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Research in Brief

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Issues and Findings

Discussed in this Brief: How the design, management, and maintenance characteristics of Metro, Washington, D.C.'s subway system, have contributed to the system's safety and appearance.

Key issues: Washington's subway system is recognized for its unusually low crime rates. To determine whether Metro's environment is responsible for its low crime rates, Metro's design characteristics were reviewed and Metro's management and maintenance policies were assessed to observe the extent to which they embody situational crime prevention measures that both theory and practice suggest would be successful.

Key findings: Some of the factors found to contribute to Metro's success include:

• High, arched ceilings that not only are architecturally sound and aesthetically pleasing but also create a feeling of openness that reduces passenger fears and provides them with an open view of the station. Additionally, long and winding corridors and corners were avoided to reduce shadows and nooks that criminals and panhandlers could occupy.

• A system that allows passengers to buy multiple-use farecards in any dollar amount, cutting down the time money is exposed to pickpockets and robbers. Farecards also must be used on entry and exit from the system, reducing the likelihood of fare evasion.

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Visibility and Vigilance: Metro's Situational Approach to Preventing Subway Crime

by Nancy G. La Vigne

Washington, D.C.'s subway system (Metro) has experienced lower than expected crime rates since its inception in 1976. The case study reported here suggests that Metro's relative safety, compared with mass transit systems in similar urban areas, may be attributable to a combination of design characteristics, management practices, and maintenance policies that incorporate principles of situational crime prevention and crime prevention through environmental design (CPTED).

This Research in Brief identifies factors in Metro's environment that are consistent with situational crime prevention,[1] which aims to reduce criminal opportunities by:

• Increasing the perceived effort of offending.

• Increasing the perceived risk of offending.

• Decreasing the perceived reward of offending.

• Removing the "excuses" for offending—i.e., lax conditions or attitudes that lead to criminality.

Results of analyses comparing Metro's crime statistics with those of subway systems in Atlanta, Boston, and Chicago are also presented. They reveal that crime rates in the Metro system are generally lower and less variable than in comparison systems. In addition, Metro's "in-ground" crime rate is favorably contrasted to the above-ground rates at each of its stations and the rates over time for the D.C. Standard Metropolitan Statistical Area (SMSA).

Methodological concerns

Demonstrating that Metro's environment explains its unusually low crime rates, or even that Metro's crime rates are unusually low, is not an easy task. Metro's design is highly uniform from station to station, a characteristic that Metro's architects deliberately planned to ensure that riders could recognize and use the system with ease. (See "Planning Metro.") The differences that do exist among stations—such as whether the station is elevated, the length of the escalators, or whether the station connects two or more lines—are characteristics that are either unavoidable due to construction restrictions or necessary to serve the needs of Metro's

Issues and Findings

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• Metro trains are equipped with graffiti- and vandal-resistant materials to discourage potential offenders. When graffiti artists or vandals do cause damage, maintenance workers clean and repair damaged property promptly.

• No public restrooms, lockers, or excess seats for potential offenders to loiter. Fast food establishments are prohibited because customers generate litter and provide victims for robbers and pickpockets.

• Enforcement of "quality of life" violations, such as smoking or eating on trains, and prompt reporting of all vandalism and graffiti to maintenance personnel to ensure a safe and clean environment.

• Continuously staffed entrance kiosks while Metro is open. Station attendants are aided by closed-circuit televisions at all unmanned entrances, tunnels, and platforms, and they carry two-way radios to report crime and maintenance problems.

Metro's crime rates have been stable and are a fraction of those experienced by the subway systems in Atlanta, Boston, and Chicago. Applying Metro's design, maintenance, and crime prevention strategies may help new or existing systems reduce crime in their subway stations.

Target audience: Urban planners, architects, criminologists, transit police, and researchers.

ridership. Likewise, the maintenance of Metro's stations is stringent throughout: Graffiti and litter are removed within hours, lights are replaced promptly, and structures damaged by vandalism or wear and tear are removed or repaired immediately.

Metro's uniformity in design and maintenance, although exemplary, nonetheless makes testing the impact these variables might have on crime within Metro difficult: The uniformity of design and maintenance variables from station to station would yield little in the way of statistically significant results. Given its design limitations, this study required a series of tests that build upon one another. (See exhibit 1.)

Situational crime prevention at Metro

Metro's environment has most of the opportunity-reducing characteristics found in a recent compilation of situational crime prevention techniques (see exhibit 2). These features and their effectiveness are discussed below.

Increasing perceived effort. Metro characteristics that might increase the perceived effort of offending include the following:

• Target hardening. Metro's seats, windows, and fixtures are constructed with materials resistant to graffiti writing and vandalism to increase the effort associated with these offenses. On Metro platforms, recessed walls and bars installed in front of the walls discourage graffiti.[2]

• Controlling access. Because Metro's design limits the number of stairways leading from street level to underground stations, gaining entry to the system to commit offenses requires more effort than would otherwise be the case. Metro also closes during low-density (early morning) hours. The risk of victimization is highest during off-peak hours due to the absence of capable guardians (third parties) to intervene; therefore, closing the Metro during these hours reduces criminal opportunities.

• Deflecting offenders. Stations have escalators on both ends of the platform to encourage passengers to occupy the entire platform rather than congregating in the middle. This design characteristic deflects pickpockets; the open environment reduces jostling among passengers. In addition, clear signage directing riders to the nearest exits and transfer points as well as maps situated at exits, entrances, and transfer locations reduce confusion and uncertainty among riders, making them less vulnerable to pickpocketing.

• Controlling facilitators of committing crime. Metro's planners deliberately omitted public restrooms, luggage lockers, and excess chairs and benches so that potential offenders would not be encouraged to linger in the system and assess their targets. Planners prohibited fast food facilities to minimize robbery and pickpocket opportunities and to decrease litter, thereby enhancing maintenance of a clean environment.

Increasing perceived risks. Metro's entry and exit screening policies, formal surveillance, employee surveillance, and natural surveillance all contribute to Metro's appearance of a high-risk place to commit crime.

Metro's automated fare collection system is designed to reject counterfeit slugs and bills and to preclude the use of one farecard by several passengers in succession, thus increasing the risks of apprehension for fare evasion. Unlike traditional token systems of older subways, farecards are distance based

and must be used on both entry and exit from the system, increasing the risk of apprehension by 100 percent. The farecard system also allows passengers to purchase cards of any dollar amount for multiple trips, enabling them to reduce the frequency with which they exchange cash for fares (thus exposing their wallets to pickpockets).

Formal surveillance is achieved through Metro's transit police, consisting of approximately 286 sworn officers and officials. They are trained to be vigilant and to take immediate action against "quality of life" violations by making arrests and issuing citations.[3] Metro prohibits its riders from eating, drinking, smoking, playing radios, transporting animals, or moving from one rail car to another. These rules are clearly posted at the entrance to and exit from the station platforms as well as on the rail cars themselves, and they are stringently enforced by Metro police. According to Angus B. MacLean, the first chief of the Metro Transit Police, the transit police are so vigilant, "Even today the word around town is, 'If you want to commit crime, do it on the streets; you'll get caught doing it downstairs'."[4] Transit police also have a role in maintaining Metro's pristine environment. From the outset, officers have been trained to report any maintenance problems, such as burned-out lights, to the maintenance department.[5]

Employee surveillance by station attendants supplements formal surveillance of the system and contributes significantly to Metro's safe environment. Metro stations are staffed during all hours of rail operation. Attendants are positioned

Planning Metro

Metro's planners faced a multitude of concerns in designing the rapid transportation system, not the least of which was to ensure the safety and security of its passengers and the residents living in areas serviced by the system. Concern about passenger security was underscored by the fact that, even in Metro's early planning stages in the 1960s, Washington, D.C., had the tenth highest crime rate in the country.[1]

The major players involved in Metro's planning included the engineering firm of Deleuw, Cather & Co. and the architectural firm of Harry M. Weese & Associates, both based in Chicago. In the early 1970s, they were joined by Angus B. MacLean, hired as the first chief of the Metro Transit Police, and John F. Hyde, hired as deputy chief. Both men contributed to the planning process during its early stages to ensure that their security suggestions were integrated into the architects' blueprints in a cost-efficient and aesthetically pleasing manner.

Metro's architects and planners set out to design a system that would deter criminals and make riders feel comfortable and secure.[2] "We were dealing with a clean slate," said Melvin Siegel, deputy director for architecture, Office of Engineering and Architecture, Washington Metropolitan Area Transit Authority. "We didn't have many preconceived notions that tended to prevail. Other subway architects and designers tended to borrow directly from railroad technology and design, which tends to lack creativity. We had a creative committee [of fine arts] and a receptive board."[3]

Metro's architects also were fortunate that many of their efforts to create good architectural form—one that was structurally sound as well as free of embellishments—also promoted a secure environment. Instead of the tension between aesthetics and security that is often observed with target hardening and other design measures,[4] these two factors were considered to make a "good marriage."[5] For example, Metro's high, arched ceilings resolve some structural requirements (the 600-foot platform requires high ceilings) while also providing passengers with a feeling of openness, thus reducing levels of fear.

Today, Metro consists of a route of 92 miles and 75 stations, with 8 more stations under construction; by early 2001, the total system will encompass 83 stations covering 103.06 miles. To reduce operating costs, Metro runs from 5:30 a.m. to midnight on weekdays and 8:00 a.m. to midnight on weekends and holidays, when Metro services are less likely to be used. Fares on Metro are distance based, ranging from $1.10 to $3.25, and dependent on the hours of travel, with rush-hour fares slightly more expensive than off-peak fares.

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1. Hyde, J.F., "CPTED Goes Underground," a presentation made at the Crime Prevention Through Environmental Design Conference, Washington, D.C., December 10, 1993.

2. Personal interview with Melvin Siegel, deputy director for architecture, Office of Engineering and Architecture, Washington Metropolitan Area Transit Authority (WMATA), May 21, 1995, Washington, D.C.; personal interview with Richard J. Bochner, supervisor, Facilities and Planning Section, Office of Planning, WMATA, May 21, 1995, Washington, D.C.; and telephone interview with John F. Hyde, former deputy chief of the Metropolitan Transit Police, WMATA, September 12, 1995.

3. Personal interview with Melvin Siegel, May 21, 1995, Washington, D.C.

4. See Weidner, R., "Target-Hardening at a New York City Subway Station: Decreased Fare Evasion—At What Price?," in R.V. Clarke (ed.), Crime Prevention Studies, vol. 6., Monsey, New York: Criminal Justice Press, 1996.

5. Personal interview with Melvin Siegel, May 21, 1995, Washington, D.C.

Exhibit 1. ***Summary Results of Eight Tests of Metro's Success***

The impetus for this Research in Brief stemmed from the need to explore and document the purported success of Metro as an application of situational crime prevention measures incorporated into a mass transit system at its creation rather than retrofitted. Two questions formed the basis of the research:

1. Is Metro safer than one would expect, given the incidence and prevalence of crime on other subway systems and crime occurring in the communities Metro serves?

2. Is Metro's unusually low crime rate explained by its environment—the way the system is designed, managed, and maintained?

The two questions were answered through a series of tests summarized below. [1]

Test	Method Employed	Result
A comparison of Metro's crime rates to those of other subway systems[2]	Comparisons of extant data; F-tests (using the Scheffe correction for multiple comparisons) of an ANOVA (analysis of variance) comparing mean rates per rider on four systems for which crime data by station were obtainable	Metro's crime rates, when calculated both per rider and per passenger mile, are lower than all other systems for which data were obtainable
An assessment of characteristics of Metro's environment and the extent to which they are consistent with situational crime prevention techniques	Qualitative analysis and comparison	Metro's characteristics are consistent with Clarke's 16 situational crime prevention techniques
A comparison of Metro's crime rates over two time periods	Calculation of Pearson correlation coefficients for Metro crime rates by station in 1993 to those in 1994	Correlations are positive and significant, indicating that Metro's crime rates are stable over time and allowing for the possibility that this stability is due to Metro's environment
A test of the correlation between Metro crime rates in stations to the crime rates above ground by census tract	Calculation of Pearson correlation coefficients for crimes per 100,000 residents for census tracts in which Metro stations are located to crimes per 1 million riders for Metro stations	Correlations are not significant, with the exception of assaults that, when eliminating outliers, are positively correlated (coefficient = .45, p<.000)
A comparison of the variation in crime rates on Metro to the variation in crime rates above ground in the communities Metro serves	F-tests to compare coefficients of relative variation (SD/mean)[3] for crimes per 100,000 residents for census tracts in which Metro stations are located to crimes per 1 million riders for Metro stations.	Variations are significantly smaller on Metro for Part I crimes and robberies, but the difference in variation for assaults is not significant

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[1]For a more detailed description of the methodology and analyses associated with this topic, see La Vigne, N.G., *Crime Prevention Through the Design and Management of Built Environment: The Case of the D.C. Metro*, doctoral dissertation, Rutgers, The State University of New Jersey, School of Criminal Justice, Newark, New Jersey, 1996; La Vigne, N.G., "Safe Transport: Security by Design on the D.C. Metro," in R.V. Clarke (ed.), *Preventing Mass Transit Crime,* Crime Prevention Studies, vol. 6, Monsey, New York: Criminal Justice Press, 1996; and La Vigne, N.G., "Security by Design on the Washington Metro," in R.V. Clarke (ed.), *Situational Crime Prevention: Successful Case Studies*, 2d ed., New York, New York, Harrow and Heston, 1997.

[2]It is important to note that these systems are far from identical in terms of important factors such as ridership, demographics, number of riders, number of stations, or total route miles. However, care was taken to choose systems that are similar in size and service area, but varied in design characteristics. Metro, MBTA, and CTA are similar in daily ridership but differ in route miles and number of stations. MARTA is much smaller than the other systems in terms of riders, mileage, and stations, and it is the newest of the systems, beginning in 1979, just 3 years after Metro. Thus, MARTA was deemed an appropriate comparison system because its planners, like Metro's, were able to benefit from the successes and failures of other systems as well as from a greater knowledge of crime prevention tactics. CTA operates 24 hours per day; Metro, MARTA, and MBTA open between 5:00 a.m. and 6:00 a.m. and close between midnight and 1:30 a.m. For comparison purposes, those crimes occurring on CTA between the hours of 1:00 a.m. and 6:00 a.m. were subtracted before calculating its crime rates and coefficients of variation.

[3]The coefficients of relative variation are calculated by dividing the standard deviation by the mean for each data set. Coefficients are compared to determine whether the difference between the two are statistically significant through the use of an F-test, which is calculated by dividing the coefficients of variation (large over small), and squaring: $(CV_{large}/CV_{small})^2$.

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Test	Method Employed	Result
A comparison of the variation in crime rates on Metro underground to those on Metro property aboveground (parking lots, bus bays, etc.)	F-tests to compare coefficients of relative variation SD/mean for crimes per 1,000 parked cars for Metro aboveground premises to crimes per 1 million riders for Metro stations underground	Variations do not differ significantly for Part I crimes and robberies, but Metro assault rates occurring underground exhibit more variation than those for Metro aboveground property
A comparison of variation in crime rates on Metro to the variation in crime rates for subway systems in Boston, Atlanta, and Chicago	F-tests to compare coefficients of relative variation for crimes per 1 million riders on Metro to those of the comparison systems, excluding parking lot crimes	Metro's variation is significantly smaller than Boston's and Chicago's, but Atlanta's is significantly smaller than the other three systems (see endnote 13); all four subway systems have significantly less variation by station than does D.C. aboveground by census tract
A comparison of trends over time for D.C. SMSA crime rates and Metro crime rates	Comparison of changes in Z-scores over time[4]	Variations in Z-scores indicate that changes in crime rates over time for D.C. aboveground are not mirrored by Metro crimes below

[4]To standardize for differences in base rates between the two data sets, Z-scores are compared and analyzed to determine the extent to which crime rates fluctuate in the same direction.

in kiosks at the entrances to the platforms to provide assistance to riders and keep an eye on potential fare evaders.

All Metro stations have at least eight strategically placed closed-circuit television (CCTV) cameras so attendants can monitor unstaffed entrances, tunnels, and platforms. CCTV screens are located in each station attendant's kiosk to increase employee surveillance, thereby increasing the risks of apprehension.

Another key component of Metro's surveillance is its communications system. All Metro employees, including maintenance personnel, are equipped with two-way radios so they can be located or alerted at any time.[6] In addition, each rail car has passenger-to-operator intercoms to enable passengers to alert drivers to dangerous situations or crimes in progress. Blue light boxes containing emergency phones and power-takedown buttons are located every 600 feet along the right of way.

Employee surveillance is aided by Metro's design, which was deliberately structured to ensure a high level of natural surveillance. Metro's platforms are a uniform 600 feet long, designed to accommodate a train of eight 75-foot-long cars. The platforms have a minimal number of supporting columns, which can provide cover for criminals. A high, free-standing vaulted ceiling arches above the tracks, giving the appearance of a wide-open design. These unobstructed views also enable riders to observe goings-on as they wait for trains.

Metro's natural surveillance characteristics include open pathways to and from train railways that maximize natural surveillance, thereby increasing the perceived risks of committing crime. In addition, the trains are characterized by a "straight through" design, enabling police to walk freely between cars, thus increasing formal surveillance capabilities. Metro's planners deliberately avoided long, winding corridors and corners found in many older systems. Such corners create shadows that could hide criminals and serve as nooks that panhandlers and homeless people like to occupy.[7]

Proper lighting also enhances natural surveillance. Lighting within Metro is a minimum of one footcandle,[8] and all new lighting is a minimum of two footcandles. Lighting is recessed so it does not cast shadows. In addition, indented walls provide greater reflection of light. As one of Metro's original designers explained, the recessed lighting within the high, arched ceilings was intended to "light the sky [and] enhance the environment."[9]

Exhibit 2. ***Sixteen Techniques of Situational Prevention***

Increasing Perceived Effort	Increasing Perceived Risks	Reducing Anticipated Rewards	Removing Excuses
1. *Target hardening* Slug rejector device Steering locks Bandit screens	5. *Entry/exit screening* Automatic ticket gates Baggage screening Merchandise tags	9. *Target removal* Removable car radio Women's refuges Phonecard	13. *Rule setting* Harassment codes Customs declaration Hotel registration
2. *Access control* Parking lot barriers Fenced yards Entry phones	6. *Formal surveillance* Red light cameras Burglar alarms Security guards	10. *Identifying property* Property marking Vehicle licensing Cattle branding	14. *Stimulating conscience* "Shoplifting is stealing" Roadside speedometers "Bloody idiots drink and drive"
3. *Deflecting offenders* Bus stop placement Tavern location Street closures	7. *Surveillance by employees* Pay phone location Park attendants CCTV systems	11. *Reducing temptation* Gender-neutral phone lists Off-street parking V-chip	15. *Controlling disinhibitors* Drinking age laws Ignition interlock
4. *Controlling facilitators* Credit card photo Caller-ID Gun controls	8. *Natural surveillance* Defensible space Street lighting Cab driver ID	12. *Denying benefits* Ink merchandise tags PIN for car radios Graffiti cleaning	16. *Facilitating compliance* Improved library checkout Public lavatories Trash bins

Source: Clarke, R.V. (ed.), *Situational Crime Prevention: Successful Case Studies*, 2d ed., New York, New York: Harrow and Heston, 1997.

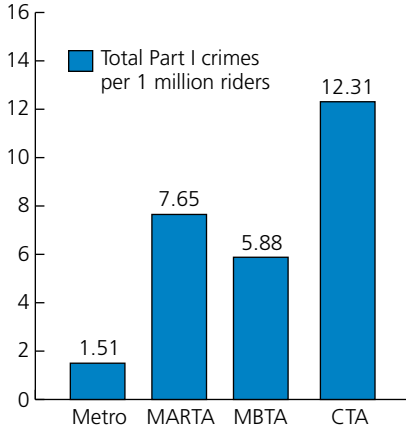
Reducing anticipated rewards. Reducing the rewards of crime can be as simple as removing the crime target or reducing benefits or temptations associated with a particular crime. In the case of Metro, the availability of public telephones both within stations and immediately outside enables riders to make pickup arrangements with a relative or friend before boarding the train, thus reducing waiting time within the system and the associated risk of victimization.

Trains are strategically scheduled to minimize the time riders are waiting on platforms, particularly during off-hours. Such scheduling increases the chances of riders arriving at stations just before trains depart. This reduces opportunities for robberies by minimizing the time suitable targets (riders waiting for trains) remain on the relatively isolated platform.

Rewards of crime are also reduced through Metro's policy of keeping the premises well maintained. Platforms, cars, and corridors are free of litter; graffiti is removed within 24 hours; and vandalism damage is repaired promptly. These actions diminish the psychic thrill for litterers, graffiti artists, and vandals because neither they nor their friends are given the chance to appreciate their work for long.[10]

Removing the excuses. Removing the excuses associated with committing a crime is a new situational crime prevention tenet,[11] based on the assumption that individuals will be less likely to commit a crime if prohibitions are clear or if public humiliation is the probable result of a violation. Metro has established highly specific and visible rules, with signage indicating proscribed activities and violations. These rules, combined with the "zero tolerance" enforcement approach adopted by transit personnel, deter potential

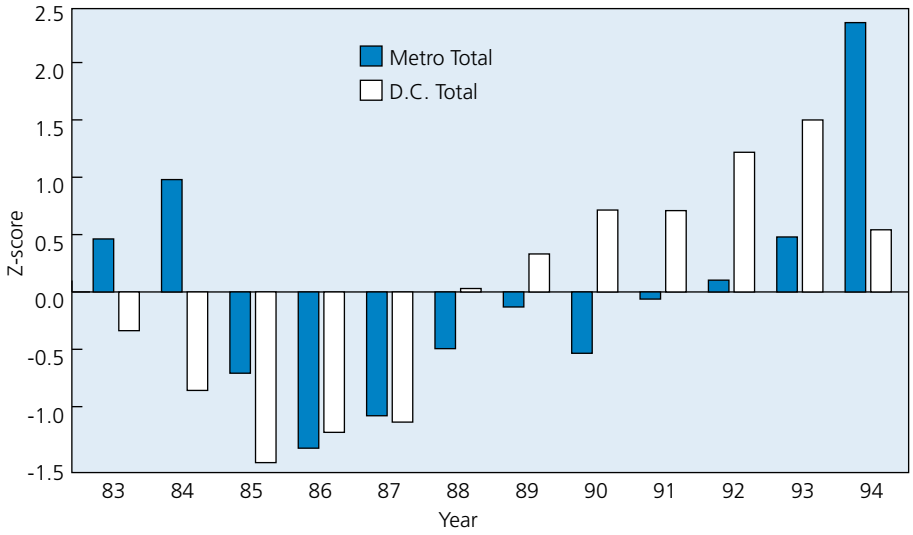
Exhibit 3. ***Comparison of Part I Crime* (per 1 Million Riders) on Four Subway Systems—1994***



*Includes murder, rape, robbery, aggravated assault, burglary, larceny, and arson, but excludes auto theft due to the nature of subway crime.

Sources: Washington Area Metropolitan Transit Authority Transit Police, Metropolitan Atlanta Rapid Transit Authority Transit Police, Metropolitan Boston Transit Authority Transit Police, and Chicago Police Department.

Exhibit 4. ***Comparison of Crime Rates for Metro Versus D.C. SMSA, 1983–1994***
(Standardized total rates per Metro rider and per SMSA inhabitant represented as Z-scores*)



*Z-scores permit comparison of Metro and D.C. crime rates in a manner ensuring elimination of distortion that, given the nature of these data, would otherwise occur. Initially crime rate data for Metro were expressed as crimes per 100,000 riders; for D.C. SMSA, as crimes per 1 million inhabitants.

Sources: Washington Metropolitan Area Transit Authority and FBI Uniform Crime Reports.

offenders by making them accountable for any violations. A related means of removing excuses is through "stimulating conscience," or evoking a sense of guilt or shame associated with proscribed behavior.[12] Metro uses its public address system for this purpose; station managers broadcast public reprimands of rule breakers.

Facilitating compliance with rules and laws is another strategy that promotes personal accountability. For example, Metro makes it difficult to justify littering by placing an adequate number of trash receptacles and newspaper recycling bins throughout each station. In addition to facilitating compliance, an abundance of trash receptacles helps transit employees to maintain a clean environment, which may in turn promote a sense of territoriality in law-abiding passengers and enhance their willingness to intervene should the need arise.

Is Metro safer than one would expect?

Analyses comparing Metro's crime rates to those of the Metropolitan Atlanta Rapid Transit Authority (MARTA), the Metropolitan Boston Transit Authority (MBTA), and the Chicago Transit Authority (CTA) indicate that Metro's crime rates are lower and that this difference is statistically significant. Metro experiences far fewer serious crimes per rider than comparison systems.

Although data access difficulties precluded a detailed comparison between Metro and a larger range of subway systems, the systems examined are similar to Metro in size and service area (see exhibit 1, footnote 2). But Metro's crime rates are a small fraction of the other systems' (see exhibit 3).[13] These data support the claim that Metro's crime rates are unusually low.

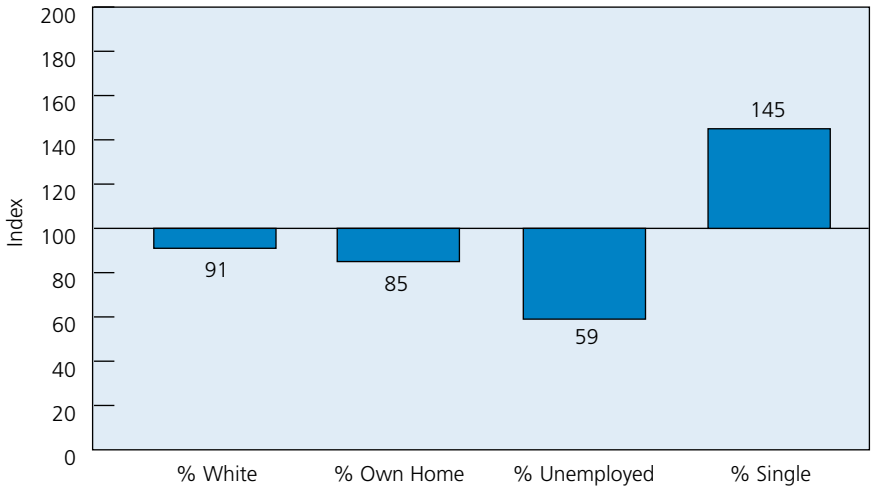
Is Metro's safety explained by its environment?

An assessment of Metro's environment suggests that it has the majority of opportunity-reducing characteristics recommended by both crime prevention theory and practice. The system is clean and well lit, affords favorable circumstances for natural and employee surveillance, and is characterized by strict enforcement of both rules and laws.

In addition to its environmental safeguards, Metro was found to have stable crime rates over time, on a station-by-station basis. This finding suggests that Metro's environment—also stable over time—could be a powerful explanation for the stability in crime rates. Thus, environment cannot be eliminated from the list of potential causal factors that might explain Metro's low crime rates.[14]

Metro experiences less crime than one would expect given the distribution of crime aboveground in the communities Metro serves. With the exception of assaults, Metro's crime rates by station do not covary with crime rates for the census tracts where Metro stations are located. However, the relationship between aboveground assaults by census tract and belowground assaults in the

Exhibit 5. ***Metro Riders Demographic Index (ratio of % of 1991 respondents who rode Metro in past week satisfying demographic category, to % SMSA population respondents satisfying demographic category, times 100)***



Source: The Scarborough Report, 1992.

Metro system is positive and significant, suggesting that assaults may not be as situationally influenced as other crime types.[15]

That offenders are less willing to perpetrate crimes on Metro property than in the areas around Metro is also supported by the fact that crime rates from station to station vary less than rates among census tracts.[16] In addition, a comparison of crime rates from 1983 through 1994 for Metro (underground) and Washington, D.C. (above ground), indicates that the two data sets do not covary, again supporting the notion that Metro's crime rates are independent of those occurring above ground. (See exhibit 4.)

Addressing rival hypotheses

It is probable that rival explanations exist that might account, at least in part, for Metro's unusually low crime rates, and these warrant attention.

Some may argue, for example, that Metro has such low crime rates because riders do not represent a cross-section of Washington, D.C.'s population; rather, they are predominantly white, middle- to upper-middle-class working people. However, exhibit 5 indicates that Metro riders are less likely to be white, to own their homes, and to be unemployed than the general population in the D.C. SMSA.[17] They are also more likely to be single, as indicated in exhibit 5.

These findings lend some validity to the argument that Metro riders are more advantaged than the overall Washington, D.C., SMSA population. However, the survey did not include all riders living in areas that Metro currently serves: It did not capture riders using Metro's Green Line stations, which began operating in mid-1991 and were expanded through 1993. These Green Line stations are found in areas with lower income levels and higher unemployment rates than most other Metro station locations. In addition, the survey failed to capture two important Metro rider subpopulations: tourists and persons under age 18, such as high school and college students who ride Metro to and from school. Although tourists are more likely to be victims than offenders, students and youths in general are more prone to offending than working people.

As an alternative to the ridership argument, an examination could be made of the changes in crime rates as Metro expanded its service area. Metro's unusually low crime rates could be explained by the system's serving a very small area, which is predominantly middle to upper middle class. This argument became significantly less valid in 1991 when the six stations on Metro's new Green Line began serving some high-crime, inner-city points and southeast to Anacostia. By the end of 1993, the Green Line was further extended northwest to Greenbelt, adding another four stations. However, an analysis of crime rates before and after this additional construction does not indicate a significant increase in crime rates for total crimes, Part 1 property crimes, or Part 1 violent crimes.[18]

More specifically, auto theft, pickpocketing, and assault declined from 1989 to 1995, while robbery increased slightly and grand larceny increased more markedly.[19] These trends do not suggest a dramatic change in crime following the addition of the Green Line, which can be interpreted as further support for the hypothesis that Metro has

been relatively successful in insulating itself against crime occurring above ground.

The ridership argument implies that those who ride the subway regularly—rather than the occasional, opportunistic rider or the potential offender who loiters aboveground without paying a fare and using the system—are the same people who are perpetrating crimes. Neither prior research nor theory offers a basis to support or refute this notion. The service area argument suggests that the type of people who offend are in a racial minority, poor, uneducated, and unemployed. The literature, however, does not universally support such an argument.[20] The answer cannot be gleaned from the data at hand, but these questions merit further investigation in subsequent research on subway crime.

Implications for theory and practice

Rival hypotheses excepted, the tests conducted for this research, when considered in combination, generally support the position that Metro is unusually safe and that something unique exists about Metro's environment that explains its low crime rates. Metro's design characteristics and maintenance and management policies, which reflect situational crime prevention principles, support the hypothesis that what is special about Metro's environment is that it reduces criminal opportunities. Metro's success suggests that the environment can be manipulated to reduce criminal opportunities. Further, it implies that potential offenders weigh the risks of apprehension against the effort and expected payoff and consider the presence of capable guardians when weighing those risks.

Characteristics of Metro's environment, from design elements to enforcement strategies, can be applied to new or existing systems in an effort to reduce crime. Although prior research indicates that the base rates of subway crime are quite low and that individuals have a greater risk of victimization aboveground than below,[21] increasing security on subway systems is an important public policy objective. Fear of victimization has been found to be greater underground than above.[22]

Levels of passenger fear affect ridership and, therefore, have widespread implications for urban policy, including issues of traffic congestion and pollution created by alternative modes of transportation, such as taxicabs, buses, and private automobiles. These indirect costs not only affect the system itself but also are ultimately translated into higher sales taxes and cutbacks on governmental services.

Thus, the benefits of implementing crime prevention tactics on subways are far-reaching; reducing subway crime saves money and increases revenues at the same time because riders will be more willing to use the system. In an urban area, the well-being of its subway system, in terms of low crime rates and ample ridership, can affect the well-being of the entire metropolitan area.

The fact that this study's hypotheses were supported with the tests detailed above has important implications for crime prevention. The majority of evaluations of crime prevention efforts focus on interventions to address preexisting crime problems, and these evaluations tend to study the impact of an intervention over a relatively short time. Counter to this typical approach to crime prevention evaluation, this study enables researchers not only to determine the impact of a comprehensive preventive effort created before a crime problem occurred but also to assess the impact of these measures over a significant period. Metro appears as relatively crime-free today as the day it began operating in 1976. This is particularly impressive considering that Washington, D.C., still ranks high in crime rates among cities its size.

Further efforts to evaluate a mix of preventive measures should be encouraged. In addition, studies of subway offenders in terms of who they are, where they live, where they commit their crimes, and what kinds of crime they commit are needed if researchers and others are to truly understand the nature and distribution of subway crime and how it can be prevented.

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Notes

1. Clarke, R.V. (ed.), *Situational Crime Prevention: Successful Case Studies,* New York, New York: Harrow and Heston, 1992, 1997.

2. Deiter, R.H., *The Story of Metro: Transportation and Politics in the Nation's Capital*, Glendale, California: Interurban Press, 1990; and Mooney, B., "Metro: Building Rapid Rail Transit in the National Capital Region," transcript, Washington, D.C.: 1976.

3. Personal interview, June 14, 1994, Washington, D.C., with B.E. Morrow, then chief of the Metropolitan Transit Police, Washington Metropolitan Area Transit Authority (WMATA).

4. Personal communication, September 13, 1995, with Angus B. MacLean, former police chief, Metropolitan Transit Police, WMATA.

5. Telephone interview, September 12, 1995, with John F. Hyde, former deputy chief of the Metropolitan Transit Police, WMATA.

6. Personal communication, September 13, 1995, with Angus B. MacLean, former police chief, Transit Police, WMATA.

7. Deiter, R.H., *The Story of Metro: Transportation and Politics in the Nation's Capital;* and Mooney, B., "Metro: Building Rapid Rail Transit in the National Capital Region."

8. A footcandle is a measure of illumination that equals one lumen of light per square foot. Fennelly, L.J., *Handbook of Loss Prevention and Crime Prevention*, 2d ed., Stoneham, Massachusetts: Butterworth-Heinemann, 1989.

9. Personal interview with Richard J. Bochner, supervisor, Facilities and Planning Section, Office of Planning, WMATA, May 21, 1995, Washington, D.C.; and personal interview with Melvin Siegel, deputy director for architecture, Office of Engineering and Architecture, WMATA, May 21, 1995, Washington, D.C.

10. Sloan-Howitt, M., and G.L. Kelling, "Subway Graffiti in New York City: 'Getting Up' vs. 'Meaning It and Cleaning It,' " in R.V. Clarke (ed.), *Situational Crime Prevention: Successful Case Studies*, New York, New York: Harrow and Heston, 1992.

11. See Clarke, R.V., "Introduction," in R.V. Clarke (ed.), *Situational Crime Prevention: Successful Case Studies*, 2d ed., New York, New York: Harrow and Heston, 1997.

12. Ibid.

13. MARTA's coefficient of relative variation is smaller than the three comparison systems, including Metro's (although Metro's is smaller than CTA's and MBTA's). One might speculate that MARTA's low coefficient is explained by the same design characteristics that Metro possesses: the system is relatively new, thus benefiting from more current crime prevention measures, and the stations exhibit little variation in design. An alternative possibility is that variations in crime rates within subway systems may be influenced by the land use of the place in which stations are located, which may be more uniform in Atlanta than Washington, D.C., Chicago, or Boston. This latter hypothesis merits further investigation.

14. A further test of the implications of this stability would be to compare Metro's year-to-year correlation coefficient with that of other systems, which would indicate whether such stability is a characteristic unique to Metro or common to subway systems in general.

15. One explanation for the significant correlation between assaults on Metro and those aboveground may be due to the nature of the act itself. The genesis for an assault may commence underground but actually take place aboveground, or vice versa. Thus, it is possible that, because assaults are less likely to begin and end in the same location, the difference between crime settings is less distinct to such offenders, and, therefore, the preventive capabilities of Metro are less likely to influence offending behavior.

16. Again, assaults are an exception to this finding. The coefficient of variation for assaults is smaller by station than by census tract, but it is not statistically significant, perhaps because assaults are less place-specific than other crime types.

17. See also La Vigne, N.G., *Crime Prevention Through the Design and Management of Built Environment: The Case of the D.C. Metro*, doctoral dissertation, Rutgers, The State University of New Jersey, School of Criminal Justice, Newark, New Jersey: 1996.

18. La Vigne, N.G., *Crime Prevention Through the Design and Management of Built Environment: The Case of the D.C. Metro.*

19. Ibid.

Related Reading

Preventing Mass Transit Crime (Crime Prevention Studies, vol. 6, Monsey, New York: Criminal Justice Press, 1996), edited by Ronald V. Clarke, contains several chapters on preventing crime in public transit settings. Below are the chapter titles and authors.

Editorial Introduction: Crime and the Economics of Mass Transit
Ronald V. Clarke

Redesigning Hell: Preventing Crime and Disorder at the Port Authority Bus Terminal
Marcus Felson et al.

Eliminating Pay Phone Toll Fraud at the Port Authority Bus Terminal in Manhattan
Gisela Bichler and Ronald V. Clarke

Target Hardening at a New York City Subway Station: Decreased Fare Evasion—at What Price?
Robert R. Weidner

Preventing Auto Theft in Suburban Vancouver Commuter Lots: Effects of a Bike Patrol
Paul Barclay, Jennifer Buckley, Paul J. Brantingham, Patricia L. Brantingham, and Terry Whinn-Yates

Safe Transport: Security by Design on the Washington Metro
Nancy G. La Vigne

Designing for Security in Météor: A Projected New Metro Line in Paris
Marina L. Myhre and Fabien Rosso

Where Angel Fears to Tread: A Test in the New York City Subway of the Robbery/Density Hypothesis
Ronald V. Clarke, Mathieu Belanger, and James A. Eastman

The Environs of Rapid Transit Stations: A Focus for Street Crime or Just Another Risky Place?
Richard Block and Sean Davis

20. See Gabor, T., *'Everybody Does It!': Crime By The Public*, Toronto, Canada: University of Toronto Press, 1994.

21. Del Castillo, V., *Fear of Crime in the New York City Subway*, doctoral dissertation, Fordham University, Department of Sociology, New York, New York, 1992; and Kenney, D.J., *Crime, Fear, and the New York City Subways: The Role of Citizen Action*, New York, New York: Praeger, 1987.

22. Wekerle, G.R., and C. Whitzman, *Safe Cities: Guidelines for Planning, Design, and Management*, New York, New York: Van Nostrand Reinhold, 1995; Levy, N.J., *Crime in New York City's Subways: A Study and Analysis of Issues With Recommendations To Enhance Safety and the Public's Perception of Safety Within the Subway System*, New York, New York: Senate Transportation Committee, 1994; Kenney, D.J., *Crime, Fear, and the New York City Subways: The Role of Citizen Action*; and Schnell, J.B., A.J. Smith, K.R. Dimsdale, and E.J. Thrasher, "Vandalism and Passenger Security: A Study of Crime and Vandalism on Urban Mass Transit Systems in the United States and Canada," Washington, D.C.: U.S. Department of Transportation, 1973.

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