexibility (ordinarily it will not be penetrated by thrown objects although it may show dents or bubble-like impressions), but it costs even more than acrylic. Both acrylic and polycarbonate are prone to scratches unless coated with an antiscratch material such as "Abcite."

When purchasing new vehicles, transit systems should methodically decide which materials are suitable for their individual situations. Systems evaluating the merits of various window materials might set up a long-term (5-year) total cost projection that would include initial installation costs, estimated vandalism and other maintenance costs, and additional inputs such as estimates of possible injuries and effects on patronage.

Damage to seats accounts for the second highest vandalism cost in most bus systems; most damage is caused by cuts in vinyl seat coverings. To combat such damage, many systems are introducing hard seats, usually of fiberglass. Compromise seats with hard shells and cushions that can be easily replaced if damaged are also being tried. Although hard seats are impervious to slashes and rips, their smooth surfaces are vulnerable to graffiti markings, and they have the disadvantage of being difficult to clean. Some bus systems are trying chemical coatings on the hard surfaces to facilitate cleaning.

Graffiti, the third item in vandalism costs, are usually found on bus interior panels, on interiors and exteriors of transit vehicles, and on any accessible surface of stationary sites. Several solvents and cleaners are on the market, but their effectiveness varies not only with the type of marking but also with the surface material being cleaned. Certain materials used in manufacturing paneling, such as melamine and coated acrylic sheeting, are more readily cleaned than others. Because bus systems frequently do not maintain detailed records of graffiti costs, they have insufficient bases for judging whether the graffiti problem is large enough to justify the expense of special paneling materials. Actually, the problem is even broader; many bus systems do not know the dimensions of their entire vandalism problem because of inadequate records. Transit systems that have more than a minimal amount of vandalism should consider keeping accurate, timely records of the levels and types of vandalism experienced. These records could provide guidance on whether to replace standard materials with more costly, resistant materials.

DETERRENCE, PROTECTION, SURVEILLANCE, AND APPREHENSION

Among the technological aids used to help control and deter crime and vandalism in transit vehicles are special devices for communication. Some devices can transmit communication one-way and undirected, as in a public address system through which an official can communicate with an entire station. Another type of public address system is one-way and directed and allows communication with selected areas of a station. There are also devices that can transmit two-way communication to an individual, as between a security monitor and a passenger or employee who utilizes an emergency telephone. A sophisticated form of two-way individual communication is the automatic vehicle monitoring (AVM) system that enables transit personnel to maintain control over buses on the streets and at the same time provides for bus-to-control center communication in the event of crime or other emergency.

UMTA has arranged for tests of several types of AVM systems over the past few

years. An outstanding example is a demonstration project in which the Chicago Transit System (CTA) installed a proximity AVM system on 500 of its buses.

The purposes of AVM are set forth in a study prepared by the Mitre Corporation: "The purpose of an AVM system is to provide the means of ascertaining the location of each of the vehicles in a large fleet, and at the same time provide a two-way voice and a digital communication capability, the latter to include a silent alarm...." The various types of AVM systems presently available are dead reckoning, phase trilateration, LORAN, proximity, inverted proximity, pulse trilateration, triangulation, and others in which the driver is the location sensor.

The proximity AVM system tested by CTA consists of a series of signpost transmitters of 300 ft (90 m) or less propagation range, each uniquely coded to identify transmitter location. Broadcasts from the signposts are relayed by the vehicle over the standard land mobile communications band to the control center, which identifies the vehicle's location from the individual signpost code.

In the event of emergency, the driver can either summon help by voice radio or can press a button to activate an alarm that cannot be heard or seen on the bus but is very audible and visible at bus system headquarters. A computer interprets the alarm as run number, route, bus number, location of signpost transmitter, distance, and direction and enables the console operator to identify and locate the bus and alert the police by direct telephone.

Many bugs were disclosed in the AVM system during the test period, and there were many false alarms. An evaluation study by the Transportation Systems Center of U.S. DOT observed that emergency alarms were handled with efficiency, although the dispatcher was very cautious and had to refer to voluminous printed schedules to ensure that the data in the monitor console was correct. It was expected that the dispatcher's response to alarms would improve with time and experience. CTA was sufficiently pleased with the results and proposed to equip all buses in its fleet with AVM equipment and greatly expand the number of signpost transmitters.

Tests of other types of AVM were carried out in Philadelphia. These tests, however, provided no fresh information regarding the use of the silent alarm.

A form of communication that is gaining wide acceptance is the two-way radio. Deterrence of crime is only one reason for the popularity of two-way radios. Fires, parades, accidents, traffic jams, emergencies of all sorts can be reported promptly to the dispatcher and instructions issued for rerouting. Economies of personnel and telephone operation are realized. Morale is improved because drivers can communicate their problems and listen in on the operations of their fellow workers. Two-way radios also aid in reporting and protecting against crime and vandalism and are useful for reporting criminal incidents in general.

Signals and silent alarms are additional means of combating crime on transit vehicles. A common form of signal is a flashing light that can be activated by bus drivers to attract the attention of police. Obviously the effectiveness of such a signal is closely linked with the density of police patrols.

Alarms are commonly tied in with two-way radios. The most sophisticated is the AVM device already described. Simpler forms transmit coded messages either to dispatchers or to police when the driver presses the alarm button. With all types, the greatest part of the overall response time consists of time required for police to arrive at the scene. Police travel time can be reduced by increasing density of police patrols, giving high police priority to transit alarms, and reducing the number of false alarms. All alarm systems periodically generate false alarms, and if the ratio of false to genuine alarms becomes too high the enthusiasm of the police for responding deteriorates.

Although signals and alarms seem to boost drivers' confidence by giving them a means of signaling for assistance, they offer little prospect of being consistently effective in deterring crime. Criminals have the advantage of surprise, and because criminals are well aware of the existence of signals and alarms, they customarily warn drivers at the outset not to touch anything or make any false motions. The question then becomes whether the driver is willing to activate the alarm at the risk of being injured or killed.

STATIONARY SITES

Communication and surveillance systems in stationary sites include telephone and radio connections and television monitors. The varieties and combinations of electronic communication and surveillance equipment not only are very numerous but also are continually being modified by improvements in existing technology and the introduction of new concepts. Because all such technology adds to transit system costs, an important question is whether the crime problem is sufficiently serious to warrant the cost of a particular electronic device to combat it. Aside from their effect on crime, harassment, or vandalism, such devices have no effect on the speed, comfort, or convenience of the ride.

Another important consideration is the human factor. An electronic system usually involves audio, motion, or light detection that initiates some form of alarm, but, although such devices can identify vandals and possibly discourage them, they cannot apprehend them. The effectiveness of any electronic or mechanical system rests on the human factor, i.e., the rapidity with which humans can respond to the alarm.

Wired communications in stationary transit sites (subway stations, elevated platforms, bus terminals) include public telephones, police telephones, and transit system phones. There is some movement toward making all phones more readily accessible to the public for emergency use: For example, all pay phones in New York City's subway stations were adapted, in December 1972, to coin-free use for calls to the police emergency number. (Other wired forms of communication are public address systems and alarms.)

Radio communications in stationary transit sites include personal walkie-talkies, to link with personnel in stations and moving vehicles, and lossy line, to overcome transmitting-receiving difficulties encountered in subways.

Electronic surveillance in stationary transit sites consists essentially of closed-circuit television. Nonrecording television is monitored by personal observation intermittently or continuously, depending on the availability of personnel. If continuous monitoring is maintained, the element of fatigue will increase demands on manpower to keep up alert coverage. Video recording reduces monitoring manpower requirements and assures that pertinent facts are available for recovery as needed, but video recording cannot react to criminal incidents. The human element is still necessary to initiate an appropriate response.

Electronic communication devices, whether for vehicles or stationary sites, do not replace the police officer but merely help him in his duties. Whether two devices will help him more than just one depends on the environment and the problems. Although cost considerations are important, investments in anticrime manpower and equipment cannot necessarily be justified on the basis of offsetting the costs by increased passenger revenues, especially in the short term. Intangible effects can be more important to a public service institution than tangible effects. Passenger goodwill and high employee morale can contribute to the well-being of the entire community.

In stationary sites, communication devices are supplemented by a host of devices for directing passengers into designated areas, preventing them from entering certain locations, deterring and detecting perpetrators of criminal acts, and helping to apprehend offenders. These devices range from the commonplace, such as a fence, to the highly complicated, such as an ultrasonic detection device.

Access and passenger flow controls consist of structures, devices, or arrangements that help the transit company guide people where it wants them to go and keeps them out of places that it does not. Fixed fences, immovable barriers, locked doors, and one-way gates are commonplace examples. More sophisticated are movable barriers and adjustable gates that can be arranged in nonpeak hours to cut down on accessible station areas, herd waiting passengers together, and reduce areas to be patrolled. Turnstiles (gates that unlock on insertion of a coin) are a familiar form of access-control device. Recently developed turnstiles are the ticket-in, ticket-out gates used by BART (San Francisco) and PATCO (Philadelphia), which scan tickets for entry, exit, and amount of fare paid or due.

Exit-blocking devices are contrivances or arrangements that impede the escape of

the criminal until police can arrive. Locking certain doors after peak hours to reduce the number of exits is an everyday example. A sophisticated variant of this consists of electronic remote control that enables a television monitor to lock exits as the fleeing criminal tries to get away. A danger in using such exit-sealers, however, is that caging the criminal can endanger other people. Exit-blocking devices are sometimes combined with other equipment, such as videotape recorders that take photographs of the offender.

A wide assortment of devices is available for protecting fixed premises, such as storerooms, against intruders. Audio detection devices set off an alarm when noise rises above a preestablished pattern or level. Motion detection devices trigger alarms when an unusual motion disturbs the transceiver's wave pattern. Electromechanical systems operate on wires or switches hidden in windows, doors, or drawers. Opening a "loaded" window activates an alarm. Electronic fences have antennae that set off an alarm when an object comes within 3 ft (1 m) or other specified distance. Manufacturers offer special provisions for foolproofing because false alarms are a recurring problem with many of these devices. Sometimes such provisions are unavailing; it is difficult, for example, to render electronic fences invulnerable to false alarms triggered by birds and animals.

Many transit systems are recognizing the importance not only of equipping stationary sites with crime-deterrent devices but also of incorporating security features in stationary site design. Thus, many systems are remodeling old stationary sites and designing new ones to maximize features that help protect passengers and employees from transit crime and vandalism.

In the words of one transit executive: "The primary purpose of all of these measures is to make people visible. By making passengers more visible to other passengers, security and other personnel, and the outside world, criminal acts can be stopped before they begin. In the event that they do occur, improved visibility will make it easier and faster to take corrective action." In view of this, some suggested security measures are

1. Make fences, parapets, gates, and windbreaks more transparent;
2. Minimize the number of structural columns in platforms and lobbies;
3. Locate collectors' booths to optimize sight lines;
4. Avoid twisted or dog-leg corridors;
5. Install mirrors or closed-circuit television to provide surveillance over areas not directly visible from collectors' booths;
6. Provide high levels of illumination for indoor and outdoor spaces;
7. Concentrate passenger waiting and circulation areas;
8. Minimize the number of station entries to ease supervision and concentrate pedestrian activity;
9. Close off nonpublic and abandoned facilities;
10. Locate entries to public toilets in easily supervised areas, inside the paid area if possible; and
11. Make transit cars more transparent so that it will be easier to see into or out of them.

As with stationary sites in general, shelters at bus stops require good exterior and interior visibility to discourage crime. Bus shelters should stand clear, unconcealed by other structures, and substantial portions of their walls should be constructed of transparent materials to provide full view of the inside. At least two exits should be provided to give patrons escape routes from molesters. Materials and construction should be strong to provide fullest potential resistance to vandalism.

POLICING PROCEDURES

According to the President's Commission on Law Enforcement and Administration of Justice, preventive patrolling by visible and mobile policemen is universally thought of as the best method of controlling crime, but little is known about the most effective way of deploying and employing a department's patrol force. Lack of knowledge about the extent to which different patrol techniques result in arrests and lead to fear of

arrests has meant that many operational patrol decisions are made on the basis of guesswork or logic rather than facts.

On transit systems, the effectiveness of patrolling and surveillance lies in deterring criminals rather than apprehending them, for it is seldom that a man patrolling or a man assigned to keep an eye on a station actually spots a crime in progress. The greater the coverage by patrolling and surveillance is, the more effective the deterrence will be, but the factor of cost-effectiveness must be considered. Because few police departments or transit companies can bear the expense of assigning large numbers of men exclusively to transit security duties, control of crime on most transit systems depends largely on rapid response to incidents. In rapid response, good communications play a key role.

Providing protection for bus passengers and drivers presents different problems from those of rapid transit because there are few stationary sites and surveillance of buses is difficult. Adoption of exact fare by most bus companies has greatly eased the problem of robbery of drivers, but assault, robbery of passengers, and harassment and other rowdyism remain.

The relative ineffectiveness of silent alarms and flashing lights in high-crime areas has led bus companies to try other deterrents. Policemen riding on school buses, police cars following selected buses in high-risk areas, private guards being hired where local police forces are too small to spare men to ride on buses, unarmed transit personnel accompanying the driver on certain runs, paid and non-paid volunteers riding, and (with one system only) bus drivers being permitted to qualify as special policemen and carry firearms are examples of alternative deterrents to crime and vandalism on transit.

A few rapid transit systems have used man-and-dog teams in subway vehicles and stations with good effect. There seems little potential, however, for use of dogs in bus systems. Large rail systems have obtained satisfactory results by using helicopters for surveillance.

COMMUNITY AND EDUCATIONAL PROGRAMS

Transit systems have sought to deter vandalism by means of public relations programs and maintenance of a liaison with local schools and educational authorities, government agencies, and community action groups.

These educational and community programs follow the general pattern of cultivating good relations with personnel of potential influence with juveniles and keeping in touch with young people themselves to nip vandalism in the bud. One transit system, for example, arranges monthly meetings with local police and fire department and school officials. Another system has developed a plan in conjunction with county authorities to employ underprivileged teenagers in an origin-and-destination survey. A third hires inner-city youths as summer tour guides. Coordination with school officials and community groups has enabled another system to utilize monitors on buses serving schools.

Numerous systems are committing resources to educational presentations in elementary and high schools. Typically, speakers address the students in classrooms or the assembly hall for 15 to 20 minutes. This is followed by a slide show in which problems of vandalism and other misbehavior are worked into the general theme of concern for the students' safety. A short question-and-answer session allows for student input. Giveaways are used to stimulate interest, the type of gift varying with the age of the students. (One system, for instance, provides a demonstration bus ride and free comic books.) To focus students' attention, questionnaires are sometimes distributed afterward for the students to complete. Analysis of the responses sometimes reveals information of use in formulating operating procedures.

A system in New Jersey, for instance, uses questionnaires, talks, and slide shows with students as young as the second grade. The responses may not be very meaningful as an indicator of student reactions, but they do furnish some measure of guidance for speakers in preparing future presentations, and the questionnaires keep the children interested in the presentation and help prevent the talk and exhibits from being quickly forgotten.

In contrast to systems that leave school relations to haphazard presentations by lower

echelon employees, a number of systems designate an employee to devote at least part of his regular duties to cultivating good relations with school authorities and youngsters. This employee assiduously nurtures channels of communication with school principals, officials, and students. Need for such employees varies from one community to another with the intensity of the vandalism problem.

A bus system in Washington, D.C., employs professional football players in the off-season to build up relations with school children through their hero image. A Seattle system suggests that a high school that trains its students in television production write scripts and put on shows about student behavior on buses. Systems in New York, Cleveland, Oakland, and elsewhere periodically invite students to visit system repair shops and garages to see what it takes to keep the buses in running order.

A bizarre aspect of relations between the community and transit system is the problem of the defacement of transit rolling stock and stationary property by graffiti. Although found nationwide, graffiti have been concentrated in two cities particularly, Philadelphia and New York, both of which have made intensive efforts to cope with the problem but without much progress. As of June 1972, Philadelphia was spending about $1 million annually to remove graffiti from school walls and buildings, and a large transit system's costs for removing graffiti from its rolling stock and stationary sites were almost $100,000. New York's total graffiti bill for 1972 was estimated at $10 million, of which more than 27 percent was for vehicles and property of the city transit authority.

Deterrent measures in both cities have been a blend of enforcement, persuasion, and education. Police have made numerous arrests. Paint retailers have asked store managers to put spray cans out of reach of the public to reduce theft of paint. City authorities issued strong statements against graffiti, television and radio stations ran anti-graffiti spot announcements, boy scouts and other volunteers devoted weekends to cleaning graffiti from buildings and vehicles. Schools held classroom discussions on graffiti, and city-wide contests awarded prizes for children's anti-graffiti posters. In Philadelphia a graffiti-alternative workshop for graffiti scrawlers was initiated with the support of the University of Pennsylvania and several foundations. In spite of all these measures, however, both cities still had a long way to go to overcome the graffiti problem.

INSTITUTIONAL COOPERATION AND CONFLICT

Urban transit systems function in an environment that involves interfaces with riders, government members, police officials, officials of the judiciary, personnel of educational establishments, labor union leaders, and representatives of the media. Each group has its own duties and objectives, some of which coincide and some of which conflict with those of each other and those of transit systems. How transit systems get along with such institutions is an important element in maintaining service to the public and combating transit crime and vandalism.

Although precise figures are lacking, indications are that the percentage of systems that maintain their own security forces is very small throughout the industry. A system that contemplates maintaining its own security force must be prepared to allocate relatively sizable funds for the purpose. Whether or not it is advisable for a system to maintain its own security force necessitates consideration of the effects of such specialization, the benefits to be derived, and the disadvantages that may result.

According to a study by Stanford Research Institute, although a special transit police force increases the operating cost of the transit system, no data have been found to demonstrate that such increased cost will be supported by savings from less vandalism or theft or from the revenues created by increased ridership. If the special force must protect the property and passengers of a company that operates in several different political jurisdictions, there is the problem of defining legal authority for enforcing local ordinances. An attractive career system must be developed to recruit high-quality personnel. The advantages of having one's own special police force should be compared with other alternatives such as hiring off-duty policemen for occasional seasonal employment or contracting with local police to provide certain services. It seems advisable to organize a separate, specialized transit police force only in the largest

companies and then only when demand for security services clearly exceeds capabilities of local police forces: when the company operates in different government jurisdictions and the crime problem is serious.

The typical transit system does not maintain its own police forces but relies on community police forces to furnish security. Because of the multiplicity of tasks confronting them, police forces often assign low priority to coordination with transit systems. Accordingly, it is to the systems' advantage to pursue a conscious program of cultivating police goodwill and coordinating with them to assure protection of transit interests.

One element that can seriously disturb good relations is for the police to form the opinion that the transit system is unwilling to prosecute. Because the police view prosecution as the logical consequence of criminal investigation and apprehension, they are liable to be reluctant to continue cooperating if the transit system declines to prefer charges against apprehending criminals.

Although transit systems are concerned about all types of crime that may affect their patrons and employees, their greatest concern is with lesser crime, particularly vandalism because, with the preponderance of incidents of vandalism over serious crime, it is vandalism that is likely to lead systems to day-to-day contacts with police and judiciary.

Because most vandals are juveniles, the majority of transit systems' dealings with the judiciary are at the juvenile court level. Thus, in cultivating good relations with the judiciary, transit systems' emphasis is necessarily on the juvenile court. The burden on juvenile courts throughout the United States is extremely heavy; the Task Force of the President's Commission noted: "It is apparent that responsibility for meeting the problems of crime rests more heavily on no other judicial institution." To the courts, transit vandalism is just one more contributor to the heavy workload. Hence, if a transit system is to secure its share of a court's limited time and resources, it must work actively with court and probation personnel, not necessarily to obtain the conviction of every apprehended juvenile but to help steer these youths to constructive pursuits.

Another institution that should be actively courted by transit systems is the media. Do media encourage crime and vandalism by publicizing criminal incidents? Transit system management tends to think so, but media men do not agree. Scholarly opinion is that the question has not been decided. Nevertheless, transit management in general prefers to deemphasize incidents of transit crime and vandalism. For example, respondents from one transit system asserted that a strong upsurge in graffiti occurrences took place after an article on the subject appeared in a city newspaper. Another correspondent wrote: "We feel that too much emphasis on vandalism [in the media] might create a public impression of 'unpleasantness—inconvenience' in riding buses."

It was concluded that transit systems and mass media may have sets of interests that conflict with each other. There is a divergence of opinion about how much publicity should be given to some types of news and how sensational such publicity should be. To consider transit-media relations in terms of generalities, therefore, is unlikely to lead to joint cooperation toward common goals. Because of the gap between the respective positions, transit systems should cultivate good personal contacts with media to establish an atmosphere conducive to compromise and negotiation to reconcile conflicting interests.

FURTHER RESEARCH

Crime is a big subject. The President's Commission acknowledged (3), "The Commission did not—it could not—find out 'everything' about crime and the criminal justice system. It became increasingly aware during its work that, far from seeking to say the last word on crime, its task was rather a step in a long process of systematic inquiry that must be continued and expanded by others."

Like its predecessor, the vandalism and passenger security study did not find out everything about transit crime and vandalism. It, too, is a step in the process of systematic inquiry that must be continued and expanded by others.

The report shows the following gaps in knowledge that require new or continued research:

1. The collecting of statistics on transit crime and vandalism should be continued on an annual basis, and the data should be systematized and standardized to facilitate comparisons and study of trends.
2. Extrapolations of the number of criminal incidents and the totals of vandalism costs on a national basis should be refined and extended.
3. Data on transit properties' experience with types of damage-resisting materials should be accumulated.
4. Many before-and-after projects are possible in technical and in social areas. Some questions that may be pursued in these projects are (a) Does installation of a device such as two-way radio on buses result in a decrease in vandalism incidents, an increase in apprehension of offenders, or other changes? (b) Does a steadily pursued program of presentations to school children lead to a perceptible change in juvenile behavior on school buses? (c) Does use of a particular type of paneling show significant improvement in facilitating removal of graffiti?

There are almost limitless possibilities for controlled experiments. Cost-effectiveness studies of available technological aids are needed. If, for example, a transit system spends $1 million to install an automatic vehicle monitoring system, can it expect to offset the investment through higher revenues, reduced costs, and increased social benefits to passengers and employees and if so, over what period of time? Who are the vandals? Identification of those who vandalize buses and rapid transit trains should be a great help in planning ways to get at the root of the problem.

More work needs to be done on the question of public attitudes toward transit crime and vandalism. Studies are needed to confirm or refute the hypothesis that fear of crime and vandalism actually is affecting ridership of urban transit. If the hypothesis is found to be valid, studies are needed to quantify the resulting loss in revenues to gauge the seriousness of the problem.

REFERENCES

1. Thrasher, E. J., and Schnell, J. B. Scope of Crime and Vandalism on Urban Transit Systems. Published in this Record.
2. Thrasher, E. J., and Schnell, J. B. Studies of Public Attitudes Toward Transit Crime and Vandalism. Published in this Record.
3. The Challenge of Crime in a Free Society. President's Commission on Law Enforcement and Administration of Justice, U.S. Government Printing Office, Washington, D.C., 1967.

SPONSORSHIP OF THIS RECORD

GROUP 1—TRANSPORTATION SYSTEMS PLANNING AND ADMINISTRATION
Charles V. Wootan, Texas A&M University, chairman

PUBLIC TRANSPORTATION SECTION
Douglas F. Haist, Wisconsin Department of Transportation, chairman

Committee on Public Transportation Planning and Development
Kenneth W. Heathington, University of Tennessee, chairman
Alan L. Bingham, Daniel M. Brown, James P. Curry, Frank W. Davis, James C. Echols, Ronald J. Fisher, William K. Fowler, G. E. Gray, David T. Hartgen, F. Norman Hill, William T. Howard, B. Thomas Moore, William T. Olsen, Joseph F. Rice, Gilbert T. Satterly, Jr., Donald R. Spivack, Edward Weiner

W. Campbell Graeub, Transportation Research Board staff

The organizational units and the chairmen and members are as of December 31, 1973.