CRIME AND ARCHITECTURE IN BRISBANE

A PILOT STUDY OF THE RELATIONSHIPS BETWEEN THE CRIMES OF BREAK AND ENTRY AND VANDALISM AND THE URBAN AND ARCHITECTURAL ENVIRONMENT IN FOUR BRISBANE COMMERCIAL SUB-CENTRES

Report of a Research Project funded by the Research Council, Australian Institute of Criminology, November, 1979

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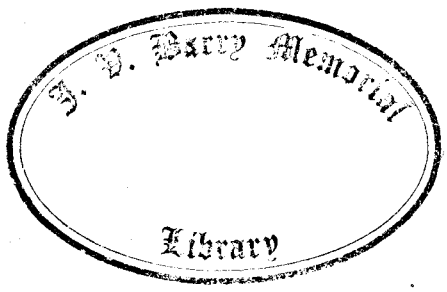

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SUMMARY OF FINDINGS AND RECOMMENDATIONS

This study examines the relationships between the crimes of break and entry and vandalism and the physical environment of the four Brisbane sub-centres of Indooroopilly, St. Lucia Village, Taringa and Toowong. It details the spatial and other characteristics of the crimes recorded and attempts to establish which aspects of the physical environment and built form have the greatest effect on the vulnerability of the buildings subjected to attack.

BREAK AND ENTRY FINDINGS

1. The incidence of break and entry was found to be on the increase in the sub-centres studied. Almost all of the ninety-three reported incidents occurred at night, a wide range of property was stolen, but very little damage was found to be done to burgled buildings.
2. Rear windows were most frequently the point of illegal entry, followed in order by side windows, rear doors, and front doors, although wall, floor and roof penetrations were also recorded.

3. Medical premises (including chemists) were found to be broken and entered 3.9 times as frequently as all other types of business category.

4. Two factors, acting in concert, were found to have a significant influence on the vulnerability of buildings to break and entry: firstly, the resistance of the building to illegal entry (passive security); and secondly, the level of night-time surveillance. Victim buildings were generally found to have a low level of passive security together with a low level of surveillance.

5. Passive security was found to be composed of the following variables: (i) the type of construction and physical condition of the building; (ii) the type and extent of fenestration; (iii) the type and quality of door locks; and (iv) the presence or absence of security grills on openings.

6. The level of surveillance was found to be dependent on: (i) the degree of exposure to observation; (ii) the level of internal and external lighting; and (iii) the concentration of potential witnesses in the surrounding area after dark.

7. The installation of security alarms, while not reducing the risk of attack, was found to substantially reduce the value of property stolen, but the study found no evidence to suggest that the employment of private security patrol services reduces the risk of attack.

8. The police were unable, in most cases, to solve the crimes and/or apprehend the offender(s).

VANDALISM FINDINGS

1. Four categories of vandalism were found to be predominant: (i) the removal of, or damage to, items left out overnight; (ii) the breaking of glass or sheeting; (iii) graffiti; (iv) damage to fixed signs or lettering.

2. Most incidents occurred at night on the week-ends, were not expensive to repair, and only 25% of them were reported to the authorities.
3. Vandals were found to have no preference for a particular business type.
4. Vandalised buildings were generally found to: (i) be more prominent in the environment; (ii) have facades with extensive areas of glass fenestration (these two factors acting as invitations to attack); and (iii) be located in areas close to entertainment premises which remained open after dark.

RECOMMENDATIONS

The study recommends the following procedures to improve the level of security in commercial sub-centre environments and to improve building security:-

1. a change in the Brisbane City Council zoning policies so as to encourage residential development within the sub-centres in order to improve natural surveillance
2. maintain the streetscape and individual buildings in good physical condition
3. install deadlocks on all exterior doors
4. install security grills to all windows, particularly to side and rear windows
5. improve internal shop surveillance by removing as many obstructions as possible to visibility of the shop interior from the street and footpath
6. leave interior and exterior lights on all night (instead of only until midnight)
7. install alarms.

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ACKNOWLEDGEMENTS

This project was funded entirely by a grant awarded by the Research Council of the Australian Institute of Criminology. The following people were of great assistance during the study and we extend our thanks to them.

Mr. D. Biles, MA(La Trobe), BA, BEd(Melb), MAPsS, Assistant Director (Research), Australian Institute of Criminology, for guidance and assistance in establishing the project and encouragement throughout its execution.

Dr. J. Braithwaite, PhD(Qld), Criminologist, Australian Institute of Criminology, for assistance in the preparation of the survey and advice on sociological aspects of the study.

Dr. C.W. Snyder, BA(Gettysburg), MA(Temple), PhD(Penn), APA, Department of Psychology, University of Queensland, for assistance with the statistical analysis.

Mr. D. Woolard, BArch, DipUrbVal(Auck), MFA(Arch),Cent. Urb.Reg.(Hawaii), ARAIA, ANZIA, Department of Architecture, University of Queensland, for assistance with the computerisation of the survey data.

THE RESEARCHERS ALSO EXTEND THEIR SPECIAL THANKS TO THE SHOPOWNERS AND MANAGERS OF INDOOROOPILLY, ST. LUCIA VILLAGE, TARINGA AND TOOWONG, WITHOUT WHOSE CO-OPERATION THE PROJECT COULD NOT HAVE BEEN UNDERTAKEN.

1.0 INTRODUCTION

1.1 Study Background

Since the middle nineteen-sixties, many researchers and crime research commentators have put forward the argument that spatial analysis of urban areas by architects, environmental sociologists and others in related fields could lead to the designing and eventual construction of built environments with a lower vulnerability to those crimes which relate directly to buildings - break and entry and vandalism (Jacobs, 1961; Jeffery, 1971; Newman, 1972). Such arguments, which imply that criminal behavior can be modified by the built environment, fall under the label of architectural or environmental determinism, adherents to which are reported to regard social factors as unimportant (Wilson, 1977). Buildings do, however, affect behavior in a number of very easy to comprehend ways which are possible to study and which in no way preclude recognition of the importance of social factors.

Much of the early work concerned with understanding the relationships between criminal behavior and the environment concentrated on the social aspects of the offenders' formative environments (Sutherland, 1924; Shaw & McKay, 1969). More recent studies have begun to shift the

emphasis towards the offence rather than the offender, but have generally worked within a broad scale of the environment (census tracts, suburbs, etc.). Both White (1976) and Winchester (1978) cite many such articles, Winchester going on to argue that more attention should be placed on the variability of conditions within areas of study (rather than relying on average characteristics) and that the places where offences occur should specifically be subjected to such detailed study (Winchester, 1978, p.116). Brantingham, Dyreson and Brantingham (1976) have also shown that there are statistical advantages to be gained in narrowing down the field of study when exploring the patterns of crime in the environment.

While the literature on the relationships between crime and environmental design is growing, almost all the studies are concerned only with housing estates and residential neighbourhoods. There are obvious reasons for this with the tragically unsuccessful mass housing schemes of England, Europe and the United States (Pruitt-Igoe the most publicised example). Studies of other urban areas by contrast have been somewhat neglected. Commercial, industrial and other non-residential districts of cities are distinctly different from residential ones, in terms of occupancy patterns and attitudes, scale, use, urban and architectural design, etc., and the lessons learned from the housing studies may not be directly applicable. Those few published reports that do examine non-residential building related crime (Crow and Bull, 1975; Capone and Nicols, 1976; Duffala, 1976; Luedtke and Assoc., 1970) tend to suggest this, and their findings are especially valuable because they have looked at their field with the sort of detailed attention that Winchester recommends.

The Australian Institute of Criminology and the Criminology Research Council has, since 1973, funded criminological research in Australia. Biles (1977, p.154), however, has pointed out that much Australian research has been descriptive or comparative and therefore relatively unsophisticated. The lack of an effective national

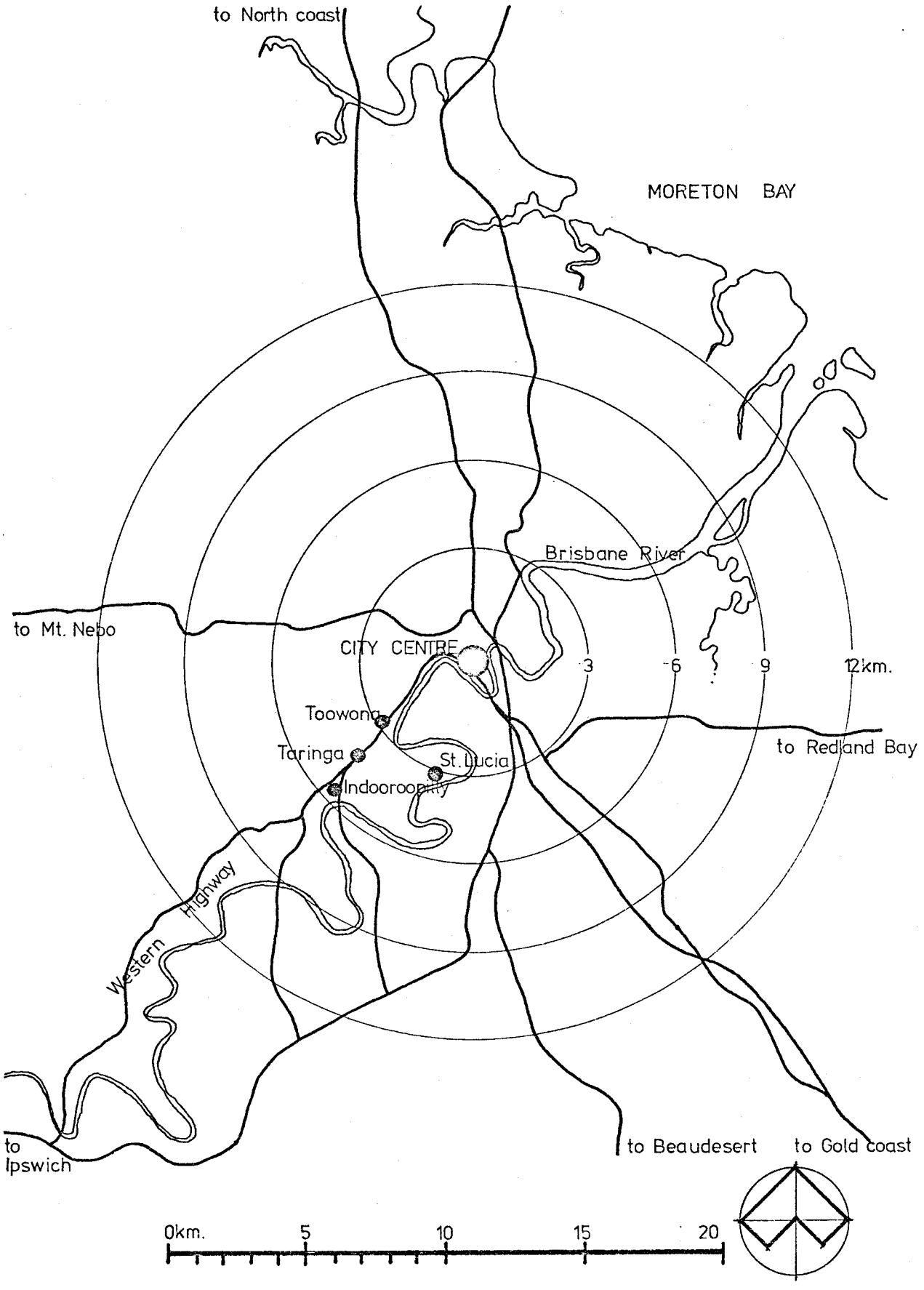
system of uniform crime statistics for Australia has hampered much research, especially that related to the incidence and opportunity for crime. Any study examining the relationships between criminal behavior and the physical environment is particularly affected, as the limited data collected by the police statisticians or the Bureau of Statistics is either unavailable or too general to be useful. This study, then, has been undertaken with the assistance of the Criminology Research Council, for two purposes:

(i) to determine the history, magnitude, location and characteristics of the crimes of break and entry (burglary) and vandalism in four commercial sub-centres in Brisbane; and

(ii) to establish which aspects of the physical environment in those sub-centres have the greatest effect on the vulnerability of the buildings subjected to criminal activity.

The study adds to the national body of knowledge concerned with the patterns of criminal behavior by examining specific acts of break and entry and vandalism. It also constitutes what is believed to be the first detailed study of crime in commercial sub-centres in Australia.

The four Brisbane sub-centres chosen for this study, Indooroopilly, St. Lucia Village, Taringa and Toowong, all lie to the south-west of the city centre, between three and six kilometres of the G.P.O., but north of the Brisbane River (Map 1). Because budget and time restrictions limited the scope of the study to only four sub-centres (about 200 premies), and because the socio-economic status (SES) variable was known to be a major determinant of crime distribution, it was decided to control the variable by selecting four sub-centres within the one SES district as delineated by the Brisbane Social Atlas (Cities Commission, 1976). The sub-centres range in size from twenty-nine premises to eighty-eight, three are on or adjacent to a major arterial road system (the



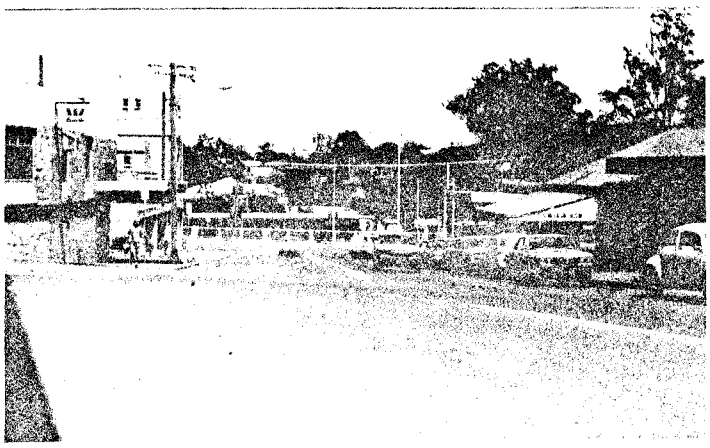
Map 1. Brisbane, showing the location of the four sub-centres in relation to the major road systems.

Western Highway) and all have been established for a considerable period of time. For the purposes of this study, the boundaries of each sub-centres were delimited by means of land-use maps as well as by field survey. All commercial premises within the local business zones, together with any special use zone obviously part of the sub-centre were included in the study area. Non-commercial premises on local business zoned land within each sub-centre were, however, excluded. Figure 1 records a view of each of the sub-centres under study.

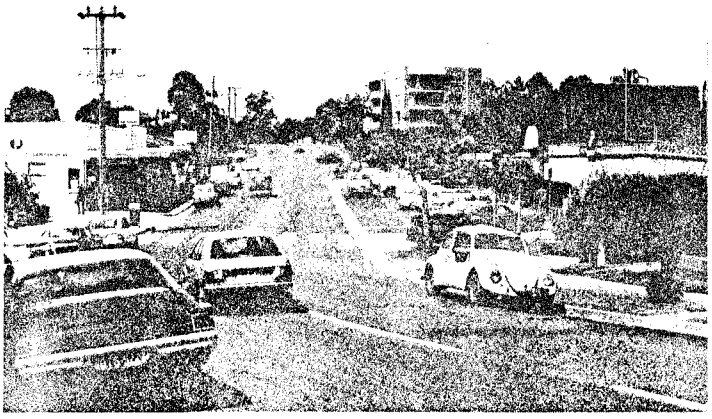
1.2 Research Background

One of the main purposes of the research was to test whether or not the vulnerability of commercial premises in a selection of suburban shopping centres in Brisbane to break and entry and vandalism was associated with certain environmental characteristics. The general form of the hypotheses to be tested was that premises are more vulnerable to the crime of break and entry and/or vandalism when associated with a particular environmental condition or set of conditions. An analysis of work done by other researchers identified some conditions within the urban environment that would be worthy of study, but others were also examined.

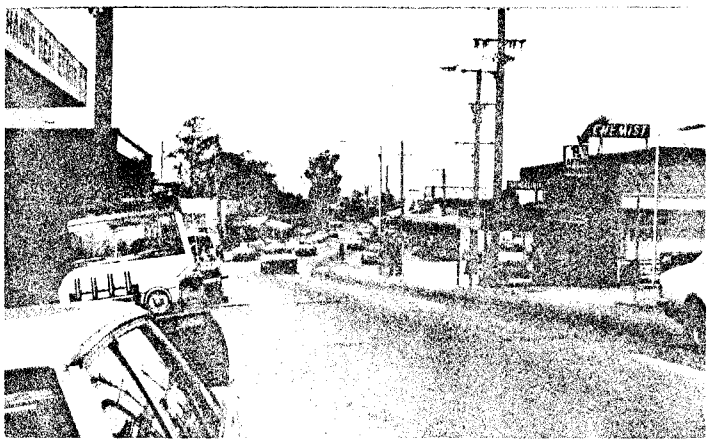
An early paper by Angel (1968), one of the pioneering efforts in the relationship between environmental design and crime, argued that crime patterns are related to the social and physical environment and specifically to the concepts of territoriality, accessibility and to victim behavior. Angel hypothesised that surveillance, community awareness and the hypothetical presence of witnesses to crime all act as deterrent measures. He found that vulnerability to crime increased with proximity to major traffic routes and in areas with poor lighting and late night entertainment houses. Newman (1972), whilst only examining residential areas, also studied the effects of territoriality and surveillance on the intensity and pattern of crime, and evolved his principles of defensible space.



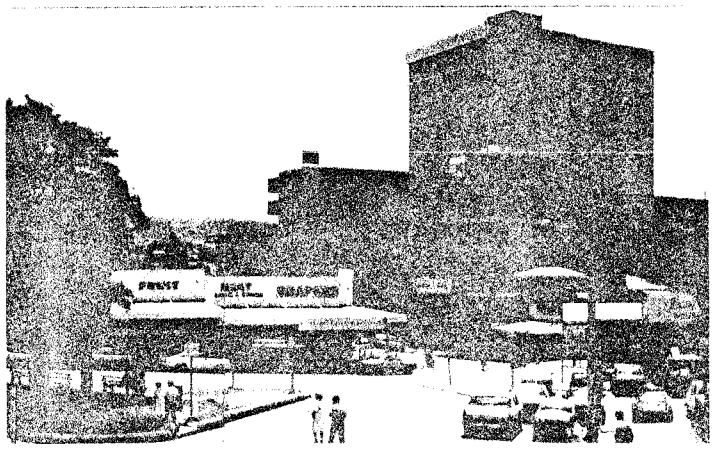
1) Indooroopilly sub-centre.



2) St. Lucia Village sub-centre.



3) Taringa sub-centre.



4) Toowong sub-centre.

Figure 1. Views of the four sub-centres under study.

Scarr (1973) found in his study of burglary that non-residential break and entry incidents occurred during the night and at week-ends, when the occupancy pattern was at its lowest. Entry was usually by doors or windows, and that goods stolen were those easily transported and quickly converted into cash. Reppatto (1974) also found that burglary rates were higher in low-occupancy buildings, thus reinforcing the observation that surveillance is a critical crime deterrent measure, at least as far as residential crime is concerned. Crow and Bull (1975) and Capone and Nicols (1976) all found that certain convenience stores were more attractive to robbers than other stores. Those that offered a minimum risk and maximum opportunity because of such characteristics as lighting, visibility, physical configuration, absence of customers and other potential witnesses and ease of get-away routes, were more vulnerable to robbery.

Recent research has narrowed down the area of concern and concentrated on examining more closely the role of surveillance in combatting building related crime. In a study of convenience store robberies in Tallahasse, USA, Duffala (1976) found that nine of the thirty-four stores analysed were robbed three or more times. The four variables that in interaction seemed to account for the vulnerability of certain stores were as follows:

1. closeness to major transportation routes for getaway purposes;
2. a street with light vehicular traffic which resulted in isolation from surveillance;
3. land use patterns or location in a residential or vacant lot area; and
4. location in an area where there was little or no commercial activity near the target store.

Duffala argued that the combined effect of these four factors, which he called the *physical environmental surrounding* provided a highly significant explanation of the crime patterns he studied. A similarly detailed

study concerned with a large married students' housing estate at Florida University, by Molumby (1976), concluded that both the type of building and the quality of surveillance contributed to the high crime rates found in parts of the estate. Again crime was more prevalent along the main access routes through the estate, incidents occurred mainly at night, and that the presence of trees, shrubs and privacy walls that lowered surveillance quality were major vulnerability factors.

1.3 Research Method

Two types of information were collected for the study: records of actual break and enter incidents and acts of vandalism; and details of the physical environment of the sub-centres. The Queensland Police Department were unable to assist with data, stating that their files were not available to the public and that their statistical information was classified into larger spatial and victim units than those required for the study. Bureau of Statistics data was also insufficient in detail for use. It was therefore necessary to collect both types of data in the field, using a victimisation survey. Although this was not an entirely satisfactory procedure it was recognised that inaccuracies caused by victim loss or distortion of memory could be balanced by the addition to the data of crimes that were not reported to the authorities, particularly acts of minor vandalism, if official records alone were used.

Data on the time and type of crime, the location, the method of entry, the type of property stolen or damaged, and its value, and any subsequent police or victim action was collected. In addition, details of each premises' location, building age and condition, passive, active and surveillance characteristics were noted. Surveillance and other security related patterns in the urban context of each sub-centre were also collected during the field survey and recorded in map form.

A complete canvass of all premises in the four sub-centres

was attempted, as it was anticipated that the incidence of crime would not be distributed widely enough to make a sample useful. Each shop owner was sent a letter of introduction followed a few days later by the one interviewer. After the necessary follow-ups, data on 226 premises was collected, representing a 98% success rate.

The information gathered covered the five year period from January 1974 to December 1978. Five years was chosen as it was long enough to collect sufficient data on crime incidents to make statistical interpretation meaningful, but was not so long as to raise the problem of interviewees being unable to accurately remember their past experiences in the detail required. It was also felt that a survey period of greater than five years could affect the accuracy of the study by reducing the proportion of interviewees who had been operating for the full study period. Subsequently, it was found that while there was some turnover of shop owners, almost 50% of the interviewees had been established for more than five years and that only 37% had been established for less than two years.

2.0 THE PATTERN OF CRIME

2.1 Break and Entry

The survey revealed that 24% of those questioned, or 55 shop owners had been victims of a break and entry incident on one or more occasions during the survey period. In all there were 93 incidents, of which all but 22 were *successful* in that something of value was stolen.

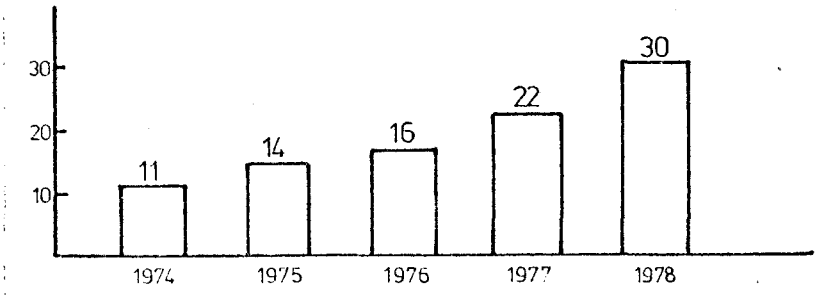
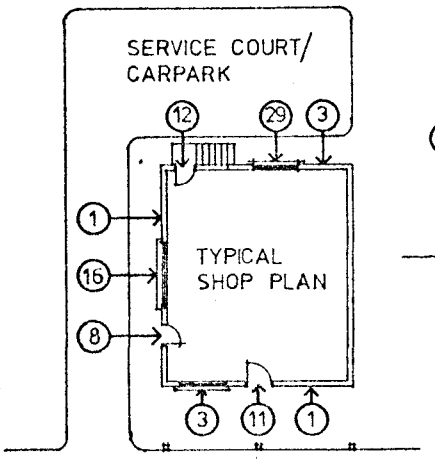


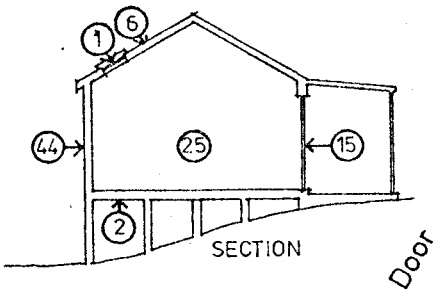
Figure 2. Break and entry, number of incidents reported over the study period 1974-1978.

Figure 2 shows the increase in incidents over the study period, with 56% of all incidents occurring in the last two years. To what extent this pattern is merely a reflection of the interviewees remembering more

accurately the most recent incidents is difficult to determine, although the nature of the crime perpetrated could be considered sufficiently severe to ensure that incidents even five years old would be recalled. Due to the inaccessibility of the Queensland Police Department files, and the generalised nature of Bureau of Statistics data, it has not been possible to check the accuracy of these figures.

Ninety-two of the ninety-three incidents reported in the survey occurred at night (dusk to dawn). Forty-six per cent. occurred between Friday evening and Monday morning, a further 46% occurred during the week, and the remaining 8% were unaccounted for. This pattern is as expected, bearing in mind that practically all incidents occurred when the sub-centre occupancy patterns were at their lowest. The time element between perpetrating the crime and subsequent discovery by the shop owner explains the preference for Saturday night. While 88% of the incidents were reported to the police, only 12% of those who reported the crime had their property recovered or heard that the offender(s) were apprehended.





	Door	Window	Wall	Other	ROW TOTALS
Front	11·8	3·2	1·1		16·1
Rear	12·9	31·2	3·2		47·3
Side	8·6	17·2	1·1		26·9
Other		1·1		8·6	9·7
COLUMN TOT.	33·3	52·7	5·4	8·6	100·0

Percentage Breakdown Table.

Figure 3. Analysis of access methods by criminals for break and entry incidents.

Figure reports the distribution of access points among the ninety-three cases of break and entry. The most common point of entry was found to be through windows at the rear of premises (almost one-third of all cases), the next most

common method was through side windows, followed by the rear door and then the front door. Few incidents involved access via side doors, front windows or through walls, although both floor and roof penetrations were recorded. Windows were thus found to be the most vulnerable point of entry, accounting for just over half of all cases. The rear facades of premises were attacked almost twice as frequently as the side facades and almost three times as frequently as the front facades. Inadequate lighting levels and poor surveillance of shop rears and "backyards" may have accounted for these results.

In almost all cases reported (96%), entry was forced. In four cases entry was gained without the use of force (unlocked window or door key) and although technically not classified as break and enter incidents, they have been so classed for the purpose of this study. While force was used to enter most burgled premises, 87% of all cases reported that the offender(s) inflicted no damage on the building or its contents other than that necessary to execute the break and enter offence. In only eight incidents was extensive interior damage reported.

The cost of the items taken was extremely large, ranging from less than ten dollars to over $10 000. Of the 71 *successful* incidents, 37% involved goods of value less than $100, 38% between $100 and $1000 and 21% between $1000 and $5000. The type of property stolen also varied greatly, but was usually related directly to the type of shop involved. Thirty-four per cent. of the *successful* incidents involved cash, but the largest category (51%) involved stock items such as clothing from fashion boutiques and portable electrical goods from electrical retailers.

By further analysis it is possible to divide the 93 cases of break and entry into three categories.

The first category, accounting for approximately 40% of all incidents, was characterised by the unprofessional selection of victim buildings, leading to poor "hauls",

and by the use of clumsy methods of entry. Professional suites, service stations and retail premises stocking tobacco and foodstuffs were the business type most frequently attacked in this category and property taken (if any) was limited to several packets of cigarettes or cash to the value of only twenty dollars. The usual method of entry was through unbarred windows or poorly secured doors, and in some cases, traces of blood were reported to have been found on sills, walls and furniture, suggesting that youths or even younger children could have been the perpetrators of this category of break and entry. Most of the cases involving interior damage were also associated with this group of incidents.

The second category included those incidents involving one of the following *modus operandi*:

1. Smash and grab - electrical appliance stores, unattended laundrettes and tobacconists were the most usual victims of this form of break and entry.

2. Planned selection - this group of incidents was characterised by the offender's(s') careful selection of matching furniture, appliances or clothing. In two cases, enough furniture, fittings and accessories were stolen to tastefully furnish the main living rooms of a home, and in another case, clothing, underwear and accessories, all of the one size and colour co-ordinated, were reported as stolen.

3. Profitable selection - after a systematic entry, these offender(s) selected large supplies of easily disposed of items such as cigarettes, electrical goods, records and tapes and cash.

4. Drug related - although medical premises were broken into more frequently than any other category of business, little in the way of drugs or dangerous medicines were actually stolen, as in most cases no drugs were kept on the premises.

Approximately 30% of all cases were classified as belonging to this second category which can be summarised as being committed by amateur criminals selecting goods for their own, and their immediate peer group's use.

The third category of offences, accounting for the remaining 30% of all reported cases, involved the fully professional criminal or criminal team using sophisticated methods of entry and escape to obtain large "hauls" of profitable items not easily disposed of in South East Queensland. Incidents in this category included the theft of clothing (whole shop stock), jewellery, medical supplies, and retail equipment (cash registers and electronic scales). In most cases these goods would have been disposed of interstate, and in one case, police were reported to believe that the stolen valuables would have been in South East Asia even before the crime was reported.

Very early in the study it became obvious that the type of business carried out on the premises would have a major effect on the vulnerability to break and entry. Businesses were therefore classified so as to isolate this factor and six categories subsequently evolved. Table 1 cross-tabulates business type with number of times broken and entered.

BUSINESS TYPE	NO.OF TIMES BROKEN AND ENTERED 0	1	2	3	4	RATE/ PREMISES
Retail	97	16	2	1	3	0.29
Entertainment	16	1	-	-	-	0.06
Medical	13	6	5	2	3	1.17
Professional	12	3	-	-	-	0.20
Banking	16	1	-	-	-	0.06
Service	17	8	2	1	1	0.66
TOTALS	171	35	9	4	7 (226)	0.41

Table 1. Cross-tabulation of business type by number of times broken and entered.

Expressed as a rate per premises, for the 5 year period shops classified as medical (including general practitioners, specialists, veterinarians, dentists and chemists) were

burgled almost twice as frequently as service businesses (service stations, laundrettes, dry cleaners, real estate agents and government agencies). Many of these incidents, however, were unsuccessful in that no drugs were stored on the premises. Service premises were burgled between twice and three times as often as any other category. Further, of the twenty premises burgled more than once, ten were medical, three of which were burgled four times over the study period. Both the medical and service categories are obvious high risk targets for break and entry, medical premises because of the drugs and related equipment believed to be stored within, and service premises for the expected large amounts of cash and poor security associated with these businesses.

In summary, the general pattern of break and entry reported by the study shows that the crime is on the increase; almost all incidents occurred at night; the rear and side facades, especially windows, were more frequently attacked than any other facade; the range of goods stolen and their value was extensive; and the offender(s) were not interested in inflicting damage. Further, the study found that the police had been unable, in most cases, to solve the crime and apprehend the perpetrator(s), or recover the stolen property. With the low detection and recovery rate for commercial break and entry offences, the need for detailed crime prevention research is clearly most pressing.

2.2 Vandalism

Vandalism is not a clearly defined legal category, unlike break and entry, nor does the term embody a precise behavioral description. It is, as Cohen (1973) has suggested, a label attached by society to certain types of behavior executed under certain conditions. It became obvious as the study reported in this document progressed that what one interviewee considered an act of vandalism, another dismissed as something not worth reporting. Continuous prompting by the interviewer, however, enabled consistency of reporting to be maintained,

and it was subsequently found that forty-nine shop owners, or 22% of all cases, sustained acts of vandalism to their premises, on one or more occasions over the five year study period. Eighty-three incidents were reported concerning private property, and an additional sixteen acts of vandalism against public property (street signs, street furniture and public telephones) were mentioned by interviewees.

Even more so than with break and entry, official confirmation of acts of vandalism was found to be difficult, as so few of the incidents were reported to the authorities. The study revealed that in only 25% of the cases were the police informed, whereas the same community reported 88% of their break and entry incidents. In most cases of non-reportage (both vandalism and break and entry), victims stated as their reasons the minor nature of the incident, the futility of involving the police and the inconvenience of the official investigation. These findings support Cohen's argument that vandalism is one of the most safe and anonymous offences, where there is no personal complainant, little property for the offender to dispose of and that although the total cost to a community may be considerable, each individual act is too trivial to respond to in any other way than to ignore it (Cohen, 1973).

Seventy-three per cent. of the vandalism incidents against private property reported in the survey took place at night, with only 4% occurring during daylight hours and the remaining 23% unaccounted for. Sixty-six per cent. occurred over the week-end, while the remainder occurred either during the week (27%) or were unaccounted for (7%). This pattern supports the conclusions reached concerning the break and entry incidents. Most incidents took place when the chances of being observed were minimal, at night and over the week-end. Peer group activity (bored gangs of youths roaming the suburbs) may also have influenced the time distribution of acts reported.

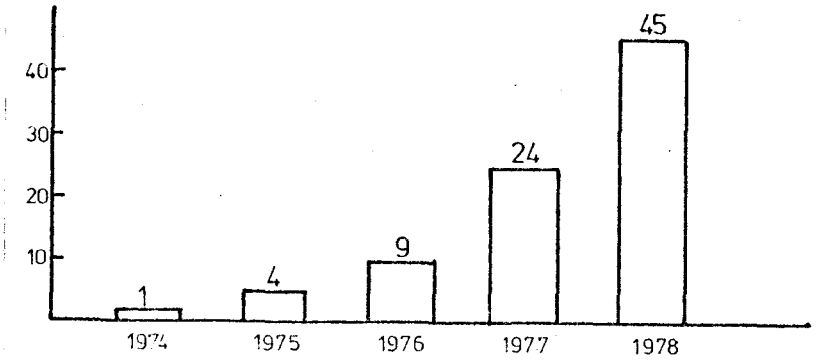


Figure 4. Vandalism, number of incidents reported over the study period 1974-1978.

Figure 4 shows the increase in incidents over the study period. Fifty-four per cent. of all acts of vandalism against private property were reported in 1978, and although it could be surmised that like almost all crimes, vandalism is on the increase, the figures may merely be a product of interviewees' difficulty in remembering incidents that occurred in the recent past. The fact that most incidents were considered so trivial as to not warrant police notification or an insurance claim supports this observation.

Four categories of vandalism predominated the survey results. The main targets were items left out overnight either at the front of the shop or around the back. Incidents in this category accounted for 46% of all cases (including those against public property) and included the turning over of full rubbish bins[1]; the stealing of or damage to movable signs, pot plants, planted gardens and street furniture; and damage to specific specialised equipment such as compressor motors for cold rooms, air-conditioning units and pump glasses on petrol bowsers.

1 An interesting anecdote concerns a number of these incidents. Six interviewees in both St. Lucia Village and Indooroopilly reported the loss of their full metal garbage bins, all, as far as could be ascertained, on the same night. A subsequent shop owner commented, in passing, that friends of his, on returning from a week-end away from home, found their swimming pool full of garbage, and about half a dozen metal bins at the bottom of the pool.

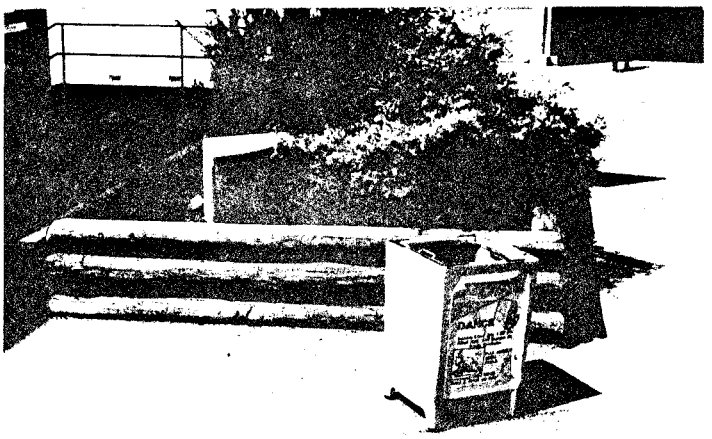
The second category involved the breaking of glass or sheeting (25% of all cases), the third, graffiti (17%) and the fourth, (12%) damage to fixed signs or lettering. (Figure 5). Ninety-two per cent. of damage incurred in vandalistic attacks was repaired almost immediately (only possible when not reported to the authorities) and most repair bills were less than $100 (83%). No act of vandalism was reported to cost more than $1000 to repair.

Interviewees who sustained acts of vandalism to their premises were also asked to offer a considered opinion as to the reason for the incident. Cohen's classification system of vandalism motives was used as a basis for a key, and Table 2 presents the results.

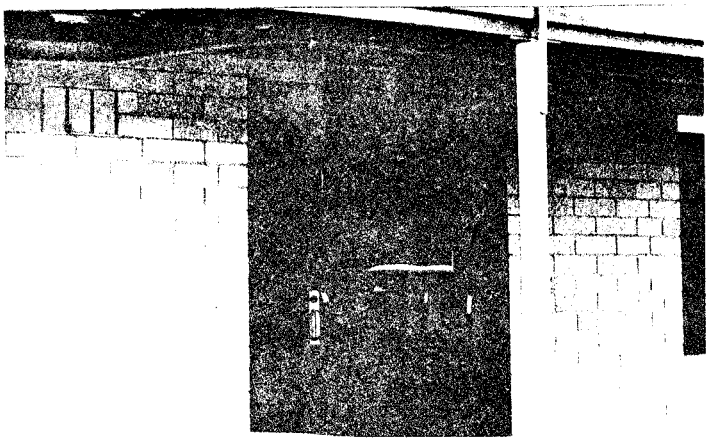
	CATEGORY	NO.
1.	Ideological - graffiti of political or social content	9
2.	Acquisitive - damage to property in the process of acquiring something	7
3.	Vindictive - destruction as a form of revenge	3
4.	Malicious fun - a combination of hostility and fun	32
5.	Don't know.	32
	TOTAL	83

Table 2. Classification of vandalism incidents by type (after Cohen, 1973).

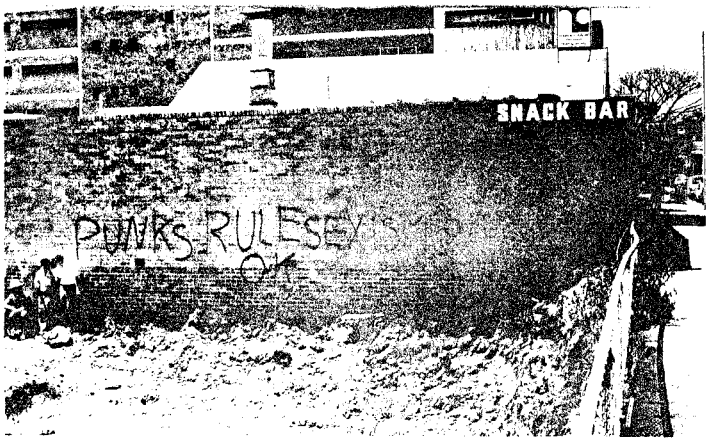
While 38% could not offer any opinion as to the reason for the attack on their building, another 38% were able to state that malicious fun was their explanation of the incident that involved them. The term malicious fun has been used in this study to imply that the vandal(s) experienced some sense of enjoyment or amusement when conducting the offence in addition to it being some form of hostile reaction to the social (or physical environment). As Cohen points out, there is an imperceptible point at which the "fun" becomes malice but both hostility and amusement were considered by many interviewees to be present in the offences committed against their property.



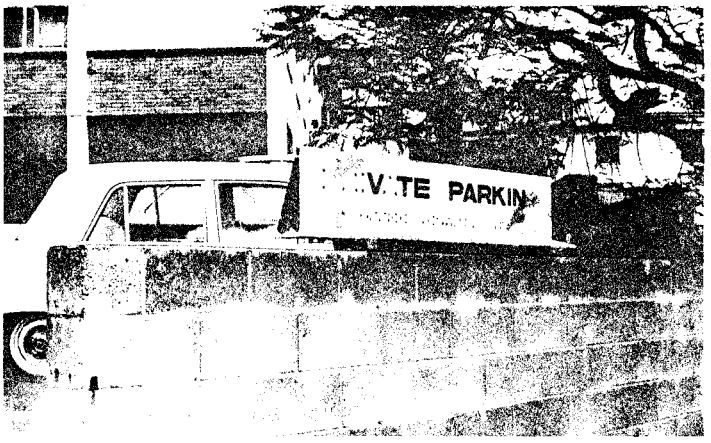
1) Damage to a rubbish bin in the forecourt area of a group of shops in St. Lucia, recorded in 1979. Note the damaged light fitting (arrowed) and the undamaged planting.



2) Broken glass door recorded in St. Lucia, 1979. The nature of the break suggests that it could have been an attempted break and entry, but the deadlock on the door foiled the criminal(s).



3) Graffiti - "PUNKS RULE SEXISM OK" and "MORE SIN" recorded in Toowong, 1979.



4) Damage to sign and wallcapping recorded in Taringa, 1979. The sign originally read "PRIVATE PARKING TENANT VEHICLES ONLY".

Figure 5. Examples of [illegible]alism recorded in the study area.

Ideological motivation, cited in 11% of the cases, was the next most frequently identified category, followed by acquisitive motivation (8.5%) and vindictive motivation (3.5%).

It is easy to speculate that there is a high degree of correlation between the categories of vandalism previously derived and interviewees' speculations as to motivation. The perpetrators of explicit political graffiti may have had ideological motivations, and the acquisitive category can quite easily be applied to those incidents where removed signs and street furniture were subsequently found in university students' college rooms. However, some element of malicious fun, or vindictiveness may have also been involved in such cases and it is very difficult to attach motives to actions with any degree of confidence. What this exercise has shown, though, is that many shop owners do see the problem of vandalism as something more complicated than the provision of a "vandalproof environment" and that the issue involves wider social and environmental concerns.

Using the same business type classification as for the break and enter analysis, Table 3 explores the extent of any relationships between business type and number of times vandalised.

BUSINESS TYPE	NO. OF TIMES VANDALISED 0	1	2	3	4	RATE/ PREMISES
Retail	92	17	7	1	2	0.35
Entertainment	14	1	-	2	-	0.41
Medical	22	4	3	-	-	0.35
Professional	12	2	-	-	1	0.40
Banking	14	2	-	1	-	0.30
Service	23	2	2	1	1	0.45
TOTALS	177	28	12	5	4 (226)	0.37

Table 3. Cross-tabulation of business type by number of times vandalised.

Vandals seem to have no preference for a particular business type as targets, perhaps because all incidents occurred external to the premises and very few were

considered of a vindictive nature.

In summary, acts of vandalism reported in the study were found to generally be of a minor nature, most occurred at night on the week-ends, and the victims did not consider many of the incidents serious enough to warrant notification of the authorities. Further, many shop owners recognised vandalism as a social rather than a criminal problem, and this recognition, more than anything else, may have influenced their attitude to detection and law enforcement.

2.3 Graphic Summary

The incidents of break and entry and vandalism reported in the survey have been plotted onto maps of each sub-centre (Maps 2 to 5). The pattern of business type and features of the physical environment have also been recorded on the maps.

Of the twenty incidents of break and entry recorded in Indooroopilly, thirteen were clustered around groupings of premises coded medical along Station Road. The remaining seven incidents involved three service industries, two retail and one medical premises. This pattern is as expected, considering the criminals' preference for medical and service businesses. The point of entry in five cases was the front of the premises, in four cases the side, and eight offenders entered through the rear. Two incidents involved entry through a wooden floor, and in one case, access was gained through a roof skylight. Eleven of the acts of break and entry were associated with private carparks or service courts, six with public carparks, and three incidents involved gaining access from the street.

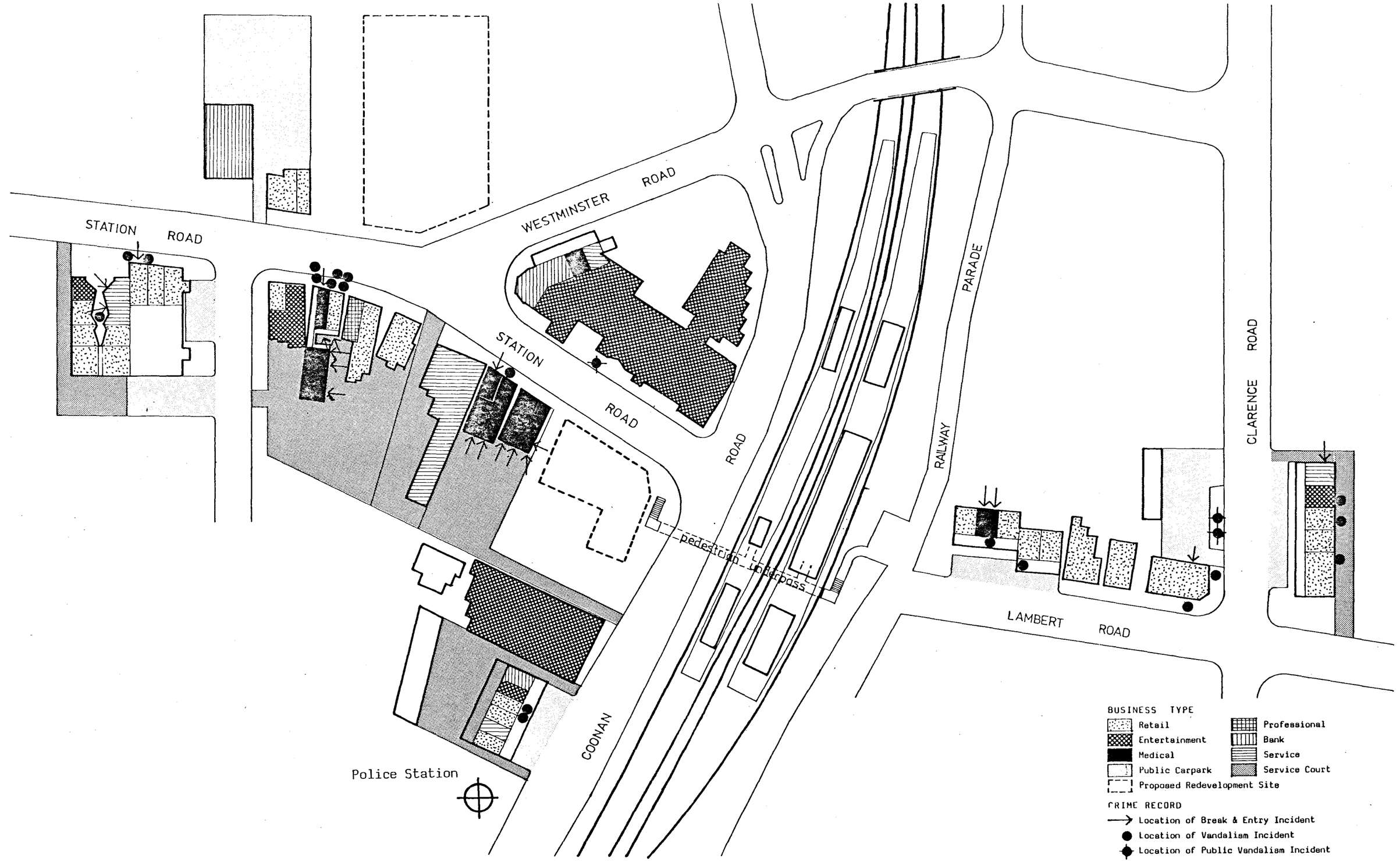
Only four break and entry incidents were recorded in St. Lucia Village over the study period. They were all clustered together, two involving retail premises and two a single service premises. The point of entry in only one case was from the front of the shop, in the remaining cases, the side or back was penetrated. Two

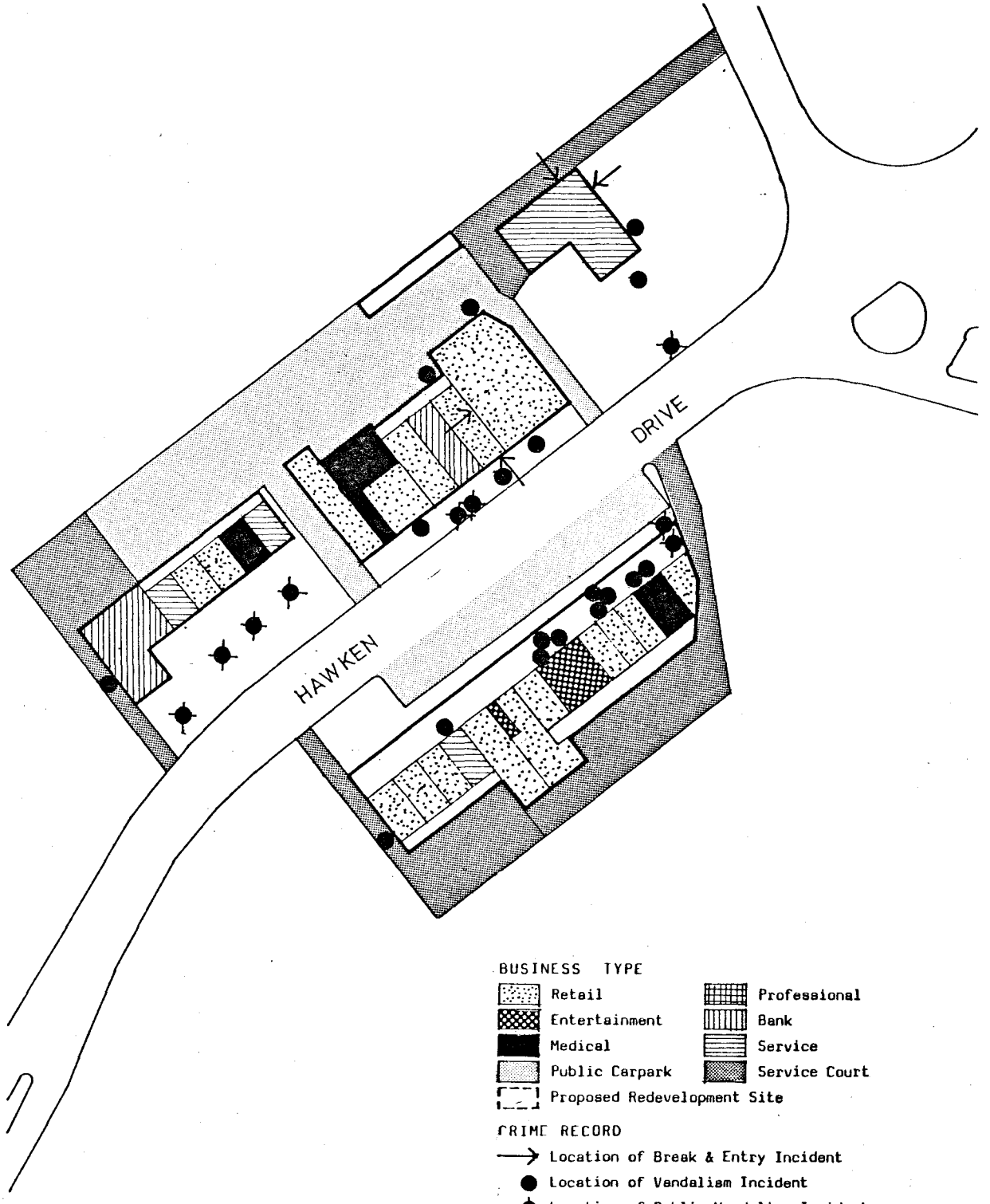
incidents occurred simultaneously, entry to one shop was gained through a seldom used doorway connecting to an adjacent shop that was entered from the front door.

The twenty incidents of break and entry that took place in Taringa involved six retail, four medical, one service and one entertainment premises. The point of entry in ten of these incidents was the rear of the premises, in four cases the side, and for the remaining six, the front of the premises. Eight incidents involved gaining access through a private carpark or service court, a further five involved a public carpark or pedestrian lane, and seven took place on the street footpath or adjacent to it.

Twenty-nine premises in Toowong were victims of break and entry incidents. Of the forty-nine that took place, twenty involved retail premises, a further thirteen involved medical premises; twelve service, three professional, and one bank incident was also recorded. The maps indicate that incidents were clustered in two areas, one along High Street, and one along Sherwood Road. These two clusters account for twenty of the forty-nine acts of break and entry but the distribution of the other twenty-nine incidents is quite wide. Eleven incidents occurred on, or adjacent to the public footpath, the perpetrators of a further twelve incidents gained access through a public carpark, twenty-six through private service courts, pedestrian arcades or carparks.

Fifty per cent. of all incidents were found to have involved access to the victim building through private service courts or private carparks, the remaining incidents evenly divided between entry from the street (or laneway) and entry from public carparking spaces (off street). This pattern confirms the earlier finding that the rear and side facades were the most often attacked.


STATION ROAD
WESTMINSTER ROAD
STATION ROAD
ROAD
RAILWAY PARADE
CLARENCE ROAD
pedestrian underpass
LAMBERT ROAD
COONAN
Police Station
BUSINESS TYPE
Retail
Entertainment
Medical
Public Carpark
Proposed Redevelopment Site
Professional
Bank
Service
Service Court
CRIME RECORD
Location of Break & Entry Incident
Location of Vandalism Incident
Location of Public Vandalism Incident
01 : INDOOROOPILLY
Map 2.
0
50m.
UNIVERSITY OF QUEENSLAND
DEPARTMENT OF ARCHITECTURE
CRIMARCH STUDY
1979



BUSINESS TYPE

- Retail
- Professional
- Entertainment
- Bank
- Medical
- Service
- Public Carpark
- Service Court
- Proposed Redevelopment Site

CRIME RECORD

- Location of Break & Entry Incident
- Location of Vandalism Incident
- Location of Public Vandalism Incident

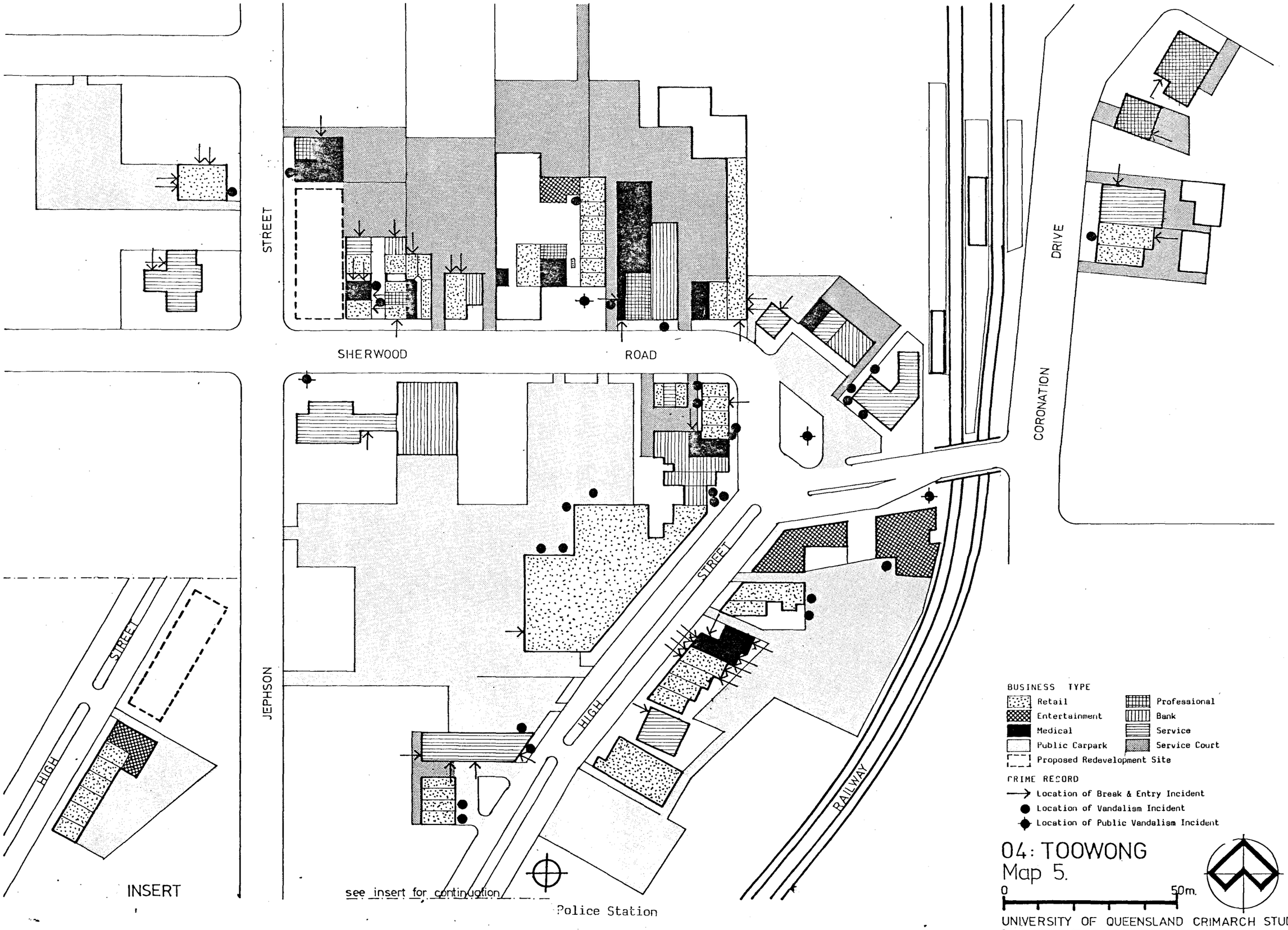
02: ST. LUCIA

Map 3.

0 50m.

UNIVERSITY OF QUEENSLAND CRIMARCH STUDY
DEPARTMENT OF ARCHITECTURE 1979


MONTROSE ROAD
BY-PASS
TARINGA
ROAD
MOGGILL
SWANN
ROAD
MOORAK STREET
TARINGA
BY-PASS
ROAD
MOGGILL
Police Station
MC.INROY STREET
RAILWAY
RAILWAY
BUSINESS TYPE
Retail
Entertainment
Medical
Public Carpark
Professional
Bank
Service
Service Court
Proposed Redevelopment Site
CRIME RECORD
Location of Break & Entry Incident
Location of Vandalism Incident
Location of Public Vandalism Incident
03 · TARINGA
Map 4.
0
50 m.
UNIVERSITY OF QUEENSLAND
DEPARTMENT OF ARCHITECTURE
CRIMARCH STUDY
1979



04: TOOWONG
Map 5.

UNIVERSITY OF QUEENSLAND CRIMARCH STUDY
DEPARTMENT OF ARCHITECTURE 1979

3.0 SUB-CENTRE VULNERABILITY TO CRIME

While all four sub-centres are within the one SES district, the distribution of break and entry and vandalism incidents among the sub-centres was not found to be random.

SUB-CENTRE	NOT BROKEN INTO	BROKEN INTO	TOTAL
Indooroopilly	36	11	47
St. Lucia	26	3	29
Taringa	50	12	62
Toowong	59	29	88
TOTAL	171	55	226
	Raw χ^2 = 7.49	d.f. = 8	Signf. = 0.06

Table 4. Cross-tabulation of sub-centre by number of premises broken and entered.

Table 4 shows that the Toowong sub-centre was the scene of over three times the number of break and entry incidents per premises as the St. Lucia sub-centre. Although the relationships were not found to be highly significant (adopting the generally accepted social research standard level of significance of 0.05 for the study) the variation between sub-centres needs some explanation. Table 5 plots the same data for acts of

vandalism and it is interesting to note that in this case, St. Lucia sub-centre was the scene of the greatest amount of crime, with Taringa the scene of the least.

SUB-CENTRE	NOT VANDALISED	VANDALISED	TOTAL
Indooroopilly	35	12	47
St. Lucia	19	10	29
Taringa	54	8	62
Toowong	69	19	88
TOTAL	177	49	226
	Raw χ^2 = 6.02	d.f. = 3	Signf. = 0.11

Table 5. Cross-tabulation of sub-centre by number of premises vandalised.

A cross-tabulation of business type by sub-centre indicates that there is no significant relationship between the categories (Table 6).

BUSINESS TYPE	S U B - C E N T R E				BUS.TYPE
	In'pilly	St.Lucia	Taringa	Toowong	TOTALS
Retail	25	17	31	47	119
Entertainment	6	3	5	3	17
Medical	7	3	7	11	29
Professional	1	0	7	7	15
Bank	3	2	3	9	17
Service	5	4	9	11	29
SUB-CENTRE TOTALS	47	29	62	88	226
	Raw χ^2 = 12.26		d.f. = 15		Signf. = 0.66

Table 6. Cross-tabulation of business type by sub-centre.

No sub-centre has a significantly greater or fewer number of any business type than any other sub-centre, after allowing for the size of the sub-centre. This result was expected, and confirms the relative homogeneity of the four sub-centres in terms of business composition.

Some account, then, must be made of the observation that St. Lucia Village, while suffering the least break and entry, was the most vandalised. Neither crime rate per premises were found to be proportional to sub-centre size, and as the distribution of business types across the sub-centres showed no significant relationship, the crime

rates must be caused by some other factor(s) apart from the burglars' preference for medical and service business types.

3.1 Break and Entry

There are some environmental differences between the sub-centres that could explain the variable patterns of break and entry incidents. Taringa and St. Lucia Village are strip developments, with all premises facing each other across the one through traffic road. Indooroopilly and Toowong are cluster developments where the retail cores have evolved around a major road intersection, with isolated linear expansion occurring along adjacent streets. General levels of surveillance by shop owners and through traffic would therefore tend to be higher in the strip developments, where through traffic could observe all premises. Working against this hypothesis, some researchers have found that the occurrence of some crimes increases with the traffic volumes on adjacent streets. Angel (1968) and Duffala (1976) both explored this issue in connection with robbery and armed robbery. They found that the anonymity associated with the larger volume of traffic and its higher speed, together with the fast get-away route that the major roads provided increased the vulnerability of convenience stores and other commercial premises. While a fast get-away route does not seem so important in cases of break and entry, the anonymity factor, and the potential for an efficient escape route leading directly to other parts of the city may influence the selection of a victim building by criminal(s). Indooroopilly, Taringa and Toowong are all located on, or adjacent to a major arterial road network that services the western suburbs of Brisbane and is directly linked to the city and from there to other major road networks.

The volume of pedestrian traffic in and around the sub-centres may also have some effect on the distribution of crime. Luedtke and Associates (1970) found in their study of break and entry offences in Detroit, U.S.A., that the levels of pedestrian flow in the general area of burglary

sites was very low, although they did not compare their results with areas devoid of crime. Pedestrian volumes, especially during the evenings, are a function of the number of premises open after hours, and the proximity of public transport routes that let down passengers late in the evenings. While all four sub-centres serve as major junctions for Brisbane's bus service, there are railway stations at Toowong, Taringa and Indooroopilly. In addition, Table 7 cross-tabulates the number of premises open after hours by sub-centres.

	IN'PILLY	ST. LUCIA	TARINGA	TOOWONG
Open after hours	8	5	5	5
Not open after hours	39	24	57	83

Raw χ^2 = 7.14 d.f. = 3 Signf. = .06

Table 7. Cross-tabulation of hours of operation by sub-centre.

In Indooroopilly and St. Lucia, over 17% of all premises were found to be open after hours, compared with only 8% and 6% in Taringa and Toowong.

The presence of local police stations at Indooroopilly, Taringa and Toowong could also influence the crime rates, as could the distribution of surveillance activities by private security services. Table 8 shows that over 50% of the shops in St. Lucia and over 30% of those in Toowong were serviced by patrols, compared with less than 8% in Indooroopilly and Taringa.

	IN'PILLY	ST.LUCIA	TARINGA	TOOWONG
Security patrol used	4	15	4	27
No patrol used	43	14	58	61

Raw χ^2 = 32.35 d.f. = 3 Signf. = .00

Table 8. Cross-tabulation of security patrol service by sub-centre.

When these six hypotheses are examined, an interesting pattern emerges. Table 9 plots, on a simple positive or negative scale, the contribution each variable makes to the vulnerability of the sub-centres. The strip layout

of Taringa and St. Lucia Village hypothetically lowers the vulnerability of those sub-centres, so they receive a negative score for the first variable, while Indooroopilly and Toowong receive positive scores. Similarly, each sub-centre receives a positive or negative score for the remaining five variables.

	Sub-centre Type	Proximity to Getaway Route	Presence of Police	Presence of Railway Station	Presence of Security Service	Presence of After Hours Premises	Rate/Premises Burglary
	1	2	3	4	5	6	
IN'PILLY	+	+	-	+	+	-	.43
ST. LUCIA	-	-	+	-	-	-	.14
TARINGA	-	+	-	+	+	+	.32
TOOWONG	+	+	-	+	-	+	.56

Positive contribution towards increasing vulnerability = +
Negative contribution towards increasing vulnerability = -

Table 9. Sub-centres according to vulnerability factors that could affect break and entry rates.

When the number of positive and negative scores received by each sub-centre is compared with the rate of break and entry, the low rate for St. Lucia Village can, to some extent, be explained. The other three sub-centres, all with four positive scores, experienced rates of break and entry between two and four times that of St. Lucia, with only one positive score. St. Lucia Village, then, may be relatively free of this crime because of the improved surveillance that has occurred from the combined effect of its strip development, concentration of after-hours entertainment premises, high proportion of shops serviced by security patrols and due to its isolated location in relation to the road network.

3.2 Vandalism

Identifying some causes for the distribution pattern of acts of vandalism between the sub-centres is more complex. Because of the nature of vandalism, where so much is in (malicious) fun and impulsive, it is difficult to select variables that seem intuitively to have some effect on

vulnerability. If it is true that vandalism is a juvenile crime, and associated with groups of youths roaming the streets after dark, then those sub-centres that provide meeting places for such youths could be expected to have higher vandalism rates than those sub-centres that do not. The major railway stations at Toowong and Indooroopilly, where commuting youths on their way home late at night could stop, may be just such a meeting place, while the youthful patrons of late night opening entertainment houses could be perpetrators of acts of vandalism instead of being "eyes on the street", especially when alcohol is involved. St. Lucia Village is also within walking distance of the University of Queensland residential colleges that could provide a large body of potential vandals.

However, when these three factors are analysed in a similar manner to that used for break and entry factors (Table 10) a pattern does emerge.

SUB-CENTRE	Presence of R'way Station 1	Concentrn. of Premises Open After Hours 2	Proximity to U/Q Campus 3	Vandalism Rate/ Premises
Indooroopilly	+	+	-	0.40
St. Lucia	-	+	+	0.62
Taringa	-	-	-	0.18
Toowong	+	+	-	0.40

Positive contribution towards increasing vulnerability = +
Negative contribution towards increasing vulnerability = -

Table 10. Sub-centres according to vulnerability factors that could affect vandalism rates.

Taringa, with the lowest rate, has three minus scores compared to the other three sub-centres which all have two plus scores, thus implying that they are more vulnerable. The highest rate at St. Lucia Village may also be explainable, if it is hypothesised that the proximity to the University should have a higher weighting than either of the other two variables. In fact, many of the St. Lucia Village interviewees laid the blame for

damage to their property on college students "letting off steam" at examination time. Of the eighteen recorded incidents of vandalism at St. Lucia, victims considered twelve to be perpetrated by students, and in four cases the removed property was subsequently found by the University's security staff in college rooms. In addition, nine of the sixteen acts of vandalism against public property occurred in St. Lucia Village, while none were reported in Taringa. St. Lucia Village also has a pizza parlour run by students that specifically caters for the college fraternity, staying open until after the library on campus closes at midnight.

3.3 Summary

This section of the report has attempted to explain the variability in crime rates for the four sub-centres by examining the cumulative effects of a set of factors each of which could be considered as having some influence on the vulnerability of the sub-centres. The results can be nothing more than tentative, with so few sub-centres surveyed. Four is too small a number to infer statistical certainty by establishing gross differences between three or even six factors.

The results do, however, point to some interesting concepts, as well as confirming many of the findings by other researchers. Sub-centre night surveillance by as many sources as possible - police, private security patrols, pedestrian and vehicular traffic - seems to be a major determinant of crime rates, with higher levels of crime, especially break and entry, occurring in areas of low surveillance.

One interesting finding of this section of the report is that while a high concentration of premises catering to after-hours entertainment tends to lower the level of break and entry in a sub-centre, the same concentration has the reverse effect on the rate of vandalism. In the case of break and entry, patrons become "eyes on the street" adding to the overall level of sub-centre

surveillance and restricting the activities of criminal(s). The same patrons, though, are potential vandals who, as a group, could be responsible for much of the minor vandalism reported in the sub-centres. This finding creates a dilemma for planners and architects. In deciding the business mix for redeveloped or new shopping centres, the number of entertainment or other premises open after hours to be included must be considered carefully, so as to limit as much as possible the overall development's vulnerability to vandalism, but at the same time to ensure that some "natural" surveillance during the evenings is maintained.

Perhaps a more effective method of increasing the quality of night-time surveillance would be to encourage the development of residential accommodation within the sub-centres. Residents would then add to the number of potential observers of break and entry incidents but would not, perhaps, become potential vandals due to the respect they would hold for their immediate environment. In addition, residents living above and between shops in medium density housing developments, would increase the custom to the sub-centre, improving business viability and reducing sub-centre deterioration that some researchers suggest is an invitation to vandals.

4.0 BUILDING VULNERABILITY TO CRIME

It is the general practice of most security consultants and organisations to consider the problem of building security in three interrelated parts: firstly, the provision of a building structure and fabric that can resist illegal penetration (often called *target hardening*); secondly, the design of the building surroundings so as to limit as much as possible the opportunity for criminals to carry out their activities unseen and undisturbed; and thirdly, detection, where any breach of the deterrent systems can be quickly identified and the appropriate action taken (Price, 1962; Hutton, 1964; Cole, 1970; Rush, 1978). These three factors, passive security, surveillance, and active security are themselves composed of many elements and aspects, all of which combine to produce an overall level of building vulnerability to criminal activity. The type of construction and physical condition of the building, the type and extent of any fenestration, the quality of the door locks and the presence or absence of security grills on openings can all contribute to the measure of a building's level of passive security. The quality of surveillance depends on the building's exposure, the level

of lighting, and the number of potential witnesses in the surrounding area. Active security controls include alarms, security patrol services, and other sophisticated detection devices.

It is one of the purposes of this study to evaluate the individual and combined effects of these variables on the vulnerability of premises to the crimes of break and entry and vandalism. It is hypothesised that premises with low levels of passive security, active security, and surveillance would be more vulnerable to crime than those premises with high levels of security. Two approaches to exploring this hypothesis have been taken: firstly, the statistical technique of discriminant analysis has been used to identify which variables have the greatest effect on vulnerability; and secondly, indexes that measure the combined effect of these factors have been created, plotted on to maps of each sub-centre, and their spatial implications explored.

4.1 Discriminant Analysis

The objective of a discriminant analysis is to derive a set of variables that are capable of statistically distinguishing between the members of two groups of cases.[1] In this study the two groups were those premises broken into and those not broken into and those vandalised and not vandalised. Because the distribution of break and entry incidents was found to be highly correlated with business type, the analysis of discriminating variables for break and entry has been limited to the three business types that sustained the bulk of the offences - the retail, medical and service categories. No correlation was found between acts of vandalism and business type, so a discriminant analysis based on the full set of 226 cases was undertaken to establish which variables best distinguished between premises vandalised and not vandalised.[2]

---

1 Appendix 2 contains a detailed description of the discriminant analysis technique used for this study.

2 A different set of variables was used for the three break and entry analyses from that used for the vandalism analysis. See Appendix 2 for full details.

In all, four discriminant analyses were undertaken. Figure 6 summarises the results of the first analysis, based on the 119 retail premises, twenty-two of which were broken into.

BREAK AND ENTRY DISCRIMINANT ANALYSIS SUMMARY

DISCRIMINATING VARIABLES	BUSINESS TYPE - RETAIL
1. Construction type and condition	
2. Door lock type	

FUNCTION STATISTICS			
Eigenvalue	0.05	Wilk's lambda	0.95
Canonical correlation	0.22	Significance	0.06

Figure 6.

Two variables, CONSTRN (computer mnemonics for the type of construction and the physical condition of the building) and LOCK (door lock type) were chosen by the programme, although a third variable, LIGHT (adequacy of night lighting) was included and subsequently removed from the function when it was found to reduce the discriminating power.[1] The function, however, was not very effective in separating the two groups of cases[2], and the implications are that the two variables, although the best of the set available, were not very good discriminators between those retail premises broken into and those not broken into. Table 11 prints the mean values of each variable for each group and the total group, together with a univariate F-ratio significance test.

VARIABLES	NOT B/E MEAN	B/E MEAN	TOTAL MEAN	F-RATIO
CONSTRN	1.12	1.27	1.15	3.13
FENES	8.80	9.64	8.96	2.98
LOCK	2.40	2.91	2.50	3.39
GRILL	3.83	4.05	3.87	0.63
SURVAIL	3.78	4.00	3.82	0.22
VISIETY	3.40	3.68	3.45	0.55
LIGHT	5.92	7.32	6.18	3.62
HOURSOP	1.99	1.96	1.98	0.26

Table 11.

Table 11. Group means (and their associated univariate F-ratio, 1 and 117 degrees of freedom) for retail business type based on break and entry data.

1 Appendix 2 contains detailed summary tables for this, and subsequent analyses.

2 The degree of separation can be established by examining the values of the function statistics. A low eigenvalue and canonical correlation with a high Wilks' lambda imply poor separation, while a high eigenvalue and canonical correlation with a low Wilks' lambda imply good separation.

There was no significant difference between the group means for the variable GRILL (security grill situation), SURVAIL (degree of exposure), VISIBTY (degree of visibility) and HOURSOP (hours of operation), indicating that retail premises broken into were not significantly less or more secure on these variables than those not broken into. Although the function composed of the variables CONSTRN and LOCK was not highly significant (for the purposes of discriminating) the means of the two variables, together with those of the rejected variable LIGHT and the variable FENES were significantly different.[1] Retail premises broken into were, therefore, more poorly lit, had less secure door locks, more easily penetrated fenestration and were of lighter construction and perhaps in poorer physical condition than retail premises not broken into.[2] When medical premises were examined (Figure 7), a significant function composed of five variables was derived to discriminate between the sixteen premises broken into and the thirteen not broken into.

BREAK AND ENTRY DISCRIMINANT ANALYSIS SUMMARY

DISCRIMINATING VARIABLES	BUSINESS TYPE - MEDICAL
1. Degree of building exposure	
2. Degree of visibility	
3. Lighting level	
4. Security grill situation	
5. Fenestration pattern	

FUNCTION STATISTICS			
Eigenvalue	0.91	Wilk's lambda	0.52
Canonical correlation	0.69	Significance	0.01

Figure 7.

Results suggest that this function does separate the two groups and that the selected variables are reasonably good discriminators.[3] An examination of the group means printed

1 An F-ratio above 2.75 indicates a significance level between 0.10 and 0.05.

2 The higher the value of the mean for a variable the lower the level of security as measured by that variable.

3 The implications of a high eigenvalue and canonical correlation and a low Wilks' lambda.

in Table 12, however, indicates that only for one variable, degree of exposure, was the mean value for medical premises broken into significantly higher than that for premises not broken into. In all other cases the mean differences were not significant to an acceptable level, taking into consideration the sample size.[1]

VARIABLES	NOT B/E MEAN	B/E MEAN	TOTAL MEAN	F-RATIO
CONSTRN	1.08	1.00	1.04	1.24
FENES	8.23	9.31	8.83	1.77
LOCK	2.08	2.06	2.07	0.00
GRILL	3.46	3.81	3.66	0.50
SURVAIL	2.69	4.81	3.86	5.91
VISIBTY	3.00	5.13	4.17	1.67
LIGHT	6.39	5.25	5.76	0.71
HOURSOP	2.15	2.19	2.17	0.05

Table 12. Group means (and their associated univariate F-ratio, 1 and 27 degrees of freedom) for medical business type based on break and entry data.

For medical premises, then, vulnerability appears to be predominantly dependent on the building's degree of exposure. The four variables: fenestration pattern, security grill situation, degree of visibility and quality of night lighting, while not as significant as the degree of exposure, do help to discriminate between premises broken into and those not broken into.

To discriminate between the seventeen service premises not broken into and the twelve that were the analysis stopped after only one variable was selected (Figure 8).

BREAK AND ENTRY DISCRIMINANT ANALYSIS SUMMARY

DISCRIMINATING VARIABLES BUSINESS TYPE - SERVICE

1. Security grill situation

FUNCTION STATISTICS

Eigenvalue	6.21	Wilk's lambda	0.14
Canonical correlation	0.93	Significance	0.00

Figure 8.

The function, although composed of only one variable, was highly significant and a good discriminator[2], suggesting that more service premises broken into had less secure openings than service premises not broken into. Table 13

1 An F-ratio above 2.90 is necessary for the mean differences to be significant at the 0.10 level, which is considered acceptable for this study.

2 A very high eigenvalue and canonical correlation together with a low Wilks' lambda confirms this analysis.

shows, however, that for no variable was the mean difference between the two groups large enough to be significant.[1]

VARIABLES	NOT B/E MEAN	B/E MEAN	TOTAL MEAN	F-RATIO
CONSTRN	1.06	1.00	1.04	0.70
FENES	10.00	10.75	10.31	0.67
LOCK	3.00	3.17	3.07	0.08
GRILL	4.59	5.50	4.97	1.59
SURVAIL	4.12	4.75	4.38	0.61
VISIBTY	4.18	5.17	4.59	1.50
LIGHT	6.77	8.33	7.41	1.57
HOURSOP	1.94	2.00	1.97	0.22

Table 13. Group means (and their associated univariate F-ratio, 1 and 27 degrees of freedom) for service business type based on break and entry data.

The three discriminant analyses for break and entry indicate that certain variables had stronger discriminatory power than other variables. Only one variable appeared more than once, the security grill situation, and the group mean tables indicated that for many of the variables selected for their discriminatory power, the mean differences were not significant. A close examination of the results reveals the beginnings of a pattern. The retail business type function, although not highly significant or a good discriminator, was composed of variables related to the concept of passive security or target hardening, as was the highly significant service business type function. Passive security variables also appeared in the medical business type function, together with three variables that combine to measure surveillance. The presence of the two variables FENES and GRILL confirm the already established criminal preference for illegal entry through unbarred windows. Considering that many of the burgled service business type premises were service stations with large areas of easily penetrated fenestration, the sole discriminatory variable for that function, GRILL, also begins to make sense. The group mean tables for the three business type analyses add to the pattern. In addition to

1 An F-ratio of 2.90 is necessary for the mean differences to be significant at the 0.10 level.

reinforcing the importance of the passive security concept in the case of retail premises (three of the four significant variables relate to that concept), the only other variable with significant mean differences, SURVAIL, appears under the medical business type category, where surveillance related variables predominate.

For break and entry, then, vulnerability appears to be influenced by both the level of passive security (CONSTRN + LOCK + GRILL + FENES) and surveillance (LIGHT + SURVAIL + VISIBTY), rather than by the influence of only one or two variables.

As no correlation was found between vandalism and business type, a discriminant analysis based on the full set of 226 cases was undertaken to establish which variables best discriminate between vandalised and not vandalised premises. Figure 9 summarises the results.

VANDALISM DISCRIMINANT ANALYSIS SUMMARY

DISCRIMINATING VARIABLES

1. Hours of operation
2. Construction type and condition
3. Fenestration pattern
4. Degree of building exposure

FUNCTION STATISTICS

Eigenvalue	0.04	Wilk's lambda	0.96
Canonical correlation	0.21	Significance	0.05

Figure 9.

The discriminatory power of the function, although significant, was not high[1], indicating that the programme had difficulty establishing any pattern that identified victim buildings. This result tends to support an earlier observation that vandals were not attracted to specific buildings by obvious environmental or architectural conditions but rather because the premises were easily accessible, had large areas of glass that invited vandalism, were open after hours, or were obviously in a poor physical condition. Variables that measure these factors, SURVAIL, FENES, HOURSOP and CONSTRN all appeared

1 The low eigenvalue and canonical correlation and the high Wilks' lambda.

in the discriminant function, but an examination of the group means table (Table 14) introduces some complexities to the interpretation.

VARIABLES	NOT B/E MEAN	B/E MEAN	TOTAL MEAN	F-RATIO
CONSTRN	1.12	1.04	1.11	2.83
FENES	9.09	9.57	9.20	1.71
SURVAIL	3.97	3.92	3.96	0.02
VISIBTY	3.64	4.02	3.73	1.01
LIGHT	6.13	6.47	6.20	0.42
HOURSOP	1.98	1.86	1.96	3.90

Table 14. Group means (and their associated univariate F-ratio, 1 and 224 degrees of freedom) for all premises based on vandalism data.

For two variables, the mean differences were significant[1] for the purposes of this analysis, but in both cases, CONSTRN and HOURSOP, the mean value for the group of premises vandalised was lower than that for the group not vandalised. Thus, vandalised premises tended to be of a better, not worse, standard of construction and condition, and were not open after hours as frequently as those premises not vandalised. The degree of exposure, as measured by the variable SURVAIL, was slightly higher for vandalised premises, although not significantly so, as was the variable FENES.

4.2 Graphic Analysis

While the variables examined by the discriminant analyses were found to have some influence on premises' vulnerability to break and entry and vandalism, a cartographic analysis of their combined effects, as suggested by the discriminant functions, could be expected to reveal additional insights. Also, additional variables excluded from the mathematical analysis because of statistical peculiarities can be included in a graphic analysis. For example, no correlation was found to exist between crime rates and the use of private patrol services, and the variable was excluded from the discriminant analysis. It

1 An F-ratio in excess of 3.84 implies an 0.05 level of significance and one in excess of 2.71 implies an 0.10 level of significance.

can be hypothesised, however, that the presence of security patrols in a sub-centre late at night could reduce the vulnerability not only of premises being patrolled, but adjacent premises as well, and therefore should be included as a variable at some stage of the analysis. In a similar way, premises open after hours consistently could be expected to play some role in helping to protect adjacent shops from break and entry, or add to a sub-centre's vandalism rate, even though no correlation was found to exist between crime rates and the HOURSOP variable.

So that the variables could be plotted onto maps of each sub-centre, they were aggregated into two indexes. The first, called the Passive Security Index, was created by aggregating the four discriminating variables that, taken together, best measure the relative resistance of the physical structure of each premises to penetration: CONSTRN, FENES, LOCK and GRILL. VISIBTY, SURVAIL and LIGHT were aggregated to create a Night Surveillance Index, and the continuous values of each index were then recoded into three discrete categories.[1] Table 15 illustrates the relationships between the indexes and the break and entry and vandalism histories of the full set of cases.

PASSIVE SECURITY INDEX

		NOT BROKEN INTO	BROKEN INTO	TOTAL
Most secure	1	81	18	99
	2	69	22	91
Least secure	3	21	15	36
TOTAL		171	55	226
		Raw χ^2 = 7.91	d.f. = 2	Signf. = 0.02

		NOT VANDALISED	VANDALISED	TOTAL
Most secure	1	82	17	99
	2	67	24	91
Least secure	3	28	8	36
TOTAL		177	49	226
		Raw χ^2 = 2.37	d.f. = 2	Signf. = 0.31

SURVEILLANCE INDEX

		NOT BROKEN INTO	BROKEN INTO	TOTAL
Most secure	1	68	19	87
	2	59	17	76
Least secure	3	44	19	63
TOTAL		171	55	226
		Raw χ^2 = 1.61	d.f. = 2	Signf. = 0.45

		NOT VANDALISED	VANDALISED	TOTAL
Most secure	1	70	17	87
	2	58	18	76
Least secure	3	49	14	63
TOTAL		177	49	226
		Raw χ^2 = 0.43	d.f. = 2	Signf. = 0.81

Table 15. Index cross-tabulations with break and entry and vandalism history.

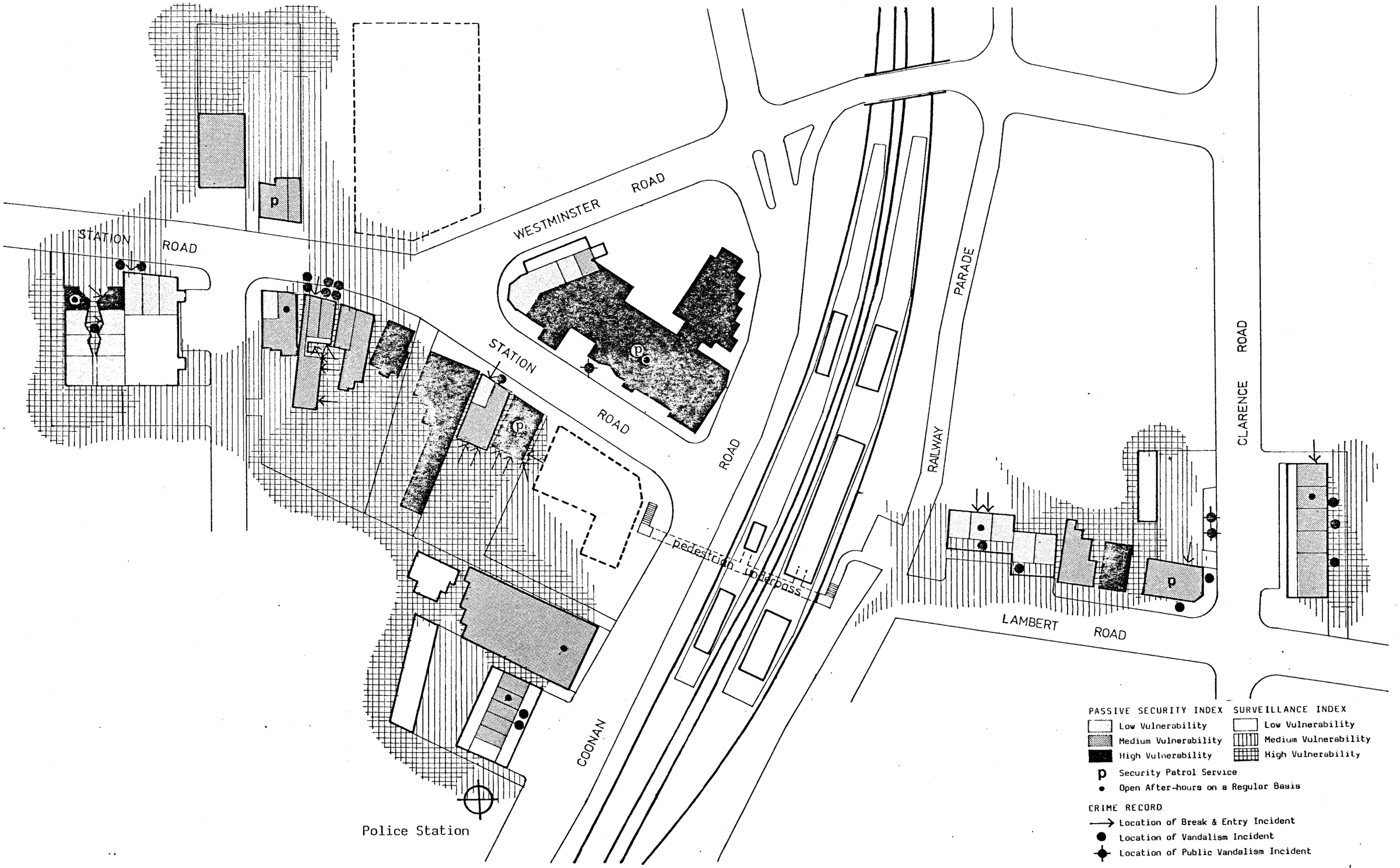
1 See Appendix 2 for details of index creation.

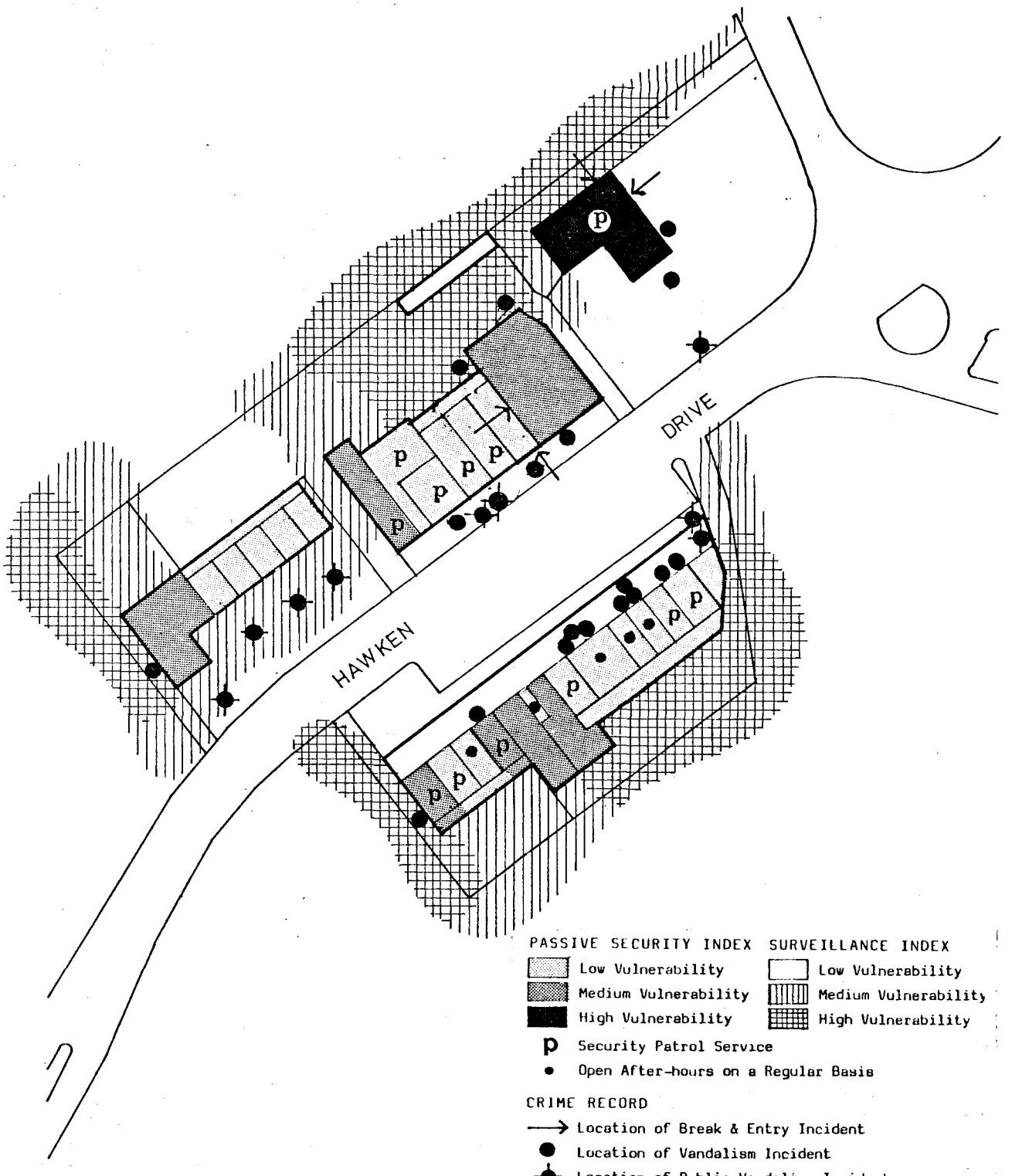
Only one of the four relationships was found to be significant. Almost 42% of the least passive secure premises were broken into compared with only 24% of those valued 2 and 18% of the most passive secure premises. This result was as expected. Buildings that were relatively easily penetrated because of poor passive security design (large areas of difficult to secure windows, no security grills, poor quality door locks, etc.) were subjected to higher levels of break and entry than more passively secure buildings. The discriminant analysis also showed that passive security variables were important indicators of vulnerability. The level of passive security did not, however, influence vulnerability to vandalism, and the level of night-time surveillance, as measured by the index seemed to play no role in influencing premises' vulnerability to either type of crime. This result was totally unexpected, considering the importance the literature places on surveillance as a crime related environmental factor, the findings of earlier sections of this report, and the presence of the surveillance variables, VISIBTY, SURVAIL and LIGHT in at least one discriminant analysis. One possible explanation for these results could be that vulnerability to crime depends not so much on the level of surveillance of the individual premises under study, but on the overall patterns of surveillance, passive security and opportunity for crime in the immediate surroundings.

Some recent research work tends to support this explanation. Reppatto (1974), in his extensive study of residential crime in the United States of America, found that while no correlation could be established between levels of surveillance and crime rates *per se*, dwellings with many accessible openings (poor passive security) made unobservable by vacant lots, alley-ways, shrubs or other obstructions displayed medium to high rates of burglary and those where there were fewer openings, all easily seen, displayed low crime rates. Duffala (1976) also had difficulty establishing significant correlations between factors involving surveillance characteristics

and rates of armed robbery until he began exploring the combined effects of all his factors. Also, the discriminant analyses showed that in no case were the surveillance related variables, on their own, capable of discriminating between premises burgled or not burgled, or vandalised or not vandalised. The analysis of group means also indicated that variables related to both passive security and to surveillance, were significant, thus reinforcing the proposition that many factors act in concert to influence the overall vulnerability of premises.

For each sub-centre, a map has been prepared. They record four components of building security: Passive Security Index; Night Surveillance Index; premises open after hours; and buildings serviced by private security patrols. Also plotted on each map is the distribution of break and entry incidents, acts of vandalism against private property and acts of vandalism against public property. Using these maps, the combined effects of all factors on premises' vulnerability can be assessed.


STATION ROAD
WESTMINSTER ROAD
STATION ROAD
ROAD
RAILWAY PARADE
CLARENCE ROAD
pedestrian underpass
LAMBERT ROAD
COONAN
Police Station
p
PASSIVE SECURITY INDEX
Low Vulnerability
Medium Vulnerability
High Vulnerability
SURVEILLANCE INDEX
Low Vulnerability
Medium Vulnerability
High Vulnerability
p Security Patrol Service
Open After-hours on a Regular Basis
CRIME RECORD
Location of Break & Entry Incident
Location of Vandalism Incident
Location of Public Vandalism Incident
01 : INDOOROOPILLY
Map 6.
0
50m.
UNIVERSITY OF QUEENSLAND
DEPARTMENT OF ARCHITECTURE
CRIMARCH STUDY
1979



PASSIVE SECURITY INDEX
- Low Vulnerability
- Medium Vulnerability
- High Vulnerability

SURVEILLANCE INDEX
- Low Vulnerability
- Medium Vulnerability
- High Vulnerability

p Security Patrol Service

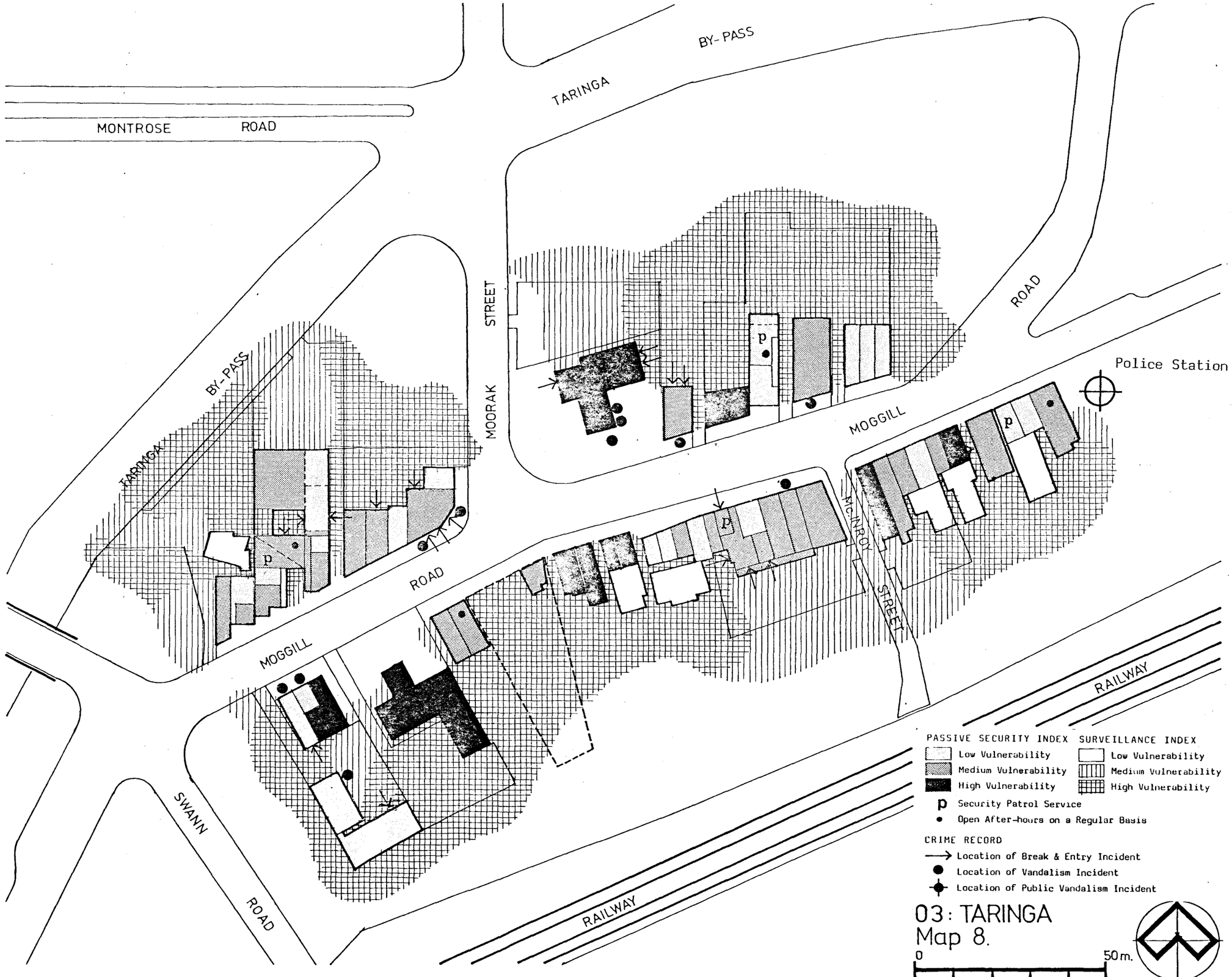
• Open After-hours on a Regular Basis

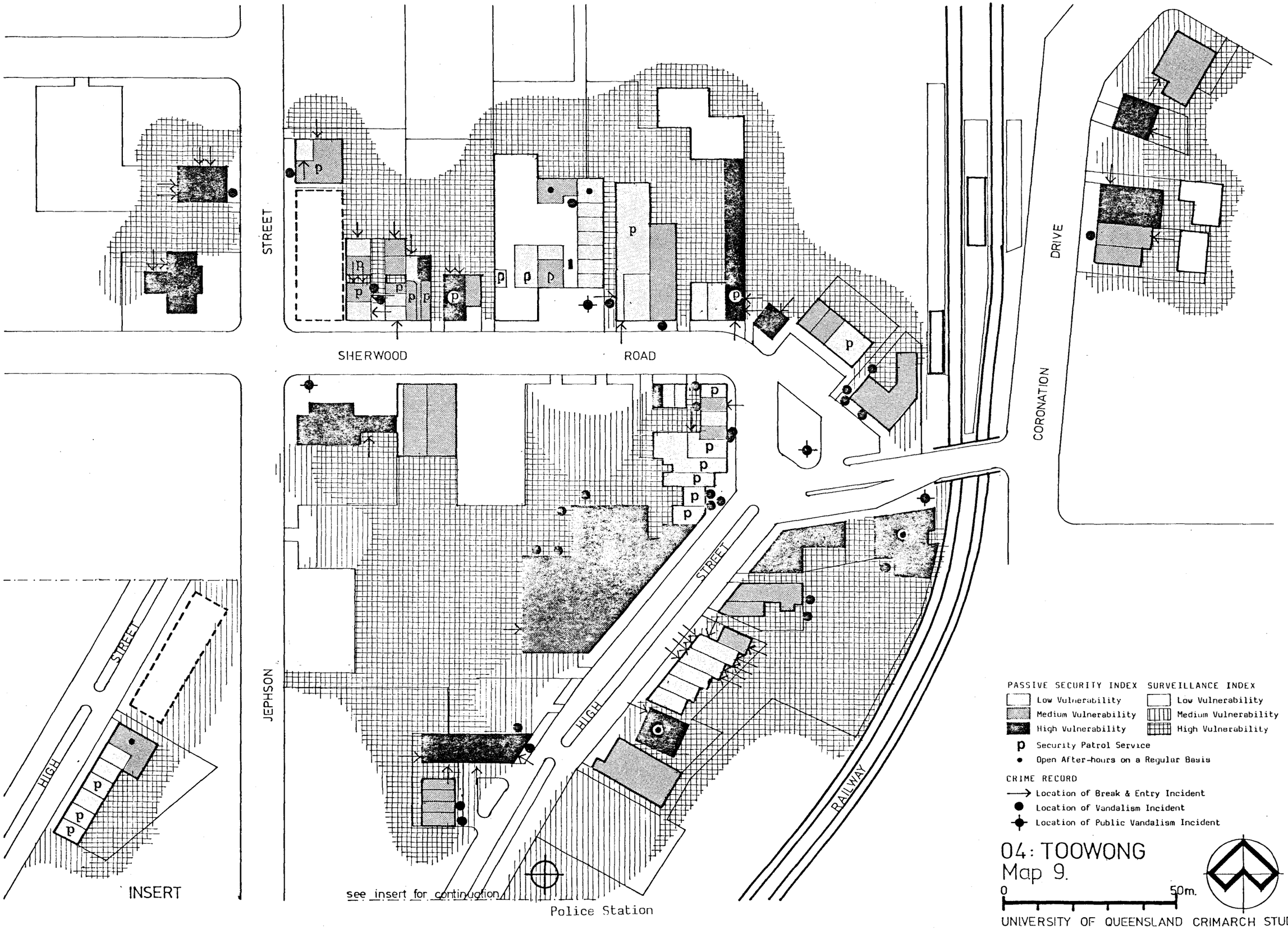
CRIME RECORD
- → Location of Break & Entry Incident
- ● Location of Vandalism Incident
- ✦ Location of Public Vandalism Incident

02: ST. LUCIA
Map 7.

0 50m.

UNIVERSITY OF QUEENSLAND CRIMARCH STUDY
DEPARTMENT OF ARCHITECTURE 1979


MONTROSE ROAD
TARINGA
BY-PASS
MOORAK STREET
ROAD
Police Station
MOGGILL
McINROY STREET
RAILWAY
SWANN ROAD
RAILWAY
p
PASSIVE SECURITY INDEX
Low Vulnerability
Medium Vulnerability
High Vulnerability
SURVEILLANCE INDEX
Low Vulnerability
Medium Vulnerability
High Vulnerability
p Security Patrol Service
Open After-hours on a Regular Basis
CRIME RECORD
Location of Break & Entry Incident
Location of Vandalism Incident
Location of Public Vandalism Incident
03: TARINGA
Map 8.
0
50m.
UNIVERSITY OF QUEENSLAND CRIMARCH STUDY
DEPARTMENT OF ARCHITECTURE
1979


STREET
SHERWOOD
ROAD
DRIVE
CORONATION
JEPHSON
STREET
HIGH
STREET
HIGH
RAILWAY
INSERT
see insert for continuation
Police Station
PASSIVE SECURITY INDEX
Low Vulnerability
Medium Vulnerability
High Vulnerability
SURVEILLANCE INDEX
Low Vulnerability
Medium Vulnerability
High Vulnerability
p Security Patrol Service
Open After-hours on a Regular Basis
CRIME RECORD
Location of Break & Entry Incident
Location of Vandalism Incident
Location of Public Vandalism Incident
04: TOOWONG
Map 9.
0
50m.
UNIVERSITY OF QUEENSLAND CRIMARCH STUDY
DEPARTMENT OF ARCHITECTURE
1979

The maps show the spatial distribution of the crimes of break and entry and vandalism as well as the pattern of security and surveillance. From observation, the concentration of break and entry incidents around particular types of buildings, or particularly insecure ones, can be seen. In Indooroopilly, incidents were clustered around groupings of premises along Station Road, where the level of both passive security and surveillance was low, few premises open after hours or patrolled by security services. In St. Lucia, the four incidents of break and entry were also concentrated in an area of relatively low security, although many adjacent buildings were patrolled. Levels of surveillance were low in twelve of the twenty incidents in Taringa, but passive security was low in only three cases. In Toowong, almost half of the forty-nine incidents involved buildings that were rated as low on the passive security index, and many were also associated with zones of poor surveillance. Table 16 cross-tabulates the two indexes, controlled for the history of burglary, and statistically tests the relationship between the indexes and the crime rate.[1]

(Not broken into)

PASSIVE INDEX \ SURVEILLANCE INDEX	1	2	3	
1	45	26	10	81
2	23	26	20	69
3	0	7	14	21
	68	59	44	171

(Broken into)

PASSIVE INDEX \ SURVEILLANCE INDEX	1	2	3	
1	10	6	2	18
2	8	6	8	22
3	1	5	9	15
	19	17	19	55

Raw χ^2=34.09 d.f.= 4 Signf.=0.00 Raw χ^2=11.55 d.f.=4 Signf.= 0.02
Conditional gamma 0.57048 Conditional gamma 0.57471
zero order gamma 0.57639 First order partial gamma 0.57092

Table 16. Index cross-tabulation controlled for break and entry history.

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1) Both tables are significant, although the presence of low values in some of the squares of the matrices would have given an upwards bias to the chi-squared value. The conditional, zero order and first order partial gamma figures allow interpretation of the tables. The conditional gammas of 0.57 indicate that there is a fairly strong relationship between the indexes and that concordant pairs predominate - premises with a certain value on one variable tend to have the same value on the other.

Twenty-two of the premises broken into had a relationship coded 2:3; 3:2; or 3:3. This represents 40% of those broken into and is almost twice as many as similarly coded premises not broken into. It appears, therefore, that premises broken into were more likely to have lower levels of passive security together with poorer surveillance characteristics rather than any other combination. No correlation was found to exist between the distribution of break and entry incidents and the pattern of premises open after hours.[1] Even when the premises on either side of a shop open after hours were included as open after hours (based on the argument that they may gain some security benefit by being adjacent and therefore surveilled by patrons) no significant correlation was found to exist. It appears, then, that the patrons of premises open after hours do not deter criminals in their activities.

In addition to the concepts of passive security and surveillance, the role of active security or detection systems in crime prevention or reduction in this study area has been examined. The influence of private security patrols on the distribution of break and entry was found to be minimal. No correlation between the crime pattern and the patrol services was discovered,[2] even when the premises on either side of a patrolled building were included as patrolled (based on the argument that they may gain some security benefit by being adjacent to a patrolled premises). This finding is interesting and a little unexpected. According to the results, the employment of a patrol service does not significantly affect the premises' vulnerability to break and entry, even though four shop owners who did employ such a service after a break and entry incident, sustained no further attacks.

Security alarms, by their very nature, would not be

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1 The 2x2 matrix produced a chi-squared figure less than 1.0, indicating a level of significance between 0.25 and 0.5, and thus little correlation.

2 ditto

expected to reduce the risk of break and entry. It is hypothesised, however, that upon a burglar being disturbed by an alarm, the offender would immediately leave the victim building, abandoning his attempt at crime. If this scenario is a predominant one, then unsuccessful incidents should be concentrated on premises with alarms fitted. This was found to be so. Of the fifty-five premises broken into, sixteen were fitted with alarms, and of these sixteen, only six had something of value taken. (Table 17).

	SOMETHING TAKEN	NOTHING TAKEN	TOTALS
Alarms installed	6	10	16
No alarms	31	8	39
TOTAL	37	18	55

Corrected $\chi^2 = 7.6$ d.f. = 1 signf. = 0.004

Table 17. Cross-tabulation of security alarms by break and entry success rate.

An examination of the maps with respect to acts of vandalism was directed towards exploring the hypothesis that incidence of the crime would be concentrated in areas where there would be: (1) poor surveillance; (2) entertainment premises open after hours; and (3) no security patrol services. Figure 10 summarises the information contained on the maps.

	VARIABLES							
	SURVEIL.			AFTER HRS.		PATROL		
SUB-CENTRE	1	2	3	Yes	No	Yes	No	TOTALS
Indooroopilly	8	10	4	20	2	3	19	(22)
St. Lucia	20	3	4	22	5	7	20	(27)
Taringa	10	-	1	-	11	-	11	(11)
Toowong	17	7	11	24	11	7	28	(35)
TOTALS	55	20	20	66	29	17	78	(95)

Figure 10. Summary by sub-centres of vandalism incidents by factors considered influential.

The majority of vandalism incidents took place in zones of high surveillance but could be associated with premises open after hours and were isolated from those patrolled by security services. In Indooroopilly, acts of vandalism

were concentrated in areas of medium surveillance on Station Road, where the Indooroopilly Hotel and two additional premises were open after hours. Incidents involving both public and private property occurred around the Clarence and Lambert Roads intersection where a late night coffee house is located, and two incidents were also reported to occur among a group of premises that included a coffee house and a picture theatre. Acts of vandalism in St. Lucia were also concentrated in areas where restaurants and late night snack bars were located, but the level of surveillance was high, no vandalism incidents in Taringa could be associated with premises open after hours, but in Toowong, the Royal Exchange Hotel, with its associated car parks, attracted many acts of vandalism. The large supermarket carpark and the post office carpark also used by hotel patrons, sustained additional attacks. In all, twenty-four acts of vandalism could be associated with this hotel and the other premises open after hours.

Altogether, almost 70% of all vandalism incidents were found to be associated with premises open after hours. This finding assists interpretation of the discriminant analysis, where vandalised buildings were found to be not open after hours as frequently as buildings not vandalised. It appears that proximity to an entertainment premises open after hours, rather than being open after hours, is a major determinant of vulnerability. Only 18% of the ninety-five vandalism incidents could be associated with premises patrolled by security services, suggesting that the services may play some positive role in deterring criminal activity.

4.3 Summary

This section of the report has used the statistical technique of discriminant analysis to explore premises' vulnerability to break and entry and vandalism; and mapping techniques to test the discriminant analysis findings and to explore additional relationships. It has attempted to identify physical factors in the

environment that have some influence on the rates of these two crimes, and has been reasonably successful in this. Rather than finding one or perhaps two discrete variables that have a significant influence, the analyses have shown that many factors, acting in concert, constitute a better interpretation of vulnerability.

For break and entry the discriminant analyses showed that notions of passive security, or degree of physical resistance to illegal penetration, and surveillance were of more or less equal importance, with perhaps surveillance slightly more dominant in premises with a higher risk due to their business type. This suggests that if a building contains property or goods that are in demand by criminals (drugs, electrical goods, etc.) the offenders will go to great lengths to penetrate the building, but only if they can do so without exposing themselves to potential witnesses. The cartographic analysis also showed that passive security and surveillance exert an influence on vulnerability and that buildings with a low level of security as well as poor surveillance are more likely to be burgled than premises with only a low value on one of the two indexes.

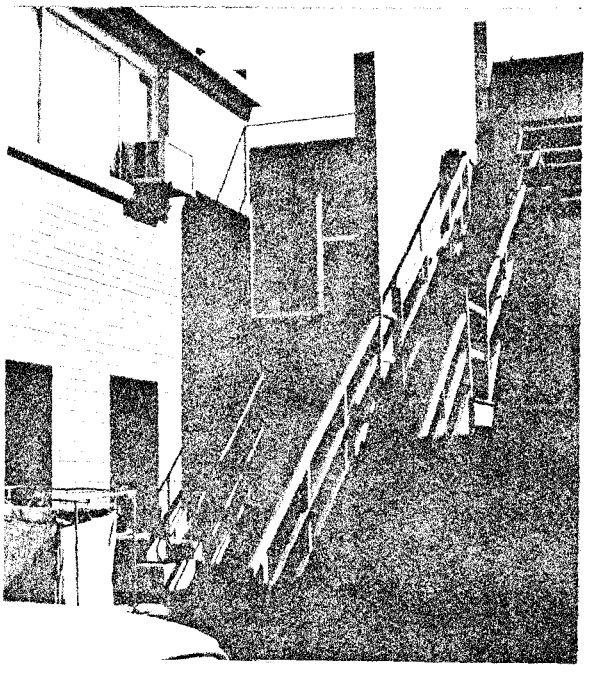

Figure 11, a view of the rear facades of a doctors' surgery, a pharmacy and a newsagency in Indooroopilly that sustained multiple attacks, illustrates these points.

The design of the building, with an area of inadequate surveillance from where criminals can gain entry to the premises, is poor from a security point of view. In this case, the installation of bars to one shop, and alarms to the other two, has not greatly reduced the vulnerability of the premises for break and entry incidents have continued to occur.

For acts of vandalism, the analyses have shown that vulnerability can be considered a product of building exposure, proximity to premises open after hours and, to a lesser extent, the quantity of easily damaged fenestration. These findings point to a dilemma for shop owners and architects. Vandalism vulnerability factors tend to be security enhancing factors in connection with break and entry. Large areas of glass, if barred, reduce the risk of break and entry by improving the visibility to observers of the interiors of shops but at the same time increase the risk of a vandal attacking. Similarly, the more exposed a building, the lower the risk of break and entry, but the higher the risk of vandalism.

Apart from affecting the level of vulnerability, these factors also influence the viability of the business carried out on the premises. Prominence of location, visibility, openness and the advertising potential of large glass shop fronts are all important considerations that shop owners and commercial architects must deal with, but are often in conflict with security principles. While a residential or housing architect can concentrate on security matters alone, the commercial building designer has to weigh all these factors and arrive at a compromise that reduces neither business viability nor security standards.

In addition to identifying variables and factors that effect vulnerability to criminal activity, the discriminant analyses have produced mathematical functions that can be used to assess the vulnerability of other commercial premises grouped into suburban shopping centres to the crimes of break and entry and vandalism. This is

one of the main research objectives of discriminant analysis, for once a set of variables that provide satisfactory discrimination for cases with known group membership has been found, a set of classification functions can be derived which will permit the classification of new cases with unknown group memberships. The derived functions could be used to classify the initial set of cases (in this case, the 226 premises of the study) to test the accuracy of the predictions but as Morrison (1969) and Frank, Massy and Morrison (1965) have shown, there is an upward bias in this, due to the method most computer packages use to create the classification table from the data used initially to derive the functions and their coefficients. By testing the functions on a separate set of premises in shopping centres located in suburbs with similar S.E.S. ratings, the effectiveness of the functions as discriminators can be assessed. If the functions are found to be good discriminators, they can then be used to judge the vulnerability of yet another premises in shopping centres and a valuable crime prevention tool would have been derived.

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LIST OF APPENDICES

APPENDIX 1 : The Survey Documents

The main focus of the survey was to collect data from shop owners and by observation of three main types:

(i) demographic background data on each premises and business, including business type, years of operation, hours of operation and the interviewee's rating of the sub-centre's crime patterns on a simple scale

(ii) detailed data on the physical nature of the urban environment as it directly relates to building crime. Passive security measures and surveillance characteristics for all four sides of each premises were collected, as were active security measures, age, type and physical condition of each building or building group

(iii) detailed data on break and entry and vandalism incidents in the study period (1973-8).

In addition to carrying out a structured interview and filling in as many details on the questionnaire form as possible, by simple observation, urban data was collected on maps of each sub-centre. A letter of introduction was sent to each shop owner before the research officer approached the interviewees.

It should be noted that during the analysis phase of this research programme, many of the variables collected during the survey were recorded, recomputed or aggregated into indexes. Some of the interview codes on the codebook, therefore, bear no relationship with variable values subsequently used in the analysis.

Survey documents

Copy of letter of introduction
Copy of coded data sheet
Copy of code book.

Department of Architecture

University of Queensland
St. Lucia
Queensland
Australia 4067
Telephone: (07) 377 1111 extension 2257 or 2412

Cables: Brisbane University
Telex: UNIVQLD AA40315

4th January, 1978

I am writing to ask you for your co-operation in a survey we are conducting at present. The University has recently received a grant from the Criminology Research Council to enable us to undertake a detailed study of the crimes of burglary and vandalism in Brisbane's sub-centres. Our aim is to record as accurately as possible the incidence of these offences and Mr. Garry Hansford, Senior Research Assistant, will be calling on you shortly to seek your help with information relating to your premises and the Taringa Shopping Centre generally.

I would be very grateful if you could help him fill out a short questionnaire when he calls on you.

Yours faithfully,

DR. G.F. DE GRUCHY
Reader in Architecture

CRIME AND ARCHITECTURAL DESIGN QUESTIONNAIRE

QUESTIONNAIRE NUMBER	
Sub-centre location code	
Business Type	
Hours of Operation	
Years of Operation	
Construction and Physical Condition code	

Details of Passive Security Measures

	f	r	s	s
(a) location code				
(b) fenestration code				
(c) door lock code				
(d) security grille code				

Details of Active Security Measures	

Surveillance Characteristics

	f	r	s	s
(a) surveillance code				
(b) surveillance quality code				
(c) time scale code				
(d) lighting quality code				

Interviewee's Rating of Sub-centre	

Details of Break and Enter (Burglary) Incidents in the Last Five Years (1973-78)

	a				b	c	d	e	f	g	h	i	j	k	l	m
Incident No. 1																
Incident No. 2																
Incident No. 3																
Incident No. 4																

Details of Vandalism Incidents involving Interviewee's Private Property

	a				b	c	d	e	f	g	h	i
Incident No. 1												
Incident No. 2												
Incident No. 3												
Incident No. 4												

Details of Vandalism Incidents involving Nearby Public Property

	a				b	c	d	e	f
Incident No. 1									
Incident No. 2									
Incident No. 3									
Incident No. 4									

CRIME AND ARCHITECTURAL DESIGN SURVEY CODEBOOK

Sub-centre Location code

(a) Indooroopilly = 01
St.Lucia = 02
Taringa = 03
Toowong = 04

(b) Adjacent to high use inter-suburb access road = 1
Adjacent to low use suburban access road = 2
Adjacent to minor roads only = 3

Hours of Operation code

Normal shop hours (Mon to Fri plus Sat morning) = 1
Normal bank hours (Mon to Fri only) = 2
Normal Entertainment hours (afternoons plus evenings) = 3
Convenience shop hours (7 days/week, all day) = 4
Periodic or other (specify) = 5

Construction and Physical Condition code

(a) Light framing with cladding = 1
Concrete framed or loadbearing machinery = 2
Other (specify) = 3

(b) Excellent to good repair = 1
Average repair = 2
Poor repair = 3

Passive Security Measures code

(a) Location code : fronting a road or lan = 1
fronting a public carpark = 2
fronting a private carpark/service court = 3
fronting a pedestrian arcade = 4
forming or abutting a premise's boundary = 5

(b) Fenestration code:
fixed glass with door = 1
fixed glass = 2
door = 3
openable glass with door = 4
openable glass = 5
"garage" type door = 6
no fenestration = 7

(c) Door Lock code: standard lock = 1
deadlock = 2
padlock = 3
other (specify) = 4

(d) Security Grill code:
fitted = 1
not fitted = 2

Active Security Measures code

(a) Acoustic alarm = 1
Silent alarm = 2
No alarm = 3
Other (specify) = 4

(b) Security services with sign = 1
Security services without sign = 2
No security service = 3
Other (specify) = 4

Surveillance Characteristics code

(a)	Surveillance code :	vehicular and pedestrian	= 1
		residential neighbours	= 2
		business neighbours	= 3
		no surveillance	= 4
(b)	Surveillance quality code:	high visibility	= 1
		medium visibility	= 2
		low visibility	= 3
		no visibility	= 4
(c)	Time Scale code:	24 hours/day	= 1
		dawn to midnight	= 2
		daylight hours only	= 3
		periodic (specify)	= 4
(d)	Lighting quality code:	high quality, evenly lit	= 1
		medium quality	= 2
		low quality, poorly lit	= 3
		no lighting	= 4

Interviewee's Rating of Sub-centre code

An excellent area, hardly any trouble	= 1
A reasonable area, some problems but no major ones	= 2
A poor area, continual problems	= 3

Break and Enter (Burglary) code

(a)	Date (month and year) of incident		
(b)	Day of the week :	week-day	= 1
		week-end	= 2
		public holiday	= 3
		don't know	= 4
(c)	Time of incident:	daylight hours	= 1
		dusk to midnight	= 2
		midnight to dawn	= 3
		uncertain, but at night	= 4
		don't know	= 5
(d)	Was entry forced:	yes	= 1
		no	= 2
		don't know	= 3
(e)	Location of entry:	front	= 1
		rear	= 2
		side	= 3
		other	= 4
(f)	Method of entry:	through door	= 1
		through window	= 2
		through wall	= 3
		other (specify)	= 4
(g)	Type of property stolen:	money/valuables	= 1
		medicine/drugs	= 2
		tobacco/confectionery	= 3
		other (specify)	= 4
		none	= 5

Break and Enter (Burglary) code *(contd.)*

(h) Value of property stolen : under - $100 = 1
$100 - $1000 = 2
$1000 - $5000 = 3
Over $5000 = 4

(i) Nature of any damage done: entry point damage only = 1
entry point damage and limited internal damage = 2
extensive damage = 3
no damage = 4

(j) Was the incident reported to the Police? yes = 1
no = 2
don't know = 3

(k) Was the property recovered and the offenders apprehended?
yes = 1
no = 2
don't know = 3

(l) Nature of any subsequent security measures taken:
improved passive security = 1
improved active security = 2
improved both = 3
no action = 4

(m) If crime was unsuccessful, how was the offender disturbed?
alarm sounding = 1
security service animals = 2
disturbed by "passers by" = 3
don't know = 4
other (specify) = 5

Vandalism Incidents involving Interviewee's Private Property code

(a) Date (month and year) of incident
(b) Day of the week
(c) Time of incident

(d) Nature of vandalism: graffiti = 1
sign damage = 2
broken glass or sheeting = 3
other (specify) = 4

(e) Interviewee's opinion as to reason for incident:
ideological = 1
acquisitive = 2
vindictive = 3
malicious fun = 4
other = 5
don't know = 6

(f) Approximate cost of repair: under $100 = 1
$100 - $1000 = 2
over $1000 = 3

(g) Was the incident reported to the Police? yes = 1
no = 2
don't know = 3

Vandalism Incidents involving Interviewee's Private Property code *(contd.)*

(h) To the interviewee's knowledge, was the offender apprehended?
yes = 1
no = 2
don't know = 3

(i) Has the damage been repaired?
yes = 1
no = 2
don't know = 3

Vandalism Incident involving Public Property code

(a) Date (month and year) of incident

(b) Day of the week

(c) Time of incident

(d) Nature of vandalism:
graffiti = 1
sign damage = 2
broken glass or sheeting = 3
damage to street furniture = 4
damage to public phone = 5
other (specify) = 6

(e) Interviewee's opinion as to reason for incident?

(f) Has the damage been repaired?

APPENDIX 2 : Statistical Appendix

The University of Pittsburgh SPSS-10 version of *Statistical Package for the Social Sciences* (Nie, et al. 1975), on the PDP-10 computer installation at the University of Queensland was used for the statistical analysis. In addition to basic cross-tabulations and chi-square tests for significance, the programme was used to (a) recode data and create variables for inclusion in discriminant analysis, (b) carry out a set of discriminant analyses, and (c) create the Passive Security and Surveillance indexes. This appendix details the data transformations that allowed both the discriminant variables and the indices to be created, and describes in detail the discriminant analyses.

The raw data values for all variables were recoded so as to give the value of (1) to the possibility that was the *most secure*, the value (2) to the *next most secure* possibility and so on. In most cases this improved the level of measurement of the variables, from nominal to ordinal. In cases when *other* was an original answer in the data file, the relevant survey form was examined and an appropriate value from an ordinal scale applied. Thus, the location, fenestration, doorlock and construction codes were recoded as follows (original raw data value in brackets):

Location code :	fronting a road or lane	= 1 (1)
	fronting a public carpark	= 2 (2)
	fronting a private carpark/ service court	= 3 (3)
	fronting a pedestrian arcade	= 4 (4)
	forming or abutting a premises' boundary	= 1 (5)
Fenestration code :	fixed glass with door	= 2 (1)
	fixed glass	= 2 (2)
	door	= 1 (3)
	openable glass with door	= 3 (4)
	openable glass	= 3 (5)
	"garage" type door	= 4 (6)
	no fenestration	= 1 (7)
Doorlock code :	standard lock	= 3 (1)
	dead lock	= 1 (2)
	padlock	= 2 (3)
	other (specify)	= - (4)
Construction code :	light framing with cladding	= 2 (1)
	concrete framed or load bearing masonry	= 1 (2)
	other specify	= - (3)

For the discriminant analysis, new variables were created by summing the values for each side of the building:

```
COMPUTE        FENES  = FENES1+FENES2+FENES3+FENES4
COMPUTE        LOCK   = LOCK1+LOCK2+LOCK3+LOCK4
COMPUTE        GRILL  = GRILL1+GRILL2+GRILL3+GRILL4
COMPUTE        SURVAIL  = SURVAIL1+SURVAIL2+SURVAIL3+SURVAIL4
COMPUTE        VISIBTY  = VISIBTY1+VISIBTY2+VISIBTY3+VISIBTY4
COMPUTE        TIME   = TIME1+TIME2+TIME3+TIME4
COMPUTE        LIGHT  = LIGHT1+LIGHT2+LIGHT3+LIGHT4
```

The two indices were created as follows:

Passive Security Index = (for each side of each building) fenestration code + doorlock code + security grill code + construction code + physical condition code.

Surveillance Index = (for each side of each building) surveillance code + surveillance quality code + (time scale code + lighting quality code) ÷ 2

Because of the method used to recode the variables that the indices are composed of, the lower the index value, the greater the level of security for that index. The range of values for each index was 18 to 39 for the Passive Security Index and 5 to 49 for the Surveillance Index. For the purposes of mapping, the indices were recoded as PASSIVE and SURVAIL into discrete categories so as to produce three groups of reasonable size, one clustered around the mean value of the index, and one group above the mean (less secure) and one group below the mean (more secure).

Discriminant Analysis

The objective of a discriminant analysis is to statistically distinguish between two or more groups of cases. In this study, the two groups were those premises not broken into and those broken into or those not vandalised and those vandalised. To distinguish between the groups a set of independent *discriminating* variables that measure characteristics on which the groups are expected to differ were selected. For break and entry, eight variables all related to aspects of passive security and surveillance were chosen for this study (computer mnemonics in brackets); construction and physical condition (CONSTRN), fenestration pattern (FENES), lock quality (LOCK), security grills (GRILL), degree of exposure to surveillance (SURVAIL) level of visibility (VISIBTY), lighting quality (LIGHT), and hours of operation (HOURSOP).

As with sub-centre vulnerability to vandalism, it was difficult to find variables that measured characteristics on which shops vandalised would be different from shops not vandalised. The surveillance variables SURVAIL, VISIBTY and LIGHT, could be important if it was assumed that premises that were more exposed rather than less exposed, but also poorly lit, could be victim buildings. Newman (1972) and others have argued that this may be true, basing their conclusions on observations of residential districts. Wilson (1977) found that buildings in poor physical condition as a result of inadequate maintenance *invited* more deterioration through vandalism, so the variable CONSTRN could also be important. Wilson also concluded in her study that amounts of visible damage were affected by the amount of glazing used, indicating that FENES should also be included in the discriminant analysis. Finally, shops open after hours could be considered possible victims of vandalism as their late night patrons, perhaps under the influence of alcohol, vent their emotions and frustrations in malicious fun. Thus the variables SURVAIL, VISIBTY, LIGHT, CONSTRN, FENES and HOURSOP were selected for inclusion in the vandalism discriminant analysis.

Having selected a set of variables, the mathematical objective of discriminant analysis is to weigh and linearly combine the discriminating variables in some fashion so that the two groups are forced to be statistically distinct as possible. A stepwise procedure, to select the most useful variables from the set available, was used in this study. The procedure begins by selecting the single best discriminating variable according to a set criterion (Rao's V in this case). A second discriminating variable is then selected as the one best able to improve the value of the discriminating criterion in combination with the first variable, and the third and subsequent variables are similarly selected, according to their ability to contribute to further discrimination. At each step, variables already selected may be removed if they are found to reduce discrimination,

but eventually either all variables will have been selected or it will be found that those not selected are not able to contribute to further discrimination.

Discriminant analysis attempts to do this by forming mathematical functions of the following form:

$$D_i = d_{i1}Z_1 + d_{i2}Z_2 + \ldots . d_{ip}Z_p$$

where D_i is the score of the discriminant function i, the d's are weighted coefficients and the Z's are the standardised values of the p discriminating variables used in the analysis. The maximum number of functions that can be derived is either one less than the number of groups being discriminated between, or equal to the number of discriminating variables, if there are more groups than variables. In this study only one function has been derived for each analysis. Ideally, the discriminant scores (D's) for the cases within a particular group will be fairly similar, but the functions are formed in such a way as to maximise the separation of the groups.

Once the discriminant function has been derived, it can be used to pursue two research objectives: analysis and classification. The computer package used in this study provides several statistical tests for measuring the success with which the discriminating variables actually discriminate when combined into the discriminant function.

(1) The eigenvalue is a special measure computed in the process of deriving the mathematical function. It is a measure of the relative importance of the function and a measure of the total variance existing in the discriminating variables. It is most useful when more than one function has been derived, for each function's eigenvalue can be expressed as a percentage of the total sum of eigenvalues, and the relative importance of each function can be assessed. When only one function has been derived (as in this study) the eigenvalue simply measures the total variance, and the higher

the value, the greater the variance accounted for by the function.

(2) A further aid in judging the importance of a discriminant function is the eigenvalue's associated canonical correlation, which is a measure of association between the function and the set of (g - 1) dummy variables which define the g group memberships. It indicates how closely the function and the "group variable" are related and is a measure of the function's ability to separate among the groups. By reversing the logic somewhat, the canonical correlation squared can be interpreted as the proportion of the variance in the discriminant function explained by the groups. The higher the value of the canonical correlation (maximum 1.0) the greater the degree of correlation.

(3) An additional criterion for establishing the effectiveness of the functions derived is to test for the statistical significance of discriminatory information not accounted for by the functions. As each function is derived, starting with no (zero) functions, Wilks' lambda is computed. Lambda is an inverse measure of the discriminating power in the original variables which has not yet been removed by the discriminant functions - the *larger* lambda is, the *less* information remaining. Lambda can be transformed into a chi-square statistic for an easy test of statistical significance.

Discriminant analysis, in addition to being a useful analysis tool, can be used as a classification tool. By classification is meant the process of identifying the likely group membership of a case when the only information known is the case's values on the discriminating variables. It has many practical applications, such as determining a medical patient's disorder on the basis of several symptoms, assigning military personnel to task groups on the basis of skills and personality factors, or predicting the likely behaviour of voters on the

basis of their attitudes and social backgrounds. In this study, the classification facet of discriminant analysis can be used to evaluate the level of vulnerability of shops to the crimes of break and entry and vandalism, based only on information collected by observation of the shops' security systems and construction.

Classification is achieved through the use of a series of classification functions, one for each group. There are several ways to derive classification functions, however. Some are based on the original values of the discriminant score. For some approaches, a Bayesian adjustment is made for *a priori* estimates of group membership, while others do not.

The traditional classification equations are derived from the pooled within-groups' covariance matrix and the centroids for the discriminating variables. The resulting classification coefficients are then multiplied by the raw variable values, summed together, and added onto a constant. The equation for one group would appear as

$$C_i = c_{i1}V_1 + c_{i2}V_2 + \ldots + c_{ip}V_p + c_{i0}$$

where C_i is the classification score for group i, the c_{ip}'s are the classification coefficients with c_{i0} being the the constant, and the V's are the raw scores on the discriminating variables. There is always a separate equation for each group; thus if there are two groups, each case will have two scores. The case would be classified into the group with the highest score.

The following summary statistics have been collated from the computer printout produced during the analysis phase of this study.

DISCRIMINANT ANALYSIS SUMMARY STATISTICS FOR BREAK and ENTRY DATA

Business type: RETAIL

Group sizes: (0) = 97 (1) = 22

Summary Table

Step number	Variable entered	Variable removed	F to enter or remove	Number included	Wilks' Lambda	Sig.	Rao's V	Change in Rao's V	Sig. of change
1	LIGHTS		3.62306	1	0.96996	0.059	3.62306	3.62306	0.057
2	CONSTRN		1.63610	2	0.95647	0.076	5.32436	1.70131	0.192
3	LOCKS		1.12020	3	0.94725	0.100	6.51690	1.19154	0.276
4		LIGHTS	0.63713	2	0.95249	0.059	5.83536	-0.68055	1.000

Classification function coefficients

	Group 0 NOT BROK EN INTO	Group 1 BROKEN INTO
CONSTRN	8.27149	9.31455
LOCKS	1.46868	1.80396
Constant	-6.41131	-8.55126

Discriminant Function	Eigenvalue	Relative Percentage	Canonical Correlation	Functions Derived	Wilks' Lambda	Chi-square	DF	Significance
				0	0.9535	5.646	2	0.059
1	0.04987	100.00	0.218					

VARIABLE STATISTICS

VARIABLES	MEANS GROUP 0	GROUP 1	TOTAL	STANDARD DEVIATIONS GROUP 0	GROUP 1	TOTAL	SIGNIFICANCE TEST (degrees of freedom - 1; 117) WILK'S LAMBDA	F-VALUE
CONSTRN	1.1237	1.2727	1.1513	0.3810	0.4554	0.3593	0.9739	3.1313
FENCES	8.8041	9.6364	8.9538	2.0292	2.1054	2.0601	0.9752	2.9757
LOCKS	2.4021	2.9091	2.4958	1.1055	1.4111	1.1769	0.9715	3.3894
GRILLS	3.8247	4.0455	3.8655	1.1998	1.0991	1.1764	0.9947	0.6271
SURVAILS	3.7835	4.0000	3.8235	2.0424	1.4475	1.9426	0.9981	0.2213
VISIBTYS	3.4021	3.6818	3.4538	1.5986	1.5882	1.5921	0.9953	0.5509
LIGHTS	5.9175	7.3182	6.1765	3.2361	2.4955	3.1506	0.9700	3.6231
HOURSUP	1.9897	1.9545	1.9832	0.3060	0.2132	0.2906	0.9978	0.2606

DISCRIMINANT ANALYSIS SUMMARY STATISTICS FOR BREAK and ENTRY DATA

Business type: MEDICAL (including Chemists) **Group sizes:** (0) = 13 (1) = 16

Summary Table

Step number	Variable entered	removed	F to enter or remove	Number included	Wilks' Lambda	Sig.	Rao's V	Change in Rao's V	Sig. of change
1	SURVAIL		5.91360	1	0.82033	0.022	5.91360	5.91360	0.015
2	VISIBTY		1.99425	2	0.76189	0.029	8.43813	2.52453	0.112
3	LIGHT		5.55987	3	0.62228	0.007	16.31938	7.88125	0.005
4	GRILL		2.92724	4	0.55552	0.035	21.60298	5.28360	0.022
5	FENES		1.37645	5	0.52415	0.008	24.51165	2.90867	0.088

Classification function coefficients

	Group 0 NOT BROK EN INTO	Group 1 BROKEN INTO
FENES	3.64386	4.29103
GRILL	0.46457	-0.99962
SURVAIL	-1.70144	-0.82353
VISIBTY	-0.34883	0.02190
LIGHT	-0.61625	-1.12962
Constant	-11.01915	-13.18322

Discriminant Function	Eigenvalue	Relative Percentage	Canonical Correlation	Functions Derived	Wilks' Lambda	Chi-square	DF	Significance
				0	0.5242	15.826	5	0.007
1	0.90764	100.00	0.690					

VARIABLE STATISTICS

VARIABLES	MEANS GROUP 0	GROUP 1	TOTAL	STANDARD DEVIATIONS GROUP 0	GROUP 1	TOTAL	SIGNIFICANCE WILK'S LAMBDA	TEST (degrees of freedom - 1, 27.) F-VALUE
CONSTRN	1.0769	1.0000	1.0345	0.2774	0.0000	0.1857	0.9560	1.2414
FENES	8.2308	9.3125	8.8276	1.3069	2.6763	2.2050	0.9384	1.7739
LOCK	2.0769	2.0625	2.0690	1.1875	0.6301	0.9232	0.9999	0.0017
GRILL	3.4615	3.8125	3.6552	0.7762	1.6429	1.3166	0.9816	0.5004
SURVAIL	2.6923	4.8125	3.8621	0.9473	3.0159	2.5316	0.8203	5.9136
VISIBTY	3.0000	5.1250	4.1724	1.4720	5.7605	4.4067	0.9418	1.6096
LIGHT	6.3846	5.2500	5.7586	3.3798	3.7839	3.5922	0.9744	0.7081
HOURSOP	2.1538	2.1875	2.1724	0.3755	0.4031	0.3844	0.9980	0.0531

DISCRIMINANT ANALYSIS SUMMARY STATISTICS FOR BREAK and ENTRY DATA

Business type: SERVICE INDUSTRIES Group sizes: (0) = 17 (1) = 12

Summary Table

Step number	Variable entered	Variable removed	F to enter or remove	Number included	Wilks' Lambda	Sig.	Rao's V	Change in Rao's V	Sig. of change
1	GRILL5		1.59298	1	0.94429	0.218	1.59298	1.59298	0.207

Classification function coefficients

	Group 0 NOT BROKEN INTO	Group 1 BROKEN INTO
GRILL5	1.24985	1.48922
Constant	-2.86731	-4.12010

Discriminant Function	Eigenvalue	Relative Percentage	Canonical Correlation	Functions Derived	Wilks' Lambda	Chi-square	Df	Significance
				0	0.1386	52.362	1	0.000
1	6.21336	100.00	0.926					

VARIABLE STATISTICS

VARIABLES	MEANS GROUP 0	MEANS GROUP 1	MEANS TOTAL	STANDARD DEVIATIONS GROUP 0	STANDARD DEVIATIONS GROUP 1	STANDARD DEVIATIONS TOTAL	SIGNIFICANCE TEST (degrees of freedom - 1, 27.) WILK'S LAMBDA	F-VALUE
CONSTRN	1.0588	1.0000	1.0345	0.2425	0.0000	0.1857	0.9748	0.6983
FENCE5	10.0000	10.7500	10.3103	1.7321	3.1945	2.4217	0.9759	0.6667
LOCKS	3.0000	3.1667	3.0690	1.5811	1.5869	1.5568	0.9971	0.0780
GRILL5	4.5882	5.5000	4.9655	1.6605	2.2361	1.9362	0.9443	1.5930
SURVAIL5	4.1176	4.7500	4.3793	1.9648	2.3739	2.1283	0.9778	0.6124
VISIBTY5	4.1765	5.1667	4.5862	2.0687	2.2496	2.1633	0.9474	1.5002
LIGHT5	6.7647	8.3333	7.4138	3.1131	3.6013	3.3543	0.9451	1.5697
HOURSOF	1.9412	2.0000	1.9655	0.4287	0.0000	0.3254	0.9918	0.2234

DISCRIMINANT ANALYSIS SUMMARY STATISTICS FOR VANDALISM DATA

All Business types

Group sizes: (0) = 177 (1) = 49

Summary Table

Step number	Variable entered	removed	F to enter or remove	Number included	Wilks' Lambda	Sig.	Rao's V	Change in Rao's V	Sig. of change
1	HOURSOP		3.89927	1	0.98269	0.050	3.89923	3.89923	0.049
2	CONSTRN		2.59393	2	0.97245	0.044	6.34574	2.44651	0.118
3	FENES5		2.33214	3	0.96234	0.036	8.76557	2.41982	0.121
4	SURVAIL5		1.09746	4	0.95797	0.049	9.82668	1.06111	0.303

Classification function coefficients

	Group 0 NOT VANDALISED	Group 2 VANDALISED
CONSTRN	9.62390	8.73844
FENES5	1.94510	2.11066
SURVAIL5	-0.65056	-0.74767
HOURSOP	12.24459	11.47928
Constant	-25.09071	-23.84309

Discriminant Function	Eigenvalue	Relative Percentage	Canonical Correlation	Functions Derived	Wilks' Lambda	Chi-square	DF	Significance
				0	0.9589	9.531	5	0.049
1	0.04367	100.00	0.205					

VARIABLE STATISTICS

VARIABLES	MEANS GROUP 0	GROUP 1	TOTAL	STANDARD DEVIATIONS GROUP 0	GROUP 1	TOTAL	SIGNIFICANCE TEST (degrees of freedom - 1,224.) WILK'S LAMBDA	F-VALUE
CONSTRN	1.1243	1.0408	1.1062	0.3369	0.1999	0.3088	0.9875	2.8078
FENES5	9.0904	9.5714	9.1947	2.1540	2.6818	2.2917	0.9924	1.7110
SURVAIL5	3.9718	3.9184	3.9602	2.2599	1.8981	2.1793	0.9999	0.0229
VISIBTY5	3.6441	4.0204	3.7257	2.4432	1.8199	2.3238	0.9955	1.0966
LIGHT5	6.1299	6.4694	6.2035	3.2874	3.1031	3.2446	0.9981	0.4190
HOURSOP	1.9831	1.8571	1.9558	0.3913	0.4082	0.3975	0.9829	3.8993