

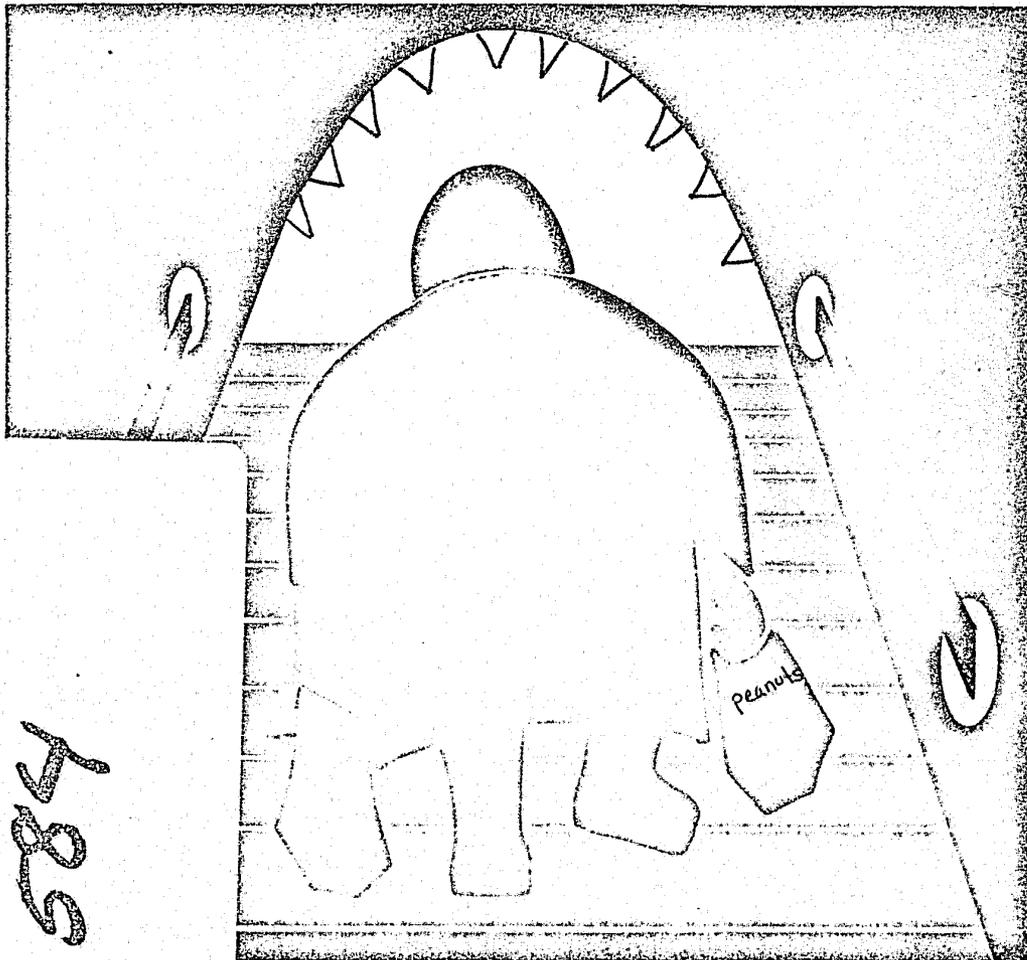
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Research Report

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Security of Patrons on Urban Public Transportation Systems



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TRANSPORTATION RESEARCH INSTITUTE
Carnegie-Mellon University
PITTSBURGH, PENNSYLVANIA

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Security of Patrons on
Urban Public Transportation
Systems
Report of the
Workshop on
Transit Security
February 24-25, 1975

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The results and views expressed are the independent products of the workshop sessions and are not necessarily concurred in by the Urban Transportation Administration of the U. S. Department of Transportation.

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Preface

This report, "Security of Patrons on Urban Public Transportation Systems," is a product of a six-step process including a workshop on transit security held in Pittsburgh on February 24th and 25th, 1975.* It represents an amalgamation of a wide range of current thinking on the nature of the crime problem on public transit systems, its affect on transit patronage, measures taken to meet the problem, and projections about what the problem will be in the future and the kind of knowledge we will need to face it. It is to our knowledge the first attempt to put together in one document a wide range of issues that the field of public transportation must ultimately face with regard to patron security.

Several months before the workshop, an attempt was made to contact 150 likely sources of information about transit security. These included transit properties and organizations or individuals dealing with transportation planning or research. A letter was sent to each outlining the goals of the workshop and included a copy of a paper, "Central Issues in Transit Security," presented before the Transportation Research Forum in San Francisco in October 1974. In addition to soliciting information and reports of studies on transit security, respondents were asked to critique the paper and suggest issues that had not been covered in it. A second step was to develop a working paper for the workshop itself. An outline for that paper was developed at Carnegie-Mellon University (C-MU) and specialists in each of the topical areas were assigned the task of writing a section for the paper. A section on Historical Perspective was developed by Professor Joel Tarr of C-MU, basing some of his writing on a contribution from Paul

Wallace of the Chicago Transit Authority's police. The introductory chapter, Central Issues in Transit Security, was based on the paper mentioned earlier and modified by the comments solicited from experts around the country. Dr. Jan Chaiken, of the Rand Corporation in Santa Monica, California, drafted a section on the measurement of risk. Ronald Johnson, from the Chicago Department of Public Works and Project Director of the Chicago project, contributed a section on the public perception of risk. Dr. Norman Sidley, associated with the Honeywell Corporation in Minneapolis, contributed the section Reducing the Risk and Improving the Image of Public Transit. The subsection Cost-benefit Analysis, a majority of which appears in the appendix, was contributed by Robert Greene, a doctoral student in the School of Urban and Public Affairs at C-MU. The section Small Vehicle Automated Systems was developed from the report by Sidley and Shellow for the Twin Cities Area Metropolitan Transit Commission. These sections constituted an eighty page working paper which was distributed to all 25 participants several weeks before the workshop.

The third step was the workshop itself. It was convened in Pittsburgh at a conference site near the airport on February 24th and 25th, 1975. Each of the three topical areas, Measurement of Crime, Public Perception of Crime, and Measures to Reduce Crime, were taken up in the workshop in serial fashion for about 3 hours of discussion. At the end of each session, a list of what we need to know was generated for each topic. During the entire workshop, three highly skilled reporters (Dr. William Lafferty, Professor Robert Slack and Professor David Fowler) kept track of the deliberations.

The workshop provided the forum for an active and lively interchange between transit operators, researchers and security specialists. At times it had a combative quality — though at all times it proceeded in a cordial atmosphere. The several occasions in which the needs of the practitioners collided with those of the scientists produced useful products. The researchers were forced to place their theoretical and methodological preoccupations into the context of the needs of transit operators, while the latter began to recognize that the answers to some practical questions may have to wait upon advances in basic and applied research. The final chapter incorporates

*This report was in part supported by funds received from the Urban Mass Transportation Administration's University Grant Program.

the previously mentioned lists of recommendations for future work and therefore reflects a consensus of the several interests represented in the entire group.

The fourth step was primarily an editorial one. The recorders turned over their notes to the principal editor, Dr. Lafferty, who related each comment made by conference participants to the relevant sections of the working paper, reworking the entire text as he went along. He then wrote up the final section on recommended future efforts. In addition, he worked into the section on Perception of Risk a dinner address by Professor Harold Proshansky, President of the City University of New York's Graduate Center. Three papers, one by Chaiken on measuring risk, one by Greene on cost-benefit analysis, and one by Tiffet, et al., on defensive practices of patrons, were redone for inclusion as appendices. These were included to give readers an idea of what some of the new departures in security research might look like, should the field develop further.

A fifth step in the process was to distribute the resultant draft report to all workshop participants for their comments, critiques and additions. And finally, the last step involved inclusion of those critiques into the final and present version.

This step-wise procedure, though an arduous one, in itself may be considered something of a research process, generating analytic examination of the issues and providing some new ideas and insights. This report, then, is the product of many hands, the entire activity merely being shepherded along by the C-MU group. It is our hope that this effort which systematically examines what is becoming an increasingly vital topic to transportation operators and planners will serve as a springboard for future developments in what can only be characterized as a badly neglected aspect of transportation research. Throughout the entire enterprise it was obvious to us that the effort would not have been possible without the high degree of involvement so generously contributed by all participants. For this we would like to express our deep gratitude and in doing so, wish to credit them with the true authorship of this report:

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I. HISTORICAL PERSPECTIVE

One of the past year's more popular thrillers, which appeared first as a book and then as a movie, was entitled *The Taking of Pelham, 1-2-3*. The subject of this work was the hijacking of a New York City subway train with attendant mayhem, murder, and terror for the passengers and the crew. While the vehicles of mass transit—buses, streetcars, and subways—have played important roles in works of fiction in the past, they had almost always been utilized as a way to achieve the more pleasurable emotions such as excitement or romance. Violence in relation to transportation was confined to inter-city transportation such as stage coaches and trains rather than intra-city transit. *The Taking of Pelham, 1-2-3* signifies a sharp break with tradition so vividly illustrated by Judy Garland singing the "Trolley Song" in "Meet Me in St. Louis." The disorder and violence which so often had been seen as characteristic of the city has finally intruded itself into the formerly sheltered urban public transit system.

In actuality, public transit had never been completely free of crime, especially crime involving property rather than person. The difference between current and past transit crime lies not only in its magnitude but also in the degree to which it is directed against persons and property. Not only have the literary and public perceptions of public transit changed, but also changed are the actual circumstances involving conditions of safety.

Public transit in America grew out of extremely congested conditions in the cities of the first half of the 19th century. The pretransit cities were essentially walking cities characterized by densely packed housing, people living close to work, and a

city radius of about two miles. These cities were congested, but theirs was the congestion of people coming into personal contact with each other as they walked about the city streets rather than the congestion of vehicle crowding. A growing and increasingly heterogeneous population crowded into a relatively small area gave rise to undesirable environmental conditions and severe problems of public safety. It was out of this situation that both public transportation systems and organized, uniformed, and armed police forces developed.

The first public transit systems in this country appeared in the 1830's and involved the use of horse-drawn buses called omnibuses. The omnibus was a horsedrawn vehicle that carried about twelve to fifteen passengers over an established route of city streets for a fixed fare. The omnibus was followed in the 1850's by the development of the streetcar, initially powered by horses and mules and eventually (1880's) by cable and electric power. Systems of "rapid transit," (transit with a private right-of-way) were introduced in the late 19th century. In 1871 an elevated system utilizing steam locomotives was constructed in New York; elevated systems with electricity as the motive power were developed in several other cities in the 1890's. Boston built the first subway in 1897, followed by New York (1904) and Philadelphia (1909). The building of these systems revolutionized the spatial patterns of American cities. Public transit produced an urbanized area roughly characterized by a central business district surrounded by concentric circles or zones with specialized residential, commercial and industrial functions. Traction lines radiated from the core into the residential and industrial areas, with crosstown lines being added as urban development spread.

From almost the very beginnings of public urban transportation transit companies recognized that public order was necessary to maintain the regular workings of the system. Rowdiness and the threat of crime on the cars would disrupt time schedules and dissuade passengers from using public transit. Early traction company regulations, therefore, forbade children from playing on or around cars and prohibited both smoking and drinking. Strict regulations existed in regard to fare collection and conductors had the right to keep possible disrupters of the peace from the cars. In spite of these regulations, the letters to the editor sections of city newspapers often contained indignant messages from irate passengers complaining about drunks on the cars, rowdy children, and obnoxious persons who annoyed the riders

and had to be ejected.

Vandalism directed against the public transit system by gangs of youths was fairly common. Several works that deal with gang life in Chicago in the early 20th century mention vandalism against the "L" and stealing rides on the streetcars. The new transit systems, of course, furnished greater mobility for the criminal as well as being an object of attack, but to a large extent, while gangs dominated many cities in America in the late 19th century, they usually tended to stay within their own territory or turf. It is entirely possible that gangs occasionally terrorized passengers on a streetcar or subway car, but such incidents were uncommon. While gangs and crime were actually much more prevalent in American cities in the middle and late 19th centuries than they were during the first half of the 20th century, they did not disturb the workings of public transit very much.

Thieves did occasionally commit armed robbery against drivers before the invention of the safety fare box, but the most commonly reported crime was the non-violent crime of pickpocketing. In 1906 one writer on crime noted that, "conditions of public travel in New York could not be better contrived for the purpose of thieves, and it is on the surface cars that they do their most effective work. They infest the subway, the elevated roads and the bridge cars, also." Gangs of pickpockets as well as individual entrepreneurs preyed on the public transit systems and in 1914 a New York City Police Magistrate complained about the existence of a "Pickpocket Trust."

In response to the problem of crime on the public transit systems and in recognition of the fact that transit crime had a different mobility dimension than other crimes, in the early 1900's many states authorized transit companies to develop their own security forces. Pennsylvania authorized one of the first such forces in 1901. The enabling legislation gave the "transit police" the right to "possess and exercise all the powers of policemen in the county in which they shall be so authorized to act." Other states gave transit security forces only limited powers, although New Jersey (1904), the Port of New York Authority (1928) and the New York City Transit Police had security forces with full police authority. The Chicago Transit Authority security force, established in 1947 with limited powers, was given full police powers in 1959, as were the forces in Boston (1968), Bay Area Rapid Transit (1970) and the six-county Illinois Regional Transit Authority (1973).

Up until the period after the Second World War, however, transit crime remained limited in scope and primarily directed against property. The negligible amount of transit crime corresponded to the general decrease in crime that accompanied the increasing urbanization of the United States. The 1950's and the 1960's, however, brought with them an out-migration by the middle class from central cities to suburban areas and a rising crime rate in the central cities. This rising urban crime rate was matched by an increase in crime on public transit systems. And this crime was increasingly directed against persons, (such as pickpocketing) and was violent rather than non-violent.

By the 1960's tensions within the society at large were reflected in the subways, elevated cars and buses of public transit systems. Roving gangs preyed on passengers, racial disorders spilled into the subways, and black and white passengers had violent encounters. Fare takers and concessionaires were under constant threat of being robbed, as were isolated passengers. And there were actual cases of the hijacking of city buses and transit vehicles. In response to this situation, transit security forces were increased, city police began to ride the lines, and various devices such as closed circuit television were utilized in an attempt to prevent crime from occurring. In New York, stations in high crime areas were closed and concessionaires were forced to hire private guards. Other urban areas with high central city crime rates, as well as European cities such as Paris and Hamburg, also experienced increasing rates of transit-related crime.

In summary, it is clear that crime on public transit is not necessarily a recent phenomena but has existed since the beginnings of public transit systems. On the other hand, over time the volume and the caliber of this crime has altered. Up until the Second World War, crimes against property, particularly perpetrated by pickpockets and some vandals, were common on public transit systems. However, the public did not necessarily view riding the subway or trolley as dangerous and although transit ridership fell during these decades, it was because of other sets of attitudes and ideas. Crime rates in the general population actually decreased as urbanization increased. In the 1950's and 1960's, however, with an increase in racial tensions and the increased concentration of poor and minority populations in the central cities, crime rates in the city increased and spread into the transit systems. And this tended to be violent crime directed against persons rather than the earlier non-violent crime typified by the pick-

pocket. In 1974 the "ding-ding-ding" of the trolley that had signified love in "Meet Me in St. Louis" was replaced by the chatter of the machine gun on the New York subway in the *Taking of Pelham, 1-2-3*.

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II. INTRODUCTION: CENTRAL ISSUES IN TRANSIT SECURITY*

Concern Over Crime: Chronic and Acute

Where does the issue of transit security fit into our thinking about public transit systems? To begin with, the question of security is often seen from two somewhat related economic viewpoints. Both proceed from a concern over the financial solvency of the system. One places emphasis on the direct cash drain crime imposes on mass transit; the other on indirect losses due to a decline in passenger revenues.

From the first point of view, crime on a transit system is seen as a pernicious theft of proceeds. Such costs include damage to the property and equipment itself by means of vandalism, cash losses in station booth robberies, and unrealized revenue whenever someone rides without paying. The system is seen as victim; its capital assets and cash stores directly assaulted. The loss of \$10,000 at station booths through robbery or the replacement cost of \$10,000 for vandalized seats or windows are regarded as equally corrosive to the precarious financial balance sheet of a transit system.

From the second point of view, a deteriorating image of a transit system also costs money. But here the costs are in terms of lost patronage. That is, patrons use mass transit less as they lose confidence in its ability to provide a secure ride. Hence the very same \$10,000, lost through booth robberies or vandalism, could be alternatively lost if 200 occasional riders (say, those riding one time per week) refrain from using the system at all. In one year this small group would account for about 10,000 roundtrip rides.

*Based on a report by Robert Shellow, School of Urban and Public Affairs, Carnegie-Mellon University, appearing in the proceedings of the Transportation Research Forum, San Francisco, California, October 10-12, 1974.

From either viewpoint, crime on mass transit is a costly affair. But the matter doesn't stop there. A third point of view must be considered, and that is the degree to which transit crime contributes to the urban dweller's sense of insecurity. Just how all this detracts from the overall quality of life in our cities is not easily measured by the cost accountant's yardstick.

Its sporadic visibility to the general public notwithstanding, crime on our public transit systems is and, as we have seen in the section on history, has been an ever-present problem. Characteristically, scant attention is paid to transit crime save for the periodic alarm generated by a single dramatic instance or the occasional rash of crime catastrophies. Thus, on March 12, 1965, a seventeen-year old was murdered on the "A" train of the New York City Subway System during the night. Mayor Wagner called for an increase in the transit police from 1200 to 3100 men at an annual cost of over \$13,000,000. On May 9, 1968, a Washington, D. C. bus driver was shot during the course of a robbery and on May 17 of that year another driver was murdered during a robbery attempt. Mobile police units of the Metropolitan Police Department were assigned to escort busses to dangerous areas and were positioned at terminals where busses awaited passengers. An exact fare procedure was instituted as an anti-bus robbery measure, a remedy soon adopted by most major cities in the United States. On July 5, 1971, a prominent and popular physician was murdered during a robbery attempt in a Chicago Subway station. Shortly thereafter, the Mass Transit Unit of the Chicago Police Department instituted a "decoy" strategy to apprehend would-be robbers. These are but a few of the measures taken in response to publicized crime occurring on public transit in the United States. Significantly, serious attention to crime as a problem indigenous to mass transit had to await evidence that a crisis existed. Then, characteristically, response followed a reactive pattern. Once the public was believed to be reassured, especially if crime temporarily receded, little further systematic attention was given to the issue.

First Efforts at Systematic Studies

Within the past few years, perhaps as a fallout of a preoccupation with "safe streets," concern over "safe transit" has spawned a handful of studies of transit crime. Such studies can also be seen as an offshoot of the increasing federal and local commitment to revitalizing mass transit as an important component in urban transportation systems. As we will see later in the paper, the product

of these studies consists of an array of scattered findings and insights raising more questions than they answer. To get a picture of our present state of knowledge, a short review is in order.

The first major study was commissioned in the late 1960's following a fivefold increase in the robbery of bus drivers and a tenfold increase in driver deaths between 1963 and 1968 (1). The purpose was to find a solution to the problem and before the study could formally recommend it, the "exact fare" procedure spread across bus systems throughout the United States and driver robberies came under control. This study also analyzed causes of crime, driver reactions to crime, possible alarm and photographic schemes, and the use of physical barriers.

In 1972, the City of Chicago contracted for a study of crime on its Chicago Transit Authority (CTA) (2). The volume of rapid transit crime (robbery, assault, battery, and crimes against persons) decreased by some 20 percent between 1971 and 1972 mirroring a decline in street crime (2, page 58). A 3 percent decrease in ridership during that period, however, held down a corresponding decrease in crime rates (2, page 56). Though the volume of crime dropped dramatically, the rates fell only slightly. Bus crime rose 28 percent during the same year with 44 percent increases in robbery and assault (2, Appendix, page 128). But despite its rise the volume of bus crimes was only a third, the risk factor only one-tenth, that on the rapid transit (2, page 200).¹ Of considerable significance was the finding that crime was particularly concentrated in those stations and sections of the rail system that ran through high crime neighborhoods (2, page 74 ff). Seventy percent of patron robbery occurred in stations, most frequently on isolated elevated platforms during the off hours. A special electronic surveillance/response system (Televue Alert System) was recommended to deal with this particular problem and has recently been adopted by Chicago.

During the same year, working independently of the Chicago study, the Rand Institute of New York examined the impact of transit police activity on crime in New York's Subway network (3). Though the overall volume of subway crime changed little across seven years (1963-1970) robberies did increase sixfold (3, page 13 ff). The

Rand Study independently confirmed Carnegie-Mellon's finding that high crime stations are located in high crime neighborhoods. Both studies came to identical interpretations, namely, that "robbers prefer to commit their crimes in familiar areas, perhaps for ease of escape" (3, page 44 and 4, page 3).

But the major thrust of the Rand study lay in its sophisticated analysis of the diurnal patterning of crime and the shift in that pattern associated with a massive deployment of police manpower during the 8 p.m. to 4 a.m. interval. Indeed, almost total coverage of trains and stations severely curtailed robbery during that time interval in addition to producing a "phantom effect," a reduction in crime during the daylight hours as well (3, pages 21 to 23). New York's distribution of crime between train and station conflicted with the Chicago findings for the year 1970 (about 50 percent on each); but by 1971 both studies were in line (with 69 percent at stations and 31 percent on trains) (3, page 33).

Finally, the American Transit Association (ATA) queried 37 U.S. and Canadian transit systems regarding criminal incidents occurring on their properties during 1970 (5). The ATA came up with an overall estimate of between 33,000 and 39,000 reported criminal incidents. In addition, the adjudged direct vandalism costs were reported as falling between 7.7 and 10 million dollars with an additional 1.85 to 2.33 million dollars in liability claims. This aggregation of data was based, as in the Rand Study, on information available in the files of the transit properties. Unlike Rand's direct use of police files, the ATA relied upon mailed questionnaires with a low return rate. For the most part reports of criminal incidents were of an "unverified" nature and thus were less reliable than the Chicago data, all of which were painstakingly verified by city police investigations. The ATA study paints the picture with a broad brush, but provides little insight of practical use to the design of control strategies. The ATA and Chicago studies came to diametrically opposed calculations as to the relative risk of crime victimization on transit versus the street; ATA contending that it is higher on transit, CMU, that it is lower. A further attempt to resolve this controversial issue is made in section III of this paper.

The extent to which crime affects ridership is still something of a mystery. Several surveys have tried to get at it but the relationship remains elusive. The survey conducted for the Chicago project by the Survey Research Laboratory of the University of Illinois's Circle Campus indicated

¹A risk factor is expressed in terms of a "crime/ridership index" or crimes per 1,000,000 entries on the system. In this case the crime/ridership for the bus lines was .7, for trains, 7.2.

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crime certainly was a factor both in selective use of the system as well as avoiding use altogether (2, Chapter 5). However, investigators at Marquette University found less of a concern over personal security in a sample of households responding to a mail questionnaire focusing on one bus route in the city of Milwaukee (6). An ATA "survey of surveys" concludes that some influence of worry over crime affected ridership behavior in Milwaukee, Washington, D. C., Baltimore, Cleveland and Chicago (7), but cautions that the extent of that influence remains unknown.

Other research on the topic of transit crime has been directed towards the knotty problem of whether police services should be provided by the transit system or by the municipalities and counties through which the system runs. These studies assume that traditional police patrolling is the preferred measure for providing patron security. (9, 10)

Research, then, on transit security is hardly at an advanced stage. What we are beginning to see is that careful studies are capable of revealing relationships which are meaningful to putting crime in its proper perspective and in designing anti-crime strategies. Despite the spotty showings of public attitude surveys, (to be more closely examined in chapter IV), we have taken a first step towards developing methods for assessing the impact of crime on system image and ridership. Naturally, even before we develop a full understanding of the security issue, measures are currently being undertaken and will continue to be employed to address the problem. Just which of the approaches presently available holds the greatest promise awaits the implementation of careful evaluative studies.

Reassuring the Riding Public

Transit managers have been exquisitely sensitive to the image that their system projects to the public at large. Oddly enough this preoccupation with image has in the past precluded researchers from systematically studying transit crime. For some time these same managers had been reluctant to assess objectively the magnitude of the crime problem for fear that by doing so, public disclosure of results would contribute to the deteriorating image of their system. In the last few years, however, this attitude has been replaced by the realization that by denying the problem, it won't go away. More and more transit properties are intent upon meeting the problem head on.

There are perhaps two basic approaches to improving the public image of mass transit. The

first is a reliance upon standard public relations techniques. Such campaigns emphasize the attractiveness of the system, its convenience, modernization programs—even presently employed security measures may be touted. Pursuing this approach exclusive of anything else runs the same risk of backfire that has occurred with public-relations-oriented police-community relations programs, where police image is improved but those citizens continually exposed to crime come to regard police with distrust and ultimately cynicism.

The second approach begins with an attempt to do something of substance about crime, and if favorable results are obtained, giving those effects high visibility through the public relations process. The latter approach, though not likely to put off the persistent critics, might very well, over the long haul, stand a good chance of improving the image of the system and convey to the riding public a valid impression that a transit system is struggling with its problems and cares about its patrons.

The fly in the ointment is the intrinsic dependency of public relations efforts on the media and the unpredictable role they play in controlling the image of transit as a hazardous environment. Serious crime makes good copy. Perhaps there is something about people being captive to the system when they are victimized that contributes to a sense of public alarm and outrage, which, in turn, commands the immediate attention of readers or viewers. But a media-generated image of danger cannot be created out of whole cloth. Regularly occurring instances of serious crime are required to feed periodic news stories which fashion that image. The number and frequency of crimes required in order to project the image of a crime ridden system are matters for conjecture. Presumably, not many crimes are required. In Chicago, transit crime hits the news about every other week. It is discouraging to note that the CTA experiences about 1100 serious mass transit crimes each year. Since only 26 such crimes are required each year to feed the image-making process of the media, reducing crime by one-half or even three-quarters conceivably could have little effect on media coverage. The problem becomes one of enlisting the aid of editorial management in presenting a balanced view of crime on a system. Obviously it is a delicate matter to ask the media without encroaching on their First Amendment rights or their obligation to report the news, to assume a responsible role in treating a social problem.

Crime Reduction

There are perhaps three basic crime control strategies applicable to the transit scene. The first is the traditional reliance on an increase in police manpower, including flexible deployment strategies directed towards specific crime problems. The second lies in an expansion of experimentation with electronic or other devices to complement police patrol, enhancing the effectiveness of police response. The third is an operational matter, that of eliminating stops in those portions of the city where street crime is high. It follows the common-sense notion that high crime stations are located in high crime environments, a conclusion which is now confirmed by the two studies mentioned above (2) (3).

Choosing Between Alternative Approaches

An important consideration in settling on the security measure of choice is an evaluation of its cost-effectiveness. Public transit will probably never be self-supporting. It is safe to assume that it will always be subsidized even if made more efficient. The very existence and continuance of public transit is predicated on the contention that it is a public good or public service, similar to garbage collection, sewage, water, fire and police protection. None of these public services are expected to or are likely to pay for themselves. Though the public is reluctant to provide public financing for mass transit, it has come to regard it as a right. Indeed, it is probably as important and necessary to urban life as the other services provided by a responsive government. In this regard, being secure in one's person and property on public transit may also be considered a reasonable right of patrons.

The goal then, is to provide adequate protection to those patrons, but not necessarily at any cost. The protection should be optimal, the price tag, acceptable. When selecting from say, two equally effective crime reduction approaches, the least costly one should have the edge. To rely exclusively on manpower for that protection, is indeed very costly. Not only is the cost borne by taxpayers during the years that manpower is increased and sustained, but substantial additions to civil service roles serve to mortgage future generations of city dwellers as they assume the burden of retirement programs. Further, recent studies of police patrols on the streets of Kansas City have raised doubt as to the effectiveness of random patrol (8).

Substitution of electronic and mechanical devices for manpower may in the long run be less expensive, but they may also fall short of produc-

ing the same sense of assurance that the sight of a uniformed policeman can evoke (2, Ch. 5). Reducing stations in high crime areas, though likely to be an effective measure with immediately observable results, can be undertaken only in callous disregard of the needs of people already disadvantaged by poverty, congestion, and lack of transportation alternatives.

A reasonable and responsible approach then, would attempt to combine some optimal mix of security measures. One such mix would involve a redeployment of manned patrol complemented by electronic systems where control is difficult and costly to maintain.¹ But most importantly it must be kept in mind that whatever the mix is, it must be tailored to the special conditions of each city. It is unlikely that a single formula can be applied to all cities with equal appropriateness. A more detailed discussion of counter crime measures appears in section V.

The several chapters of this report probe in detail each of the issues identified in these introductory remarks. The first chapter places the phenomenon of transit crime in an historical perspective; the third examines the question of crime measurement and opens up the controversy over comparative risks on transit systems as opposed to the city streets. The fourth lays out what is presently known about the role transit crime plays in fashioning public attitudes towards transit systems and the willingness to take chances in using it. The fifth chapter looks into past, present, and proposed measures for countering crime and increasing public confidence, followed by the sixth, an attempt to project what we already know to the new generation of automated small vehicle fixed guideway systems. The final chapter summarizes the recommendations of the workshop with regard to what we need to know if the matter of patron security is to be brought fully into a rational planning process for old systems as well as new.

¹See the discussion of such a system designed by the CMU group, "the Televue Alert System" (2) Chapter 6.

crimes, but only on the number of arrests for such crimes. However, in the context of transit systems, these "less serious" crimes may nonetheless have an important impact on the public's perception of safety on the system. So the absence of reliable methods for gauging the frequency of these activities, while not a problem peculiar to transit systems, is not to be overlooked as a serious methodological difficulty.

In general, research into mass transit crime is going to require more complete and different information than is currently available. Special household surveys have already been conducted to determine victimization rates in some cities, but these are too expensive to be carried out routinely. Unfortunately, the National Crime Survey, which is being conducted by the Census Bureau for the Law Enforcement Assistance Administration, categorizes the locations of crimes in such a way that transit crimes cannot be distinguished from crimes in stores, restaurants, or other commercial establishments. Thus this instrument, which was designed to permit distinguishing "reported" crime rates from "true" crime rates, will not be of use for analysis of transit crime.

Computerized systems can furnish valuable information from police reports, but only if the information appears on the reports in the first place. A very helpful and probably necessary innovation is the development of a standardized police crime report form which would be used to report transit crime across the country. The New York transit police are currently using a form which contains more information as to location of crimes than most standard forms and might profitably be used as a starting point for developing a new standard form.

There is also a problem of determining the extent to which crime rates are affected by anti-crime measures. Even such general phenomena as changes in people's values, attitudes, lifestyles and income levels are all relevant to transit crime. If transit crime rates decreased in a city where unemployment levels dropped and per-capita income rose significantly, transit operators would probably be mistaken to believe that some particular change in security had caused the change.

Turning now to those problems of crime measurement that are unique to transit systems, we encounter the following particular difficulties.

1. An unambiguous determination of whether a crime is or is not related to the transit system is not always possible. Part of the problem here is related to the operation of the crime reporting system. Especially in

III. MEASURING RISK

Problems of Method

On the one hand, transit crime shares with all other crime certain methodological problems of measurement. On the other hand, it has some unique features of its own. The common problems shared with all crime types are (a) discretion of the police in reporting crimes, both with regard to whether they are recorded at all and also with regard to the classification of those that are recorded; (b) the failure of some crimes to come to the attention of the police; and (c) the lack of any uniformly applied scale of seriousness for crimes or format for reporting such details as would be needed to rate the seriousness of the crime.

As a consequence, it is possible, for example, for police statistics to show a decrease in the reported number of robberies on some transit system, and yet it would require considerable effort to determine whether the problem of robbery has in fact lessened or whether the actual explanation is one or more of the following:

- A smaller fraction of robberies on the transit system are being recorded.
- Some types of crimes previously recorded as robberies are now being recorded as purse snatches or something other than robbery.
- There is a smaller number of robberies, but they are now more serious or involve more victims than previously.

Certain types of crimes, such as possession of drugs, loitering for purposes of prostitution, vandalism, and others that the FBI classify as "Part II," are so unlikely to be reported by members of the public that the number of them that are recorded is a direct function of the extent of police effort. For this reason, the FBI does not even compile statistics on the numbers of Part II

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cities where a special police force protects the transit system, a simple separation may be made between crimes reported to the transit police and crimes reported to the city police. If a person reports a crime that occurred on the transit system to the city police, it may not be entered into statistics for transit crime. Indeed, it is a common experience for researchers to inquire of city police as to whether they may obtain tabulations of bus robberies and find that no such statistics are kept.

Should the researcher desire to produce a special tabulation, it may be necessary to inspect the text of numerous crime reports if there is no special place on the form for the police officer to indicate that the crime occurred on a bus.

Aside from these problems related to the crime reporting system, there is also an ambiguity as to whether or not some types of crime should appropriately be considered transit crimes. Included in this category are robberies and assaults of persons who are either waiting for buses or walking to or from transit systems. For practical reasons the latter are usually excluded from transit crime, since at present most crime reports do not note where a person was going when he was the victim of a crime on the street. However, the fact that a patron of a transit system must pass through areas he knows to be of higher risk than the places he normally frequents is not an unimportant characteristic of these systems. The adoption of a uniform crime reporting format and system in all major cities would be a considerable aid to research.

2. The next methodological problem peculiar to transit crime is that some classes of crimes do not have patrons as victims in any meaningful sense. Instead, the system itself is the "victim." Included in this group are robberies of fare collectors, vandalism of transit system property, and theft of service (getting a free ride). Other crimes, such as robberies of concessionaires, are neither directed against the system nor against the riding public. Such differing sorts of crimes may have very different effects on transit ridership. Vandalism, for example, may discourage ridership by the sort of continuous, if subdued and latent threat it suggests, while robberies of fare collectors may pass almost unnoticed by the vast majority of

customers in the actual vicinity of the robberies.

In attempting to calculate a victimization rate for patrons of the system, it seems appropriate to exclude all crimes of the types just mentioned, and yet it seems likely that the public's perception of the extent of transit crime is influenced by events such as these. Even if a transit system could assure that there would be no crimes against the public, daily reports of robberies and shootings of transit system employees would be adequate to convince the public that the system is unsafe.

Finally, there are classes of crimes for which the public in some generalized sense is the victim, and yet no particular patron is the victim. These include public drunkenness, sales of drugs inside the transit system, littering, and the like. In attempting to measure the amount of transit crime and compare it with crime elsewhere, is it appropriate to include or exclude such incidents? Do these incidents, some of which are anti-social but not criminal, have an impact on ridership?

3. Next, we come to the thorny problem of developing appropriate normalized measures of crime rates that will permit comparing the extent of crime among transit systems, among different parts of the same transit system, or among different times of day in one part of a system. Measures traditionally used for comparing municipal crime rates, such as robberies per 100,000 population, are clearly inadequate in the context of transit crime. Primarily this is because the size of the system is ignored in a per-population measure. A city that chose to have no public transit could achieve a rate of zero transit robberies per 100,000 population.

Other measures that have been used or proposed include crimes per revenue passenger, crimes per vehicle-hour, and crimes per vehicle-mile. The American Transit Association compared several systems according to these measures and showed that relative rankings depend on which one is used. In addition, the study criticized all the measures for failing to distinguish between revenue passengers and "users." "A person riding twice a day 300 days a year counts as 600 revenue passengers, but he is only one user." (5, p. 111-15). The ATA proposed an

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exposure index for measuring crime rates. A modified version of this index appears suitable for comparing on-system with off-system crime rates, but further research is needed on this issue. A discussion appears in Appendix I.

4. The next problem is that of availability and reliability of the information needed to calculate appropriate transit crime indices. Presumably, transit systems do not usually collect the data required to calculate the exposure to risk. Indeed, the exposure index in the ATA study is calculated on the assumption that the average time spent in the system is 15 minutes. This appears extremely questionable, especially for fixed-rail systems, suggesting that no reliable statistics were located. (Average time spent in the system ought to mean the amount of time elapsed from the moment the patron enters the system until the moment he leaves, and therefore it would include various waiting times as well as travel times.)* Origin-destination studies will be required to establish more accurate estimates of "average time." Since some new systems have ticket-in ticket-out procedures for collecting fares, it may be possible in the future to study the times spent on the system in considerable detail.

A comparison of crime inside and outside the system is valid only if what is compared are "true" crime rates. Using *reported* crime rates may distort the comparison if reporting practices differ between on-system and off-system crimes.* But as was mentioned above, we are far from having any reliable victimization data to compare with reported transit crime figures.

5. Even if suitable on-system and off-system crime rates can be calculated, there remains the methodological difficulty that the potential transit system patron is not logically

*It is noteworthy that other definitions of "average time" are possible. Some researchers believe that the problem of security begins when a patron decides to go somewhere.

*The hazards for researchers who use police crime reports are highlighted by the recent resignation of Robert Rapp, longtime chief of the New York Transit Police, under circumstances where he admitted to "encouraging the making of false entries concerning the times of commission of crimes in official departmental reports." The Rand study (3) was partially based on assembling information from transit police reports whose accuracy is now placed in doubt.

faced with a choice between using the transit system or staying at home or in his neighborhood. Instead, he is faced with a choice between using the transit system and using some other means of reaching his desired destination. Since the probability of being robbed while riding in one's personal automobile must be extraordinarily low, it may well be that no reasonably achievable crime rates on transit systems will ever compare favorably with such alternatives in regard to safety from crime.

6. In order to more fully understand what choices are available to the transit patron and to better understand who the patron is, patron stratification studies as to sex, race, age and income need to be done.
7. In using transit crime rate data to evaluate various intervention and prevention activities, the possibility that crime is being displaced to other times or targets should be explored fully. However, the number of transit crimes is ordinarily small in comparison with the number of crimes committed against reasonable substitute targets, so determination of the extent of displacement effects may be extremely difficult.

Review of Findings to Date

The ATA study previously cited obtained aggregate annual data for 38 transit systems and calculated the violent crime exposure index for fourteen (14) major systems. This index is somewhat suitable for comparison with the FBI violent crime index, but it included an assumption that all systems have the same 15-minute average duration per trip. The findings using 1971 data were as follows:

System	Violent Crime Exposure Index (EI)	Ratio of EI to FBI Violent Crime Index
San Antonio	0	0
Cleveland	450.9	0.4
Phila. PATCO	519.0	0.7
San Diego	578.4	1.9
NYCTA	662.7	0.4
Baltimore	856.3	0.5
Phila. SEPTA	1763.6	2.3
Los Angeles	2084.9	1.8
Boston	2571.3	2.3
Seattle	2637.5	4.4
Indianapolis	2813.0	6.2
NYC PATH	2821.0	1.7
Milwaukee	3678.6	54
Chicago	6491.8	5.7

These figures are extraordinarily suspect. For example, the NYCTA EI is based on an assumed total of 305 violent crimes for 1971, while The New York City-Rand Institute (3) reported 565 passenger robberies in NYC subway system for just the months of January to April 1971. Similarly, a Carnegie-Mellon University study of the Chicago transit system (2) reports 783 robberies in 1971, while the EI is based on 714 violent crimes, total. The San Antonio figure of zero is, of course, suspect on its face. Evidently a more careful process of collecting data and checking definitions of crime types is needed, rather than the mailed questionnaire used by ATA, but it does seem feasible for reasonable comparisons of this type to be made in the future.

The Carnegie-Mellon study just cited made a comparison between robbery rates on the Chicago transit system and robbery rates in the rest of the city, concluding that robbery rates were lower on the transit system. This is the reverse of the ATA findings for Chicago, shown above. However, there may be a conceptual error in attempting to compare the index used in the Chicago study (robberies/ridership) with the FBI crime index. Suffice it to say that we do not have in hand a measure of patron risk which is easily and practically applied to the transit environment.

In any case, there is some question as to whether such a comparison is needed.* To begin with it is inappropriate to consider that people sitting at home are exposing themselves to crime in a way comparable to people using the transit system. But that is what would be done if one compares patron exposure during his brief stay in the transit system with his exposure to non-transit crime during the entire time he is out of the system, including the time he is in his home. There is also the problem of knowing what to measure. It may be that the primary worries of transit patrons concern crimes that are traditionally considered non-serious and that rarely involve arrests. Perhaps the most difficult problem of all is that even if statistics showed that it was safer to ride the system than to be at home, such statistics might not mean anything to persons who had been robbed or brutalized in some way on the transit system.

The New York City-Rand Institute study did not attempt to compare the amount of subway

crime with city crime in New York,* except in regard to rate of increase, which was found to be substantially higher for robberies in the subways. Comparisons among stations and among times of day were performed both in Chicago and in New York, leading to the following findings in common:

- In the absence of special police effort at night, more transit robberies will be committed during a nighttime hour than during a daytime hour.
- Even when special police patrols are used at night, the transit robbery victimization rate is substantially higher at night than during the day.
- Stations vary by a factor of 40 or more in crime rate, and the highest crime stations are located in the areas having the highest nontransit crime rate.
- Uniformed police patrol on transit systems decreases the number of crimes there, but the effect may be simply a matter of displacing crimes to other targets.

Portraits of particular types of transit crimes, their victims, and their perpetrators have been developed in the Chicago and New York studies and in a major study of bus robberies and assaults. (1) Findings that appear to have some generality are the following:

- Passengers who are robbery or battery victims tend to be lone individuals, while the perpetrators often belong to groups of two or three.
- Firearms are rarely used in crimes against passengers, but in a minority of instances the victim suffers serious injury from fists, knives, or other weapons.
- Robbers of passengers tend to be extremely young, male, and black.
- Perpetrators tend to exit the system as rapidly as possible.
- Some transit robbers' careers include a large number of crimes committed in rapid succession, and even an arrest does not cause a major interruption.

*Representatives of transit properties who attended the Workshop on Transit Security were unanimous in the view that a determination of whether their system was safe or less safe than the city as a whole would be of no practical use to them.

*Those who conducted the New York study found the lack of information about numbers of persons entering and leaving given stations, and about the average time such patrons spent in given stations, a barrier to making meaningful comparisons.

Other findings of these studies, related to the deterrent effort of police activities and the effect of crime on ridership are discussed elsewhere in this paper. These are questions of considerable importance deserving research in the future to supplement what is already known.

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IV. THE IMPACT OF PUBLIC PERCEPTION OF CRIME ON MASS TRANSIT PATRONAGE

PART I

The Major Questions

At this writing we are only beginning to study the impact of perceived danger, real or imagined, on the willingness of people to patronize public transit. Methodology for conducting these studies and the sorts of questions that should be asked are in developmental stages. The first major problem that such studies must resolve is the relationship between actual crime on the system and the public's awareness of crime. Secondly, the public's attitude towards its perception of crime must be determined. Thirdly, it must be determined whether or not the public's attitude toward crime affects its patronage of mass transit systems, and if so, in what ways.

Studies to Date

Only a few published, substantive studies exist in the area of public perception of crime and its impact on transit ridership. Those focused on in this paper are representative of the type of work done in this area at the present time. These studies were done in:

- Milwaukee (A Study of the Attitudes of Transit Users and Non-Users Toward Crime, Vandalism, and Passenger Security Problems and Their Relationship to Transit Patronage on Bus Route 60, Milwaukee and Suburban Transport Corp., Milwaukee, Wisconsin, by the American Transit Association.)
- Washington, D. C. (A Study of the Attitudes of Transit Users Toward Crime, Vandalism, and Passenger Security Problems and Their Relationships to Transit Patronage on the Pennsylvania Avenue/Wisconsin Avenue Bus Route, Washington, D. C., Metropolitan Area Transit Authority by the American Transit Association.)

- Baltimore ("Baltimore Patronage Study" by the American Transit Association. Studied a particular bus route.)
- Cleveland ("Cleveland Patronage Study" by the Cleveland Transit System. Studied particular adjacent rapid transit stations.)
- Chicago ("Personal Safety Involving Victimization on Public Transit" by N. Ferrari and M. Trentacoste. Examined patron choice between parallel modes: an express bus line and a rapid transit line.)
- Chicago ("Chicago Transit Security Study" by the City of Chicago, carried out by Carnegie-Mellon University. The only survey to cover a city's entire public transportation network.)

Limitations of Studies not Surveying Passenger Attitudes

The Baltimore and Cleveland studies consisted of approximations of the decline of ridership immediately following a major crime on the systems. Neither study surveyed passenger attitude and neither accounted for the possibility that while some riders may have purposely been avoiding the route where a crime occurred, they might be using alternate-route public transportation.

In the Baltimore study, the crime involved was that of an armed robbery of the driver and passengers on a city bus. The incident occurred in mid-afternoon on a Wednesday in August. The "before" ridership statistics were taken from a count done three weeks previous to the incident and the "after" count was done exactly one week after the incident.

The raw figures gathered from three ridership check point locations showed approximately a five percent decrease in ridership on that route. However, comparison of these figures with annual ridership fluctuations shows that August—a favorite vacation month—traditionally displays a drop in ridership from July. In addition, a number of problems were noted in the method of the ridership count itself. For one thing, no actual headcount was taken. Instead, personnel made educated guesses as to the number of patrons they estimated to be on each bus. In view of these factors, the City of Baltimore decided that "... the possibilities of error were so numerous as to raise serious questions about the validity of the figures. . . . It was concluded . . . that because of the many imponderables, it may be unfeasible to reach conclusions in a situation of this type."

In Cleveland, an evaluation of somewhat the

same nature was done. An attempt was made to evaluate the effect on ridership of a homicide which occurred at a rapid transit station. The evaluation found that the ridership at the station where the homicide occurred and at adjacent stations along that segment of the system showed a decrease for at least three weeks after the crime. Although it was noted in the in-house memo which described the evaluation that an overall decrease in ridership had been occurring for months previous to the homicide, Cleveland officials concluded that the crime did have a short-term effect on ridership at the station in which the crime occurred.

Because no direct survey of passenger attitudes was taken, patrons who might wish to stop riding public transit, but who have no alternative mode, could not be taken into account. Nor could an estimate be made of the numbers of persons who avoid public transit because of fear of crime, who only have this opinion strengthened by incidents of transit crime.* Even if it is decided to ignore attitudinal changes resulting from transit crime, both studies failed to isolate the criminal occurrence as the direct cause of ridership changes. To attempt to verify a connection between ridership changes and a criminal occurrence, the effects of all extraneous factors, such as extremes in weather, school openings and closings, and inaccuracies in the ridership count would have to be filtered out.

The Use of Questionnaires

A difficulty encountered by all the studies using the questionnaire technique was the inherent "bias" of the topic: crime. The Ferrari-Trentacoste study admits that its questionnaire was readily identified by respondents as dealing with crime. This they felt, probably resulted in a greater concern for transit crime than a less direct, more subtle questionnaire would have generated.

Such a subtle questionnaire was developed by the American Transit Association. The form used was limited to one question directly addressed to crime in order to avoid the bias problem. Obviously this limited the amount of data that could be collected regarding citizen views of crime.

The Transit Security Study by the City of Chicago, having the necessary time and funding, was able to carry out as one aspect of its investigation an extensive, highly sophisticated

interview which focused initially on transit service, then gradually turned to the issue of transit crime. The questionnaire consisted of 19 pages with 45 questions, a majority of which were of a multi-part nature. The form took approximately 30 to 35 minutes to administer. The results appear to have muted much of the "knee-jerk" reaction associated with discussions of crime by easing or moderating the conscious concern the citizenry has over transit crime.

In the Milwaukee and Washington studies, which concentrated on a particular bus route, very similar questionnaires were used. The Washington questionnaire in fact, was an outgrowth of the Milwaukee questionnaire although there were slight variations in the method of distribution of the two studies. In Washington, all questionnaires were given out by hand either on the bus, at bus stops, or at shopping centers along the route. In Milwaukee half of the questionnaires were hand distributed on the bus with a mail-back option while the other half were sent to selected addresses along the route. It was decided to use the mail-back option when, in the pre-test, it was found that a number of transit patrons were unwilling to complete the questionnaire while in transit, but were willing to complete the form at home and return it. Also, because many of those approached in shopping centers were reluctant to respond, probably because they were non-transit users, the decision was made to have a second distribution of the questionnaires by direct mail.

In Chicago the survey performed by Ferrari and Trentacoste patterns closely those studies completed by the ATA in Milwaukee and Washington. The survey was limited to a portion of the CTA system and used the "mail-back" questionnaire technique. The questionnaires were distributed in two ways: approximately one-fifth of the total were distributed by hand at stations, on the street, etc., in the target area. The remainder were mailed to selected residents. A total return of less than fifteen percent was received. In gathering the data no systematic approach was used to assure that the sample would be a true cross-section of the particular universe; and the sample size would appear to further jeopardize its representiveness.

It must be further pointed out that the bus route examined in this study was not chosen as a miniature profile of the CTA system. It was instead, selected for its proximity to another mode, a rapid transit line, so as to investigate the relationship between patrons' perception of crime and modal choice.

The other perception study done in Chicago

*See Appendix II for a study of defensive behavior as seen in rapid transit patrons.

was by the City's Department of Public Works. It differed from all other studies in that it was designed to cover the entire Chicago Transit Authority and drew a sampling of transit riders and non-riders from all parts of Chicago. Carried out by the University of Illinois' Survey Research Laboratory Center under the direction of Carnegie-Mellon University, the survey questionnaire was administered by telephone rather than by mailing or through direct personal interviews.

The rationale for utilizing the telephone was several fold. Since the survey was to include the entire city population, the use of the phone was seen as the optimum method to obtain a cross-section from all areas of the city from riders and non-riders alike. The survey used "random digit" dialing as a means of potentially including unlisted numbers and thus guarantee a high degree of representiveness in the sample. It was found, too, that voice to voice contact generated a high percentage of cooperation—the survey had a response rate of 72 percent. Also the interviewers were right at hand to clarify any confusion over the questions, although all interviewers were carefully instructed to avoid leading the respondents.

Now that the methodology of a number of recent studies has been briefly described, it is perhaps appropriate to note that more thought needs to be given to the general question of methodology of conducting transit questionnaires. What questions should be asked of whom? Instead of treating all respondents to questionnaires as if they are alike, it is perhaps advisable to make prior distinctions among broad categories of respondents and ask particular questions of each category. The categories can be established by surveying an office building in the central city to find out how people get to work, whether or not they patronize the transit system during the day, even if they do not ride during peak hours, and whether or not they ride the system at any other time. When the various categories of respondents are figured out, questions for each category can be asked. For example, if a respondent has a job in a location which would prevent his riding the system to work, it does not make sense to ask him how he feels about crime on the system during rush hours. If he has occasion to ride during off-hours, it would be appropriate to ask him questions about the system during that period of time. If another respondent drives to the city but has occasion to travel within the city during the day, it would be appropriate to ask questions both about his driving and also about his possible or actual use of the system during the off-peak hours.

Crime/Perception/Ridership

It is readily evident, even from the limited knowledge which exists, that patrons' perception of transit crime significantly affects their daily ridership patterns. It is also clear that these perceptions are not necessarily related or correlated with the actual level of crime but rather appear to relate to the total environment in which an individual lives.

A long-standing belief of many transit operators has been that the level of transit crime is exaggerated far beyond its actual proportions by the general citizenry. However, it is difficult to suggest to a transit patron that he is exaggerating the seriousness of transit crime.

Comparisons of various crime environments have been made showing relative risk in each environment. The crime figures for different environments have been compared to citizens' perception of crime in those environments. As mentioned earlier, the Transit Security Study in Chicago concluded that the streets were far more dangerous than the public transit system, while the ATA study came to the opposite conclusion. In the Chicago study, however, the citizen perceived the streets as being a safer part of the rapid transit trip than the actual premises of the rapid transit system. Whether the perception of respondents was accurate or not awaits the refinement of a more convincing method for determining the relative crime risks on transit and street. (See Chapter III.)

The significance of the citizens' perception of transit crime as it relates to their ridership is extremely difficult to pinpoint. This results from the lack of data, the conflicts among that data which exist and the extreme complexity of the motivations for human actions. Therefore in New York, Boston, or Chicago, for example, it is difficult to emphatically state that a specified number of persons do not ride because of crime or the perception of crime.

A major concern that needs further research with regard to patron perception of crime is the question of what activity the patron perceives as criminal. It is possible that researchers are currently defining crime in a way that does not relate to patron concerns. There is some evidence, for example, that patrons are offended by other patrons' use of obscene language, the making of thinly veiled threatening gestures, kissing or petting on the train, rowdiness by teenagers, and acts which indicate a contempt for and even a desire to disfigure the transit property. These activities and others like them almost never result

in arrests. Even if it is determined, then, that such activities disturb patrons and possibly have a detrimental effect on ridership, it would be impossible to do a statistical study based on arrest records to determine the actual occurrence of these activities. This sort of problem leads some researchers to believe that if transit authorities are to spend their security money on matters that most concern patrons, it is more important to research patron attitude than actual crime occurrence as shown by police records.

Present data indicate that a patron's perception of crime depends upon the socioeconomic characteristics of the patron, the mode of transportation he uses, and when and where the patron uses public transportation. In general it is clear that the citizenry rates personal safety as a concern of greater importance than other standards that have been used in the past by operators to determine the operating patterns of the transit system. It is a consensus opinion of all studies available that security is the prime reason given for not riding in the off-peak hours of the evening.

In the Chicago Transit Security Study 64 percent of the bus-only riders, 75 percent of the rapid transit only riders, and 62 percent of those who ride both modes stated that there was a time when they would not ride the system. Over 80 percent of the riders indicated a reluctance to ride between 6 p.m. and 6 a.m. and gave personal security as the predominant reason. All but four respondents out of 713 said they would not ride after 12 midnight. Other choices in this question included "not convenient," "dislike the class of people," "wait too long," and "not used then." Left unclear in these results is the impact on ridership; it is clear the citizens perceive this period to be unsafe and that it would affect their travel, but it is unknown whether they would ride if the system were considered safe. One has to wonder if it is fear of the system that discourages people from riding after midnight, fear of getting to and from the system safely, or whether they simply have no need for the system in that time period in any case. This is an important consideration from the operator's point of view, considering the financial strain most public transportation systems are facing. An operations planner is going to be skeptical of investing his limited resources in early morning security unless there is some assurance of a reasonable return.*

*What is "reasonable," however, will depend to some degree on what the problems of the system are. The Rand study points out, for example, that increasing police patrols significantly during the off-peak hours in New York had the effect of significantly decreasing

Perception of Crime by Chicago Patrons

The clearest demonstration of the impact of perception of crime on a transit patron's riding behavior is the patron's decision of which mode to ride. Again, existing knowledge has not as yet been developed into firm statistics of ridership choice. It is clear, however, that in the Chicago surveys at least, the rapid transit system was perceived as less safe than the bus system by riders and non-riders alike. Patrons were directly asked which they considered the safest, the buses or the rapid transit trains. Seventy percent chose the buses as the safest mode while only 16 percent chose the trains. In addition, in the same study, bus-only riders cited security as the second more predominant concern for riding the rapid transit system, whereas concern for security on bus by rapid transit only riders rated no better than sixth in the quantity of responses. For riders who use both modes, the rapid transit system is also viewed as the most dangerous.

When the various components of a trip on public transportation were ranked by Chicago patrons, the patrons chose the bus ride as the safest, and waiting for the bus or walking to the public transit system as the next most safe aspects. The areas perceived as least secure by the patrons were the "stairs, rampways and tunnels" of the rapid transit system. Following in order of increasing security levels were "waiting at the rapid transit stations" particularly on the platforms, and "riding" the train. Assuredly, caution has to be used in generalizing from these figures for they are based on data coming from only a single city. It is interesting to note, however, that the perceived level of insecurity on the part of the citizen and particularly on the part of the transit patrons parallels very closely the pattern of actual crime occurrence on the system. Most transit crime occurs on the rapid transit system rather than on the bus, and within the rapid transit system itself the occurrence of crime is more frequent at the station than on the trains.

The Attitudinal Impact of Patron Crime Perception

Drawing largely from the Transit Security Study in Chicago, it was found that massive variations in perception exist among the sub-groups of transit

serious crime during those hours. Gradually, however, serious crime increased during other hours, when police patrols were less concentrated. But patrons (witnesses) were more concentrated. Therefore, the nature of the increased crime changed and the offenders were forced to commit crimes during times when they would normally choose to avoid committing them.

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patrons. It has been believed by some that the greatest impact of crime occurrence is on those who are furthest from the scene of the incident. Recent indications show that this premise requires some modification. Both Chicago surveys show that the highest levels of perceived crime come from lower income, black, and the older aged segments of our society. But, the higher income, white segment cite security more often as the *reason* they *do not* ride public transit. One explanation of this phenomena is the different groups' actual degree of choice. The black, older, lower income citizens tend to be captives of the public transit system. Because they have no alternative mode of transportation, they tend to ride more frequently, and thus are more frequently exposed to crime. They also tend to ride more frequently during high crime periods or in high crime locations. It seems likely, however, that attitudes of both groups are adversely affected when they witness crimes or when their friends or relatives have been victims.

Summary

From the data available, it is clear that the citizen's perception of crime on public transit, and riding or not riding because of this perception, is likely to emerge as an essential ingredient in the planning and the operating of public transportation. It is unclear from the existing information whether or not the perceived level of crime accurately reflects the existing occurrence of crime. For the transit planner, this is critical in terms of choosing strategies of operation, marketing techniques, and so on. If the level of crime is exaggerated, then a communication/marketing strategy might be the most appropriate course of action. If citizens' perception of crime reflects the climate accurately, then it may be more appropriate to develop an effective deterrence/security program.

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PART II

IMPACT OF PERCEPTION OF CRIME ON MASS TRANSIT PATRONAGE: A PERSONAL VIEW

We have examined some of the concerns and problems of researchers who deal with how the public views crime in mass transit. Let's turn now a more personalized view of a single mass transit patron who is also an environmental psychologist, Harold Proshansky. The remarks that follow are excerpted from his address prepared for The Workshop on Transit Security.

Facts, Fears, and Fancies in the Public Transportation Patron

"My concern with security, safety, and dehumanizing experiences of bus and subway transportation began in the middle sixties but really reached its peak in the 1970's after spending a year living in London. Since I used the subway—or if you prefer, the underground—in both cities, the culture shock I experienced when I returned to New York City in January of 1970 was traumatizing to say the least.

I suppose you could say that my deep concern about public transportation in urban settings arose from purely personal experiences. After all, from 1962 to 1967 I used the New York City subway on a daily basis to go each morning from my home in Brooklyn to do my job at City University of New York's Graduate Center on 42nd Street, and returning, of course, to my home in Brooklyn at the end of the day. I also used the subway and indeed the various buses as well for a variety of other purposes. When I returned from London I continued the same routine, and if I was concerned before, I was now frantic. I will not describe all that happened to me, but merely tell you that a colorful summation of my remarks after an interview by the New York Times regarding the views of an environmental psy-

chologist on the New York City subway, I was quoted as saying that I was "sat on, spat on, and shat on" in the subway. I don't know whether or not those were my exact alliterative words in the interview, but nevertheless they were accurate enough, not to mention the other human indignities of crowding, system breakdowns, and constant fear of accidents, delays and personal abuses.

In the midst of all this there is, of course, the matter of security in transportation, or to put it in simple and direct language: "worrying about getting beat up, robbed, mugged, wounded or even just plain killed." For me as an environmental psychologist, the problem is not just how frequently it happens; but having it happen frequently enough so that the public transportation patron who does not have access to an alternative means of transportation, enters, uses, and leaves the public transportation conveyance in a state of apprehension, suspicion, or terror. Putting all these things together, helps me to recall that Mina Rees, the former President of the Graduate School and University Center, said to me some years ago, "I no longer use the subway in New York City and I never will. It's a degrading human experience."

Of course, at the present time, it's not just degrading, it's dangerous. Indeed it may be fatal. As I review what data there are, it's not just New York City, but Philadelphia, Paris, France, Boston, and still other cities.

My deep concern, however, about public transportation goes well beyond these critical matters of human dignity, safety, and personal security. It is evident that what is happening in public transportation—and not just in subways but in bus systems as well—is merely symptomatic of what is happening in large and small urban centers. The problems of public transportation are merely the manifestations of the problems of cities. What is at stake is not just the viability of public transportation but the meaning and efficacy of urban life.

It could be suggested that with great outpouring of funds over an extended period of time our major urban centers would be saved and with new public transportation. This may well be true but who can possibly wait? The demise of mass transportation in conjunction with an already auto-infested urban life can only hasten the decay of our cities.

Concepts such as freedom of choice, privacy, strategic nonsocial action, environmental control, territoriality and personal space all have relevance to the problem of public transportation and more

particularly the special questions of safety and security. Studying the patron of public transportation in the context of these concepts should help us understand what the patron thinks, wants and believes, and perhaps how to reduce the effects of threats to his or her security. The comments that I make later on are made with this hope, but are also made about public transportation in the very large urban American city. I suspect that the solution to problems of public transportation in a given city will require an analysis based on that city's particular population of users, the physical features of its transportation system, the nature of the threats to the security of its patrons, and even something about the sociocultural history of that community.

Let me talk first about the "facts" that pertain to the public transportation user. Some of my facts are self-evident, whereas others are based on my research experiences with other kinds of physical settings. One thing is certain, whether or not the facts I present—or indeed even the "fancies" and "fears" to be described below—are valid, we need a great deal more systematic research to both confirm and more importantly to extend and deepen our understanding. Fact one: There is no such thing as a typical mass transit user, and if there is in the sense of a set of "average" characteristics it is a useless conception. The patrons of our public transportation systems vary in age, sex, education, cultural orientation, social class, physical ability and disability, and still other ways, and yet we design our transportation systems as if there were no such differences. The assumption is made that the users all walk, talk, read, understand, learn, experience events, and react in the same way. The fact of the matter is they don't.

How else can one explain the naive view given to me by a City Planning Commissioner that there had been a breakthrough in subway design because of the change from a "Comfort Quotient" of 160 persons in a single car to 120 persons in a single car. When I asked what that meant he stated that for a subway car of a given size, before the breakthrough, hand straps, seats, poles, and sides to lean on accommodated 160 people; after the breakthrough, for the same sized car there were to be fewer straps and poles so that the optimum number of people per car was now 120. When I asked whether the number of people who could be in the car during actual use was to be controlled, or what did comfort mean if all the people who were using straps were much older than those who got seats, he looked at me as if I were some kind

of university radical. Since the number of people who could enter the subway car during rush hour was not to be controlled, the 120 comfort quotient car was likely to be more uncomfortable since there were less straps and poles to be used by those who had to stand.

Individual differences among patrons have implications for whatever approaches to security are taken. Old people can't defend themselves, give alarms, or move to places of safety as well as young people; the presence of police may have a more ameliorative effect on the sense of security of a white lower middle class subway user than a comparable member of a racial minority group; nor can the poorly educated grasp the meaning of elaborate precautions to protect them as well as the better educated riders who use the system. If you have ever used the newest subway maps provided by the New York City Metropolitan Transit Authority, then you will know that individual differences were never an issue in designing those new maps. The use of escalators, the width of seats, the height of strap hangers, the distance between change booths and train platforms, the availability of bathrooms, ad infinitum reflect the same disregard of this factor.

Let me give you another fact. Most public transportation users *know* little about the system itself beyond their own particular use of it. Said differently, their knowledge of it is limited to their direct experiences with it in getting to and from work, using it to visit friends, or any other purposes. On the other hand, beyond this direct knowledge, they clearly have a set of beliefs and conceptions about it derived far less from what they have experienced and far more from the reports provided by the media on matters of safety, security, and even convenience. The mass transit user—particularly in the last decade, suffers from a highly distorted and stereotyped view of the extent to which the public transportation system he uses is unsafe, crime ridden, and subjects the user to delays and other inconveniences.

Such stereotyped views—like ethnic prejudice—are rooted in feelings of fear and a sense of threat, and as such, information campaigns, reduced fares and other "goodies," are not enough. What is worse is that with such feelings, individuals refuse to get involved and therefore act toward each other with hostility and suspicion, thereby completing the self-fulfilling prophecy that the bus, subway, or elevated train system is a dangerous place to be.

But let me present you with another fact and

then lead you into a fantasy that probably characterizes all regular transportation users. Environmental psychologists and sociologists have long given up the view that an urban dweller's sense of "house and home" consists simply of the apartment, private home, or residential home he or she occupies. It includes far more than this. It takes in the physical setting of his household beginning with the buildings or site, then the immediate neighborhood of the house including such necessary conveniences as shopping areas and available transportation systems. In terms of the complexity of urban life, *house and home* in a functional sense necessarily must include the means of access to the outside world and the return from this world.

The fact is, however, that while the urban dweller easily identifies with his home, his neighborhood, and surrounding institutional settings such as parks and other recreational sites—assuming he is not threatened by any of them—there is little to suggest that he has any real commitment or place identity with his public means of transportation. However, this system is both instrumental and important, in that the value of his household, neighborhood, and other conveniences depends on whether or not this regular public transportation system works—whether he or she can get in and out of his or her housing area, particularly with respect to the basic objective of earning a living. The mass transit patron is ready, willing, and able to denounce an unsafe and security-threatening bus line, subway, or elevated line because in fact it can undo his identification with and commitment to the place he lives in; the place that defines, expresses, and gives meaning to his existence as a member of the community.

Of course, it is possible that a sense of commitment to or identity with a public means of transportation can't occur because it is an expected service that one pays for; or that experiences with public transit are highly instrumental and transient; or perhaps most important, because few transit systems really meet the central needs of people who use them—speed, comfort, safety, peace of mind, courtesy, and user participation. The issue I have raised is an empirical one. However, regardless of the reason, it can be stated with certainty that increasing security and making it work in any setting becomes a special problem when those who are to be protected and made to feel secure have no commitment or sense of identity with the setting in question. What happened in the Kitty Genovese case and other homicides where spectators witnessed a crime but

did not "get involved," is generally true for the setting of the public transportation system. In a real sense this system should serve people in terms of its institutional purposes—movement to and from places—and not make other demands on them, particularly when it is not serving them well in the first place. It is interesting to note that whether out of a common need for safety or place identity, residents of unsafe neighborhoods (often strangers at first) are forming and have formed citizen patrols to police apartment house hallways, immediate neighborhoods, and even shopping areas. The transient and "no man's land" quality of a transportation system for a person going from place A to place B, may be a factor to account for this not happening with an urban transit system, but this is only part of the story. I believe that to some degree the lack of commitment to or identity with such systems is a factor to be reckoned with.

What are the "fancies" of the public transportation user? These are easy since we all have them. The bus, train, or subway car will be clean, neat, efficient, safe, trouble-free, dependable, luxurious, and so on. Oftentimes the fancies, or perhaps better said, the fantasies we have are more modest and specific. I recall how often in using the Seventh Avenue subway after a full day's work in Manhattan, I would silently pray that the wait for a train would not be as long as usual, that there would be no breakdowns, that there would be a transit patrolman moving through the cars and so on. My bus fantasies were not identical but they were generally the same.

But let me go out on a limb and tell you about a deeper fantasy or fancy that I believe is rooted in many public transportation users. If there is a deep-seated wish, or perhaps better stated, a long-term expectation within the public transportation patron, it is that some day he will not have to use the system at all regardless of how good it is; or if it is a superb system, that he can be free to use it if he desires, or not use it depending on how he feels or what events require on any given day. I remind you that for Americans who live in large urban centers and who must use public transportation systems, such use in the largest number of instances is the result of economic necessity. The fact is that upward social mobility and the American Dream of Success at the present time is no less potent than it has been in previous decades. To use one's car or to be taken by a private taxi, regardless of the "delay, linger and wait" caused by traffic is a sign of status and "the good life." Certainly among the lower class, riders

who do not have cars available, or those in the lower middle or middle classes who have them but can't afford their daily use to work, this dream remains strong and influential on their views of public transportation.

As public transportation systems become increasingly deteriorated, crime ridden and undependable, there is little question that the middle-class user—except for short trips and unusual circumstances—will, and has, given it up. Part of this withdrawal must be attributed to the fact that with increasing numbers of lower class, inner city residents having no other alternative but to use this system, the middle class user experiences even a greater sense of unease. The transportation patrons became increasingly alien, unfamiliar, and from his or her point of view indistinguishable from those he saw or read about in the media as having committed crimes on buses, subways, elevated trains, and so on. It is going to take a great deal to lure back middle America to certain kinds of public transportation in urban centers. If my analysis is correct about social mobility and status in relation to the fantasy of the public transportation use, then getting a commitment to the system itself so that both lower and middle class individuals will care and thereby contribute by their own behavior to its safety, security, and comfort will take a herculean effort of change in the existing systems. Clearly the beginning point must be an infusion of funds, far, far greater than what is now provided.

I really don't have to recite for you chapter and verse what are the fears of the public transportation patron. Many have already been suggested both general and specific in my previous discussion. For the individual going to work and coming home after work dead-tired, being on time is crucial. Fears of "delay, linger and wait" are realistic, and certainly detract that much more from the mental health of the urbanite. But with increasing deterioration of an existing system, particularly in the case of subways, then fears of accidents and personal safety loom even larger in the thinking of the user. Yet there can be little question that in recent years the single most pervasive fear for users of different kinds of public transportation systems in a variety of cities is the threat of criminal attack. Boston has had its thefts and murders; in Los Angeles, over ninety-five bus drivers were assaulted in 1973 which was more than the total for 1970 and 1971; and in Philadelphia, the University of Pennsylvania Handbook recommends not taking the subway at night, especially if one is alone; and finally in New York City, just to illustrate in one area of the city, on

April 12th of last year, Bronx Borough President Abrams called for 700 more NYCTA patrolmen to combat the "reign of terror" on the city's buses in the form of bus hijackings, stripping of female passengers, Jesse James type hold-ups (wherein all passengers are robbed), and so on.

How do we overcome this problem of security in public transportation services? Is the problem one of simply providing enough police support in the buses, subways, elevated rail systems, so that criminal acts will be deterred? It would seem so at first if you consider what happened in the New York City subway system. I am sure you all know that crime in this system was contained at night by a transit police saturation program. There was a sharp decline in crime to the point that relatively speaking the New York subway during late hours was a safe place to be. However, you must also know that there was a corresponding sharp increase in crime on those transit lines during the afternoon and early evening hours. From January to mid-August of 1974 there were 831 robberies, 198 felonious assaults, and 952 purse snatchings. For an accurate tally, these figures should probably be at least doubled—if not trebled—since many victimized passengers don't report the crime and transit patrolmen are encouraged not to make arrests but to issue a summons for a lesser violation.

Suppose, however, we could saturate all public transportation facilities with police every day, twenty-four hours a day in a given city. Is this really the solution? I suppose from the point of view of the user or patron, it is a good solution if the public transportation becomes a completely safe place. The economics of manpower involved in such a solution would involve costs beyond words. But suppose a community could afford to do it or to invest in some major manpower-electronic system strategy that would decrease sharply if not deter completely criminal behavior in the setting of its public transportation systems, would this bring the patron who has abandoned the system back as a regular user? Possibly, but I think not. We know that police saturation reduced crime in the late hours in New York City subways, but we don't know if the continuing decline in riders was halted or if those who left the system returned.

There is, however, a far more critical point to make which is not unrelated to our earlier view that security problems in public transportation is simply a symptom of the larger crisis of urban life. We can say this in another way. Crime in public transportation is not an isolated phenomenon. Where it exists there is also crime in the streets,

crime in housing, crime in department stores, and even in parks. Will the public transportation patron come back to it if he feels unsafe in many of these other settings, particularly when he or she knows that at least on off-hours once he leaves the safe bus or safe train, he still has to contend with crime in the so-called outside world. As he walks to his office, shopping area, or what have you, it is conceivable that the automobile—relatively speaking—is not just convenient, comfortable, handy, and a status symbol, but it is the last refuge of safety from the new kind of urban predator.

If my analysis is correct then only one conclusion can be drawn, or if not a conclusion then at least the following provocative assumption:

1. From the point of view of both theory and practice, the problem of public transportation security can only be understood and solved when viewed as part of the larger problem of urban crime.

Now let me go a step further with my analysis. Even if urban crime were reduced considerably in a larger metropolis by whatever means of surveillance and police practice, would those who left the urban transit system return? Again I think not. If you argue that people who had to use it in the past because it represented the cheapest and fastest mode of transportation, and now that it is really safe to use it they could not afford not to take advantage of it and therefore would again use it; I would have to say you have a point. However the point only has validity if you assume that crime is the necessary and sufficient condition as to why riders deserted the system, I can assure you it is not. The increase in public transportation crime is merely the straw that broke the camel's back. True it was one of the biggest pieces of straw, but this in no way overturns my next assumption:

2. It is not merely the growing crime in this setting that has decreased the number of public transportation users, but the interaction of this factor with a host of other negative features in the transit system. It is this assumption that leads me to my next one which in my judgment is fundamental.
3. Only by providing the public transportation user with a transit system that satisfies all of his needs—not just his needs for security, will it be possible to lure back the patrons who left and to add new ones.

When I say satisfy all of his needs, what I really mean is a subway system or bus system that is aesthetically satisfying, humane, convenient, reliable, dependable, sensitive to individual differ-

ences, and if I may exaggerate the case, worthy of being called "home." As I have said elsewhere the real environmental crisis of the next decade is not the threat to human life but the threat to *human dignity*.

Time and space do not permit me to go into detail about the broad environmental needs that underlie human satisfaction vs. frustration in a physical setting. But to state the matter briefly, what human beings require from complex physical settings whether it is a transportation setting, a neighborhood, or a hospital ward, goes well beyond adequate space, cleanliness, safety, aesthetic and sensory satisfaction, and so on. In addition to all these satisfactions, it must allow them such other human needs as freedom of choice, familiarity, predictability, and environmental control. Said differently, they must be able to understand, use, vary their behavior in, and indeed even transform this environment if necessary.

After all, with the growing problem of congestion in the use of automobiles, the energy crisis, and the pollution of the environment, the goal is to make public transportation attractive to all groups. It's not simply to lure back those who left the urban transit system but to make that system significant and useful to all community groups. Obviously, all of this must begin with extraordinary sums of money, but it's what we do with this money that also counts. To the extent that we can produce public transportation systems that reflect the value of human dignity rather than the person's infinite capacity to adapt, to *that* degree can we expect its patrons to be as committed to protection and enhancing it as they are to their homes and neighborhoods.

I realize I may have strayed far from the immediate problem of public transportation systems and the security of its users, but it is only through such broader changes in these systems that we can really cope with this problem. Against the backdrop of such changes, committed patrons become the most effective weapon for coping with criminal behavior. Such commitment will only occur if they identify with the system, and such identification in turn—as I already suggested—requires that the system serve them well by recognizing their worth as human beings. Perhaps I am a dreamer, but on my side is the skepticism we all must share in piecemeal patchwork solutions that in the end cost far more, and then taunt us with the continuing reality of the decay of our cities."

V. REDUCING THE RISK AND IMPROVING THE IMAGE OF PUBLIC TRANSIT

Policing Problems

The cost of police patrols is perhaps the largest item in any security system budget. Further, existing transit experience makes it unclear whether it is more effective to use local police forces, system based forces, or some combination of the two. In any case, the fact that most transit systems pass through several political subdivisions raises jurisdictional questions, whichever form of police service is used. Crimes originating in the transit facility proper and involving the pursuit of the offender into non-transit areas, and emergencies where non-transit police could make the fastest response will require cooperation between all of the security forces involved.

Opponents of the use of specialized transit police argue that it would be better to establish a transit division within an existing police department in order to be able to utilize the more sophisticated command and communications facilities of the larger force in an emergency. Some also feel that remaining under the wing of the larger department produces a more professional police officer. Proponents of the separate transit police system argue that such a system is needed wherever a train passes from one political jurisdiction to another and that whatever the virtues of generalized police service, it is crucial for transit police to know everything about how to deal with emergencies in the system. As one transit officer put it, "In New York, each force needs the other. Both forces are good, but precinct police are not transit specialists. They are not familiar with transit law and the problems peculiar to transportation operations."

A compromise approach, where street units respond to emergencies but are then backed up by transit police who take responsibility for all

paperwork, might be feasible. The advantage of having street units respond is that they are often able to reach the scene quickest. The advantage of having transit police follow up is that their presence frees the precinct police to return to regular duty without being tied up in paperwork, and it allows the transit police to bring to bear whatever specialized knowledge they may have on the situation at hand. It is possible that the transit police who respond to these calls should be primarily investigators. They could fill out specialized transit crime reports and funnel these reports to a central information center, thus giving the system immediate access to information that it might otherwise never have. In the case of criminals still at large, their patterns of operation might be established. In the case of security planning, decisions could be based on the greater detail which would presumably be available from police reports.

Deployment of Police

Most available data argues against regular, predictable deployment of police patrols. If deployment is to be unpredictable, it follows that the structure of the force must be adaptive and flexible. Another goal for assignment of patrols is to minimize response time. Patrol strategies possibly aligned to these goals are zone assignment of forces, game-theoretic assignments, and near-optimal connected route assignments. Variables affecting these strategies are the temporal distribution of crime in any given system and the phantom effect of concentrating large numbers of patrols in high-crime rate areas. Whatever method of deployment is used, it should be implemented in conjunction with a feedback method that compares performance with goals of performance.

Electronic Technology

Technology has produced some aids to surveillance which not only could provide service that would otherwise not be provided, but which also may do it cheaper. Closed circuit television (CCTV) is one such device. Cameras are available that have remote controlled focus, zoom lenses and slewing capacity. On-vehicle CCTV is also available, though both fixed and mobile systems are relatively new at this point and would require a cost/benefit analysis for each application.

Disadvantages to the CCTV system are that it requires constant monitoring, which can be costly,* depending on the design and coverage of

*Besides being costly, monitoring may also be of questionable effectiveness. How long can a person view monitoring screens and remain effectively alert? Part of the answer to this question no doubt has to do with the

the system, it is subject to vandalism, and it may be impractical to install in locations which are not easily covered visually from a few fixed locations, such as old transit stations which have numerous hiding places not covered by cameras. This last difficulty can be overcome in part by installing at each exit cameras which become activated when an alarm is tripped. The vandalism problem can be curbed by the utilization of proximity detection devices located near the cameras. Also, enclosures similar to ticket booths, but built with one-way armored mirrors, could be strategically located and manned on an unpredictable basis. There is evidence that tamper-proof booths and other physical deterrents are effective.

Telephones and transceivers adaptable for use in transit security systems are also available. If an emergency telephone system is used it must be carefully designed so that persons under stress can properly use the telephones and so that emergency messages are recorded and response is activated. Vandal proofing phones and making them false-alarm proof may conflict with making them easy to use. Transceivers, on the other hand, could be used for surveillance and provide two-way communications with police. Developmental funds will have to be expended to design either of these approaches, because at present the components but not the systems are extant.

Similarly, there is also the need for developing system logic in aiding the response of security forces and in apprehending an offender. Some possibilities are that after an alarm is given exits to stations or to vehicles could be remotely opened or closed. This might prevent anyone from leaving/entering a station or from leaving/entering a vehicle. The potential danger, of course, is trapped bystanders in the company of a criminal. Another possibility, mentioned earlier, is that an alarm could automatically trip monitoring cameras at exits. When an alarm in a vehicle is activated or there is indication that a criminal has used a vehicle for an escape, the vehicle could be slowed until it is met by security police. A tagging device might be released remotely by a monitor when the

motivation of the monitoring person to do a good job. The Port Authority Transit Corporation (PATCO) employs handicapped persons to monitor and reports good success with their work, although PATCO has no tests of effectiveness (such as crimes staged to see whether or not the monitors would pick them up). Interestingly, PATCO claims that in six years of operation the system has not ever been used to respond to a serious crime. However, graffiti damage to the system, when compared to stations not equipped with CCTV across the river in Philadelphia, is much lower.

location of the criminal is known, and electronic signaling bugs could be passed with the money in token booth robberies.

One system that is currently being developed has been designed for the Chicago Transit Authority (CTA) by the Carnegie-Mellon group. It is called the Teleview Alert System and consists of CCTV, emergency telephones, and publicly activated alarms. The system is designed to deal primarily with platform crime, which is three times more common in Chicago than crime in other transit areas. The CCTV is not designed to be monitored continuously, but only when an alarm button is pushed. At that point the entire station is monitored at police headquarters and put on video tape.

The theory behind this arrangement is that anyone who feels threatened or who wants immediate police surveillance of the platform or stairwell in which the system is located, need only press a button. The police monitor can then decide whether or not emergency help is needed and what kind is needed. If the alert is a false alarm, the monitor can see that and avoid sending a unit where none is needed. He can also warn off vandals and those giving false alarms by way of voice contact over the p.a. system. It is a unique feature of this system that a person giving a false alarm or tampering with the equipment is immediately put on video tape.

The system also has an optional surveillance feature which permits the police monitor to view stations even when no alarm has been activated. Cameras and alarm buttons are placed in stairwells, ticket booths, and platforms. When an alarm is sounded, this pre-empts any routine surveillance. Police response comes from the precinct in which the alarm occurs. CTA authorities are called immediately after emergency help is dispatched.

Direct police monitoring is an interesting feature of the Chicago system that may not be appropriate in other locations. In Chicago the police felt that they were best qualified to evaluate the nature and seriousness of each emergency and to dispatch the help required. In Atlanta, the MARTA system, which is currently in the planning stages, will make extensive use of emergency phones, both on the platform and in the cars. On the platform, the phones will be connected to four zone security stations operated by MARTA. The operators in those stations will have at their disposal 28-button pre-dialed telephones to summon emergency help. On the cars, passengers will be able to talk with the train driver, who will have radio contact with the zone security stations.

Some form of quick and easy to use communication for patrons to summon help is crucial, especially in light of the Chicago study's finding that when a crime was reported within four to five minutes, 60% of the offenders were caught.

Architectural Design

There is a general feeling among researchers that a large amount of security money should be spent in architectural and situational investments. Stations should be designed so that a small number of CCTV's give complete coverage and so that all surveillance and communications equipment is inconspicuous and protected from accidental or willful damage. Visibility of all activity on the platform from within and, if possible, from without, is desirable. Structural materials should include walls with large unbreakable glass windows and barriers that can be seen through, both from within and from without the station. The station should be located where passersby and local businessmen will see what is happening in the stations and who is coming out of them. All in-station commercial facilities should be located so that they do not interrupt sight lines. Lighting and platform types should also be designed with surveillance in mind.

The platform should incorporate features that allow the size of the platform to be adjusted in order to accommodate large crowds during peak hours and to reduce the area of surveillance during hours of low usage. Building materials should, in addition to being transparent, be sound deadening in order to make communication easier and should be vandal proof wherever possible. There is evidence that immediate repair of vandalism is a deterrent to further vandalism. The layout of the station should be such that patrons can easily determine where they are and where all relevant facilities, such as exits, token booths, emergency equipment, are located. Finally, stations should be located in areas easily accessible to police.

Whatever security system is chosen its goal should be at least in part to prevent crime rather than merely to react to crime once it has occurred. There is some evidence that many transit criminals do not pre-plan their crimes, but are motivated by a desire for instant gratification. Some researchers believe that the two certain deterrents to crime are convincing offenders that they will be *immediately* apprehended after committing a crime and building vandal-proof and robbery-proof structures in the transit system.

Operational and Procedural Considerations

Automation of transit vehicles reduces the number

of personnel required to run the system. This reduction could be used to pay for an increased security force. Instead of a motorman riding each vehicle, an increased number of security guards might ride vehicles. Automation might be used also in fare collection. Fixed fare collection systems, turnstiles, selling tokens outside the system, or even credit systems would reduce the need of the patron to handle currency. Such automation would also reduce the exposure of the system itself to robberies of token booths. It goes without saying, of course, that whatever machines are used must meet patron demands and must be vandal proof.

Because a large number of crimes occur while patrons are waiting for trains to arrive, it would seem advisable to keep waiting times to a minimum. There are a number of ways in which this could be accomplished. Highly predictable schedules would allow patrons to enter stations just before their trains arrive. Persons waiting outside the system could be alerted by an automatic signal that a train was approaching the station. Dynamic scheduling in which train speed and availability is adjustable to demand would reduce waiting time. Demand responsive schedules, proposed in some transit systems, have the advantage of reducing waiting time under certain circumstances, but when origin-destination scheduling is considered, there is a security risk arising from the difficulty which patrons may have in choosing their riding companions. This is particularly hazardous in small capacity vehicles.

One interesting operational suggestion that has not received much attention is that rapid transit systems adopt a class system of riding similar to that used in British trains. Under this proposal patrons would pay varying amounts for their tickets and would ride in cars with comfort that corresponds to the price of their ticket. Certain riders, such as school children, would ride free and would be segregated into the free segment of the train. Such a system would segregate economic groups of patrons, and thus theoretically eliminate at least some of the discomfort experienced by patrons who object to being forced to ride with those of different economic standing. Supporters of this approach suggest that one of the reasons that many people continue to drive their cars even when mass transit is available is that they choose to travel first class. If there is a correlation between auto travel and the desire to travel first class, the idea may have some usefulness in enticing more people into mass transit use.

The Response of Management to Crime on the System

In addition to providing sophisticated and accessible warning and reporting devices on transit systems, it may be necessary to respond to and offset media reports about transit crime which distort or misrepresent the real extent of passenger safety on public transportation. Typically, public carriers of all types have emphasized the comfort, efficiency, economy and dependability of their particular service as compared to others, such as the automobile. At the same time, they have consciously ignored negative reports about a crime or catastrophic event. Most often this has taken the form of disappearing from public view following a widely publicized confidence shattering incident.

With the growth and development of all forms of local mass transit, carrier management may have to implement a broader variety of public relations or public information techniques to offset public responses to transit crime, whether real or imagined, and to educate the community to the relative safety of individuals traveling on public transportation.

Media Role in Fashioning the Security Image of a System

The news media in most cities have judged the planning, development and operation of public mass transit to be an issue of significant public interest. Many news organizations are covering developments in mass transportation on a regular basis; in some cases, editors have made this subject a specialized beat. This reporting may include providing information for citizens on routes and schedules, analysis of trends in mass transit and their effects on the community, investigations of the funding and decision making process for transit systems, editorial comment, and spot stories on sensational crimes, accidents or special experiments. Although the quantity and quality of coverage may vary depending on the city and its circumstances, interest in the subject has clearly increased recently as a result of energy and economic problems and the actions of governmental bodies.

In light of the media's appetite for news on public transportation and its role in keeping the public informed of important community developments, the management of transit systems may wish to reassess its relationship with the news media. Management may wish to view heightened media interest as an opportunity to initiate or improve public information campaigns, to educate

the media, and ultimately the public, on developments and service. Cooperation with the media and a well organized public information program may result in favorable coverage and help avoid negative reports based on misinformation or misinterpretation. Moreover, keeping the media informed of all phases of the operation on a regular basis may help eliminate the distorted negative perceptions that citizens may form as a result of disproportionate coverage on aspects such as crimes and catastrophes. When transit crime is covered, there may be some deterrent effect in covering as well the penalties imposed against those committing transit crime.

Citizen and Employee Involvement in Crime Deterrence

It seems clear that if every patron or even a majority of patrons took an active interest in the operation and safety of his mass transit system, the system would run more efficiently and would be safer to ride. Operators would respond to informed complaints and suggestions and criminals would be reluctant to expose themselves to the surveillance of patrons who could be predicted to become as indignant about crime in their subway as in their neighborhood. Of course, this would not prevent criminals from attacking lone patrons; perhaps it would even force them to do that. But some properties report that this sort of citizen involvement has been successful in deterring minor crimes, such as seat slashing and property defacement. Perhaps operators could profitably study the feasibility of involving patrons in all phases of crime deterrence.

Similarly, non-police transit employee involvement should be studied. Even though transit employees are normally instructed to notify police and avoid direct interference in crime, there are many situations where their intervention might be helpful. Training in dispute settlement and the use of humor to defuse arguments, for example, might be appropriate. Both kinds of involvement, employee and patron, seem desirable in that involvement suggests that people care about what happens on the system and how people treat the system. At present it is easier to look the other way when a crime occurs. (See part 2 of chapter IV.).

The Judicial Role in Fashioning the Security Image of a System and In Deterring Crime

Legislatures have not specified special penalties for felonies and misdemeanors committed against transit carriers or riders; thus courts do not differentiate between transit crime and street

crime. Therefore, little is known about judicial treatment of transit crime or its actual or potential role in the deterrence of transit crime. Because of this situation and the difficulty in apprehending transit criminals, the reduction of transit crime may reside in the development of community-wide crime prevention programs not targeted directly at mass transportation systems.

On the other hand, there is at least one relatively simple judicial change that may have some effect on transit crime: put all transit matters before one or two judges, depending on the size of the system. In jurisdictions where this has been tried the trend seems to be that the judges impose stronger penalties because they see at first hand the seriousness and the scope of the problem of transit crime. Even though it may be some time before determined transit criminals would be deterred by increased penalties, minor offenders might be deterred by stricter penalties and greater media coverage of these penalties.

Cost-Benefit Consideration in Security Planning
Studies will have to be conducted both in the cost of security systems design and also in the cost of maintenance. It might be possible to estimate maintenance costs by examining costs of large building security system or of a military security installation. While it is possible to cost transit security components, it is not possible at this writing to determine the cost of a system, since no such system is now extant.

Extensive analysis and research will also be necessary to show the effects of any single component or combination of components of the security system on crime. When New York added large numbers of men to their security force in 1965, certain crime dropped dramatically, but the cost of this was \$35,000 per serious crime deterred. The system was both effective and costly.

This raises the question of how to decide the economic equivalent of a reduction in robbery or crime rate. Whatever the formula is it must measure the cost-benefit of any security system on a basis that is wider than just the transit system in which the security device is deployed. If the security device improves the efficiency of criminal apprehension, what effect will this have on an already overburdened judicial system? If the system improves mass transit image, what effect will this have on the demand for more mass transit facilities? At what point would increased ridership necessitate costly construction, or renovation, or more cars and buses to carry the people? It would be foolhardy to attract riders by improving security only to repel them by the congestion that

a large increase in ridership could entail. However, assuming that the increased ridership could be handled, there would be benefits of decreased air pollution, decreased gasoline consumption and street maintenance costs, and a decline in auto accidents. On the other hand, all of these benefits would have some impact on employment, and there would be a decline in revenue from city parking. Possibly city parking areas would then be put to more productive and revenue-producing use. See appendix III for a more extensive discussion of cost-benefit.

VI. EXTRAPOLATING WHAT WE KNOW TO THE NEW GENERATION OF AUTOMATED SMALL VEHICLE SYSTEMS*

What We Presently Know about Transit Crime

For the purposes of this report, personal security is seen relative to three classes of crime; 1) Robbery, 2) Assault and/or Battery, and 3) Crimes against People (rape, murder, indecent exposure, etc.).¹ It is clear from many current critiques that crime statistics are among the most difficult to collect and compare meaningfully. In large part this is a result of the changing definition of crime, procedural changes in administration of criminal justice, and changes in methods of recording and reporting crime. (11)

What is more important is that crime itself may not be as relevant to a personal perception of safety as publicity about crime. The President's Commission on Law Enforcement and the Administration of Justice reported:

The first (conclusion) is that the public fears most the crimes that occur least often, crimes of violence.

Second, the fear of crimes of violence is not a simple fear of injury or death or even of all crimes of violence, but, at bottom, a fear of strangers.

Third, this fear of strangers has greatly impoverished the lives of many Americans, es-

*Based on a report entitled PATRON SECURITY ISSUES IN AUTOMATED SMALL VEHICLE FIXED GUIDEWAY SYSTEMS, Norman A. Sidley and Robert Shellow, prepared for the Twin Cities Area Metropolitan Transit Commission, October, 1974.

¹ *Robbery* is the taking of property from a person by force or the threat of force. *Assault* is the conduct of an individual when he unlawfully places another person in apprehension of receiving a battery. *Battery* is intentionally and knowingly and unlawfully causing bodily harm to another or making physical contact of an insulting or provoking nature.

pecially those who live in high-crime neighborhoods in large cities. People stay behind the locked doors of their homes rather than risk walking in the streets at night. Poor people spend money on taxis because they are afraid to walk or use public transportation. Sociable people are afraid to talk to those they do not know.

Fourth, the fear of crime may not be strongly influenced by the actual incidence of crime as by other experiences with the crime problem generally. For example, the mass media and overly zealous or opportunistic crime fighters may play a role in raising fears of crime by associating the idea of "crime" with a few sensational and terrifying criminal acts." (12)

Keeping those views in mind let us examine what is known about patron crime that originates in the mass transit environment.

Review of Selected Studies on Rapid Transit Security

Significantly, of the very few reported studies of personal security in transit systems (1, 2, 3, 5, 6, 13) only four have dealt with fixed guideway systems (2, 3, 5, 13) and none have dealt with automated vehicles. For this reason it is well to caution that any conclusions or recommendations for automated fixed guideway systems are bound to be opinions based on extrapolation.

Profiles of Transit Crime

Whatever its relative importance to crime in other urban systems, it is instructive to examine the how, when, where and what of transit crime. In this regard the Chicago study does provide us with a set of rapid transit crime profiles:

Rapid Transit Robbery—Rapid transit robbery was about evenly divided between armed and strong-armed offenses. Very few attempts were reported; most reported robberies were carried through to completion.

The majority of these crimes occurred in the evening between 6 p.m. to midnight. In contrast, few robberies occurred in the morning or early afternoon. The heaviest robbery periods occurred on Friday and Saturday nights.

Victims were almost always lone individuals. Over 50% were male and Caucasian and most were under 50 years of age. C.T.A. employees (mostly station agents), students, and service workers were prevalent among the victims.

A substantial number of these robberies were perpetrated by groups of two or three offenders. Offenders as a whole were overwhelmingly male and Black; most were under 30 years of age.

Most robberies occurred on station platforms where most of the victims were waiting for their trains. Those which occurred within the station lobby almost always involved station agents. Virtually none occurred in station restrooms. Where the robbery took place on a rapid transit vehicle, it usually occurred while the train was in motion between stations. Few witnesses, if present, reported crimes.

Weapons (most commonly revolvers and knives) were used in a majority of cases, though a significant number of offenders used no weapons at all except their hands or feet. When used, weapons were almost always displayed. Few victims were struck, stabbed, or shot by weapons, but many were punched or kicked. Though a majority were not injured, those who were, often required hospitalization. Proportionately more Caucasian than Black victims received injuries.

Money alone, or money and credit cards, jewelry, wallets, or purses were taken in most cases. Losses were generally under \$20, though many multi-victim and station agent robberies netted the robber in excess of \$100.

Offenders attempted to exit the rapid transit system as quickly as possible following their crimes. Where the robbery occurred on a platform, the offender usually fled onto the street via stairs or ramps, avoiding the station lobby wherever possible. Few offenders boarded trains. Where the robbery occurred on a rapid transit vehicle, virtually all the offenders exited the train at the first regular stop. Very few either moved to another car or pulled the emergency stop.

Most robberies were self-reported by the victim. Police responded quickly, arriving on the scene within five minutes of the report of the crime in a substantial number of cases. Where officers did arrive while the crime was still in progress (or had been completed only a short time before) the apprehension rate was substantially higher than where a delay occurred between the commission of the crime and the arrival of the police.

Relatively little of the stolen property was recovered.

Battery (and Assault)—Most batteries involved either the infliction of minor injury without the use of a weapon, or physical contact of an insulting or provoking nature.

Batteries were about evenly distributed across the week with slightly more occurring on Wednesday and Thursday. They tended to be committed earlier in the day than robberies (almost half occurred between 4 and 10 p.m.). The evening rush-hour was the peak battery period. As with robbery, few batteries occurred during the morn-

ing or early afternoon hours.

Rapid transit batteries were distributed geographically across the system in about the same proportions as robberies, occurring as they did in those portions of the system located in high crime neighborhoods.

Almost all battery victims were lone individuals. Most were male and Caucasian. C.T.A. employees (very few station agents, however) students, and service workers were the most prevalent groups of battery victims.

Slightly more batteries than robberies occurred on trains, though the majority were still carried out on station platforms. Most victims were waiting for their trains while on their way home from the loop.

Just over 50% of the batteries were perpetrated by lone offenders—although a substantial number were carried out by gangs of four or more. Most offenders were male, Black, and under 30 years of age.

Most rapid transit batteries involved no weapon other than the threatened or actual use of hands or feet. Victims were generally kicked or punched or were struck by a weapon; very few were stabbed or shot. However, most victims who were injured required hospital attention.

Like their robbery counterparts, battery offenders attempted to escape the system completely following their crimes.

Most victims reported the crime themselves. As with robbery, police responded quickly, generally arriving on the scene of the crime within five minutes of receiving the report. Apprehensions were made in almost 33% of the cases.

Crime Against Persons—Most crimes against persons were minor in nature, generally involving indecency in public. A few, however, were serious: murder, justifiable homicide, or rape. Most occurred during the morning rush-hour or early evening from 5 to 10 p.m.

Most victims were again lone individuals. Unlike the other crimes however, the majority were perpetrated against women, mostly C.T.A. personnel (generally station agents), students, or clerical workers.

Almost all crimes against persons were committed by lone individuals, though several offenders were involved in some of the more serious crimes. Significantly fewer of these offenders (though still a majority) were Black than was true for either robbery or battery offenders.

Few weapons were used in these crimes, though the victim was seriously injured in a large percentage of the cases in which a knife or firearm

was involved.

Almost 50% of these crimes were committed on a rapid transit vehicle—generally while the train was between stations. In these on-train crimes, the offender usually left the train at the first possible stop. Most in-station crimes against persons were committed on platforms, though a significant number did occur within station lobbies. Almost 50% of these in-station offenders escaped by boarding trains.

As with the other rapid transit crimes, most victims reported the incident themselves. Police generally responded quickly once the crime was reported.

Crime on the New York Subway

The Chicago findings are reinforced and extended somewhat by similar conclusions from the Rand Study of the New York subway system. In the Rand Study they concluded:

1. Except for changes clearly attributable to anticrime activities of the Transit Police or the Transit Authority, the rate of serious crime in the subway system has tended to increase steadily from year to year.
2. When a particular type of crime proves to be lucrative and relatively safe, additional offenders will be attracted to it, possibly in lieu of other criminal opportunities. This apparently happened in 1969 with bus robberies, for which the data suggest that some individuals who otherwise would have been committing subway robberies were robbing bus drivers instead.
3. The geographical locations of subway crimes are not evenly spread throughout the system but are focused on a small number of stations and the portions of train routes that run between those stations. The high-crime locations can be easily identified from historical data and tend to be where surface crime rates are also high. A finding congruent with the Chicago Study.
4. Subway robbers are predominantly young and Black, but there are substantial differences between those who rob passengers and those who rob token booths. Many passenger robbers are school-age children, and the bulk of their crimes are committed in the afternoon just after school hours. Few passenger robberies involve the use of guns, but many are violent crimes. By contrast, token booth robbers are somewhat older and frequently used guns, but do not often use violence.

5. In 1970 about half of all robberies took place in the station while in 1971 more than 70 percent of the robberies took place in the station and the remaining 30 percent aboard the train. Again, confirming the findings of the Chicago Study.

Summary: What We Know About Rapid Transit Crime

In Table 3, we have taken the conclusions from the previous transit studies cited and stated them as facts in Column 1. In Column 2 we express our opinion as to the reliability of these conclusions. Our reliability rating is given in three qualitative terms; high-medium-low and indicates the extent to which we feel that the fact stated would be true in most transit system. In Column 3 is our opinion as to the relevance of the fact to the design of any proposed rapid transit system. Again we have used high-medium-low ratings. When the relevance is rated as high, it is our opinion that there are definite personal security implications in the choice of system designs relating to the fact stated.

TABLE 3

Conclusion	Confidence	Probable Relevance
1. Majority of crimes occur in the evening	H	H
2. Heaviest robbery period is Friday and Saturday night	H	M
3. Robbery victims are lone individuals	H	H
4. Transit employees were most frequent robbery victim group	M	M
5. Robberies frequently are perpetrated by groups of two or three	H	M
6. Offenders were most often young male Blacks	M-L	M-L
7. Most victims are robbed on the station platform while they await the train	H	H
8. When robbery occurs in the train it usually occurs while train is in motion between stations	H	H
9. Very few witnesses report transit robberies	H	H
10. Weapons (revolvers or knives) were used in a majority of cases	M	L

TABLE 3 (Continued)

Conclusion	Confidence	Probable Relevance
11. Majority of robbery victims are not injured	H	M
12. Money, jewelry, credit cards were most often stolen	H	M
13. Robbers tried to escape as quickly as possible	H	H
14. When robbery occurred in station, robber fled to the street	H	H
15. When robbery occurs in train robber flees at next stop	H	H
16. Robbers rarely pull emergency stop	H	H
17. Most robberies were self reported by the victims	H	H
18. The shorter the delay between crime and arrival of police, the greater the apprehension rate	H	H
19. Those stations where robbery is highest have high surface crime	H	H
20. Most batteries occur during the evening rush hour	M	H
21. Geographic distribution of battery is similar to robbery	L	H
22. Most battery victims are lone individuals	M	M
23. Most batteries occur on station platforms	L	M
24. About half of the batteries are carried out by lone individuals	M	L
25. Half the batteries are carried out by gangs of four or more	M	L
26. Those who commit battery are young, male and Black	M	M-L
27. Most batteries involve no weapon	H	L
28. Most victims who were injured required hospital attention	L	M

TABLE 3 (Continued)

Conclusion	Confidence	Probable Relevance
29. Those committing battery attempted to exit the system as fast as possible	M	H
30. Most victims of battery reported the crime themselves	H	H
31. Most crimes against persons (CAP) occurred during morning rush hour	L	M
32. Most CAP's were minor, involving indecency	H	M
33. Most victims were lone individuals	L	M
34. 50% of CAP's are committed on trains in motion between stations	M	H
35. When the CAP occurred in the station the offender escaped by getting on the train	L	H
36. Most patrons would feel more secure if they knew emergency assistance could be readily obtained	H	H
37. Perception of crime on a system has a definite effect on ridership patterns	M	H

Implications for Small Vehicle Systems

Crime Exposure Scenario for Typical Transit User
 The typical user of a rapid transit system will go through a fairly stereotyped sequence of events in riding from origin to destination. We can describe that sequence with the scenario shown in Table 4. Also shown are the areas or factors that pose potential personal security risks. The rankings are based on findings in the Chicago study, the actual risk from crime data analysis, perceived risk from the attitude survey.

TABLE 4
 Scenario for Rapid Transit System User

Action	Security Rank	Hazard Area/
	Perceived Actual	Factor
1. Arrival at Station	6	Parking Lot

TABLE 4 (Continued)
Scenario for Rapid Transit System User

Action	Security Rank		Hazard Area/ Factor
	Perceived	Actual	
2. Enter Station	1 (most dangerous)	4	Stairways, Escalators, Elevators, etc.
3. Fare Collection	-	3	Handling Currency
4. Waiting for Vehicle	3	1	Isolation
5. Entering Vehicle	-	5	Crowding
6. Riding	3	2	Isolation, Unknown Arrival Environment
7. Exiting Vehicle	-	7	Unfamiliarity
8. Exiting Station	1	8	Stairs, Escalators Ramps, etc.

The initial hazard listed in Table 4 is arrival at the station. In some areas there will be parking lots provided for a "park and ride" type of service. This service encourages commuters to leave their autos at central suburban locations and to proceed to the central business district on the rapid transit system. In our survey of existing systems we have not found reports of crimes (other than auto theft) with any frequency. Auto theft or thefts of articles from autos is on the increase in the park and ride facilities of the Bay Area Rapid Transit System (BART).^{*} While this is not a problem that would cause fear of bodily harm, it could reach a point where ridership decreases because of the unwillingness of commuters to leave their cars unattended at the transit facility lots.

Entry into the station usually will involve stairways, walkways, ramps, elevators or escalators. Very few existing systems have elevators, although they are specified in most proposed systems to transport the aged and handicapped. While the elevator will undoubtedly provide a potential hazard, we have not been able to gather data on its magnitude.

Walkways, stairways, escalators etc. provide a hazard in so far as they contain areas which are not under direct observation by the user.

^{*}Personal Communication from Ralph Lindsay, Director Security Services BART.

Fare collection is a problem area in systems such as Chicago and New York where token booth employees make up a substantial proportion of the robbery victims. Automated fare collection systems will not pose this hazard, but will nevertheless provide the only place in the transit scenario when a potential victim will usually be handling his currency. Automated fare collection systems have significantly reduced the number of robberies where they have been used and will undoubtedly reduce the number of transit robberies in a proposed system.

The most dangerous segment of the transit scenario is in waiting for a vehicle. Waiting is most dangerous at night in a large station with many areas which cannot be observed by the patron. There are two separate but related aspects to this portion of the scenario, the length of the waiting time and number of people waiting per unit area. It appears from studies cited that if people can wait in groups they are safer. Thus, when there are but a few people waiting, they should have a small waiting area. Typically, as waiting time increases the number of people waiting in queue will also increase and the area in which to wait must be increased. With scheduled service this implies variable sized waiting areas. Current systems in New York and Chicago attempt to some extent to solve this problem by closing exits and limiting ready access to platform areas at off-peak periods. One of the recommendations from the Chicago study was for movable barriers which could be used to reduce platform size and thereby increase the number of people waiting per unit area thus making their wait safer.

Entering the vehicle is an act which places people in close proximity to one another and is the site of most assault and battery crimes. It is reasonable to believe that many factors are at work here, most of which can be classed as frustrations. Again, station size is an important variable. When the patron density is high and crowding takes place, these "expressive" crimes are more likely.

Riding on the vehicle is the second most likely time for a crime to occur of the eight activities in the scenario. Approximately one-third of all robberies, one-third of all assault/battery crimes and one-half of all crimes against persons are committed on the trains.

Exiting the vehicle presents special characteristics during rush hours where high density traffic may again be the focus of assault and battery. This condition is actually much safer however than entering, probably as a result of the

greater patron density in entering vehicles at the end of the work day when frustration tolerance is likely to be lower. In other words, in the morning on the way to work there are large numbers of patrons exiting the trains in the central business district (CBD) stations. These patrons have not yet faced the day's frustrations. In the evening when there are a great number of patrons entering at the CBD stations the frustration tolerance is lower and the assault rate is higher.

Exiting the station is the safest portion of the scenario even though it takes place over the stairs, walkways, etc. which are perceived to be the most dangerous portions of the system. Perhaps it is the rapid purposeful movement of most patrons at the exit points which is responsible for this safety factor. When patrons arrive at their destination they move quickly out of the system thus reducing the chance of crime in the system.

Vehicle Size and Comparative Risk

The foregoing patron risk scenario for large systems cannot presume to hold true for automated small vehicle guideway systems as well. To arrive at that point in our analysis it was necessary to examine four such systems now being tested or in operation (BART, Westinghouse SKYBUS, AIRTRANS, and Morgantown PRT); identify the

crucial specifications of each, and develop the probable relationships between features of these systems and transit crime.

Table 5 portrays nine relevant characteristics of certain small, medium and large vehicle systems. Tables 6, 7, and 8 go beyond those characteristics to generate a list of features and their possible relationship to crime occurrence, probable crime sites, as well as possible resultant security requirements.

No element of a transportation system can exist by itself. For example, the *capacity* of the vehicles in the proposed small vehicle system cannot be considered an isolated design element. The vehicle capacity interacts with and/or determines most of the other characteristics of the transit system. In and of itself, vehicle capacity is a variable that has an indeterminate relationship to personal security. In order to relate the data we have reviewed and the scenario we have developed to the capacity of any system characteristic, it is necessary to assume some system parameters. We have chosen three vehicle capacities and postulated other system characteristics that would conceivably be associated with them. The three systems are referred to hereafter as "small," "medium" and "large" and are shown in Table 5.

TABLE 5
Alternate Small Vehicle Systems*

Characteristic	Small	Medium	Large
1. Capacity (people)	4-6	6-18	30
2. Guideway Length (miles)	300	150	100
3. Headway (seconds)	0.5	3-10	10-20
4. Number of Stations	200	100	50
5. Waiting Time (minutes)	0-1	2-5	2-5
6. Service	Demand Responsive	Scheduled/ Demand Responsive	Scheduled
7. Average Vehicle Occupancy (people)	1.3	4	10-15
8. Guideway Characteristic	mostly Aerial	all grades	more underground
9. Number of Vehicles	1000's	1000	500

*Personal Communication—P. A. Anderson, Urban and Environmental Systems, Honeywell, Inc.

Risk Features Common to All Systems

Regardless of vehicle size, the several systems under consideration will share a number of risk features with each other as well as existing large scale rapid transit networks. The following list of such features has been culled from Tables 6, 7, and 8.

Station location, and surrounding neighborhood crime rate, become a matter for concern and planning regardless of vehicle size. The same holds true for:

1. station level
2. access to guideway for station
3. location and functions of booths
4. sight lines in stations and illumination levels
5. fare collection systems
6. orientation of seating
7. vehicle identification
8. automation override provisions
9. communication to and from vehicles
10. door openings and closings and override provisions
11. emergency stop provisions
12. emergency escape provisions
13. internal surveillability
14. access to guideways between stations
15. identification of guideway segments
16. everything having to do with collateral sites
17. on-board emergency detection systems
18. the entire list of emergency procedures
19. car identification by central control

Now let's take a look at each of the systems separately.

Risks Associated with Small Vehicle Systems

The small vehicle has the shortest proposed waiting time of the three systems. Waiting time can be translated into exposure time. Waiting on the platform is a dangerous activity and the reduction of this time is a positive security feature. It may be possible to design the platform area to insure that patrons wait and ride only with those they choose. This feature should be easier to implement with the shorter waiting time system than with the other two.

Because of the vehicle size and the demand responsive service, average vehicle occupancy of the small system is similar to a passenger car. This occupancy level is obviously safe while riding. However, the security that one might enjoy while riding the small vehicle disappears when faced with

the uncertainty of exiting into the destination station alone.

The elevated guideway of the small system can be a security advantage if properly designed. If the guideway and the vehicle are designed with maximum use of transparent walls, the subsequent observability of the system gives it a security advantage over systems with more underground portions. Also, systems with more guideway at grade provide greater security risks because of the potential access to the vehicles at other than stations. The guideway must be designed to insure that entrance and exit can only take place at stations; and in this way simplifies response to crime emergencies.

The small system has security disadvantages in the areas of guideway length, number of stations and number of vehicles. These disadvantages are related more to the probable numbers of vehicles, stations and guideway miles than they are to the vehicle capacity. The primary disadvantage of large numbers lies in surveillance system required. Even if it were possible to afford to monitor 200 stations and 1000's of vehicles by voice or by closed circuit television, it is not clear how to monitor the system or respond to emergencies without a large trained labor force. In this area, the problems would become labor intensive and defeat one of the chief advantages of an automated system.

An additional disadvantage of the small system operating in an origin-destination demand responsive mode lies in the fact that people who wish to ride together to destinations which are close but not identical will not be allowed to do so. Thus, if you desire to ride home with a friend who gets off one station removed from your own, it cannot be easily done. The security advantage of riding with a friend is thus lost. Distance between stations in conjunction with riding time (in the demand mode) becomes important if interstation emergency stop procedures are provided, especially if the possibility exists that the ride can be forcefully shared by an unwanted additional rider.

Risks Associated with Medium Sized Vehicles Systems

The characteristics which distinguish this system from its smaller counterpart are its increased length, possible use of multiple car trains, increased headways, increased platform waiting time (from 1 to 2-5 minutes), and most important the likelihood of introducing strangers as copassengers in either the demand or scheduled modes. Platform space will also increase depending upon vehicle size or train length. The question of

inter-vehicle passage, communication and surveillance enters in as well. Instead of guideways being exclusively elevated, all three levels will be used and access and escape routes become potentially complicated.

The exposure of patrons to strangers becomes a significant factor in systems of this sort. Risk while waiting for vehicles on platforms increases. Risk of victimization while riding between scheduled stops also is present. The risk goes up if on-board automation override capability is present, especially if vehicle and guideway escape paths are easily accessed.

Crimes can now take place on the vehicles with perpetrators standing some chance of escape. Properly designed guideways are much more difficult to effect underground because of safety considerations. It would probably be necessary to have relatively closely spaced access points to underground guideways in the event of emergency. These access points will provide getaway routes for criminals and therefore are not desirable.

Risks Associated with Large Vehicle Systems

The large system has as its chief advantage the smaller number of vehicles and stations and the shorter guideway. These characteristics make crime surveillance and control systems more practical and easier to implement.

The large system has a number of disadvantages. 1) The waiting time of up to five minutes is much more hazardous than for the small system.

2) The number of people on the vehicle, the schedule and the waiting time will probably be enough at rush hours to cause frustrations to develop and the subsequent assault/battery crimes will be greater than in the small system. 3) The guideway will likely have more underground portions which raise security issues because the vehicles are not easily observable. Underground sections also raise problems associated with fear of tunnels and isolation when travelling at night. 4) To the extent that the large system requires larger stations, these stations will pose greater security problems at off-peak times because they will provide areas in which people may hide. 5) Service policies of the large system allow for intermediate stops. In other words, vehicles will pull off-line to pick up passengers going in the same direction. Used only in a scheduled mode, patron-stranger contacts are virtually assured. Though dense vehicle occupancy during rush hours is liable to decrease robbery risk, it will increase that of theft and assault. This is not as safe a travel mode as the small system. Vehicles could, however, be compartmentalized so that passengers may ride with only those they choose. Compartmentalization, while it may reduce robbery, would probably have no effect on crimes against people, especially indecency. Intercar mobility and communication are probably no more significant than in trains made up of medium sized cars, but surveillability becomes more of a problem with increased size.

TABLE 6
System Features Possibly Related to Crime Occurrence

- | | |
|--|---|
| <p>A. Station Location</p> <ol style="list-style-type: none"> 1. Neighborhood Crime Environment | <ol style="list-style-type: none"> 11. Noise Level Control |
| <p>B. Station Design</p> <ol style="list-style-type: none"> 1. Platform Expanse (Long: 600-1200 ft.; limited: 30-200 ft.) 2. Platform Style "island" vs. "side" 3. Levels—Single (at grade, subsurface, elevated); multiple levels 4. Access to track from platform—open vs. barred 5. Attended booths (location, hours manned, surveillance and communication capability) 6. Fare collection system—cash stored, tokens, tickets, change storage and transport 7. Concessions/vendors (location, nature of, cash stores) 8. Graphics—maps, train destination, instructions (location, clarity) 9. Occluded vs. clear sight lines, (open view vs. deadspots) 10. Illumination (level in ft. candles) | <p>C. Vehicle Design</p> <ol style="list-style-type: none"> 1. Length—Width (capacity and average occupancy) 2. Orientation of Seating (facing one direction, facing ends, facing isle) 3. Identification of vehicle identity—graphic/electronic—at control center 4. Access doors between cars (multi-car trains) 5. Dependence on manned operation (automated override provisions) 6. Communications between and within vehicles (voice, to attendant, to patrons) 7. Communications to and from vehicles 8. Door openings and closings—delay and dwell times (automated override provisions; control-center on-board conductor-passenger) 9. Emergency stop provisions and mechanisms 10. Emergency escape provisions and mechanisms |

TABLE 6 (Continued)

11. Internal Surveillability (by operator, on-board police, on-board CCTV)
 - a. Illumination levels and source
 - b. Location of blind areas
 - c. Outside illumination—windows, ceiling
- D. Guideways
 1. Access to by emergency vehicles and personnel (repair medical and security emergencies)
 2. Access to and off guideways by passengers from interstation stalled vehicles (elevated, at grade and subsurface)
 3. On-site and central identification of guideway segments
- E. Collateral Sites
 1. Walks and rampways to station
 2. Bus terminals and stops associated with RT stations
 3. Maintenance yards—sidings
 4. Parking lots
 - a. Distance to platforms
 - b. Means of access—surveillability [stairs, ramps, escalators (walkways)]
 - c. Illumination level of same
 - d. Controlled vs. free access and egress
 5. Fencing and other forms of barriers to access
- F. Operational Features
 1. Headways (method of monitoring and range of)
 2. Intervals (time and distance) between stations
 3. Passenger or on-board ability to override scheduled stops or demand destinations
 4. Systems for detecting and identifying type of on-board vehicle emergencies (mechanical, passenger, medical, security)
 5. Emergency Procedures
 - a. For stalled vehicles in and between stations
 - For mechanical failures on moving vehicles
 - For hazardous situations in stations (jammed doors, fires)
 - b. For on-board passenger emergencies (medical-security)
 - Use of: speed up
 - slow down
 - stops at next station—(doors open or doors closed
 - stops between stations
 - c. Response of police patrols
 - Communication network between sta-

tions—vehicles—control-police dispatch and police patrols

- (1) Time required for communication
- (2) Response times to stations, to vehicles, to guideways, to collateral sites

6. Car identification/locating system (mimic display at central control)

TABLE 7
Probable Crime Sites

- A. Long platforms
- B. Station cul-de-sacs (hidden areas) at station entry (occluded rampways, or under elevated structures) on platform, stairwells
- C. Platforms when headways are long i.e. over 5 min. (especially in demand mode)
- D. Station change booths
- E. Multi-car trains—unsurveilled or on cars not under surveillance
- F. On vehicles—when interval between stations is long
- G. On stalled vehicles—between stations with emergency escape possible
- H. On small unmanned vehicles in scheduled mode where passenger emergency stop or override features are present
- I. During off-peak hours at all sites
- J. In unattended or unsurveilled parking lots—and walks and rampways to station

TABLE 8
Possible Security Measures

- A. Changeable platform lengths
- B. High ceilings, unobstructed platform area, low seats (no blind areas)
- C. One person (airline type) water closets/lavatories
- D. Ticket-in/out fare collection
[High walks or fences in turnstyle areas (vs. theft of service)—photoelectric eye to signal unpaid entry or exit]
- E. CCTV
 1. On platform—patron activated Television Alert* and cycled surveillance with closed circuit T.V.
 2. At waiting area—Television Alert and cycled surveillance

*A Patron activated combination of alarm, telephone and CCTV recommended in the Chicago Study.

TABLE 8 (Continued)

3. On turnstiles, change and ticket machines—
Televue Alert, Photo-electric alarm, cycled surveillance
 4. Over parking lots—cycled surveillance
 5. On-board vehicles
Wave guide transmission to control if automated guidance. Closed circuit to operator/conductor if attended.
- F. Controlled entry and egress at parking lots
- G. Remote controlled access to guideways and other guarded areas
- H. Limited transit security force
- I. Routine checks of stations by local police departments
- J. Extended on-system patrol, uniformed and plainclothes, details, by transit security force
- K. Response to verified crime, or medical emergencies by closest available municipal police or ambulance unit. (Crimes of certain severity specified, in-progress or within 5-min. post incident)
- L. Direct lines to Transit control center—transit police, to police dispatchers in jurisdictions through which system passes.
- M. Emergency phones (handheld and mike/speaker types to control) and local police dispatch allowing police to listen-in and evaluate appropriateness of dispatch
- N. Positive identifying—vehicle locator and mimic board indicating status of vehicles, platform doors, switches, emergency exits, barriers in tunnels or elsewhere on guideway

Security Planning for New Transit Systems

We have considered the general security aspects of any small vehicle system and have pointed out some of the specific advantages or disadvantages of each of three hypothetical alternatives. It is clear at this point that we have not really been able to consider in detail a specific automated small vehicle fixed guideway transit system. We have considered only a limited set of characteristics of such a system. While it would be possible for us to go characteristic by characteristic and say this characteristic has this advantage and that characteristic has that advantage, it is a meaningless exercise to configure a system where each characteristic is selected on the basis of its personal security aspects alone. No system would ever be implemented that way. Further, an individual characteristic may have advantages in combination with one set of companion characteristics and

disadvantages with another set. It is nevertheless reasonable to believe that a proper set of characteristics can be chosen to make the smallest system as secure as larger systems. The choice of characteristics must be made, however, with continuous realization of their security aspects.

In choosing characteristics of a system, we can offer general guidelines based on the data presented earlier. First, it is important to make the system surveillable. Whenever there is a choice, from the size of the windows in the vehicle to the location of a post in a station to the location of a station in a neighborhood, the choice should be made in the direction of maximum visibility. Sight lines whenever possible should allow for maximum surveillability whether by an attendant, passengers, closed circuit television, or passers-by. Every attempt should be made to allow as much natural surveillance to occur as possible. Exits and entrances should be located at intersections that are generally perceived as safe, well lit and enjoy a good deal of traffic.

Secondly, the system should be designed to reduce waiting time as much as possible. Waiting alone on a platform is a dangerous activity. Reducing the waiting time or the time that people spend unaccompanied is a desirable security goal. Those aspects of system design which determine the time that patrons must wait alone should be scaled toward short times. The design variables here include service policy, platform size and morphology to list a few.

Thirdly, every system characteristic that effects the detection and response to a security incident must be designed to insure that the quickest possible response can be made to that incident. This consideration is particularly critical in an automated small vehicle system because of the access, or lack of it, that security forces would have to criminals on-board vehicles that are between stations. The most elaborately designed surveillance system will fail to deter crime in the long run unless those crimes that do occur are dealt with swiftly by the security forces.

Once the selection of a system is in progress, reference should be made to what we have identified as unique security issues in each of the three systems. When general features of the system of choice are known, an extended analysis of security considerations should begin. This analysis should be correlated with the selection of detailed specific characteristics of the final system. In this manner each step of the design and preliminary engineering process will receive comment and advice with regard to its probable impact on

patron security. Performance, choices will be made on vehicle size and configuration, emergency stop and override provisions; the details of station layout; guideway properties; and intra- and extra-system communication capabilities. It is important to keep in mind that making a station or a vehicle or for that matter an entire system more secure need not entail additional cost. Indeed, security considerations may result in net cost savings. On the other hand, there are obviously special security measures which necessitate additions to overall system cost, (both in terms of capital outlay and operational costs); and in those instances final decisions should be predicated upon estimated beneficial effects on the system as a whole. Careful thought should be given to each of the multitude of choices before the final design is ultimately adopted. Before finalizing any step in this process, designers must be confident that the security of transit patrons has been given full and careful consideration and that the design configuration has been chosen from this point of view.

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VII. WHAT WE NEED TO KNOW: RECOMMENDATIONS COMING OUT OF TRANSIT SECURITY WORKSHOP

Participants in the workshop generally agreed that while much excellent work has been done in the beginning stages of transit security research, many areas remain uninvestigated and others need additional work. What follows is a brief account of topics which the workshop participants felt should be researched.

Measurement of Crime

1. RANGE AND FREQUENCY OF CRIME. What is transit crime? Is all "crime" illegal activity? How, when and why does it occur? Are all crimes reported? Which are not? How would one measure crime that is not reported? Under what circumstances would it be helpful to attempt such measurements?

2. CRIMINAL PROFILES. What are the standard operating procedures of transit criminals? What sorts of persons commit transit crimes? What patterns of repetition are there? What motivates these offenders? What dissuades them?

3. MODEL CRIME REPORTS. Researchers and operators need to be able to extract detailed and similar information regarding transit crime from police reports across the country. At present, police reporting forms are not only dissimilar from city to city, but they are also inadequate in the information they record about the nature of the crime, the location of the crime, and whether the crime is or is not transit related. The New York City transit police use a form that contains more detailed information than forms used by most police forces, so perhaps that form could be used as a resource. In addition to the usual problems of form design, the researcher will also have to deal with the definition of transit crime and the selection of information needed to describe it on

transit crime reports.

4. POLICE DEPLOYMENT. How do different kinds of police deployment affect crime? Are uniformed officers most effective? Plain-clothes officers? Some combination of the two? How can the phantom effect best be exploited, i.e., is it possible to keep criminals from finding out that they need not stop committing crimes in daylight hours just because police are heavily deployed at night? Should transit security forces be on the trains? Above ground? In the stations? In booths with one-way mirrors? On elevated platforms in stations?

5. CIRCUMSTANCES OF CRIMES. Where are crimes committed? Are different types of crimes committed in different places? At different times? By different types of offenders? Do certain crimes occur more frequently in relation to certain types of victims? What behavior, if any, typifies victims? Do they resist? Do they dress in certain ways? Are they of certain ages? In general, what similarities and differences are there among victims for each crime type? Criminals for each crime type? (Note the overlap here with the more specialized study on criminal profiles.)

6. EFFECTIVENESS OF DIFFERENT DETERRENTS. It would be valuable to know what sorts of deterrents prevent what sorts of crimes. There is some speculation that only two sorts of deterrents are effective: physical barriers that cannot be defeated and the certainty of immediate apprehension. Perhaps there are other sorts of deterrents that would be effective. What might they be? If physical barriers are effective, what different sorts of barriers are there and what are they good for? If fear of immediate apprehension is a deterrent, would it be possible to instill a fear without really having the capacity to immediately apprehend? Would such a fear be effective?

7. COMPARISON OF TRANSIT AND CITY CRIME RATES. As discussed in Chapter III, there is some uncertainty about the value of comparing crime rates on and off transit systems. There is even question about how this would be done at all. What would the proper comparisons be? Nevertheless, it may be useful to make such comparisons selectively for certain segments of a transit system and in certain parts of a city. It would be helpful to identify situations in which such a comparison would be usefully made and determine how it would be done. In any event, developing suitable methods for comparing crime rates at different locations within a single system will be useful for security planning.

8. WHAT HAPPENS TO OFFENDERS? After

an offender is arrested, what happens to him or her? Are they charged with what they did or some lesser offense? Are they set free on bail? How are they sentenced? Do they go to prison? For how long? Do they repeat their earlier offenses after arrest and/or jail?

Impact of Crime on Transit Usage

1. **DEVELOPING SURVEYS.** As mentioned in Chapter III, there is a need to ask different kinds of questions of different classes of people, principally users and non-users of mass transit. Assuming that one's concern is to establish the impact of crime on a person's decision to ride or not ride mass transit, one must also determine what impact other matters have on his decision, e.g., cost of traveling some other way, convenience, speed, self image in relation to mode of travel. In other words, one must determine exactly what role personal security has in making the decision to ride or not to ride.

In general, however, there would seem to be no use in asking any person questions about security in the system if that person could not conceivably have occasion to ride the system. If the person might have occasion to ride the system at a particular time, then it would be appropriate to ask questions about that time, but not times during which the person would have no occasion to ride.

2. **THE EFFECT OF DIFFERENT CRIMES.** What crimes trouble patrons or potential patrons the most? While it seems probable that the so-called spectacular crimes, murders, rapes, Jessie James type robberies, terrify large numbers of people, it may be that much less spectacular crimes actually have a greater impact on ridership. It is possible that certain persons would be willing to take the chance of being robbed or murdered, but are unwilling to expose themselves to the virtual certainty of encountering, say, graffiti on station walls.

3. **ATTITUDE TOWARD CRIME AND DEPENDENCE ON THE SYSTEM.** Is there any relationship between a patron's dependence on the system and his tolerance of crime? As dependence increases, does tolerance increase, of necessity? As dependence decreases, does tolerance decrease because the patron can afford to have a choice? Or do both groups, those who are dependent on mass transit and those who are not, have comparable tolerances for crime?

4. **RELATIONSHIP BETWEEN IMPROVED SECURITY AND RIDERSHIP.** If security effectiveness changes, is there a change in ridership? Or do people ride mass transit regardless of the

effectiveness of security? Is there a cut-off point at which a decrease in security effectiveness affects ridership? Is there a point at which improved security effectiveness increases ridership?

5. **ATTITUDES VERSUS CRIME STATISTICS.** Is it possible to plan security systems based only on patron attitudes toward crime, disregarding statistical records of crime occurrence? What will attitude research tell us that record searches cannot? Should security systems be directed toward decreasing patron fears or toward actual crime that occurs? Or is there a difference?

6. **PAST CRIME STATISTICS COMPARED TO MEDIA COVERAGE AND PATRON ATTITUDE.** Using past crime statistics as a base, a study could be done of the relationship between actual crime (as revealed in the statistics), media coverage of this crime, and patron's impression of crime in the system, either in the present or as revealed in past surveys. How much is media coverage determinative of patron attitudes? Do patron attitudes about crime have any relationship to actual crime? Does witnessing crime or knowing that friends or relatives have been victims influence patrons attitude?

7. **UNMANNED SYSTEMS.** What do people feel about the security risks involved in riding unmanned systems?

8. **PERCEIVED EFFECTIVE SECURITY.** What makes people feel secure? Uniformed officers? Undercover decoys? Electronic gear? Certain types of alarm systems? Emergency communications systems? Why do people think that one sort of security measure is better than others? Are their choices geared to deal only with certain types of crimes?

9. **COMPLAINT FILES.** Transit property complaint files need to be searched to determine whether or not they contain materials relevant to transit security or ridership in general.

Measures to Improve Security

1. **POLICE.** Should transit properties retain their own transit police forces, or should precinct police service the systems? Are there local differences? Should some combination of the two approaches be taken? (See Chapter V).

2. **CCTV.** What are the advantages and disadvantages of closed circuit television coverage of stations? Effectiveness? Maintenance? Initial cost? Staffing of monitoring screens? Patron attitude? Criminal attitude? Vandalism?

3. **CONFLICT TRAINING.** What are the costs and benefits of training transit personnel in some form of conflict management to decrease tension

on the system, perhaps improve its image, and perhaps even its crime rate?

4. PUBLIC INVOLVEMENT. Is it feasible to involve the public in crime reduction strategies? Would there be increased public involvement in testifying against criminals if the properties offered rewards for testimony leading to the conviction of offenders? Would the public activate a surveillance system when they see a crime in progress?

5. DESIGN FEATURES. What design features of stations and cars would reduce crime?

6. OPERATING POLICIES. What effect on crime do different operating policies have? Does closer headway between trains result in a lower platform robbery rate? Is closer headway economically or operationally feasible?

7. COMPENDIUM OF SECURITY MEASURES. Operators need a catalogue of existing equipment and systems currently being used across the country.

8. ATTITUDE SHAPING. Is it possible to change the public's attitude about public transportation systems and system crime? How would it be done? What changes would be hoped for?

9. COST-BENEFIT ANALYSIS. There is a need to develop formulas to apply a cost-benefit analysis to transit security systems. Without such analyses it will be difficult for operators to know how much to budget for security. (See Appendix III)

10. CRIMINAL JUSTICE SYSTEM. What possible new approaches are there within the criminal justice system that would expedite the processing of transit criminals and have a deterrent effect on crime in transit systems? What are the costs of these changes? What is their importance and scope?

Conclusion

In general, then, we know something about crime, its effects, and its control in public transit environments. But it is clear that we are only at the beginning stages of our knowledge. If transit systems, those in existence now and those soon to be built, are to effectively protect patrons at a future time when their anticipated usage will increase, now is the moment to get research, demonstration and evaluation projects underway. If not, public transit in the United States may drift into a future for which it is not entirely prepared, and may again find itself overwhelmed by a problem of crisis proportions.

APPENDICES

The three short entries which follow are included as information supplemental to the workshop. Jan. Chaiken's model Exposure Index offers a method for comparing crime on a transit system with crime off the system. The Tiff, Littlejohn, Bosen and Sherizen study of patron behavior on systems deals with the ways in which patrons cope with fear. Although the workshop did not deal directly with this phenomena, such behavior may have some bearing on how security can best be assured in mass transit systems. The Greene paper suggests a formula for calculating costs and benefits of improved transit security. This topic was discussed throughout the workshop, but no one suggested a model for determining costs and benefits.

APPENDIX I*
 A MODEL FOR CALCULATING A
 VIOLENT CRIME EXPOSURE INDEX

The ATA study proposed a "transit violent crime exposure index," which is defined as

$$EI = \frac{\text{Annual number of violent transit crimes per 100,000 population}}{(\text{Average annual number of trips per person}) \times \frac{15}{525,600}}$$

where the number 15 is present because the average trip was assumed to last for 15 minutes, and 525,600 is the number of minutes in a year. Although the ATA study did not simplify this formula, it can be easily seen, using the ATA definition of trips per person in terms of revenue passengers and population, that

$$EI = (\text{transit violent crimes per revenue passenger}) \times 3.504 \times 10^9.$$

This index is intended to be compared with the FBI index of violent crimes per 100,000 population. The ATA study performed such a comparison, and found values of the EI ranging from under half the FBI figure to over 50 times as great.

By modifying the definition of the EI so that the actual average duration of a patron's stay in the transit system is used instead of the figure 15 minutes, it can be shown that the EI is the most appropriate basis for comparison. Thus, measures based on crimes per revenue passengers become singled out from the others as being of special interest.

To show this, we will first consider a very simplified (and thus unrealistic) model in which patterns of the transit system use and crime

*The material in this appendix is based on a working paper submitted by Jan Chaiken for use in the workshop.

activities do not vary by time of day, Consider a particular crime type, and let

λ_t = number of crimes of this type per hour committed against patrons of the transit system

λ_o = number of crimes of this type per hour committed against persons outside the transit system

P = population in the region to which λ_o refers

Λ = rate per hour at which patrons enter the transit system

τ = average length of time (in hours) that a patron stays in the system (for one trip).

Then the average number of patrons in the system is $\Lambda\tau$ and the rate at which any one patron will be a victim of this crime is $\lambda_t/\Lambda\tau$. Now a person who spends a fraction f of his time in the transit system will be the victim of f $\lambda_t\tau/\Lambda\tau$ transit crimes of this type, on the average, in a time period T. In addition, he will be the victim of $(1 - f) \lambda_o T/P$ crimes of this type outside the transit system. In order for the total expected number of crimes against this person to be independent of the amount of time he spends on the transit system, we must have

$$(1) \quad \lambda_t/\Lambda\tau = \lambda_o/P,$$

which is the same as saying the EI must equal the number of crimes of this type per 100,000 population.

Equation (1) describes an *indifference level* for the crime in question: if the equation holds, a patron would not care whether he used the transit system or he did not use the system, if he were just concerned about that crime. Correspondingly, if $\lambda_t/\Lambda\tau > \lambda_o/P$, then the transit system is more dangerous than the rest of the city with regard to that crime, and if $\lambda_t/\Lambda\tau < \lambda_o/P$, then it is less dangerous. The conceptually interesting feature of Equation (1) is that when it is true, it doesn't matter how often a person uses the transit system; his probability of victimization remains the same. He could use the transit system once a year for ten minutes or he could stay on the system all year; it makes no difference.

To summarize this discussion, we see that under certain simplifying assumptions the theoretically correct index for comparing on-system with off-system crime rates is *crimes per passenger-year*. Moreover, a practical means for calculating passenger-years is to determine the average length of time a patron stays in the system in connection

with one trip.* This is multiplied by the rate of entries into the system. By considering less simplified models than the one discussed above, one can similarly conclude that comparisons of crime rates at different times of day are properly accomplished by determining λ_t , λ_0 , Λ , and τ separately for each hour of the day, and calculating hour specific $\lambda_t/\Lambda\tau$ and λ_0/P . In this case, a more convenient version of the crime index is crimes per *passenger-hour*.

To calculate crime rates for individual transit system stations, the quantity $\Lambda\tau$ must be interpreted as the average number of people in the station. Therefore Λ should be the sum of the rates at which patrons enter and leave the station, and τ should be the average time they stay in the station.

If one is not interested in comparing different transit systems or in comparing on-system with off-system rates, but merely in comparing different parts of a single system, then it may be appropriate to assume the value of τ does not vary much from one part to another. In this case a *crime per-passenger* index (i.e., the number of crimes per person who enters the system) is an appropriate measure. Alternative calculations in which the number of entries is converted into an estimate of the number of users of the system, yielding a *crime/ridership index*, are equally suitable for such comparisons, but no useful purpose is served by performing the conversion.

Another variation on the relationship shown in Equation (1) permits analysis of individuals who generally experience crime levels different from the average for the city. In this case λ_0/P should be replaced by the expected number of crimes that the person would be the victim of in some time period T . This is to be compared with $\lambda_t T/\Lambda\tau$ to determine whether the transit system is more or less safe for that person.

*Note that we do not currently know how long patrons remain in any system.

APPENDIX II
HOW PATRONS COPE WITH CRIME
AND THE FEAR OF CRIME
ON MASS TRANSIT

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This paper is an attempt to describe the social setting of rapid transit and the numerous strategies people use to cope with that setting. In the framework of Goffman's work, as well as others, the study describes how the transit user makes out without being offended or offending others. Patterns of scanning, seat selection, blocking, positioning and non-verbal communication are analyzed as they create or disrupt the civil inattention of mass transit riding. Both observational and interview data are utilized in understanding riders' behavior in this setting.

In recent decades there has been a drastic decrease in mass transportation ridership. This trend has been attributed to the great increase in automobile ownership, to affluence, to residential disbursement and to the current movement of employers away from the central city. Their use patterns are, in a large part, designed and controlled by the auto, highway, and oil interests for the nation's auto owning majority. Consequently, economic and social inequities are manifested in the denial of geographic mobility to a large number of persons because they are unable to afford it.

Much of the mass transportation ridership, especially in the non-rush hours, is captive. Many persons have to use public transit for normal transportation needs regardless of cost or level of service. There is irony in the economics of mass transit, especially in bus transportation. When

single fare policies are in operation, off-peak riders actually subsidize costs associated with providing peak service to the more monied commuting peak riders. Captured lower income riders pay more than the cost of service provided, peak riders less.

Economic interests are also central in stimulating a concern about crime on mass transportation. A review of the mass transportation crime literature reflects the interest of transportation executives and employee unions. Executives have been almost exclusively concerned with the loss of revenue funds. Employee unions have gone on strike on the issue of robberies and assaults on their membership. Little concern, however, has developed regarding crimes committed against transit users or the loss of ridership attributable to the fear of crime on mass transportation. Perhaps this concern has been minimal because 1) mass transit is price inelastic, 2) most riders are viewed as captured (no choice) riders and consequently the demand for mass transportation is perceived as not being significantly affected by diminished personal safety, 3) transit riders generally are members of socially devalued and powerless groups, and 4) the victims of crime, and transit riders generally, are not collectively organized.

Several studies on consumer choice behavior suggest that people choose one form of transportation over another because it makes them less tense rather than because it is faster or cheaper. One such study notes that car drivers prefer those route selections which produce the least amount of tension. Transit riders most likely follow this same rationale where they have a choice of routes. The overwhelming choice of car over transit suggests, however, that the mass transit mode contains more intense tension producing elements. Several authors have suggested that mass transit forces people into unnecessary physical contact creating a degree of stress that exceeds one's capacity to cope and yielding feelings of discomfort and aversion. Others suggest that these violations of personal space or privacy are accompanied by the violation of "cultural space or privacy." This reflects the desire of persons to be with others who share their values, beliefs and standards of behavior to the exclusion of those who do not.

There is no question that tension and stress are generated by every mode of transportation. The critical question is: Which distinctive features of each mode yield specific kinds of stress and consequent user behavior and concerns? Car drivers are seemingly most concerned with dependability, length of trip, convenience, waiting

time, speed, parking and safety from crime, in this order. Transit riders are seemingly concerned with cleanliness, safety from crime, safety from accident, and getting a seat, in this order. The greater concern of transit users for their personal safety is further specified in a study comparing work and non-work transit riders. Work riders, accustomed to strangers and large crowds, apparently worry less about their personal safety than non-work riders, who encounter strangers in uncrowded cars, platforms, stations and streets during their trip. The greatest difference between consumer groups in the URBTRAN "experiments" was the level of concern with personal safety. Low income consumers, who also tend to be the non-work trip consumers, were much more concerned with safety than were middle income transit consumers, who also tend to be the work trip consumers. The middle income consumer is more likely a "choice" rider who uses public transportation during the day and only during rush hour. It is also possible that the middle income consumer's lack of concern with crime emanates from the fact that "his strangers" are also middle income consumers, and though he may travel through low income-high crime areas, his trip is usually not interrupted, nor does it terminate in these areas.

One element which critically affects modal choice, ridership, and perceptions of safety from crime is the tension created during the whole transit "trip." Conceptually one's walk to mass transit, one's experience in stations, on platforms, bus stops, in train cars (buses), and the "walk" to one's destination defines the trip. Any consideration of crime or perceptions of crime on mass transit must use trip data as a base. Proof of this conceptualization can be found in inner city residents' demand for a door-to-door transportation system. Such a program (Dial-a-Ride) was activated in recognition of the fact that the poor, young, old, and ill are obstructably immobile. Among high crime area residents, the fear of being victimized both on and off transit has created an increased fear of strangers and the practice of staying off the streets at night. Crime has reduced the level of mutual trust and impoverished the experience mobility of millions of people.

Political savvy and bureaucratic myopia have contributed to minimal action and concern for passenger personal safety on mass transit. When crime statistics have been collected, which is not often, they usually include crime on transit vehicles (buses, rapid transit trains) and/or their support systems which are separate from other

public space (subway platforms, stations, tunnels, stairs but excluding bus stops). In terms of limited bureaucratic responsibility, the crime problem is located only on "transit property." That the safety of the complete transit trip is critical to the consumer is not recognized by these authorities.

The dominant current strategies to combat crime on mass transit are basically hardware oriented. Such strategies attempt to control people so that the opportunity for committing crimes is reduced to a minimum at minimum costs. Target hardening devices such as exact fare safes on buses, movable walls on platforms, video scanning and other hardware can be used to reduce crime on transportation property. These approaches, in providing a framework for reducing the occurrence of criminal acts, do go beyond the apprehension approach. However, and unfortunately, target hardening strategies are accompanied by "value" consequences. Crime may be significantly reduced on mass transportation property yet merely shifted to other public space, notably the street. Less successfully transferred, the targets of crime might shift from bus fares or the driver to the passengers. If "successful" the hardware approach may make the hardware manufacturers happy, the transportation executives secure, and the transit riders safer on transit property. However, the transit consumer may then be faced with increased acts of crime going to and coming from stations. The low income off-rush hour rider might not be appreciably relieved by these strategies, though the middle income user might be.

The better literature on the problem of crime and harassment in subway stations and trains addresses the issue of how the incidence of various types of criminal acts are associated with the physical and, consequently, the social environment. It is not merely the size of the car, the fixed seating arrangements, or the density of the platform crowd which are critical to the incidence of crime. The hardware approach has serious behavioral limitations beyond the conceptual-spatial liabilities presented above. The behavioral act which comes to be defined and perceived as an offense is the product of the interaction of persons in a specific setting.

The attitudes of fear of being a victim, discomfort, uneasiness, are one set of products of the interactions in the social setting of transit. While the innocent victim-willful offender dichotomy has led to personality difference searching, our attention is directed to interaction patterns and processes. Numerous authors have discussed the

fact that many crimes (homicide, assault) are victim precipitated, that some are victim compliant (con games), that some are victim contributive (pick pocket) and that some have been called "victimless" (drugs, prostitution). However, the distinction between victim and offender is neither particularly insightful nor clear. In the offenses occurring on mass transit, victims inescapably play an important part not only in an offender's choice of victims, but even in the offender's decision to commit the offense. It is clear that some persons exhibit behavior which invites offenses. Sleepers and drunks are choice pickpocket victims. Resistive behavior may deter robbery but incite battery. Excessive scanning may invite interaction, indicate passivity or present the appearance of being a "good" victim. Indeed, blocking an available seat might prevent interaction and preserve personal space, or lead to secondary offenses like assault.

Transit patrons who find themselves in stressful or threatening situations manage their interactions and the persons around them. They constantly size-up the situation and try to place other persons into social categories. They attempt to maintain some degree of personal distance, position themselves to maintain personal space, and utilize various devices, both verbal and non-verbal, to avoid provoking interactions with those around them, especially those whom they perceive to be most threatening.

McDonald's study suggests that certain persons are culturally disposed to victimization. Their vulnerability emanates from the fact that their norms and beliefs prevent them from recognizing danger for what it is. He further suggests that victims are likely to be individuals with low concern and high exposure rather than individuals with high concern and high exposure.

In this study our attention was directed to understanding the nature of the social settings of the transit trip, especially the setting of the on-train phase of the transit trip. We also were attentive to the levels of concern and exposure existing on different transit trips and the habits and attentions which transit users marshalled to cope with the social settings and stress of rapid rail transit. Our emphasis was on the personal, interpersonal, spatial, and structural circumstances which affect the genesis and process of offensive behavior. The social setting of the subway transit car, territoriality, social distance, avoidance patterns, personal space, perceptions of threat, and defense capability were our critical concepts.

The Study

Despite the great amount of aggregate time that people spend on mass transit, there is relatively little sociological understanding of the phenomenon or of the meaning it has for its participants. Davis and Levine feel, in fact, that the behavior of transit users is mostly governed by the rhythms and requirements of the vehicles themselves. They describe the social setting as mono-instrumental. Riders are almost exclusively oriented to getting from one place to another. Consequently, the behavior of transit users is governed by an exit orientation. They are interested in getting out of the setting. In addition, transit offers the consumer a paucity of diversions or common focal orientations. Transit patrons concerned with their individual trip conclusion share no common interest, focus or bond with other riders. This does not mean, however, that transit users can not instantaneously develop social ties or change their behavior into other social configurations. Indeed, transit riders have converted to aid-giving groups, unaiding bystanders, crowds and angry mobs.

While riding rapid transit, a large number of persons are in close physical proximity but few engage in verbal-social interaction. The noise level, the presence of strangers, an instrumental orientation, the lack of common focus, and a concern for personal safety would all seem to create a setting in which non-verbal social communication dominates. In this setting the transit rider has little control over the physical setting and little control over the selection of his fellow riders. In these settings lie the basic dangers of co-presence. Others can threaten physical attack, sexual molestation, robbery, passage blocking, importunity, insult, and the discomfort of violated personal space.

Persons riding mass transit interact within a complex set of obligations which generally assures the orderly uneventful co-mingling of persons. In this setting modes of personal territory are delineated and respect for these boundaries is a critical means by which mutual presence is ordered. Violations of and by these territorial imperatives are potentially criminogenic. Territorial impingement is a strong stimulus yielding the reactions of avoidance, threat, flight, or aggression.

Mass transit can be characterized as a setting of constructed civil inattention. Each person employs numerous postures, gestures, vocal mechanisms, and social routines which create orderly transit. From these postures, gestures and routines, each

transit user receives and transmits information. If one is to be at ease, at civil inattention, one requires knowledge of the intent and purpose of action of those in his presence. The transit rider is not merely moving about from place to place unobservantly in silence. He is not indifferent to strangers in his presence. He is actively defining and establishing himself through gestures and territorial positioning, actively creating, when possible, mutual trust.

But the social order of transit is also composed of by-passings, secret deviations, excusable infractions and flagrant violations. There are remedial interchanges, accounts, and requests through which an individual exculpates himself from blame or receives permission to perform an act without impunity. Furthermore, there are signs (tie signs) through which persons indicate to one another the nature and boundedness of their relationships to the persons around or sitting next to them. The setting of mass transit is one of reciprocal scanning, body placement, gesture, defense, avoidance, and civil inattention. Moreover, mass transit seems to be an environment in which wariness is particularly important, an environment that calls for constant monitoring, scanning, and an alertness poised for quick reaction. Yet, this wariness is handled as a side involvement. Most riders initially attempt to construct a situation so that they feel safe enough to give only peripheral attention to checking up on the other riders.

In order to explore the settings of mass transit, two studies were conducted. In the first study, the seating practices of Chicago rapid transit riders were observed. In the second study riders were interviewed regarding their attitudes and concerns which underlie their transit behavior. The initial question was: What uses of space and defenses are erected by persons who place themselves into the setting of rapid transit cars?

Systematic observations were conducted on three separate rapid transit lines, selected for their variation in patron racial composition. In order to maximize our observation of choice adaptations to this setting, mid-week, non-rush hour times were selected. An observational recording sheet was constructed to record the seating patterns of riders. However, these observations were of a "snapshot" rather than a continuous flow nature. The observers recorded each patron's race, age, sex, spatial location, and position on the seat, the location of any objects (markers) in the car, and the conversational exit and entrance behavior of all riders.

The seating patterns and behavioral techniques utilized by over 3,200 persons to create a social order of transit were observed. Most readily observable were the numerous techniques of limiting eye contact. Many persons, especially those sitting alone, scanned the persons who entered the car. Yet, this was done ever so quickly and if possible before mutual eye contact took place. At each stop, people look up to scan and just as quickly retreat into their paper, the street outside, or the bug on the window. All is well until the next stop when the process is repeated. As a rule, it seems most persons will take an empty seat before sitting with anyone else. To sit next to a stranger when the seating is relatively empty is an intrusion. When the seating is packed it is much less so. Consequently, many persons sit alone by choice and in order to avoid an offense, an intrusion of others.

These single sitters are much more attentive than those who are in pairs, sitting side-to-side on two-person seats. It seems that the scanning process subsides once the single sitter has a seat partner, especially, if the intruding partner is a person whom they assess as inattentively safe. Scanning, then, seems to be generally a process of waiting to see who will move in on you. Consequently, many persons sit in a position in the car such that they can view the flow of other persons.

However, persons who are already seated are not the only scanners. Persons entering the train scan not only for available empty seats but in order to make an instant selection of seatmates. Most entering riders quickly move their heads from side to side view of the whole car and selecting a direction to proceed while continuing the scanning process. Others will have already done this from the platform, selecting not only their path but also the car they enter or avoid. Full view windows facilitate this process.

Individuals seem to reliably avoid contaminating others and becoming contaminated by sitting alone when possible. However, when doing this they are exposing themselves to being chosen as a seatmate by someone with whom they would rather not be. The transit dilemma thus is: When does the seating allow one to choose with whom he sits, rather than to be chosen? In the transit context, to be with someone seems to offer the relief of inattention and the protection from invasion, threat and harrassment. Singles are much more vulnerable. What becomes crucial in the seating of transit, then, are the seatmate choice patterns of riders.

Seatmate Selection

There have been several other studies of mass transit (bus) seating patterns. These studies suggest that, when possible, people choose to sit with other persons who have similar visible characteristics. Race, sex and age similarity are apparently the most critical characteristics. However, these may only reflect the social characteristics which the researchers could best observe and record. Nevertheless, we collected similar data on the observed social characteristics of persons sitting next to each other on a two-person seat. This pair data indicates that racial similarity is the most important element of choice. Over three-fourths (77.6%) of all the pairs observed were race similar. In comparison only 58.2% were sex similar, and 55.1% age similar. During both the afternoon and evening observations on all three lines, the percentage of pairs matched on all three characteristics (race, sex, age), was higher than the percentage of pairs in any other combination of elements category. Only 5.9% of the pairs in the whole sample were mismatched on all three characteristics.

The probability of racially homogeneous pairs was higher than expected by chance on all lines during both afternoon and evening periods. This finding is evident in spite of the wide variation in racial composition evidenced by the ridership being 94.4% black during the Jackson Park-Englewood afternoon observations and 86.5% white on the Howard line at night. The data also indicate that the greatest difference between expected and observed racial homogeneity of pairs were observed on the lines on which whites were minority riders.

Of course, the probability of racial homogeneity in pairs is affected not only by the racial composition of a transit car but by the density of the population in that transit car as well. In a study of transit seating patterns in New Orleans there was a low degree of integration in the seating patterns of blacks and non-blacks under conditions of both low and high density. These results stem from two opposite sorts of motives; as a bus becomes more crowded and segregation more difficult to keep in operation, it also becomes more important to uphold segregation, since a crowded bus provides a more "threatening" environment. Integration on crowded public transit means adjacent seating, shoulder to shoulder and hip to hip, rather than just occupying a seat in the vicinity of the other race, and it means performing

that act before a large audience. This study found that in buses where whites were in a minority, there was a high degree of segregation since whites saw themselves as being placed in a threatening situation—more so than blacks in a similar position.

Blocking

Moving in on somebody or being moved in on is quite commonplace when the car is full of persons. It is less commonplace under low density conditions. In our observations, numerous persons were observed erecting boundaries to discourage others from intruding on them. We call these people "blockers" and their techniques for discouraging intrusion "blocking."

The various forms of blocking include: 1) sitting in the middle of a two-person seat; 2) sitting on the window side of a two person seat and blocking the occupancy of the aisle seat with a package, one's legs, a briefcase, or some other marker-object; and 3) sitting on the aisle seat of a two-person seat, using one's body to discourage or block the occupancy of the window seat. There are, of course, numerous combinations of these types of blocking but all essentially erect a spatial barrier which must be removed by request or be violated by another person if that person wishes to occupy the blocked seat.

By blocking, the blocker clearly expresses his desire that no one violate the staked territory. And generally most persons accept the block of another by non-violation. They select another seat. However, when the seats in a car fill up or when there are numerous blockers in a car, blocking presses territorial demands into a sphere wider than others feel is acceptable.

Often an "excuse me" forces the blocker to move from the center of the seat, to pick up his package, or to slide over to the window seat. This occurs regularly and usually without additional interaction. There are however, aisle sitting blockers who won't move when asked and who either force the intruder to scramble over the blocker's legs and knees, with at least a scowl on his face for the inconvenience, or who scan the car and direct the intruder curtly to another available seat. There are of course other possible interactions but these seem to be the most common. For most riders, especially the short ride transit user, it may not be worth intruding, much less escalating the encounter if the blocker is non-responsive to one's presence, an "excuse me" or some other request for the seat.

From our observations of blocking we hoped to learn in what social contexts and with what frequency blocking occurred. And we hoped to gain more insights as to who the blockers were, where they sit, they block, and how their perceptions of the transit car setting differ from the perceptions of non-blockers.

Blocking is not a rare phenomenon; 11.8% of the seated riders observed engaged in some form of blocking. We observed a total of 379 blockers among our seated riding population of 3,212. There was at least one blocker in 113 of the 123 transit cars observed (91.9%). Furthermore, there was a median number of three observed blockers in the car which before had blockers.

The incidence of blocking is widespread among the observed lines and times. The overall ratio of blockers to other persons sitting alone was 1:3.4. On the Jackson Park-Englewood line in the afternoon there was one blocker for every two other single sitting riders. But the range of this ratio between line/times is not great: 4.8-2.2.

The data indicate that the frequency of blocking varies with the density of the transit car population. In the cars which had blockers, there were more blockers in the medium density cars than in either low or high density cars. Apparently, when there are very few persons in a car the rider feels that it is not necessary to block or defend his personal space. He expects that both entering riders and present riders will prefer to sit alone. When the car is crowded, blocking becomes an unmanageable activity because another rider is going to request/demand a seat. To continue to obtrude is to violate expectations regarding the free availability of seats. Persons who block under medium density conditions may not block under crowded circumstances and consequently can avoid the unwanted interactions emanating from their obstruction. Most blocking occurs when the car is becoming dense, when partners must be selected, and when there are a few, if any, seats left for the entering patron. High frequencies of blocking seem to occur in this social setting, and only when it is either nonviolative to others or unlikely to produce undesirable interaction.

There were no race or sex differences in the alternative methods of blocking selected by our observed blockers. Each of the forms of blocking contains at least two critical variables: body invasion distance and convertability. Over half of our observed instances of blocking involved window sitting (51.8%). And a majority of window sitters also used an object-marker (books, purse, handbag, cane, newspaper) to define their

enlarged territory, thus minimizing vulnerability to body contact and aisle accessibility to an oncoming rider. Only one-fourth (26.4%) of our blockers placed their bodies on the aisle. The data also indicate that three-fourths (73.6%) of the observed blockers exhibited blocking styles that are readily converted into window sitting without detailed exchange or movement. Virtually no verbal exchange is necessary to get a blocker of this type to convert. The approach, presence, or glance of another rider initiates the quick conversion. Of course, one way to avoid conversion is to avoid inviting selection, by not scanning the persons coming down the aisle. Another way of avoiding the necessity of conversion is to minimize one's visibility as a prospective seatmate.

Many blockers indicate a preference for sitting in sections of the transit car which minimize their contact with other riders. When the transit car is divided into eight sectors, blockers seem to have a preference for sectors most removed from traffic. Blockers tend to express a preference to avoid the highly accessible middle sectors of the transit car. Additionally, most place themselves in a position with maximum scanning potential.

Maximum scanning can also be obtained by not sitting at all. Some persons stand rather than violate another's space or sit with any of the available single sitting persons. Standers were observed on 32.5% of the cars we observed. However, three-fourths of these cars were of high density (30 plus persons). Consequently, we must attribute most of our observed standing either to crowded conditions, the lack of visibility of an available seat, or to the phenomenon of exit orientation. This, however, should not detract from the observation that standing is utilized as an avoidance technique, an inattentive maintenance mechanism, and a scanning position on mass transit trains.

Not only did blockers select the sections of the transit car in which to sit and/or scan, but they practice other "safety" routines as well. One such routine is choosing to sit in the car with the conductor, which requires knowledge of and familiarity with the run such that one, prior to the arrival of the train, positions oneself on the platform where the car with the conductor will stop. Blocking seems to be disproportionately associated with the presence of a conductor in the car.

Logically, one could argue that the presence of a conductor would reduce the necessity of blocking, thinking that the conductor's presence would add to the rider's security and the creation of

inattention. The opposite seems to be indicated in the data. Persons who block seek out cars with the conductor, thinking that the conductor's presence adds to but does not significantly alter the seating safety or reduce their need for safety and avoidance of others.

Many riders seem to develop coping behavior patterns which are activated prior to and independent of the peculiarities of each different transit car's assessed setting. This does not deny the fact that these persons size up the setting of a specific car as do others who adjust only to specifically assessed settings. Many persons size up each specific car in addition to developing routines for specific transit trips. This analysis is concerned only with the former phase.

Though we have explored some aspects of the social context of blocking (density), a companion exploration of the social characteristics of blockers must be conducted in order to comprehend the interaction of these elements. The data indicate that black riders and female riders are over-represented in the blocker population. More specifically, black females have the lowest ratio of blockers to riders. For every seven (6.62) black female riders there is one black female blocker. Comparatively, there was one white male blocker for every eleven (10.79) white male riders. Furthermore, the data indicate that there are transit line differences in the rates of blocking. These differences perhaps reflect an evaluation by the riders of the neighborhoods they are riding through, and thus the types of persons who potentially might enter the train car, or sit with them. The Jackson Park-Englewood line had the highest ratio of blockers to riders and is well reputed for its high crime victimization.

The social context of the ridership also significantly affects the blocking practices of the riders. On the white male dominated Howard line, black females, and blacks in general, block at a rate disproportionate to others. On the black male dominated Jackson Park-Englewood line, white females, and females in general, are disproportionate blockers. In addition, when the ridership of a line at a specific time is disproportionately populated by persons with the same social characteristics, these persons infrequently find it necessary to block. On the Congress line, dominated by black males in the afternoon, the ratio of black male riders to black male blockers is 19.8 : 1. On the Howard line dominated in the afternoon by white males, the ratio of white male riders to white male blockers is 18.8 : 1.

Though inconclusive, the data suggest that

blocking is affected by the social reputation of an area ridden through, by the social context of the transit car (density), and by the specific context of the social characteristics of the patrons on the train. In summary, the following points should be made. Riding through areas perceived as threatening heightens the incidence of blocking. Riding within moderately dense cars heightens the incidence of blocking. Riding with persons viewed as dissimilar heightens the incidence of blocking. Riding with others having similar visible social characteristics (race, sex) lowers the incidence of blocking.

Study II

In a second exploratory study, we attempted to elaborate our insights on the social order of transit by interviewing Chicago Transit Authority riders. Persons observed blocking, as well as non-blockers, were interviewed regarding their use of territorial imperatives, their techniques for creating civil inattention, their transit routines, their perceptions of personal safety during all phases of a transit trip, and their reactions to an escalating threat encounter.

Out of 120 interviews completed, 60 interviews were with blockers, and 60 interviews with non-blockers. The persons interviewed were selected on the basis of completing a quota of ten blockers and ten non-blockers per line-time. The interviewers also selected persons within the range of the race and sex distributions revealed in Study I. A blocker was operationally defined as a person observed exhibiting one of the styles (aisle, middle, window) discussed in Study I. As it turned out, our sample of interviewed persons did not greatly differ demographically from those persons observed in Study I. Moreover, the interviewed blockers were demographically similar to those blockers observed in Study I.

As in all interview studies, there were a number of persons who refused the interview. However, the resistance was lower than we anticipated. Of the eight persons (8/128—6.25%) who refused, four were middle blockers and four were non-blockers. Among the blockers, the interview request was more of an intrusion than for non-blockers. In the case of persons using objects to block, these had to be removed, thus allowing the interviewer to sit down and ask the questions. Side-by-side sitting was nearly a mandatory condition for conducting the interview. The noise level in the train (with windows open) approached the pain level and challenged a conversational attempt, consequently most interviews were con-

ducted in such a way that the interviewee could see the questions being asked.

However, there were eight persons *all blockers* who would not move over, or remove her/his object-marker such that the interviewer could sit alongside. Interestingly, none of these resisters, or defenders of their territorial imperatives, were window blockers even though 46.7 per cent of the blockers interviewed (28/60) were window blockers. This means that one-fourth (8/32) of the other styled blockers, while accepting the interview, refused physical, i.e. spatial intrusion. Of these eight non-movers six were females (75%) whereas females constituted only 56.7% of the blockers interviewed. In addition, whereas both interviewers were white males seven of the eight non-movers were black, even though black blockers constituted only 55% of these blockers interviewed. This data certainly presents confirming evidence that blocking is an avoidance-defensive technique specifically directed at dissimilar, potentially intruding, transit patrons.

Safety: Perceptions and Context

Throughout our analysis we have focused on on-train behavior. Further clarification of on-train behavior, perceptions and routines was attempted in the interviews. Yet a further understanding of these realities, on-train, required an understanding of their context within the transit trip. On-train was, in our perspective, only one of the several phases of the transit trip.

Of the persons we interviewed (blockers and non-blockers alike), most were frequent users of rapid transit. Most were, in fact, daily riders of the transit lines on which they were interviewed. Because we wished to place our analysis of on-train behavior in trip perspective each interviewee was asked to indicate whether or not he/she felt safe during each specific phase of the transit trip. There was a startlingly low percentage (17.5%) of the persons interviewed who felt safe during all phases of the transit trip. For most persons traveling the Chicago rapid transit lines, some phase of their trip engenders personal safety fears and compensatory behavior patterns. Of those interviewed, 55% indicated that they attempt to avoid riding the CTA during night hours, and a sizable number (34.2%) report that they attempt to avoid riding through specific areas of the city.

More of the persons interviewed felt safer during the "walk" to and from the rapid transit system than during any of the other phases. However, fully 30-35 per cent of the riders did not

feel safe during these non-transit property phases. The perceived safety afforded while on-train ranks next most safe (61.6%); the platform phases received the fewest evaluations of perceived safety (42.5% felt safe). To further specify the comparative safety of the phases, the interviewee was asked to indicate when (on which phase) he felt least safe. Subway stations and platforms appear to cause the most anxiety and fear for the persons we interviewed. Almost half (48.3%) of our respondents specifically noted these places as the most unsafe. Of the three specific phases; the platforms, on-train, and getting to and from the transit system, being on the train received the fewest evaluations as the least safe phase.

Our observations of created civil inattention, scanning, blocking, sector and seatmate selection are observations of coping behavior which are not enacted in the space or phase of the transit trip which riders perceive as eliciting the greatest concern for their personal safety. If these fascinating and elaborate routines take place on-train, then questions should be raised to determine what is occurring in these highly ranked threatening places i.e., non-safe.

Certainly this data does not diminish the value of our limited inquiry but it does place it into a more meaningful context. We did not focus our study on the perceived "most unsafe" phase of mass transit; however, the large proportion of transit users' concern for their personal safety on the train is of primary importance. Of the persons interviewed, 46.7% indicated that they attempt to sit in the car with the conductor, and 30.8% indicated that they regularly attempt to sit on one of the single seats. Furthermore, 57.5% report that they attempt to avoid certain types of persons on the train. The most often mentioned types of persons avoided were drunks, men and groups of boys. Other included those who "didn't look right," those who "look different, you know," "sleepers," "rough lookers," those with unpleasant expressions on their faces. To avoid these persons our interviewees ignored them, looked out the window, or moved. Other techniques utilized were standing in a crowd, sitting in the other direction far away, finding another person with whom to sit, and telling the person to move.

Several of these latter techniques suggest that some seatmate combinations are formed as avoidance reactions. Yet we know that positive selection processes also occur regularly. When asked if they carefully selected the person they sat with (if they had a choice and had to sit with someone), 60% of our respondents indicated that

they did. Many transit patrons select pleasant, cheerful, clean-cut, well-dressed, modest-looking or business-type persons as seatmates. However, the responses to this choice situation were dominated by the selection of "non-threatening" persons, namely *women* (36/72—50.0%) and *old persons* (12/72—18.6%). Not only do women choose to sit with other women but men also choose to sit with women. Eleven men mentioned the choice of women as preferred seatmates; only one man selected other men; and no women interviewed selected men as a preference. This situation would seem to place women in the undesirable circumstance of disproportionately being intruded upon and perhaps consequently disproportionately blocking (as was pointed out previously). We might, then, expect women to elect to sit with a seated female rather than to block, or sit alone, knowing that a male might choose to sit with her as a defense positioning technique. Interestingly, only two respondents mentioned race in this selection context. What must be deeply ingrained, unconscious, understood, or simply not acceptably mentionable is the practice of racially similar seatmate selection preference.

The Perceptions of Rider Types

In exploring the personal safety perceptions and practices of rapid transit riders, we expected to find a sizeable difference between those persons observed blocking and those not observed blocking at the time of the interview on the train. However, the notion and distinction, *blocker* (a person labeled by our observation), proved to be a limited concept for our comparative analysis. Even though interviewees were selected by their observed blocking behavior, they were also asked about their use of blocking techniques.

The reality of blocking is that it is a widely utilized technique. From our two methods of data collection we found four categories of persons: (B) Persons observed blocking who indicate in the interview that they block (N = 40); (NB) Persons observed not blocking who indicate in the interview that they do not block (N = 34). These are the congruent or pure types of blockers (B) and non-blocker (NB). Category (O), occasionals, contains persons who were not observed blocking, but who indicate in the interview that they do frequently block (N = 26). Finally, there were a number of persons who were observed blocking who say they do not block (N = 20) (D = deniers). This is an interesting group in that they either are not intentionally blocking or they feel guilty or

embarrassed about blocking (taking up someone else's seat) and deny it. It is difficult to know which is the case, though the individual who would not allow the interviewer to sit next to them would probably be of the denial type, and those who quickly moved over and seemingly didn't realize they were taking up more than their share of the seat would be of the unintentional type.

Given that there are four types of riders, a comparison should be made of these groups' perceptions of safety, use of alternate defense mechanisms and regular transit routines. As has been stated, few (17.5%) of the riders interviewed felt safe during all phases of their transit trip; only (12.8%) of the blockers (B) felt safe. During each phase of the trip, the perceptions of safety by blockers were lower than those of the non-blockers. In fact, the perceptions of safety among the blockers, occasionals, and deniers were lower than those of the non-blockers during each transit property phase of the trip. The platforms were viewed as the most unsafe place by each group of riders.

Perhaps as a consequence of these varied perceptions of safety (especially as related to the on-train setting), a higher percentage of blockers and occasionals state that they carefully select the person with whom they sit, carefully avoid sitting with others, avoid riding during certain hours, and avoid riding through certain areas of the city. Avoidance-selection techniques are not, however, exclusively employed by these groups. There was a substantial number of the deniers and non-blockers using these practices. In fact, the practice of sitting on one of the few single seats in the car is most frequently used by the non-blockers. Half of the non-blockers report that they regularly sit in a car having a conductor present.

Some type or form of avoidance-defense behavior is regularly practiced by almost all transit riders. Only 15% (18/120) of the persons interviewed indicated that they neither block, attempt to sit in a car with the conductor present, nor attempt to sit in a single seat. Of these eighteen persons half were observed blocking (deniers) and four of these nine also carefully selected their seat partner. The remaining nine persons who were not observed blocking report that they neither block, sit with the conductor, nor sit on the single seat. Of these nine, four admittedly carefully select the persons with whom they sit. The result is that five persons (4.2%) were neither observed blocking nor employ any of our mentioned avoidance-positioning strategies. If 95.2% of the interviewees

utilize at least one of these strategies, it is relatively safe to conclude that such strategies are commonplace, everyday reactions to the type of co-mingling order created in a public place, generally perceived as unsafe.

Defense Capability

If avoidance-positioning strategies are commonplace, though employed varyingly by place and individual, what are the factors affecting the selection of alternate strategies? One such factor hypothesized was the person's degree of perceived capability of handling a threatening situation. In Study II, each of the respondents were asked to react to hypothetical situations in which the degree of threat was gradually increased. Each person was asked to imagine that they were riding the train and sitting alone next to the window on a double seat. Each person was then asked to assess how well they felt they could handle whatever might happen if a person entered the train, looked around, and walked toward them—eliciting in them the reaction of fear.

Most of the persons in each group type felt that they would be either very or somewhat capable of handling the described situation. However, those persons observed as *not* blocking (non-blockers and occasionals) assessed themselves as more capable than those who were observed blocking (blockers and deniers). Thirty per cent of the deniers and 23.1% of the blockers felt "not very capable" of handling the situation. These findings suggest that low degree of defense capability in combination with a higher perceived level of unsafety leads to the more frequent use of blocking and other positioning-avoidance strategies.

Several authors suggest that increased familiarity with a setting makes one more aware of the way in which the setting works. The familiar person is not overloaded with stimuli and can react in the setting. One might hypothesize that the daily transit rider might feel more capable of handling the described threat situation than the non-daily rider. Among the four groups of riders (blockers, occasionals, deniers, non-blockers) the proportion of non-daily users is approximately the same. However, among those who state that they block (blockers and occasionals) there was a higher percentage of persons describing themselves as "not very capable" among the non-daily riders than among the daily riders. Blockers (B and O) who are unfamiliar with the transit setting describe themselves as "not very capable." Blocking among this group could therefore be viewed as a counteractive device for these feelings. Among non-

blockers (NB and D), a higher proportion of daily users describe themselves as "not very capable" in the hypothetical threat situation. Are these non-blockers who are unfamiliar with the setting yet describe themselves as capable (as McDonald's study might suggest) the most ripe for victimization, being exposed yet unable to recognize the situation for what it is?

Sex is another interacting factor with the degree of assessed capability, defense strategies, and setting familiarity. A higher proportion of males describe themselves as capable of handling the situation, which given our present sex role patterns, is not startling. The data suggests that female, non-daily riders feel incapable of handling the threat situation. The data further indicates that among females the percentage of "not very capable" females is higher among blockers (B-31.1%; O-40.0%; D-50.0%) than among non-blockers (NB-23.1%) again suggesting that blocking is one technique utilized to counteract feelings of insecurity in a "non-safe" setting.

Reactions to Threat

In response to our hypothetical situation, the respondents were asked what they would do as the person approached them. Interestingly in almost all cases, the respondents began to clarify the question or discuss their reactions in terms of a *male* approaching. In these circumstances, many of the respondents (55.0%) indicated that they would do nothing or indicated that they would sit there and wait to see what might happen (17.4%). For most of the rider-interviewees "flight distance" had not been violated. Those persons whose flight distance had been reached by the mere approach of the "intruder" (16/109—14.7%) stated that they would "move," "get up and walk past the person," or "get off the train." A disproportionate number of these persons who defined their flight distance at this point was found among those persons observed blocking, and who described themselves as not very capable of handling the situation (not very capable deniers 5/6—83.3%; not very capable blockers 2/9—22.2%). However, one-fourth of the non-blockers who described themselves as very capable moved at this time (3/12—25%), which might indicate that this early assessment and flight is one of the criteria used in defining capability. Unless one's flight direction intersects with the oncoming intruder, it could be argued that these persons are very unlikely on-train victims of crime-harrassments. They have acted to at least avoid any form of offensive activity which might take place if the intruder takes the seat next to them.

Escalating the encounter and considerably shortening the distance between intruder and person intruded upon, the riders were asked what they would do if the person sat next to them. At this distance, 30.2% (33/109) of the riders were now ready to "get up pretending they were getting off the train," "to move away," or "to move away and notify the conductor." The number of persons whose flight distance had been reached more than doubled in this circumstance, compared to the original approach circumstance. When intruded on, more of the riders say they would become alert, watch and wait, and/or purposely ignore the invader. Slightly fewer than a third of the riders stated that their reaction would be to do nothing (34/109—31.2%). Of those whose flight distance had been reached at this point, more could be found (as in the approach situation) among those who felt less than very capable—37.5%. Yet, one-third of the very capable non-blockers were ready to move under these circumstances.

To further escalate the threat involved in the encounter, the riders were asked what they would do if the person was then to demand their money. This circumstance did not allow most persons to either ignore or take flight. Only 9.2% of the total number interviewed suggested these reactions. The most frequent response in this situation was to give one's money to the demander (40.4%). However, this response varied according to the respondent's assessment of his/her capability of handling transit setting encounters with those who describing themselves as not very capable of handling the originally described situation being the most likely to yield their funds to the demander (17/24—70.8%). Only 12.5% (3/24) of these persons were ready to fight or would refuse to give the demander their money. In contrast, those who defined themselves as very capable in the originally described situation were reluctant to give the demander their money. Only 18.6% (8/43) of these persons would give up their money and 41.9% (18/43) were ready to fight-refuse. Many (27.9%—12/43) of the self-described capable felt that their actions would depend on the nature of the demander. For example, if the demander were bigger, had a weapon, was black, or was with a group they might yield their money. But if the demander was smaller, weaponless, white, alone, or just a kid they would not.

The interaction of defense capability and defensive positioning factors presented some interesting observations. Persons who said they block (blockers and occasionals) and also said they were very capable of handling transit encounters

reacted to both the initial approach situation and the seat intrusion situation with observance, but they disproportionately resisted in the money-threat situation. Not so capable assessed blockers (B and O) are more likely to move, get up, flee in the initial and seat intrusion situations and are unlikely resisters in the money-threat situation. Like the not very capable blockers, the very capable non-blockers are ready to move in both the initial and seat intrusion situation. However, unlike the not very capable blockers they resist the money-threat demander as do the very capable blockers.

As was stated earlier, males felt more capable in handling transit setting threat situations than females. Consequently, since resistance to the money-threat demander is most frequently a response of the very capable there are more male resisters than female resisters. However, among those who at least profess some capability, females are as likely to resist as males. In these capability groups, there are no sex differences in the proportion who resist. Among the non-blockers, males were more likely to resist than the females. But among those who say they regularly block (Blockers and Occasionals), females are as likely to resist as males.

It is difficult to draw conclusions regarding victimization from our data. The limited number of interviews and the hypothetical nature of the threat sequence allow only conjecture dependent upon the premise that the approaching person elicits fear or presents a threat. Often, when one perceives that he is giving alarm to another, the appearance of normality will be constructed. So as to quickly diffuse the flight of an alarmed co-rider, approaching seat hunters often avoid the alarmed person, change directions in search for another seat, walk past the alarmed person. Even a smile or a quickly refocused "eye ignore" of the alarmed person will reconstruct civil inattention. Another assumption of the hypothetical situation was that the approacher posed the threat to the person seated and not the other way around. The scanning of the seat hunter is, as we have discussed in Study I, directed to avoid such a turnabout. Once all are seated, disattention can preside as few persons will move, unless they move and leave, as some of our threatened interviewees suggested.

Blocking seems to be a technique of pre-judged defense. If combined with confidence in its successful prevention of intrusion, it eliminates the need to interact with any other patrons. While blocking, one can afford to wait longer to become alarmed, disalarmed, or to react. Those who

confidently block, shorten their flight distance. Because they are blocking they are in a sense *a priori* resisting any threats. They can disattend, knowing that most persons will discount them as a potential seatmate. Without becoming alarmed, the block saves their getting up or off at every false or true alarm. The confidence of the blocker, of course, comes with experience—daily usage. We can only suggest that blocking and other positioning-selection techniques prevent or protect one from victimization. Those who block and yet are unsure of their safety flee early. Those who block and yet are unsure of their safety flee early. Those who block and are sure of this defensive mechanism project their awareness of the threatening situation. Those who avoid specific hours and places, sit in a car with the conductor present, sit in a specific sector or on a single seat, and those who avoid certain persons and carefully select a "similar" seatmate are at least aware and attempting to protect themselves. Those not practicing these common co-mingling strategies of urban rapid transit, would seem to be the most ripe for victimization, which might suggest an inability to recognize the transit setting for what others know or fear it to be.

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APPENDIX III

A MODEL FOR CALCULATING COSTS AND BENEFITS OF TRANSIT SECURITY IMPROVEMENT

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The most important feature of improved mass transit security is its effect on ridership. Ideally improved security would result in patronage. In the short run, though, it is more realistically expected that improved security will only stem the current declining rate of transit usage. This is a much more difficult characteristic to quantify than others might be, since short-term ridership figures are responsive to numerous factors in addition to gains in real or perceived security. Whichever above-mentioned ridership trend exists is irrelevant to the model presented below.

Some of the spin-off effects of increased ridership are also considered. Newly attracted regular users can expect to realize substantial monetary savings. Further data acquisition and reduction will serve to pinpoint the following figures more accurately, but conservative assumptions about average trip lengths, gasoline consumption, parking rates, and automobile maintenance costs lead to the assertion that net daily savings in the order of \$4 to \$6 are available to many commuters, representing some \$1,000 to \$1,500 annual gain per converted user of transit. Lower benefits will accrue to occasional users.

Medical costs vary over a wide range, depending on intensity and duration of treatment as well as geographic region. For the purposes of this study, in-and-out emergency room visits stemming from assault and battery incidents on the transit line are taken to be billed at \$20, while those injuries requiring hospitalization are assigned a daily cost of \$150. These are not direct out-of-pocket costs to the transit system itself, but any reduction in

*This material was prepared specifically for inclusion in this report and appears here in a highly edited form.

medical costs from injuries sustained on the system must be viewed as a benefit. It is noted that the C-MU Chicago study found that 32% of batteries and 75% of assaults on the CTA requiring hospitalization have CTA personnel as the victim, so a substantial portion of the gain engendered here is internalized.

More definitive data are needed on the cost of vandalism to the operating authority. Actual expenditure changes in repairing vandalized property, not the cost of total rejuvenation, are what should enter the model.

Given the prevailing police stolen property recovery rate (less than 20%, in Chicago's experience), the minimum expected effective loss per rapid transit robbery or crime against person is about \$29. Reductions in these crimes can thus be entered directly into the model. Failure to consider murder or rape reductions in like manner is obviously not meant to imply that no gain would be seen in a reduction of these crimes. Rather, it is felt that the incidence of murder is too low to allow of statistically significant changes, and that the assignment of some dollar value to either of these crimes would be highly arbitrary. Others have derived economic meaning for death by the device of lost productivity, but this requires, again, statistically significant measurements. The economic and social costs of rape can only be accurately assessed by the individual victim.

Due consideration must also be given to the costs associated with installing, operating, and maintaining the security system. In keeping with the conservatism demonstrated in previous estimates, the useful life of the entire installation was taken to be ten years, with amortization proceeding at an assumed interest rate of 10% per year. This results in an annualized cost, excluding maintenance, of approximately \$7,500 per station serviced.

Since the CCTV is conceived as an augmentation to police patrol, no change in the latter is assumed. However, it would be of interest to compare the above cost to that which would be incurred by an escalation of manned patrol. To cover the most critical time period, 6:00 P.M. to 2:00 A.M. would require one two-man shift seven days a week. With allowance for holidays, vacations, and general time off-work, this translates into 16 man-days of coverage per week. The cost is thus given as:

16 man-days per work-week times
52 work-weeks per year = 832 man-days per
year
divided by 5 days per week = 166.4 man-weeks
per year

divided by 52 man-weeks per man-year = 3.2 man-years per year
times \$20,000 per man-year = \$64,000 per year per team.

Under this breakdown, each two-man team would have to cover \$64,000/\$7,500, or between 8 and 9, stations as well as CCTV covers one to achieve cost-parity. The figure above represents a daily cost of about \$175 for manned patrol increase, as opposed to CCTV's \$20 daily cost.

It is assumed, due to the exhibited decline in transit usage over the recent past, that there is sufficient capacity presently available to handle the anticipated ridership surge. The marginal cost of transporting these attracted passengers is thus limited in the short run to fuel, personnel expenditures, and replacement of retired equipment. If the upward trend continues to the point where large capital investment is required to accommodate new users, major revisions must be made in the model; these are straightforward, though, merely entailing the addition of another amortization term. In this vein, consideration should be given by operating authorities to cost-effective alleviation of spot capacity constraints in the network, primarily stations downtown in the morning and evening rush hours.

With all this in mind, the following model was developed:

$$AG = 0.6RI + 5DCT + V + 29ROB + 20HER + 15OHOSP - 7500N - DE$$

where

AG = annual gains, in dollars

RI = annual ridership improvement in trips @ 60¢ per trip

DCT = annual number of deferred commuter roundtrips

V = annual vandalism expenditure reduction, in dollars

ROB = annual robbery/crime against person reduction

HER = annual emergency room visit reduction

HOSP = annual reduction in days hospitalized

N = number of stations equipped with CCTV

DE = additional annual operating expenses incurred, in dollars

Solving the above equation for ridership improvement needed to have the system pay for itself, the following assumptions are made:

- a) 1972 base ridership is 70 million,
- b) 20% of RI is DCT,
- c) Crime is reduced 20%,
- d) 15% of assault and battery victims require emergency room treatment only; 6% require hospitalization,

e) 40 stations are equipped with CCTV, and

f) cost of transporting one additional passenger is \$0.10.

Ridership improvement of just under 200,000 is required to implement CCIV, an increase of 0.3% on the base year and far lower than might be expected in light of the Market Facts, Inc. survey.¹ This RI would be attained if 2,000 occasional riders took one more roundtrip per week, or if 400 commuters abandoned their cars and used transit. If police patrols were utilized, one team would have to cover 8 or 9 stations as effectively as the television surveillance system to produce the same value of RI.

Shortcomings of the Model

Several omissions are apparent—some of which can be incorporated into the model when useful data become available. For example, the term relevant to deferred commuter trips could well be adjusted to account for gains associated with reduced air pollution, gas consumption, and street maintenance costs. Some of the difficulty in assessing the magnitude of this effect stems from a sort of merry-go-round effect expected to exhibit itself: as people choose mass transit and avoid freeways, the freeways become relatively more attractive until they may in fact lure travelers back. Similarly, it is conceivable that the improved service provided by transit will enable some patrons to divest themselves of that second or third automobile, but estimates of the number who would do this are uncertain. Greater willingness to use the system could also signify impact on the numbers and kinds of jobs available to lower-income groups.

On the other hand, these gains are to some extent expected to be financed by the court system, and criminal justice offices in general. There is much talk of revamping the judiciary with an eye to expediting the arrest-to-trial procedure, but until this is achieved anticipated higher arrest and conviction rates will increase criminal justice costs.

Factors on both sides of the ledger are not addressed in the model. It is felt, however, that these are only refinements to its body and bulk. The model is a great simplification: some factors might be better approached with a set of simultaneous equations. But it yields ball-park figures, and can easily be expanded to incorporate new developments. It is once more noted that the benefits have been depressed and the costs inflated in the presentation.

¹"CTA Attitude and Usage Study: A Report to the Chicago Transit Authority," *Market Facts, Inc.*