PLANNING GUIDELINES FOR IMPROVING ENVIRONMENTAL SAFETY IN SINGLE FAMILY DETACHED DWELLING AREAS

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SUMMARY

This study does not attempt to explain the social, political, judicial nor economic forces at play in criminal behaviour: its objective is far more circumscribed in that it attempts to examine burglary as a phenomenon in spatial terms and attempts to relate burglary patterns to locations, forms of urban environment, specific physical layout configurations and distribution characteristics.

Based on an analysis of the physical characteristics of an area including location, topography, adjacent land uses and access routes certain design guidelines with respect to both locational considerations and site configuration, are suggested.

As clearly indicated in the study, with respect to the high incidence of burglary vis-à-vis the proximity of public and private open space, amenity and privacy are gained at the expense of safety and defensibility.

Whilst the study is primarily exploratory in nature and is limited to Stellenbosch as a case study, it is contended that the findings, principles and guidelines which emerge have a wider application and serve to focus attention on design criteria which may promote safety in single family residential areas.

Hierdie studie probeer nie om sosiale, judisiële of ekonomiese faktore wat kriminele gedrag mag beïnvloed, te verduidelik nie: die doel is heelwat meer beperk, deurdat dit probeer om huisbraak as verskynsel in ruimtelike terme te ondersoek en huisbraakpatrone in verband te bring met liggings, omgewingsvorms, uitlegeienskappe en verspreidingseienskappe.

Volgens 'n analise van die fisiese eienskappe van 'n gebied, insluitend ligging, topografie, aangrensende grondgebruike en toegangsroetes word sekere ontwerpriglyne, met betrekking tot beide liggingsoorwegings en terreinkonfigurasie, voorgestel.

Soos in die studie bewys, met betrekking tot nabyheid van publieke oop ruimte, word leefbaarheid en privaatheid verkry deur om veiligheid en verdedigbaarheid in te boet.

Alhoewel die studie hoofsaaklik verkennend van aard is en tot Stellenbosch as gevallestudie beperk is, word die mening gehuldig dat die bevindinge, beginsels en riglyne wat na vore kom veralgemeen kan word en kan dien om aandag op ontwerpeienskappe wat die veiligheid van enkel residensiële dorpsgebiede kan bevorder, te vestig.

1. INTRODUCTION

Urbanization is accompanied by increasing demands on resources. As the existing economic and productive infrastructure may not be able to accommodate the needs of all, there is a tendency to resort to actions outside the normal and legal framework of society: theft, burglary and other crimes are examples of these behaviours.

Those who 'have' are perceived by the 'have nots' as a 'resource source' to be exploited and in consequence the former become vulnerable and feel threatened.

Steps taken to protect themselves, their possessions and property in the form of high walls and fences may in practice be counterproductive in that these reduce the visibility of the house and the potential for passive surveillance by neighbours.

2. OBJECTIVES

This study does not attempt to explain criminal behaviour, nor deviance, nor to address issues such as social justice or injustice nor inequalities of "... the property-based class distinctions of

capitalist society" (Davidson 1981:161), nor "social control as an outcome of unequal distributions of economic and political power in which laws serve the dominant classes" (Herbert 1982:25).

It does not attempt to explain the social, political, judicial nor economic forces at play: its objective is far more circumscribed in that it attempts to examine burglary as a phenomenon in spatial terms and to attempt to relate burglary patterns to locations, forms of urban environment, specific physical layout configurations and distributional characteristics.

As this study is primarily exploratory in nature and focuses on Stellenbosch as a case study, specific findings may not be directly applicable to other areas. It is however, contended, with respect to principles and guidelines which emerge, that these may well be generally relevant and may serve to focus attention on possible design criteria for township layouts. As there is no generally recognised methodology on which to base the study, a part thereof was aimed at exploring possible techniques which could be used.

3. PROCEDURE

As point of departure the following hypotheses were addressed:

* The geographic location of single detached residential areas plays a role in the incidence of burglary.
* The form and physical configuration of township layouts influence the occurrence of burglary.

The study area was divided into six zones, corresponding by and large to existing suburban subdivisions (Figure 1). Details pertaining to the number of cases in each zone are presented in Table 1. The location of burgled properties is indicated on Figure 2 and the main access routes on Figure 3.

Data on burglaries from the police records for the period 1983 to June 1991, or eight and a half years, were plotted on maps and analyzed with respect to the incidence of burglary by zone. Of the 1 763 detached dwellings in the study area, 448 (25,4 percent) had been burgled.

As the intention of the study was to examine the patterns of burglary in 'established' single family residential areas, all burglaries to flats, group housing, houses occupied by students, houses in areas in the course of development and houses in areas of mixed land use were excluded.

As only burglaries to properties falling within the zones as indicated on the accompanying map were included, the number of burglaries is considerably lower than for the town as a whole. Furthermore, the resultant pattern reflects the location and not the number of burglaries, i.e. the position of burgled houses is noted irrespective of the times it has been burgled.

As an aid to evaluating the environmental context of each zone aerial photographs were used. These photographs proved extremely useful in the analysis, in that they provided detailed information not contained on the maps and which might otherwise not have been as clear from observations at ground level. Of particular importance here was their usefulness in ascertaining site and locality characteristics in relation to the burglary patterns plotted from the police records.

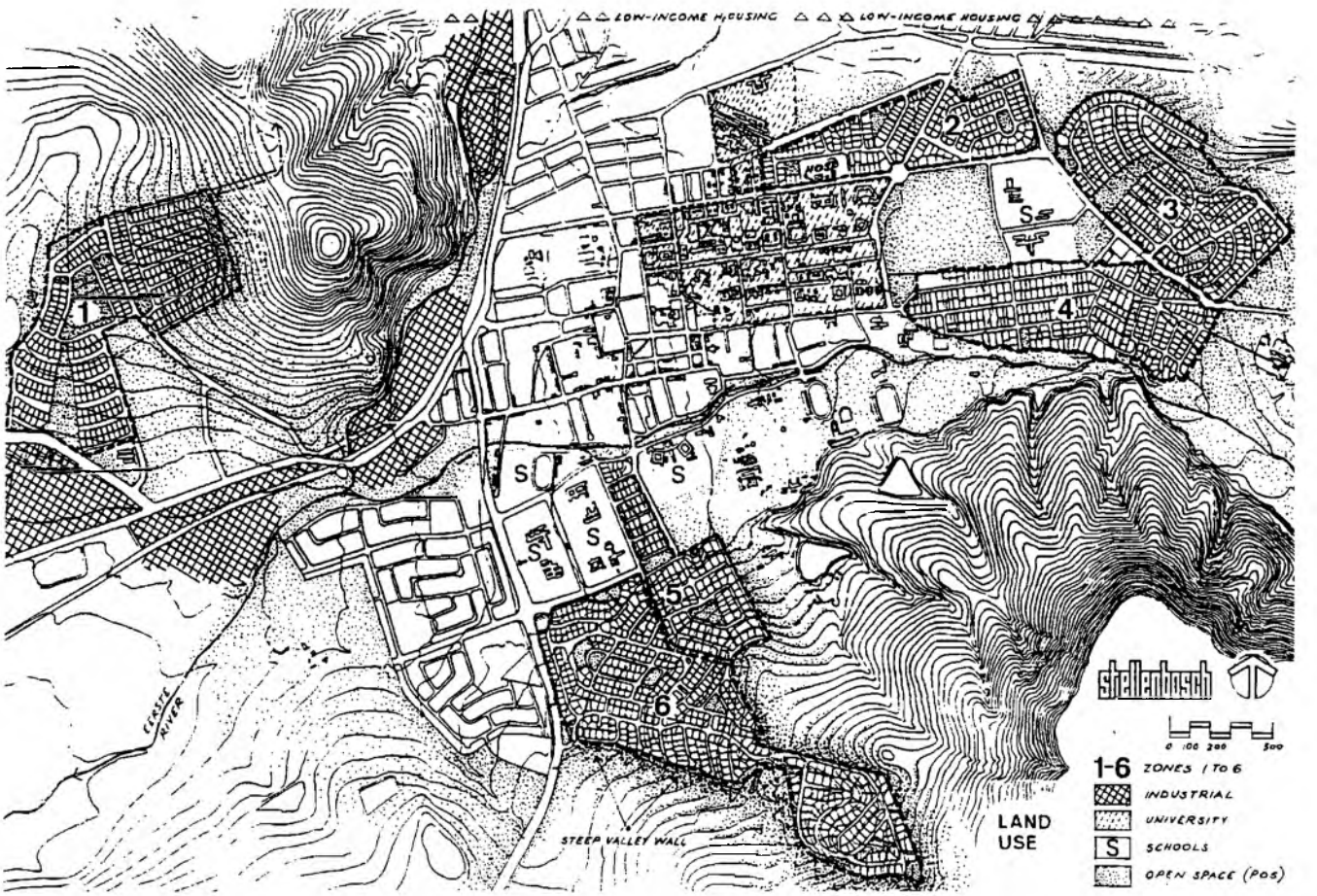

FIGURE 1: *Primary land uses.*

FIGURE 2: *Burglary patterns: over the period of eight and a half years.*

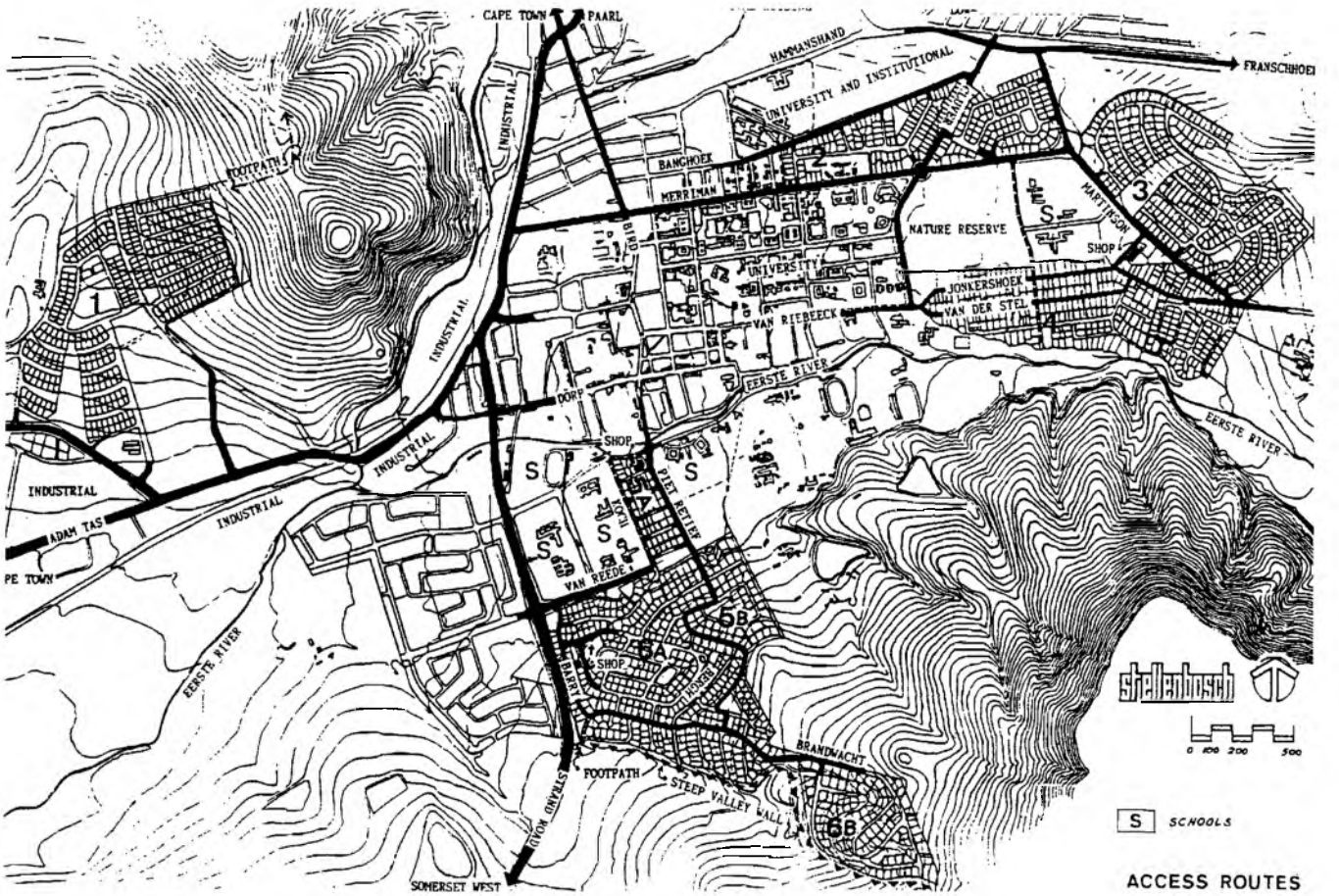

FIGURE 3: *Main access routes.*

4. INCIDENCE OF BURGLARY BY ZONE

Data pertaining to the incidence of burglary in each zone are presented in Table 1.

Table 1: Number of Houses and Burglaries by Zone

Zone	No. of Houses in each Zone	% of Houses in all Zones	No. of Houses Burgled in each Zone	% Distribution of Burgled Houses / Zone	Burglary Index	Burgled Houses as % of Houses in Zone	Number of Burglaries	Ratio of Houses to Burglaries
1	353	20,0	60	3,4	5,9	17,0	89	1,5
2	228	13,0	91	5,2	2,5	40,0	91	1,5
3	278	15,8	64	3,6	4,3	23,0	73	1,1
4	316	18,0	90	5,1	3,5	28,5	120	1,3
5	133	7,5	42	2,4	3,16	31,6	60	1,4
6	455	25,8	101	5,7	4,5	22,2	109	1,1
	1763	100%	448	25,4%	3,9		590	1,3

The total incidence of burglaries against burgled houses represents a ratio of 1,3 burglaries per burgled house (i.e. some houses have been burgled more than once). In for example: zone 1 one corner property overlooking public open space has had eight burglaries; a corner site in zone 2 had during the period of major road reconstruction adjacent to the property, four burglaries - this should be attributed to the general disruption caused by construction work in the vicinity and not to the construction workers.

As a measure of the relationship of burgled houses to non-burgled houses a 'burglary index' was adopted (Table 1). This was determined on the basis of the number of houses in each zone divided by the number of burgled houses in each zone over the period of eight and a half years.

The resultant indices were used to rank order the six zones from the highest incidence of burglaries to the lowest i.e. from worst to best.

Accordingly the higher the index the better the rating. Hence zone 2 with an index of 2,5 reflects the worst case (the highest incidence of burglaries) and zone 1 with an index of 5,9 the best case (the lowest incidence of burglaries).

When the six zones are ranked from worst to best a pattern as reflected in Table 2 emerges.

Table 2: Rank Ordering of Zones according to Burglary Index

Rank Order of Zones from Worst to Best	Burglary Index
2	2,50
5	3,16
4	3,50
3	4,30
6	4,50
1	5,90

5. DESCRIPTION OF LOCATIONAL CHARACTERISTICS BY ZONE

In an attempt to explain the pattern of burglaries and provide some basis for determining the characteristics which promote or inhibit its occurrence, each of the zones, with respect to *inter alia* location, geographic features, movement patterns, proximity to open space and other land uses were examined (Figures 1 - 3).

Zone 1

This zone comprises 353 single residential erven and is comparatively isolated in the urban structure. Except for the industrial area immediately to the south-west, from which it is separated by an open buffer area, the whole is surrounded by institutional, agricultural and forestry land uses.

In addition, the town's cemetery which lies on both sides of the main access road, abuts the residential area to the south-east.

At face value one might expect that because of its isolation and the nature of the surrounding land uses the zone would be 'vulnerable' and have a high incidence of burglaries, this is not so. On the contrary it has the least incidence of burglaries of all the areas studied (17 per cent of the erven in the zone).

The fact that the zone is 'open' or 'exposed' with respect to the surrounding land uses and is penetrated by park areas relates clearly to the pattern which burglaries follow i.e. around the periphery and adjacent to public open areas within the zone.

Except for access to the adjoining farms to the north where the number of people is minimal, access to the industrial areas to the south is achieved outside the zone i.e. no traffic passes through the zone to reach other areas. This accounts for the fact that few 'outsiders' have cause to be in the area and a sense of territoriality is firmly established.

It is however interesting to note that where movement through the area does take place, between this zone and low-income areas to the north-east, along a footpath over the mountain at the

north-eastern corner of the zone the incidence of burglaries along the north-eastern, eastern and southern edges is extremely high. If one takes half the erven on the north-eastern edge and those along the eastern and southern edges there are 32 erven. Of these 20 (62,5 per cent) have been burgled.

Furthermore, burglaries along this edge account for 45 percent of the total number of burglaries in this zone. The corner site in the south-east has been burgled at least eight times: jokingly one might say that people don't bother to walk around, they just walk straight through and help themselves en route.

While the zone as a whole exhibits the lowest incidence of burglary within the study area, mainly due to its isolation and the fact that little extraneous through movement takes place, the occurrence of burglaries on the periphery, in areas adjacent to public or other open space and along routes where casual movement takes place, is noticeably evident.

It seems reasonable to postulate that extraneous movement together with open space adjacent to residential areas contribute to the vulnerability of an area with respect to the incidence of burglary.

Zone 2

This zone comprises 228 single residential erven.

It is a relatively long, level, narrow, wedge-shaped area bounded by Banghoek and Merriman Streets to the north and south and Simonsberg and Bosman Streets to the east and west. Cluver Street cuts diagonally across the zone to the west. Simonsberg, and particularly Merriman, Cluver and Banghoek are important distributor roads which connect the town centre and most of the town's development in the north-eastern sector and beyond.

Except to the west, the zone is surrounded by non-residential land uses, including *inter alia* the University campus, the Fruit Research Institute, the Jan Marais Nature Reserve, a school property and other open space and institutional land uses. The hospital is also situated in this zone.

Because of its location there is a considerable amount of traffic passing along its edges and through it, along Cluver Street. Taking its location, the volume of vehicular and pedestrian traffic passing through it and the openesss of the non-residential land uses which surround it, it is not too surprising to find that this zone has by far the highest overall incidence of burglaries (40 per cent of the poperties have been burgled) of the six zones forming the study area.

However, it is of interest to note that the incidence of burglaries to those properties in the vicinity of the park at the eastern end of the zone and at the south-eastern corner - to which access is gained from a separate service road and which are set well back from the intersection of Merriman and Simonsberg Streets - is noticeably less.

The properties immediately to the north and west of this corner, fronting onto Simonsberg and Merriman Streets respectively, have virtually all been burgled.

Furthermore, all of the properties adjacent to or in close proximity to the traffic circle at the intersection of Cluver and Merriman Streets have been burgled, often more than once, in the past three years, during the time that major road reconstruction of the traffic circle was in progress.

It should not be inferred that the road workers were responsible for the burglaries but that the closure of the streets to through traffic, the general disruption due to construction work and the presence of construction materials and machinery created what could be described as a 'no man's land', from which forays into the adjoining area could be made, where loitering could pass undetected and where surveillance of the properties by outsiders was facilitated.

Zone 3

This zone comprises 278 single residential erven. It is situated on sloping ground at the base of Bothmaskop and is served by Martinson Street which forms its southern boundary. No through roads pass through the zone: roads within this zone provide access exclusively to the residential component. Except along its southern edge, the zone is surrounded by public open space or agricultural land.

What is most characteristic of burglaries in the area is their concentration around the periphery, or adjacent to the broad swath of public open space which bisects the zone, or along roads in close proximity to public open space. Properties occupying mid-block positions, by contrast, are relatively free of burglary.

Zone 4

This zone comprises 316 single residential erven. It is bounded to the south by a public open space system on the northern bank of the Eerste River, to the east by agricultural land and to the north by the Jan Marais Nature Reserve, school sites and open space. Martinson Street to the north-east is taken as the boundary between this zone and zone 3. This can also be seen as a natural division between the zones, in that the residential development to the south is on low-lying relatively flat terrain whilst that to the north is on the hillside.

Jonkershoek Road and to a lesser extent Van der Stel Street, serve as the main distributor roads in this zone. These two roads join Van Riebeeck Street to the west, which in turn connects this zone to the town's central areas.

Because of its location with the river to its south, and the fact that it is bordered on the east by agricultural land and the Jonkershoek Nature Reserve further up the valley, traffic movement is largely to and not through the area. In essence therefore the zone can be described as a comparatively isolated, quiet residential area with little through movement of extraneous traffic.

In terms of its rank order with respect to burglaries it occupies the third worst position with 28,5 per cent of the properties in the zone having been burgled.

If one takes all sites backing onto, fronting or adjacent to public open space on the periphery, these account for 24 per cent of all the erven in the zone. Of these 41 per cent have been burgled.

Although the incidence of burglary is not as high as that on the eastern and southern edge of zone 1 the effect of public open space on the incidence of burglary is again evident.

It would appear that the relatively long and narrow form of the township, with the whole of its southern edge fronting onto the open space corridor of the Eerste River plays a decisive role in the

pattern of the burglaries. Apart from the high incidence of burglary along this southern edge, burglaries also tend to cluster within short distances from this edge and along roads leading away from the river corridor.

The presence of "bergies" (a term loosely and incorrectly used to describe all casual/occasional workers, hobos, indigents and vagrants) in the area and along the river front is often commented on by residents. Whether this element is responsible for burglaries or not, is unknown, but the generalized pattern of pedestrians "filtering" through the area to and from the river appears to be a contributory factor with respect to burglaries in this zone.

Zone 5

This zone comprises 133 erven and with respect to its location can be divided in two: the northern portion, comprising 58 erven, which is comparatively flat and the southern portion, comprising 75 erven, which is laid out on the lower slopes of Stellenbosch Mountain.

While this zone as a whole has a lower incidence of burglaries than zone 2, the northern portion is indeed worse.

This may be attributed to the following:

* The area is flanked by or fronts onto school sites, public open space or the University's experimental farm.
* It lies between the town centre and the residential areas to the south. These are almost exclusively connected by Piet Retief Street which runs along the eastern edge of the zone.
* The short block lengths facilitate the comparatively free 'permeation' of pedestrian and other movement throughout the area. In addition, the surrounding open space (including school sites) the shopping complex and the open space corridor along the Eerste River immediately to the north of the zone makes it difficult to distinguish between those who are legitimate passers-by and those with ulterior motives. Territoriality is in consequence rather diffuse.
* Because of the short block lengths there is a disproportionately large number of corner sites (19 - 33 per cent) of which 12 or 63 per cent have been burgled. The percentage of corner sites in the whole study area is 9,19 per cent with 34,6 per cent having been burgled.
* If the incidence of burglaries at corner sites in the northern portion of the zone is compared to the southern portion the vulnerability of the former sites is marked. In the southern portion there are 17 corner sites (23 per cent of the erven in this portion) of which four (24 per cent) have been burgled.

Table 3: Comparison of Burglaries in the northern and southern portion of Zone 5

	Number of Erven	Number of burglaries	Percentage of burglaries
Northern portion/A	58	27	46,6
Southern portion/B	75	15	20,0
	133	42	31,6

As in the case of those properties which front onto Van Reede Street where 53 per cent have been burgled - noted in the discussion of zone 6 - 47 per cent of those properties fronting onto Park/Vrede Streets, which can be regarded as the continuation of Van Reede, have been burgled.

Zone 6

This zone comprises 455 single residential erven. It is contiguous with zone 5 to the north-east and is bounded by Van Reede Street to the north and the Strand/Somerset West Road to the east. A steep edge to the valley separates this zone from the lower lying farmlands to the south and defines its southern boundary. To the east the zone borders onto the University's experimental farm and the forest reserve at the foot of Stellenbosch Mountain.

The township is laid out on a spur of the foothills of the mountain. Because of the substantial grade separation along the southern edge and restrictions on road connections to the major arterial route to the west access to the rest of the town is restricted to two points on its northern edge: at the intersection of Barry and Van Reede Streets at the extreme north-western corner and along Piet Retief Street towards the north-east.

Pedestrian access can however be gained at the south-western corner, at the termination of Brandwacht Street just off the Strand/Somerset West Road.

The zone may be characterized as: elevated and steeply sloping; surrounded to the south and east by agricultural land; cut off to the west by the Strand/Somerset West Road and with limited connections and tortuous access to the north.

Because of the above and that the zone is comparatively isolated with no extraneous traffic passing through the area the incidence of burglaries is low: it has the second lowest burglary rate of the six zones studied. For discussion purposes this zone may be divided into two portions, 6A and 6B as illustrated in Figure 3.

Table 4 illustrates how the incidence of burglaries becomes less with isolation and reduction in extraneous movement.

Only fractionally more than 16 per cent of the properties in portion 6B, at the eastern extremity of this zone have been burgled, compared to approximately a quarter of those in portion 6A.

Furthermore as reflected in Table 5, if one subdivides portion 6A along Bergh Street, 17 per cent of the properties to the east of this street have been burgled with 27 per cent to the west.

Burglaries tend to be concentrated along the south-western and western edge - where pedestrian access is gained via the opening at the termination of Brandwacht Street to the lower western portion of the zone - and the northern edge along Van Reede Street. One may also note that with respect to the latter, of the 17 erven which front onto this or its service road, or public open space adjacent thereto, nine (53

per cent) have been burgled.

The patterns of an increase in the incidence of burglary along roads and other access corridors, including public open space, where extraneous movement occurs, and a reduction in the incidence of burglary as the area becomes more 'residence specific' and isolated, is clearly reflected.

6. DESIGN GUIDELINES: DISCUSSION AND SUMMARY OF FINDINGS

Burglary Rates

The 448 burgled properties, over the eight and a half years, include only those which were classified as single family households. Within the study area, 1 763 properties fell into this category. Houses shared by students, group housing and flats or granny flats (second dwellings) and the like were excluded.

Calculations based on these figures give an annual average burglary incidence of 53 per year or a burglary rate of approximately 1 in 33 households or 30 per 1 000 households.

As one is not sure as to whether one is comparing like with like or the extent to which larger urban areas differ from smaller urban areas with respect to burglary patterns or the influence that the presence or absence of social cohesion etc. have on burglary, comparing burglary rates derived from overseas studies is difficult. However, notwithstanding these shortcomings they do serve as a guide as to the relative degree of correspondence between the findings of this study and those of other similar studies.

For example in cases cited by Poyner (1983:31) Reppetto showed that "... the annual rate of burglary in the core area of Boston was 39 per 1 000 dwellings (1:25,6); adjacent to the core the rate was 22 per 1 000 (1:45) and the outlying areas studied had an average rate of only 12 per 1 000 (1:83)". In terms of the degree of social cohesion Reppetto found that in those areas classified as having low degrees of social cohesion the burglary rate was 90 per 1 000 (1:11) as against 28 and 16 per 1 000 in areas with medium and high degrees of social cohesion (1:36 and 1:63 respectively). In a study by Maguire and Bennett (Poyner 1983:30) of Gerrods Cross, an affluent area with a population of 8 000 in the Thames Valley, with "... a high proportion of large houses laid well back from the road and hidden by trees and shrubs", had a burglary rate of 1 in 25 which was the highest in that area.

Table 4:Comparison of Burglaries in Portions 6A and 6B of Zone 6

Zone 6	Number of Erven	Number of burglaries	Percentage of burglaries
Portion 6A	357	85	23,8
Portion 6B	98	16	16,3
	455	101	22,2

Table 5:Comparison of Burglaries East and West of Bergh Street - Zone 6A

	Number of Erven	Number of burglaries	Percentage of burglaries
East of Bergh Street	106	18	17,0
West of Bergh Stret	251	67	26,7

Taking cognizance of the pitfalls of too literal an interpretation it would nevertheless appear that at a rate of 30 per 1 000 households or 1 in 33 households, the incidence of burglary in Stellenbosch is relatively high. Furthermore, if the number of burglaries is taken into account, as against the number of burgled properties, i.e. properties having multiple burglaries, the incidence of burglaries is 590. On this basis the average number of burglaries becomes 69,4 per year or approximately 40 per 1 000 households or 1 in 25. This tends to indicate that the former figures are on the low side and reflect a conservative picture.

Locational Characteristics

Whilst the burglary rate of 1 in 33 households reflects the rate for the whole study area there are as shown in Table 6 significant differences between the burglary rates of each of the six zones.

Apart from the considerable differences in burglary rates between the worst and the best, those areas with rates below the 1 in 33 are:

* older residential areas;
* closer to the town centre;
* comparatively low-lying; and
* have a fair degree of through and extraneous vehicular and pedestrian movement.

Those with rates above 1 in 33 are:

* newer residential areas;
* further from the town centre;
* situated on high ground; and
* have very little through and extraneous vehicular and pedestrian movement i.e. opposite characteristics.

In short burglary patterns can be visualized in terms of the flood plain of the Eerste River: more vulnerable on the low ground and less vulnerable on the high ground.

Locational Guidelines

On the basis of the foregoing a number of clear patterns emerge which need to be borne in mind in township layout and design. Furthermore, it is of interest to note that these patterns are evident in studies conducted overseas and hence the suggested guidelines for the location of single detached dwelling

Table 6: Rank ordering of Zones from Worst to Best according to Burglary Rate

Zone	Burglary Index	Burglary Rate
2	2,5	1:21
5	3,2	1:27
4	3,5	1:30
3	4,4	1:37
6	4,5	1:38
1	5,9	1:50

areas are similar to those suggested by Poyner (1983).

* **Avoid locating high income housing in close proximity to low-income housing**

Maguire (Poyner 1983:30) found in Reading, that the most heavily victimized properties were "... high-value properties in the centre or near poorer areas". There was apparently little penetration of large middle-class areas which tended to have burglary confined to their fringes.

This pattern is clearly evident in Stellenbosch. Zone 2 with the highest incidence of burglary is in close proximity to low-income housing developments immediately to the north thereof. Although generally evident in each of the zones, the concentration of burglaries along the eastern and south-eastern edges of zone 1 clearly illustrates the pattern of confinement to the fringes noted above by Maguire.

* **Avoid locating high income residential areas adjacent to open land**

Poyner (1983:47) in citing the Kent study notes that houses "... not adjacent to gardens of other houses but next to some other land use, particularly privately owned open land such as farmland," were more victimized than those "...bounded by other gardens or inaccessible land uses". In Stellenbosch the vulnerability of dwellings located not only adjacent to private farmland but public open space, forest and nature reserves, is apparent. Although a number of other contributory factors are present, the burglary pattern in zone 1 underlines this point. As described previously the incidence of burglary along the eastern and south-eastern edge of this zone (all fronting onto private or public open space) is extremely high, with 20 (62,5 per cent) of the 32 properties having been burgled at least once in the last eight and a half years.

In general open space provides shelter, hiding place and pedestrian movement corridors, from which forays into adjacent residential areas can be launched. Whilst open space affords a much sought after amenity this is gained at the expense of safety.

The principle enunciated by Poyner (1983:47) that "Plots with large detached houses are best planned adjacent to each other or to inaccessible land and not adjacent to open land...", is apposite.

* **Avoid locating high income residential areas in close proximity to main access roads**

The generalized burglary pattern in the study area supports Poyner's (1988:42) contention that "... Houses should not face onto main through roads, and should preferably not be visible from such roads. Houses should face onto and be accessible only from side roads." The influence of main access roads is clearly evident in the case of zone 2 which is not only bounded by main roads but is also bisected by a main road which connects a low-income area to the rest of the town (Figure 3).

This pattern is similarly reflected in the northern portion of zone 5 and in zone 4. In the latter case the river frontage along the southern edge serves as a pedestrian access route and may be regarded as fulfilling a similar function to access roads.

***Avoid locating high income residential areas between low-income areas and work areas (industrial and town centre).**

Those residential areas which lie in the path of generalized movement patterns between place of work and low-income housing are more exposed or vulnerable to burglary: for example zone 2 has a burglary rate of 1:21. Those areas which are situated away from work and low-income areas are considerably less prone to burglary: for example, zone 3, zone 6 and zone 1, have burglary rates of 1:37, 1:38 and 1:50, respectively.

In the case of zone 1 it should be noted that although the area is adjacent to an industrial area to its south, no roads serving the industrial area pass through the residential area i.e. the latter does not provide a source for extraneous movement through the residential area. However, where pedestrian movement occurs along the south-eastern and eastern edges and where a linkage in the form of a footpath (shown dotted on maps) over the mountain to the low-income areas to the north is evident, the occurrence of burglary is high.

* **Avoid narrow and triangular shaped residential layouts, flanked or bisected by main roads or abutting public open space**

As reflected in this study,in the case of zone 2, the narrow wedge-shaped configuration facilitates easy cross movement between the main roads, which introduces a high incidence of extraneous pedestrian movement which can freely permeate through the area. This reduces the possibility of intruders or those without legitimate reason for being in the area being recognized and hence the opportunities for passive surveillance of the area by residents, is greatly reduced. It should be noted that zone 2 has the highest incidence of burglary of all zones: a burglary rate of 1:21.

7. INCIDENCE OF BURGLARY WITH RESPECT TO SITE CONFIGURATION

In order to ascertain whether sites of a particular configuration were more prone to burglary than others an analysis of nine common site configurations in each of the zones was done.

The nine site configurations are as illustrated in Figure 4.

The number of sites and the number of burgled sites of a particular configuration for each of the six zones were recorded and as in the case of the zones, a burglary index was calculated for each configuration.

When ordered, from worst to best, for all six zones (as presented in Table 7), it is clear that dwellings which are exposed on two sides, either as corner sites or adjacent to public open space or backing onto or overlooking public or private open space are considerably more vulnerable to burglary than those flanked by other dwellings and with dwellings at their rear (i.e. dwellings 'surrounded' by other dwellings).

In the case of the former group the indices range from 2,0 to 3,2 and in the latter two configurations the indices are 5,9 and 6,5: an appreciable difference with respect to safety.

Clearly amenity and environmental quality, measured in terms of openness and access to public open space, is gained at the expense of 'defensibility'.

Site Characteristics

From the analysis of the incidence of burglary with respect to the nine possible site configurations the following is evident:

Dwellings that are open on two sides, either as corner sites or adjacent to public open space or backing onto or

overlooking public open space are considerably more vulnerable to burglary than those flanked by other dwellings and with dwellings at their rear: i.e. a typical mid-block position.

These findings support Poyner's (1983:47) contentions that "... The most satisfactory layout for larger detached housing seems to be a conventional arrangement of plots always bounded by other gardens or inaccessible land uses ...". With regard to accessibility he notes that "... It is probably not the form of the housing as such but the ease of access in any particular case that makes it vulnerable to burglary (Poyner 1983:33).

As noted previously under Locational Guidelines, the degree of exposure, from through and extraneous movement patterns, to which the area or individual sites is subjected, appears to be closely related to the occurrence of burglary.

Site Configuration Guidelines

In principle the following should be borne in mind:

* maximize the visibility and accessibility of houses from within the neighbourhood;
* minimize the visibility of houses from main access routes, including uncontrolled public open space pedestrian corridors;
* restrict access from the front to the rear of the house;
* where the sides of houses are accessible, these should be kept "... relatively open and unobstructed by walls, trees or other landscape and they should be close to the street and to other houses which overlook them" (Poyner 1983:42).

In essence one is looking at planning residential layouts which in their configuration maximize systems of mutual support based on increased visual surveillance of properties by those who belong in the area and reduce access to these and private areas by unwanted elements.

By and large these principles reinforce Newman's (1972) concept of defensible space and territoriality through making it clear in the layout as to who belongs and who does not, and by keeping the public zones open to surveillance by the residents.

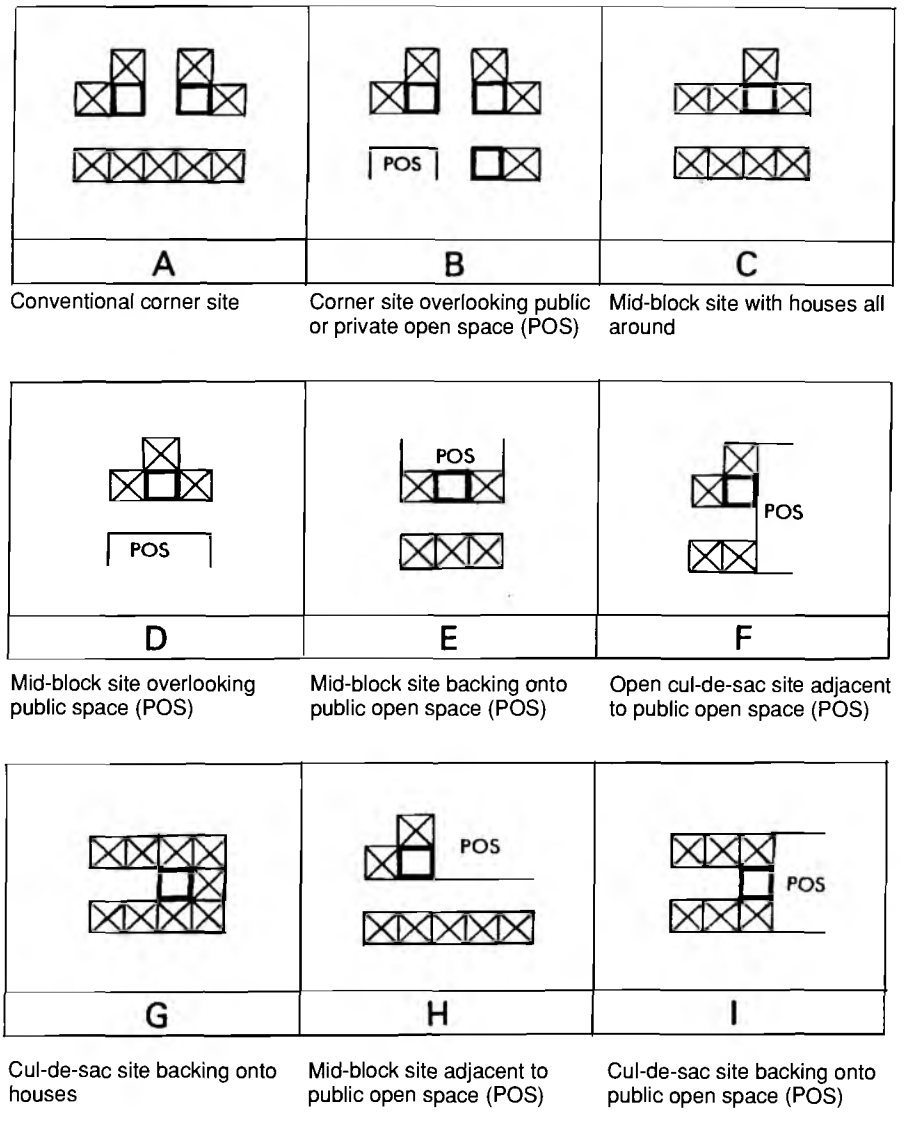

FIGURE 4: *Nine common site configurations.*

Table 7: Rank ordering of site configurations from worst to best according to burglary index

BurglaryIndex	Rank Order	Site Configuration
2,0	1	I Cul-de-sac position backing onto POS
2,3	2	F* Open cul-de-sac position adjacent to POS
2,6	3	H* Mid-block site adjacent to POS
2,62	4	B* Corner site overlooking POS
2,9	5	A* Conventional corner site
3,1	6	E* Mid-block site backing onto POS
3,2	7	D* Mid-block site overlooking POS
5,9	8	C* Mid-block site with houses all round
6,5	9	G Cul-de-sac position backing onto houses*

*Site configurations present in all six zones.

8. CONCLUSION

Although single family dwellings in the suburbs provide a lifestyle to which most South Africans aspire it is becoming increasingly evident from the way people are barracading themselves behind high walls and fences that residents feel vulnerable to intrusions by

outsiders: some residential areas convey the impression of a community under siege. In many cases this practice may be counterproductive for having once breached the defenses the intruder can go about his work without fear of being observed. In the process potential for passive surveillance by neighbours as noted for example by Newman (1972) is nullified. The study illustrates that to a degree such defensive steps result from poor location and the characteristics of site configuration.

Extraneous vehicular and pedestrian movement through residential areas contributes to the incidence of burglary. While proximity to public open space enhances a perception of amenity, privacy is gained at the expense of security.

It is contended that environmental quality may be enhanced in the first instance through the careful consideration of locational factors and township layout characteristics pertaining to site configurations, when developing single family residential areas. Other devices to achieve a desired level of security, in the form of walls, fences, security gates and the like, tend to reflect weaknesses with respect to the former and are at best secondary measures and at times may even prove to be counterproductive.

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