
GASOLINE DRIVE-OFFS: DESIGNING A LESS CONVENIENT ENVIRONMENT

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***Abstract:** Recent studies of convenience store crime have focused on robberies, but gasoline thefts are a troublesome and often overlooked public policy problem that drain valuable police resources. An analysis of calls for service from 38 convenience stores in Austin, TX reveals that gasoline drive-offs account for 48% of all convenience store calls. This paper ties the environmental characteristics and business practices of convenience stores to reported gasoline drive-offs. The findings suggest that removing signs from windows, installing brighter lights and instituting a pay-first policy can deter such crimes.*

Over just a two-year period, an Austin, TX convenience store was criminally victimized not once, not twice, but 385 times (Austin Police Department. 1090).¹ Ninety percent of these victimizations were gasoline drive-offs (offenders filling their tanks with gas and driving off without paying); the others consisted of shoplifting, disturbances and acts of criminal mischief. Why is this store so attractive to criminals—particularly those who steal gas? It could be that the store is located in a high-crime neighborhood. Or perhaps the clerks are fearful of crime and are therefore vulnerable to victimization. And there is always the possibility that the store has certain business practices that encourage particular crimes.

Patrol officers spend thousands of hours responding to convenience store incidents. In the year 1990 alone, Austin convenience stores reported over 6,000 thefts (Austin Police Department. 1990). The strain on patrol officers* time in responding to convenience store calls for service translates into higher costs for police services as cities are pressured to hire more

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patrol officers. Opportunity costs of responding to gas drive-off calls also exist: police could otherwise be spending their time on apprehending more serious offenders, conducting better preliminary investigations and engaging in crime prevention activities. Does it make sense—both politically and economically—to encourage or mandate changes in convenience store practices? What kind of incentives can a city use to encourage these changes? Although there are no simple answers to these questions, the research described here suggests that encouraging stores to make simple changes in business practices and store maintenance can reduce crime and improve public safety. This paper explores the various factors associated with the incidence of gasoline drive-offs and discusses some of the policy implications of alternative approaches to the problem.

OVERVIEW

Criminal Decision Making and the Environment

To understand the relationship between convenience store victimization and variables such as physical environment and business practices, an examination of the factors that affect the decision-making process of potential offenders is essential. Becker (1968) contended that criminal behavior can be examined in the same manner that economists analyze consumer choice. Criminals, just like the rest of us, consider the costs and benefits of using their time in different ways and conclude that crime is the most profitable occupation or hobby, as the case may be.

Research on criminal decision making assumes that criminals are "rational" beings: they make a conscious decision as to whether a crime is worth the risk of getting caught and being punished, weighing the costs and benefits associated with the crime (Cornish and Clarke, 1985). The expected payoff of the crime becomes particularly important in terms of how big a risk the criminal chooses to take. If the perceived risk of getting convicted on burglary charges, for instance, outweighs the monetary benefit of the crime, the rational criminal will not commit the burglary (Lattimore and Witte, 1986). This rational decision making, however, will always be somewhat flawed: criminals are constrained by the amount of time they have, their mental capabilities and the information available to them, which is why their decision-making processes are believed to be based on somewhat limited, or bounded, rationality (Cornish and Clarke, 1987).

One way in which a criminal measures the potential risk and reward of an offense is through observation of the physical and social environment surrounding a potential crime target. Habitual criminals are well-practiced at reading environmental circumstances and making conclusions about the desirability of a crime target (Harries. 1980). Studies linking the physical character of an area to its level of crime have determined that certain physical environments are more conducive to criminal activity than others (Brantingham and Brantingham. 1091; Newman. 1972). These characteristics have been grouped into a category of situational crime prevention termed "natural surveillance" (Clarke. 1992). Among these are the presence of physical obstructions behind which offenders can hide, such as fences and bushes; poor physical maintenance, such as large amounts of litter and low lighting; street design that allows for easy escape; and land use. such as location in a primarily commercial neighborhood.

Interestingly, criminals do not appear to be deterred by the mere possibility of being seen, but by the possibility that those who see them will take effective action against them. Offenders particularly avoid being seen by those who are familiar with, and are committed to defending, the property, persons, or environment under threat (Brantingham and Brantingham. 1991; Mayhew. 1991). Observation by residents is the basis for defensible space theory, which contends that crime control cannot be implemented through physical design alone, but must rely on the strength of the neighborhood social organization (Newman, 1972). It stands to reason, then, that offenders are most often deterred by the police, residents with a vested interest in their neighborhood, and employees who have a general responsibility for security of an area, such as bus drivers, parking lot attendants, and receptionists. Interestingly, the use of closed-circuit television (CCTV) can achieve a similar deterrent effect (Poyner. 1988; 1991).

While no research exists on the decision-making processes of those who commit gas drive-offs. related findings indicate that convenience store robbers make rational, albeit limited, decisions when choosing a target. Several studies have shed light on the decision-making processes of convenience store robbers. Swanson (1986) asked convenience store robbers to rank the five most desirable conditions they look for when considering which store to rob. Forty-five percent of convenience store robbers said "remote area." 32% indicated "one clerk on duty," 32% answered "no customers" and 25% listed "easy access/getaway." In addi-

tion, over 50% of the respondents indicated that the store's location, its interior visibility from the street and the sex of the clerk(s) were important considerations when choosing a target (Swanson, 1986). These findings suggest that use of some loss prevention practices can make stores less appealing to robbers.

Loss Prevention Practices

The pioneering study on convenience store loss prevention was conducted by Crow and Bull (1975). Researchers examined 340 Southland Corporation convenience stores (mostly 7-Elevens), obtained prevention procedures from interviews with robbers and developed a ranking scale to determine which stores were most attractive to robbers. They determined that providing a clear view of the cash register from the street, maintaining a view into the store, providing bright lighting in the store and parking lot, posting signs indicating low amounts of cash, and training employees in what to do in the case of a robbery all make a store's environment less attractive to potential robbers. Upon implementing the changes recommended by the study, the 7-Eleven convenience store chain experienced a 65% decrease in its robbery rate over a 12-year period (Crow and Erickson, 1988).

A study of convenience stores in Tallahassee, FL (Jeffery et al., 1987) quantified the business practices associated with "high crime" (8-18 robberies/year), "medium/high crime" (4-7 robberies/year), "medium/low crime" (1-3 robberies/year) and "low crime" (zero robberies) stores. Of the data collected, those variables found to be significant predictors of low-crime stores were: 1) the location of the clerk in the center of the store; 2) more than one clerk on duty; 3) clear visibility both within and outside the store; 4) the absence of concealed access /escape routes; 5) the location of the store near commercial or residential property rather than woods or vacant lots; 6) the existence of gas pumps in front of the store; and (7) the use of a limited cash policy. A follow-up study conducted by Hunter (1990) indicated that, of the seven initial crime prevention characteristics, the location of the store in a residential or commercial area, the use of a limited cash policy and the absence of access/escape routes were no longer significant.

Probably the most controversial study of convenience store crime was conducted in 1985, when the city of Gainesville, FL experienced a barrage of convenience store robberies. Convenience stores in Gainesville, police

found, had experienced twice as many robberies in a five-year period than both gas stations and fast food establishments combined (Callahan and Clifton, 1987). In an effort to control this outbreak, police officers began an in-depth study of convenience store crime, making contacts all over the country to determine if other jurisdictions had successfully combatted the problem.

Based on what they knew about convenience store robbers and their methods, officers designed an environmental survey to measure business practices in each convenience store in Gainesville. Officers rated the lighting of each store and its premises, any visual obstruction to cashiers and the number of clerks on duty. Despite the limited number of indicators used, police found that the better the environment (more brightly lit with fewer obstructions), the lower the crime rate. An even stronger negative correlation was found between the number of clerks on duty and the amount of crime. And when the environment was rated high in terms of good lighting and few obstructions and two clerks were working, no robberies were reported at all.

The Gainesville study influenced public policy; shortly after its release, the city council passed an ordinance requiring convenience stores to have two clerks on duty from the hours of 8:00 p.m. to 4:00 a.m., or closing. From the time of implementation, April 2, 1987 to October 26, 1987, convenience stores in Gainesville experienced a 65% reduction in robberies (Callahan and Clifton, 1987).

Studies of convenience store robbers indicate that these criminals consider the expected payoff of a crime as well as the risk of getting caught, and that they assess the environment and business practices of potential targets. This is evidenced by the relative success of particular convenience store crime prevention methods. Gainesville experienced a significant and continual reduction in convenience store robberies after implementing the two-clerk policy. And a Florida statute passed in 1990 requiring convenience stores to comply with certain robbery prevention measures has produced a reduction in convenience store robberies statewide. Such robberies dropped from 5,548 in 1989 to 4,904 in 1990, despite an overall increase in violent crime during that same period, arguably because many of these preventive measures had passed before 1990 (Hunter and Jeffery, 1992).

While research on convenience store business practices associated with gasoline drive-offs is limited, at least one study's findings suggest that gas thieves undergo rational decision making as well. The Economic

Crimes Unit of the St. Petersburg (FL) Police Department studied gasoline drive-offs at area convenience stores and gas stations. The study found that frequently victimized establishments had common characteristics: They specialized in food service facilities, had many gas pumps available to the public, had fewer than three attendants or clerks on duty, provided no garage service and did not have a pre-pay policy during hours of heaviest losses (Donohue, 1990). After interviewing clerks, police determined that clerks in stores without food sales had fewer distractions than those stores with food sales, and therefore were more aware of gas pump activity. Clerks found it easier to watch a few pumps than many, particularly because retailers with fewer pumps tended to locate the pumps centrally. Stores with at least two clerks on duty were better able to monitor activity at the pumps, and those that had pre-pay gas policies had markedly fewer drive-offs than stores without pre-pay policies (Donohue, 1990).

Prior research on convenience store criminal behavior, therefore, suggests that it is a function of both the external environment (physical barriers, community maintenance, street patterns and land use) and the internal environment (business practices, such as the level of lighting and amount of cash on hand).

THE AUSTIN CASE

In the fall of 1990, a study of convenience stores in Austin, TX was conducted to determine whether the findings of the studies described above are applicable to this city. A random sample of 52 stores was selected from city business permit records: 38 had gas pumps and available data on drive-offs. Based on previous findings that 46 to 74% of robberies are committed in the evening or late at night (Clifton, 1987), the site observations of the convenience stores were conducted between the hours of 6:30 p.m. and midnight.

The survey instrument addressed both internal and external characteristics. The Internal characteristics included the level of lighting, the presence of video games and automated teller machines (ATMs), the number of exits/entrances, the number of cameras and parabolic mirrors, the number of clerks on duty, the percentage of windows covered by posters, and so on. Interviews with the clerk or clerks on duty were also conducted to determine their impressions of crime and security at their store as well as the level of fear for their personal safety. The outside

characteristics analyzed included lighting, both at the entrance of the store and at the exterior of the parking lot; the amount of litter and graffiti; the street layout and speed limit; the number of gas pumps; and whether the store had a pre-pay gas policy. The lighting was measured through the use of a hand-held light meter, which measures in terms of foot-candles. Additional qualitative data were gathered from police officers during ride-alongs, and from interviews of clerks at both chain and privately owned stores.

Secondary data were collected from the Austin Police Department's calls for service records. Calls for service were collected over a two-year period from September 1, 1988 through August 31, 1990 for each convenience store. The calls were divided into the following categories: (1) robberies; (2) violent crimes, such as assaults and rapes; (3) gasoline drive-offs, which were listed under theft of gas; (4) all other property crimes, which include shoplifting incidents, non-gas thefts, burglaries, auto thefts, and burglaries from auto; (5) disturbances, such as family disturbances, public intoxication and criminal mischief; (6) drug-related calls; and (7) all other calls, including traffic violations and false burglary alarms.

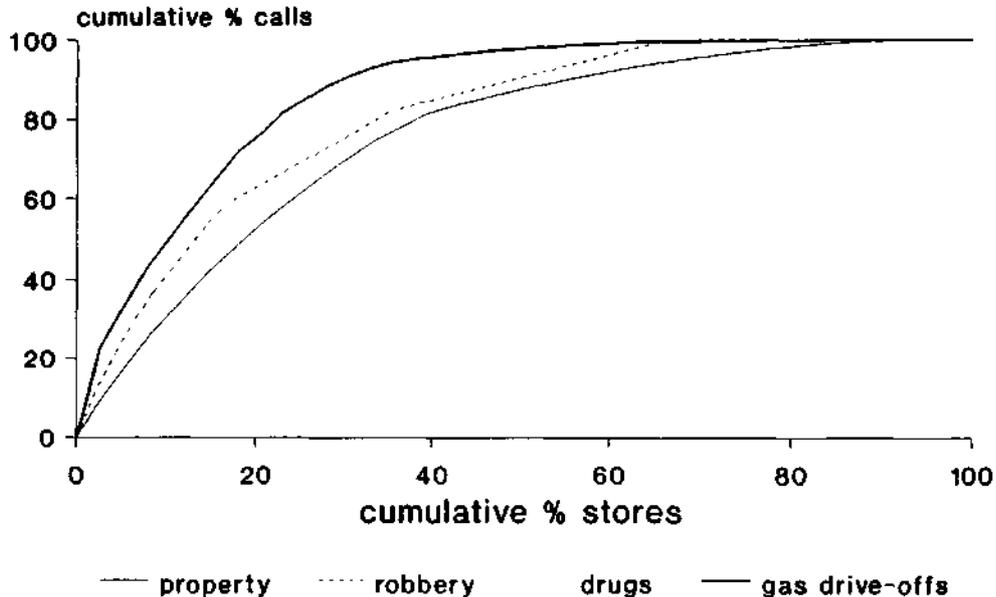
Despite the heavy emphasis on convenience store robberies by researchers and convenience store chains alike, property crimes accounted for the highest proportion of calls for service at the convenience stores sampled. About half of all calls were gas drive-offs; only 7% were violent crimes of any kind. Table 1 provides a visual explanation of the way in which calls for service were distributed by crime type for the 48 stores sampled. Calls for service were concentrated among a relatively small number of establishments.

**Table 1: Breakdown of Convenience Store Calls
by Crime Type**

| CRIME TYPE | PERCENTAGE OF TOTAL CALLS |
|-------------------|----------------------------------|
| Gas Drive-offs | 48% |
| Property Crimes | 25% |
| Disturbances | 5% |
| Violent Crimes | 4% |
| Robberies | 3% |
| Drug Crimes | 1% |
| All other calls | 13% |

Figure 1 demonstrates the concentration of calls for service by percentage of stores. A reverse plotting of the traditional Lorenz curve allows us to easily determine what percentage of stores is responsible for what percentage of calls for service (see Figure 1). Calls for service were most concentrated for gasoline drive-offs and drug crimes: only 10% of stores accounted for over 50% of both types of crimes. Ten percent of the stores sampled accounted for 26% of property crime calls, such as shoplifting and burglaries, and 36% of the robberies for the period analyzed.

**Figure 1: Concentrations of Calls to Police
— Convenience Stores in Austin, Texas**



After quantifying the information gathered from site observations and collecting calls for service data, several regressions were run on gasoline drive-offs. Each regression was based on a different theory of crime causation, and contained a different set of similar, related, and usually highly correlated independent variables.² For instance, street patterns were characterized by number of exits, distance the store was set back

from the street, type of street, traffic flow, speed limit and number of driving lanes. Table 2 provides a complete list of how these analysis categories were defined. Gas drive-offs were analyzed to determine which analysis categories were most influential. While groupings of variables enable us to determine what overall factors contribute to each crime type, individual variables, when statistically significant, were also analyzed to determine what specific changes can be made to deter crime.

Table 2: Analysis Categories

| ANALYSIS CATEGORY | VARIABLES |
|-----------------------------|---|
| Street Patterns | Number of exits Distance store is set back from street Type of street Traffic flow Speed limit Store on corner Number of driving lanes |
| Physical Maintenance | Number of broken overhead lights Amount of graffiti Amount of litter on store premises |
| Land Use | Neighborhood type Store located on same block as: school; park; wooded area; liquor store; sex shop; bar; restaurant; 24-hour establishment; abandoned/vacant buildings; capital Metro stop. |

| ANALYSIS CATEGORY | VARIABLES |
|---------------------------------|--|
| Outside Visibility | Exterior lighting at door Exterior lighting at edge of parking lot Prepay gasoline policy Register visible from lot Clerk in view of pumps Number of overhead street lights Percent of windows covered Number of gas pumps |
| Inside Visibility | Number of CCTVs Shelf height Number of parabolic mirrors Number of regular mirrors Percent of windows covered Number of blind spots Interior lighting Type of register Store size (SF) Number of entrances Location of register Height of counter |
| Robbery/Theft Prevention | Auto door lock Robbery alarm Bars on windows "Inaccessible safe" sign "Limited cash on hand" sign "Robbery alarm" sign "CCTV" sign |
| Attractive Nuisances | Video games ATMs Single beers sold Number of pay phones with call-in numbers |
| Informal Surveillance | Free coffee to cops Number of clerks normally scheduled for night shift Store parking lot Number of spaces in parking lot Number of cars parked in lot Number of loiterers |

| ANALYSIS CATEGORY | VARIABLES |
|---------------------|---|
| Clerk Vulnerability | Clerk participated in training program Clerk's level of fear when working alone at night Age of clerk Sex of clerk 1 Store ever been robbed |
| Social Factors | Percentage of nonwhite population Median family income Percentage population below poverty level Percentage population between age 15 and 19 Percentage of female-headed households |

This analysis strategy was dictated by the nature of the data. There were few cases and many variables, making the prospects for multicollinearity substantial. Had a guided procedure such as stepwise regression been employed, it is likely that many apparently significant results would have been obtained that were really due to chance variation. By focusing on categories of variables, rather than exclusively on the variables themselves, it was hoped that the impact of these Type 2 errors would be reduced.

Analysis Limitations

Certain limitations exist in the manner in which data were collected and analyzed. Relying on calls-for-service data alone does not provide a completely accurate picture of convenience store victimizations. For instance, on a ride-along with an Austin police officer the officer expressed the belief that "Mom-and-Pop" stores fail to report many crimes. These corner-store owners know most of the customers because they are from the immediate neighborhood; the tendency is for store owners, who usually double as clerks, to handle problems of shoplifting and other crimes themselves (Gonzalez, 1991).

In addition to variations in reporting rates between chain stores and privately owned stores, inconsistencies in calls-for-service data may limit

the validity of the analysis. Buerger (1992) analyzed calls-for-service data from a number of convenience stores in Minneapolis, MN. Police officers used an internal tracking system on public phones outside store locations to identify which calls for service were connected to the store's interior. At one store, only six of 30 calls were related to store activity (Buerger. 1992). This finding illustrates a phenomenon police call the "magnet phones" situation: People in the neighborhood use public phones at the local convenience store to call the police because they have no phone at home. However, the problem of magnet phones should not affect the validity of gas drive-off calls, as it is unlikely that the specific crime of gas theft would be reported by anyone but convenience store clerks or management.

A final potential limitation in the collected data is the problem of distortions produced by false reporting. There was no way to determine what percentage of calls were made by clerks who actually stole gas themselves or allowed their friends to pump gas and drive away, and then reported the thefts to the police as a means of explaining these losses to their managers.

Results

The effect of each of the analysis categories (listed in Table 2) on gasoline drive-offs was ranked in order of importance from highest to lowest. For the purposes of this paper, only those significant findings that are subject to policy change are included. Table 3 represents the percentage of reduction in crime one can achieve by making specific changes in store policy and environment. This table is applicable to stores that have not yet taken the particular crime prevention measure listed in the left-hand column. For instance, if a store lacks a sign indicating that a CCTV is in use, and installs one, it can potentially reduce drive-offs and other crimes. Stores that already have a CCTV sign will not reap the same benefits by posting an additional sign.

These potential reductions in crime are based upon regression equations that predict the effect of one variable on crime, holding all others constant. If the sample size had been larger than 38, or the number of variables less than nine, a regression of all these significant crime prevention measures would have been appropriate. As it is, one cannot confidently predict the effect of any combination of these crime prevention measures.

Table 3: Drive-Off Prevention Measures and Potential Reductions

| PREVENTION MEASURE | PERCENTAGE REDUCTION IN DRIVE-OFFS |
|---|---|
| Install auto door lock button | 76% |
| Hang "CCTV" sign | 72% |
| Place register near door | 68% |
| Increase parking lot lighting to 15 foot-candles | 65% |
| Eliminate call-in phones | 60% |
| Uncover windows (to less than 25% covered) | 58% |
| Don't sell single beers | 51% |
| Make register visible from lot | 47% |
| Institute pay-first policy | 40% |

Drive-offs are most strongly affected by the inside visibility category, which includes the factor associated with window coverage. The analysis indicates that reducing the amount of window coverage on a storefront will reduce gasoline drive-offs. The location of the register to the immediate right or left of the door also reduces drive-offs, probably because the clerk is situated to have a better view of the goings on in the parking lot than if the register is in the center of the store. Contradicting this finding, however, was the measurement of whether the cash register is visible from the parking lot; if it is not visible, drive-offs decrease dramatically. The only explanation for this finding is that perhaps other unknown negative factors are correlated with register visibility.

The crime prevention category is another important grouping. Regression results show that the use of a CCTV sign (whether or not any CCTVs exist) and an automatic door lock button decrease drive-offs by significant percentages. These findings suggest that potential offenders see such robbery prevention measures as an indication that store management is watching them carefully.

Outside visibility is an influential category because of the influence that lighting plays on crime. An increase of just one foot-candle of lighting in the parking lot reduces drive-offs by 5%. The brightest store parking lot had a measure of 15 foot-candles, and the mean lighting level was 1.89 foot-candles, so installing brighter lights could have a significant impact on gas drive-offs for the average store. In fact, a store with exactly 1.89

foot candles of light can expect to reduce drive-offs by 65% if it increases its lighting to 15 foot-candles. Use of a pay-first policy, which was included in this category as a possible factor associated with crime outside the store, will reduce drive-offs by almost 40%.³

The remaining analysis categories were less influential as a whole, but some individual variables within these categories were significantly influential. If management removes video games from the store, drive-offs will be cut in half. It is likely that video games attract youths who, in turn, distract the clerk and make it easier for an offender to escape the clerk's notice when driving off without paying for gas. Two other significant variables—the sale of single beers and the number of pay phones with call-in numbers—were measured on the theory that these factors attract delinquents who are likely to drink on the premises, as well as those who use the pay phones for drug contacts. The analysis indicated that stores that do not sell single beers have half the number of drive-offs than those that do. Likewise, stores with pay phones that have call-in numbers would reduce drive-offs by roughly 28% by removing them. The positive correlation between phones with call-in numbers and crime is supported by actions taken by public telephone companies, which have removed public phones from places where drug dealers and users congregate (Law Enforcement News, June 15/30, 1991).

It is interesting to note that land use, while not easily changeable in terms of crime prevention policy, is nonetheless an important factor in gasoline drive-offs. Neighborhood type—whether commercial, residential or mixed—is particularly significant: If the store is located in a primarily commercial area, gas drive-offs increase. This finding is consistent with prior research on land use and territorial control (Brantingham and Brantingham. 1991; Dietrich. 1977; Jacobs. 1961; Mayhew. 1991). Because few people live in commercial areas, criminals are less likely to be seen by those who watch for potential victimizations, report crimes in action or take preventive measures, especially during evening hours.

As with any research study, it is equally important to cite those factors that had no significant effect on the dependent variable. While many such variables exist, the most notably insignificant are those within the social factors analysis category. This category measured census tract data and included such variables as the percentage of non-white residents, the median income, the percentage of households below the poverty level, the number of single-headed households, and the percentage of residents between the ages of 15 and 19. None of these factors proved significant;

in fact, they were not significantly correlated with any convenience store crime type measured.

POLICY IMPLICATIONS

The results of the Austin study support the theory that a few minor changes in business practices have the potential to reduce crime dramatically. This section will make policy recommendations aimed at reducing gasoline drive-offs. Special attention is paid to the costs of crime, and who bears those costs, as this information can help guide policy recommendations.

Drive-offs are crimes that are highly concentrated among a very few stores; as noted earlier, 10% of the convenience stores sampled that sold gas accounted for over 50% of gasoline drive-off calls. This concentration of calls bodes well for public policy efforts: If efforts are directed at encouraging better business practices and preventive measures at the worst 10 to 15% of convenience stores in Austin, drive-offs can be reduced dramatically.

Let us now consider addressing the crime problems of the store highlighted at the beginning of this study. How can the present data analysis help determine the nature of the crime problems at this store, and how can these problems be addressed? The store had a staggering 385 calls for service, 90% of which were gasoline drive-offs. The results reported here allow us to pinpoint what policy changes should be made at this store according to the business practices already in place. For instance, gasoline drive-offs are associated with covered windows and low levels of lighting; this store has both of these characteristics. The policy initiatives outlined in the remainder of this paper can help reduce the number of gas drive-offs at this store and others like it.

Drive-Offs: The Problem

Drive-offs account for almost half of convenience store calls for service, and cost police departments significant amounts of money each month in responding to calls and in recording and processing information. The 1990 study of police response to gasoline drive-offs in St. Petersburg, FL estimated that approximately 80 hours per month of St. Petersburg officers' time is spent recording, reporting and investigating drive-offs (Donohue, 1990). In Austin, the police are dispatched for gasoline drive-off calls only if convenience store clerks have the offender's license plate

number or an accurate description of the offender's car: the Austin Police Department has determined it costs \$98 per response (Williams, 1990). In most cases, clerks do not have such detailed information about the offender. These drive-off incidents are reported to the police through the TeleServe system, a team of operators who enter the reported information into the police database. Approximately 65 to 70% of all reports through TeleServe are for gasoline drive-offs; each call reported costs an average of \$1.65 (Grant, 1991).

From the perspective of convenience store owners, the drive-off problem is primarily one of inconvenience; they can recover their losses through insurance claims and higher prices. But the cost to the public in terms of police time and financial resources is not as easily absorbed in these times of fiscal constraint. It is therefore in the taxpayer's interest to provide the necessary incentives—financial and otherwise—for stores to improve their business practices.

The findings discussed above show a strong relationship between business practices and the incidence of crime. Many of the findings are consistent with common sense; it seems obvious that obstructed windows and low levels of lighting would create an environment conducive to crime. So why do stores have these practices, and how can these stores be encouraged to change them?

Pay-First Policy

The most obvious way to prevent people from driving off without paying for gas is to require them to pay for the gas before pumping. But while a pay-first policy may indeed reduce drive-offs, it is not always a politically acceptable solution to the problem. The Austin City Council, for example, has already considered and rejected a pay-first ordinance because many council members felt that such a policy would be an infringement on free enterprise (Silvus, 1991). The convenience store industry is also opposed to the use of a pay-first policy; some store owners feel that customers would be discouraged from making last-minute purchases of food and beverages if they paid up front for the exact amount of gas they planned on pumping (Shipp, 1991). Others argue that it is insulting to customers to require them to pay first, implying that they cannot be trusted (Ross, 1991).

It is possible that views on a pay-first policy differ geographically. In states like New Jersey and Oregon, for instance, it is unlawful to pump

one's own gas, virtually eliminating the drive-off problem. Oregon has turned this law into a selling point for tourism. A recent Oregon tourism advertisement that appeared in *Outside Magazine* (April 1, 1903:37) reads as follows: "When you walk down the street in an Oregon town, people tend to smile at you. They smile because the streets are clean, the parks are green. They have fine wine, an excellent symphony, real rodeos, and an old state law that says they never have to pump their own gas. They should be grinning."

Obstructed Windows

Why *do* convenience stores cover their windows with ads? The most common reason is to draw customers into the store. But why not use some other means of advertising? One reason is that in order to advertise anywhere else but on the store itself, establishments must apply and pay for sign permits (Washington, 1991). If a permit is not purchased for a particular posting, the city will confiscate and place an impoundment fee on the unlawfully placed sign. In addition, certain types of signs are prohibited altogether, including sandwich boards and any signs that are within 12 feet of a public right-of-way and: (1) are more than 30 inches above the pavement: or (2) have a clearance of less than nine feet (City of Austin Ordinance #900607-G). In other words, all ground signs—save small directional signs—are prohibited by city ordinance.

On the other hand, another ordinance states that the total coverage of signs on a storefront cannot exceed 20% of the total area of the store front (Buckner, 1991). Although this study did not specifically quantify the percentage of window-to-wall space for each store, a number of stores had over 20% of the store fronts covered. When asked how the ordinance is enforced, Connie Buckner of the Austin City Planning Department explained that storefronts are inspected on a complaint basis only: "If (a city official] happens to be driving by a store and notices some new signs up, he may catch a store for non-compliance. Or it could be that the storefronts you saw with covered signs were protected by a grandfather clause, because the ordinance only went into effect in 1985" (Buckner, 1991).

Even if the ordinance were properly enforced, if a storefront is 80% wall and 20% window, the owner can still legally cover all of the window space with signs. An obvious policy recommendation is for the city council to pass a new ordinance prohibiting stores from covering more than 20% of their *window* space. There is no reason to provide a grandfather clause

for stores already in existence; signs are easily removable and can be installed on the outside of the building with little effort.

Asking convenience stores to keep their windows unobstructed without giving them alternative advertising options will probably not result in a significant change of behavior. Although the cost of a sign permit can be as little as \$30 (Bucker, 1991), the inconvenience of going to the city clerk, applying and paying for such signs can be a strong disincentive. A policy measure to encourage use of ground signs or non-obstructive free-standing signs should be designed to make the permit process easier and more affordable. One such measure would be to allow store owners to apply and pay for sign permits by mail. Of course, the permit requirements for signs are in existence for a purpose: to control "sight pollution" and ensure that signs do not obstruct traffic. But restrictions on the size and nature of signs can still be in place while allowing businesses alternatives to advertising on their windows.

Another measure would be a city ordinance allowing those convenience stores that comply with a city policy requiring stores to keep windows less than 20% covered to use sandwich boards as an alternative means of advertising. The use of banners that extend across the top of the store and do not obstruct the store windows could also be encouraged.

Limits on Lighting

City code sign restrictions explain why stores would choose to cover their windows, but why do so many stores have such poor outside lighting? Common sense suggests that bright lighting would attract more customers into the store. Although the city does not prohibit bright lighting in store lots, the process of installing such lights is burdensome, to say the least. Austin city code specialist Larry Heinski explained the process in detail:

In order to install brighter lights, the business must obtain a permit from the city. But the business owner cannot go and apply for the permit himself. Instead, the owner must contract an electrical technician who is licensed with the city of Austin to go to the installation site and prepare a written estimate of the future light's wattage and cost of materials and installation. The technician then brings the written estimate to the city clerk to obtain a permit for installation [Heinski, 1991].

As with signs, the complexity and cost of obtaining additional lighting for convenience store parking lots discourage many stores from doing so.

Particularly for smaller, privately owned stores, the costs of hiring a licensed electrical technician, getting a permit, and buying and installing the lighting are strong disincentives. Again, a city policy that waives permit fees and/or licensing requirements for stores that want to install brighter lights in their parking lots might have positive results.

Crime Prevention Signs

The use of signs deters some kinds of crimes, but none of the stores surveyed—with the exception of the eight stores with "pay-first" signs—had crime deterrence signs that applied specifically to gasoline sales. If low levels of lighting and covered windows provide a favorable environment for gasoline drive-offs, then the assumption can be made that potential offenders seek targets where they are least likely to be identified. A store policy that calls for signs placed by the pumps stating, "Our clerk is recording your license plate number as you pump." particularly when combined with good outside lighting and unobstructed windows, could deter potential offenders by increasing the risk that they will be identified. Even in cases in which the clerk is unable to provide this surveillance, the presence of the sign should serve as a deterrent.

Eyewitness

The use of CCTVs significantly deters disturbances and drug-related calls, and CCTVs are also associated with a minor reduction in other convenience store crimes (La Vigne. 1991). The use of CCTV cameras above pumps, although more expensive than signs, could also deter gas drive-offs. As with other crime prevention measures, the use of CCTVs might increase if stores were offered some financial incentive. Perhaps waiving the annual business permit fee of \$25 would be incentive enough for some stores. Unfortunately, the costs of CCTVs can be high: One Austin security store, Racal-Chubb, quoted a 1991 price of \$3,000 for two cameras and a monitor. A more effective incentive would be to offer an abatement on property taxes to either subsidize or fully reimburse stores for expenses aimed at deterring crime.

While many readers may conclude that the high cost of CCTVs would outweigh the benefits of installing them, the data analysis indicates that the existence of CCTVs inside convenience stores not only reduces drive-offs, but also reduces disturbances and drug crimes significantly. In fact, this study found that an increase of one CCTV reduces total convenience

store crime by 19%. It is likely that the existence of CCTVs outside the store would have the same deterrent effect on many crimes, thereby making CCTVs well worth the cost. Further, prior research suggests that the mere possibility that a CCTV is in use deters crime. A transit authority in England placed CCTVs on double-decker buses to deter vandalism and found that while only a few buses were fitted with cameras, vandalism on all buses decreased by over 60% (Poyner, 1988).

Fee for Service

Perhaps drive-off reports are so frequent because convenience stores—particularly chains—conscientiously report every drive-off incident; without a police report number for each incident, most stores cannot recover shrinkage loss from their insurance companies (Scott, 1990; Shipp, 1991). Stores that do not need the report number for insurance purposes still have reasons for reporting each offense. Circle K district manager Mike Ross says that requiring clerks to report drive-offs to the police deters clerks from stealing gas themselves or allowing their friends to pump and drive away (Ross, 1991).

One way of encouraging stores to practice good crime prevention policies is to charge stores for each incident that exceeds a certain pre-determined number of drive-offs per month. For instance, the average convenience store in the Austin study reported 39 gasoline drive-offs over a two-year period. Divided by 24 months, the mean number of reported drive-offs is less than 1.5 calls per month. A reasonable policy would be to require those stores that exceed two drive-off calls for service each month and that have not implemented pre-determined police/city-recommended drive-off prevention measures to pay a fee of \$3.00 for each additional call. The fee would cover the costs of Teleserve and the additional administrative costs incurred in ensuring that stores comply with prevention measures. Stores would have to present copies of light permits and evidence that their windows are unobstructed in order to have their calls-for-service fee waived. The charge is by no means prohibitive; the idea is to get the stores—instead of the city—to absorb the costs of their own poor business practices.

TAKING A STEP BACK

This paper has attempted to address a problem that continues to burden both the city and taxpayers: convenience store gas drive-offs. But

the results of this study and its policy recommendations are by no means limited to such crimes. Rather, many of the business practices found to be associated with convenience store crime are also in place at gas stations, grocery stores, fast-food restaurants, liquor stores and drug stores, to name just a few other businesses. Identifying environmental characteristics associated with crime can help businesses and security experts establish situational crime prevention measures (Clarke, 1902). These same measures can serve as an invaluable tool for police officers, city planners, store owners and neighborhood groups trying to combat crime in residential areas. By anticipating the conditions that foster crime—and by substituting conditions that deter crime—the business community and public policymakers can do much to further both the economic and public welfare interests.



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NOTES

1. Drawn from the files of calls for service made to the Austin Police Department, September 1, 1988 through August 30, 1990.
2. The regressions were originally run with a log-linear model according to the previously defined analysis categories and an additional variable, volume. The volume variable was created to capture the amount of business activity at each store by identifying whether the store is a chain or privately owned, and the number of hours the store is open. Volume was found to

be such a strong explanatory variable, and so highly correlated with other explanatory variables, that data were analyzed in the following manner:

Regressions were run to capture the effects of each analysis category on each crime type by first running a regression using volume as the sole explanatory variable, and then adding the other variables that make up that particular category.

Example:

Equation 1:

Crime = f(volume)

$\text{Log}Y_c = \alpha + \beta_v \text{VOLUME} + e$

Equation 2:

Crime = f (volume, number of broken overhead lights, amount of graffiti, amount of litter)

$\text{Log}Y_c = \alpha + \beta_v \text{VOLUME} + \beta_L \text{LIGHTS} + \beta_G \text{GRAFFITI} + \beta_T \text{TRASH} + e$

This method allows us to assess the validity of the model (measured by the change in R^2) when adding the category of explanatory variables to the equation (in the above example, lights, graffiti and litter). The size of the change in R^2 created by adding these three variables is an estimate of the relative explanatory power of the category for crime—how much the category improves the overall explanatory power of the model. Because of the small sample size and the exploratory nature of the study, the regression results of individual explanatory variables are included in this study when they prove to be statistically significant at the .20 value for a one-tailed student t test.

3. The reader may wonder why a pay-first policy would not eliminate drive-offs completely. The answer is that stores with pay-first policies at any time of day were credited with having a pay-first policy. Those stores with pay-first policies in effect in the evening hours may still be victimized during the day.

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