
TESTING BUILDING PLANS FOR PUBLIC SAFETY: USEFULNESS OF THE DELFT CHECKLIST

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Public safety in research and policy

Establishing connections between safety and urban planning goes far back in history. In his pronouncements on the ideal city Plato pointed to the need for wide streets easy to survey to protect the mobility (De Klerk, 1980). The safety of the 'lower orders' was rated rather less highly in those days. Their houses, which tended to be packed together along narrow, dark streets were considered good enough. Not much may be found of Plato's ideas in the early history of Dutch architecture and urban design. Here it was above all the town ramparts and the town gates that were designed to offer the burghers of the Middle Ages protection against thieves, highwaymen and attacks from outside. This is clear from surviving town plans. In many Dutch towns remains of these ramparts may still be found. At the individual level citizens relied on thick walls and small windows to offer a 'protective shell, standing between man and the dangerous world outside' (Prak, 1968). Later still the realization dawned that good public lighting could likewise have a positive effect on public safety. The more systematic study of the relation between the physical environment and public safety is of only relatively recent date.

At the beginning of the development of criminology as a discipline emphasis was placed on perpetrator-oriented theories. For many Dutch criminologists around the turn of the century the book *L'huomo delinquente* by the Italian psychiatrist Lombroso (1876) was an important source of inspiration. It precipitated a number of studies in which the causes of crime were sought above all in the personality of the perpetrator, criminal behaviour being seen as innate and hereditary. In so far as a link had already been established in those days between crime and the environment, the emphasis fell above all on socio-economic variables (Bonger, 1932). Not until the 1950s and 1960s was the importance of adequate housing and good socio-cultural facilities increasingly recognized, largely as a result of the ideas of the Chicago School (Park et al., 1925; Shaw and McKay, 1942). A well-known Dutch study in this connection is the investigation by Buikhuisen et al. (1969) into the effects of neighbourhood redevelopment on crime. The ideas developed in other countries on crime

prevention through environmental design (Jacobs, 1961; Jeffery, 1971; Newman, 1972; Reppetto, 1974) are to be found only later in Dutch research, at the end of the 1970s; an example is a study into the lack of safety felt in and around an underpass for pedestrians and cyclists in The Hague (Van der Voordt and Van Wegen, 1979).

Political interest in this subject is even more recent. The protest by organizations such as *Blijf van mijn lijf* (Hands off me) and *Vrouwen tegen verkrachting* (Women against rape) resulted in 1981 in a motion on sexual violence debated in Dutch Parliament. A study conference organized as a result of this induced the government to publish a memorandum, *Sexual Violence*. In this memorandum there appeared for the first time a recommendation concerning the use of spatial design as a means of preventing sexual violence, at least outside the home. At the same time (1984) the Second Chamber likewise explicitly called for spatial measures to prevent sexual violence. The Minister for Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Housing, Physical Planning and the Environment) broadened this demand to encompass public safety for everyone. In 1985 the Policy Plan for Society and Petty Crime was published. In this document the implementation of spatial measures for the furtherance of public safety were officially declared government policy; this document stressed, for example, the importance of:

'Designing the environment and taking into account planning and building characteristics in such a way that as a result the supervision of young people particularly is not unnecessarily hampered and the committing of theft etc. is not unnecessarily facilitated'.

To encourage the implementation of its recommendations at municipal level the central government in 1986 instituted a Steering Group for Administrative Prevention of Crime. This steering group has a budget of forty-five million guilders to encourage local authorities to develop a coherent policy against petty crime, and to explore the possible ways in which public safety might be increased. Spatial organization is one of the three main areas under consideration. The growth in academic and political interest in the relationship between physical environmental characteristics and (fear of) crime has meanwhile led to a large number of studies and policy documents. The link with actual crime has been investigated inter alios by Van Dijk and Van Soomeren (1981), Van Andel (1984), Van Dijk et al. (1985), Savornin Lohman et al. (1986), Starmans et al. (1988), and Coenen (1989). For research into the relationship between the fear of crime and environmental characteristics reference may be made inter alia to the publications of Van Selm et al. (1985), Kriekaard et al. (1987), Musterd et al. (1988), and Van Delft and Van der Ven (1989). Of all Dutch local authorities, some 25% have compiled or have in preparation a policy document on crime prevention, in which in addition to perpetrator-oriented measures environment-oriented measures are also proposed (*Vereniging van Nederlandse Gemeenten*, 1988). Of the local authorities with more than 50,000 inhabitants, no less than 58% have prepared such a note. Furthermore, in practice many projects are being set up to increase public safety using spatial measures to

combat and prevent (petty) crime. It is clear then that the idea that environmental design partly affects (fear of) crime is subscribed to in wide circles.

Testing building plans for public safety

The knowledge gained from research and practical experience is not always easily accessible to designers, planners and others involved in urban development. The research results are scattered among a large number of books and articles and are often accompanied by detailed methodological commentaries. For that reason the Delft University of Technology has set up a project for 'translating' the results of research and practice into a form as accessible as possible to designers and planners. The result of this is a checklist of points deserving attention arranged around six criteria (Van der Voordt and Van Wegen, 1986). Of course use has been made of earlier checklists and manuals in this field, including those of Newman (1973), Zeisel (1976), Gardiner (1978), Wallis and Ford (1980), and Poyner (1983). For a description of the set-up of this Delft checklist and the theoretical model forming its basis reference may be made to an earlier article which appeared in the Netherlands Journal of Housing and Environmental Research (Van der Voordt, 1987). In brief the checklist amounts to a large number of critical questions that every designer or planner ought to ask himself or herself when screening building plans or existing situations for public safety. The criterion 'accessibility/escape routes' is concerned for instance with questions such as 'Has consideration been given to sealing off routes or facilities such as shopping areas and pedestrian subways at night?'. Or 'Is it possible to call for help in case of danger, to ring a doorbell, to telephone?'

Testing the checklist in a field project

For several reasons the checklist is of the nature of an interim list:

- a. Although many publications point in the same direction, on a number of points contradictory views or research results are encountered which call for further empirical verification.
- b. In many studies the (spatial spread of) crime has been examined solely by means of an examination of official crime statistics. It is known however that only a small proportion of all offences find their way into police statistics. That makes it desirable to check whether supplementary sources perhaps necessitate the revision of certain conclusions.
- c. In various investigations the operationalization of 'the influence of the built environment' has been insufficiently elaborated, as a result of which an unequivocal interpretation of the research results is not feasible. In particular, more attention has to be paid to the relative weight of physical environmental variables compared with other relevant variables, such as the social characteristics of residents and non-residents.
- d. Much research originates from abroad. This makes it desirable to investigate to what extent the views based on it are applicable to the Netherlands.

The above considerations led us to consider the empirical validity of the (interim) checklist (Van der Voordt and van Wegen, 1988). We wanted to investigate the degree to which it was possible, using the checklist, to predict where the strong and weak points - from the point of view of public safety - were in a design or existing situation.

In addition to the question of the empirical validity there is the more practical question about the extent to which the checklist is actually usable for designers and planners. What information is required to be able to use the checklist adequately? And is the present form in which the checklist is framed - a large number of questions 'to be asked of the design', arranged in accordance with six basic criteria and divided into urban plan level, residential environment, block/dwelling characteristics and the provision of specific amenities such as schools, garages, and greenland - suitable?

In this article we shall first deal with the nature and results of our field project. Then, on the basis of empirical testing and critical reflection, we shall indicate what in our opinion is necessary for arriving at a more definitive checklist and provide draft instructions for its use.

Method

The general question of to what extent the interim checklist in its present form represents a sufficiently reliable and usable instrument for screening the public safety aspect of designs, new and existing, has been translated into the following research questions:

- a. To what extent can the checklist enable us to identify places susceptible to crime in a particular area? In other words, can it be shown where crime may be expected or where residents and non-residents may be expected to feel unsafe?
- b. To what extent do the places where one expects crime coincide with the places where offences are actually committed or places that are actually considered unsafe by residents or non-residents?
- c. How can the coincidences or divergences be explained?

To be able to answer these questions, vulnerability analyses have been made of four carefully selected urban areas, which have then been compared with distribution maps showing the incidence of various forms of common crime and feelings of insecurity (Figure 1).

Four locations in The Hague were chosen; these differ strongly with regard to urban design and architectural characteristics but in terms of social characteristics they display a great degree of similarity. The areas chosen were the Bloemfonteinstraat and Stellenboschstraat estates in the pre-war Transvaal district and the Veldzicht and De Stede estates in the post-war district of Bouwlust (Figures 2-5).

In each of the four locations examined the following points have been considered:

Figure 1 Research design

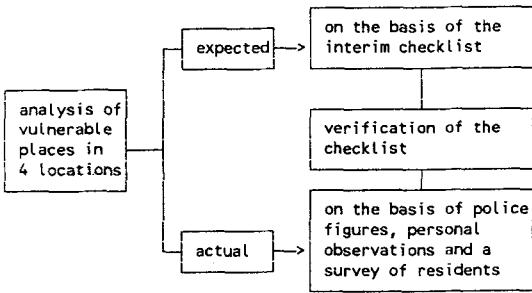


Figure 2 The Bloemfonteinstraat estate is an example of substitute new construction in an area of urban renewal. The estate consists of 74 dwellings, with on the ground floor 31 old people's dwellings with direct access from the street, and on the first floor 43 maisonnettes, accessed by a balcony on the inside of the estate. The whole complex has been built as a closed block, with private gardens in the courtyard.



- a. Using the checklist we have tried to determine which places may be expected to be vulnerable from the point of view of public safety. In this context expected vulnerability refers both to expected high crime rates and expected high levels of fear of crime among the residents.
- b. Next, on the basis of police figures, talks with those directly concerned, a survey of residents and personal observations, we have tried to determine where crimes actually occur. Further, on the basis of a survey of residents and talks with 'key persons', we have identified the places where people actually feel unsafe.
- c. Finally, the similarities and differences between the places mentioned in a and b have been compared.

Figure 3 The Stellenboschstraat estate is an example of renovated dwellings in an area of urban renewal. The estate dates from 1920 and consists of 144 dwellings, in part directly accessed from the street and in part by staircases. The whole complex is three storeys high and comprises two closed blocks, which together form a more or less square block that is intersected by the Stellenboschstraat. The ground-floor dwellings have private gardens with a storage shed in a courtyard (closed to non-residents). The estate further includes a number of amenities (greengrocer, baker, tobacconist, cafe) and also around twenty-five storage places.



Figure 4 The Veldzicht estate and its surroundings provide an example of a varied urban residential project with on the edges 136 dwellings accessed by staircases in 4 or 5 storeys, a 6-storey block (25 dwellings in total) accessed by a balcony and on the inside 48 single-family terraced houses. In all there are 209 dwellings and 2 other premises (a former nursery school and an old people's home).



Figure 5 The De Stede estate is an example of a typical 1960s residential district with dwellings above shops. The estate contains both the district shopping centre and a tower block with 84 balcony-accessed dwellings (13 storeys) and 30 balcony-accessed flats in 3 storeys built above shops. Along the edges 116 staircase-accessed dwellings are situated. In total this location comprises 230 dwellings and 13 shop premises.



Determining the location of expected safe and unsafe places

In our vulnerability analyses and the mapping of places that may be expected to be safe, unsafe or 'neutral' (i.e. neither safe nor unsafe), use has been made of the six criteria from the Delft checklist:

1. Presence of people, with as indicators:
 - actual presence of people, depending inter alia on the location of dwellings and amenities, the degree of functional heterogeneity and the character of the routes (busy/quiet, through route/only local traffic);
 - noticeable presence of people, depending inter alia on the degree of visual contact between dwellings or amenities and public outside spaces, level of vacancies, informal supervision.
2. Level of involvement and responsibility, primarily determined by the following environmental variables:
 - size of the buildings (individual recognizability versus anonymity, affected by number of dwellings per entrance, dwellings per block, blocks per site, etc.)
 - nature of the buildings (transition/boundary between private and public)

- social involvement
 - maintenance and management.
3. Visibility, to be established on the basis of:
 - the degree of visibility of the buildings to the public outside and vice versa (sight lines, lighting)
 - the division and design of the outside spaces.
 4. Accessibility/escape routes or psychological and physical barriers to the transition from public to private space, both from a victim's point of view and from that of burglars and other criminals. Relevant indicators are:
 - number of entrances/escape routes
 - ease of access to entrances/escape routes
 - physical accessibility of entrances/escape routes (open versus locked entrances, large-scale balcony access versus partitioning, similarly for corridors and basement storerooms)
 - symbolic barriers (e.g. signs giving commands and signs giving prohibitions, personal furnishings by residents).
 5. Attractiveness (especially important as a condition for evoking feelings of responsibility and care), with as indicators:
 - size of the buildings
 - complexity and variation
 - use of colours and materials
 - maintenance and management
 - atmosphere (lively/dead, busy/deserted, cheerful/dull)
 - degree of nuisance.
 6. Vulnerability of materials, with as indicators:
 - presence of objects susceptible to vandalism (telephone boxes, bus shelters)
 - presence of blank walls (susceptible to graffiti)
 - quality of vulnerable elements (hinges and locks, light fittings).

We used the six criteria with accompanying indicators to operationalize the variable 'built environment', which is to be interpreted as the independent variable in this study. It is assumed that the presence of people, the involvement of residents and non-residents in the environment, the level of visibility and openness of public areas, an attractive design and the avoidance of elements and materials susceptible to vandalism all make a positive contribution to public safety. With regard to the criterion accessibility/escape routes it is assumed that being within easy reach of escape routes and the restricting of access by potential criminals likewise exert a preventive effect.

So as to arrive at an overall map of expected safe and unsafe areas on the basis of the vulnerability analyses, the following procedure has been used:

- for each criterion a score has been employed of +1 = safe, 0 = neutral and -1 = unsafe, on the basis of the various indicators;
- an overall score has been calculated on the basis of an unweighted sum of the scores per criterion, with three possible values:
 - . safe = an overall score of +2 or more

- . unsafe = an overall score of -2 or less
- . neutral = in between +2 and -2.

Establishing the location of scenes of offences and places actually regarded as unsafe by residents

With regard to the variable 'public safety' (the dependent variable in this study) only those offences have been included that could be assumed to be influenced by the spatial structure. This means that the primary concern here is crimes that are committed in (semi-)public spaces, namely vandalism (damage, graffiti), break-ins, thefts (of bicycles and mopeds and theft from/of cars), and threatening behaviour and violence, including sexual violence.

Besides the petty crime actually occurring we have also included in our study consideration of in which places an absence of safety is perceived or felt. To obtain as complete and reliable a picture as possible of the extent and spatial distribution of the offences mentioned we have relied upon a combination of the following sources of information:

- Data from the police. Use has been made of data both from the Identification Service (which keeps records centrally for The Hague on such details as the location and the nature of offences committed) and from the 'sets', notes for internal use on all kinds of incidents leading to police intervention.
- Talks with 'key persons', i.e. persons who professionally or on account of their social involvement are well acquainted with the extent and background of crime in one or more of the locations examined.
- Observations in situ. The four locations were visited on different occasions and at varying times (during the day, evening) by the researchers and their assistants (four observers in all). Besides mapping the indicators from the checklist, such as the level of lighting, the quality of the hinges and locks, and the presence or absence of people, particular attention was paid to signs of vandalism (damage, graffiti) and pollution.
- A survey among the residents to identify victims of offences committed in the past three years. For each location a random sample was taken of on average one hundred residents (Table 1). Those sampled were asked, in addition to personal questions, to state whether and, if so, how often and where, they had been confronted in the last three years in their own neighbourhood with vandalism, bicycle or moped theft, theft from/of cars, or violence. They were further asked to indicate whether there were within their own neighbourhood places where they felt unsafe. The respondents were approached in writing with a request to participate in the study. Later they were approached in person in order to increase the likelihood of a positive response. In nearly half of the cases the questionnaire proved to have been already completed. The remaining questionnaires were completed on the spot by the interviewer together with the respondent. When those not at home and vacant dwellings are excluded the response varied from over 57% (Stellenboschstraat estate) to 83% (Veldzicht). An analysis of the characteristics of residents has shown that the sample in each of the four locations is representative of the

Table 1 Size of the sample and level of response

	Bloemfonteinstraat	Stellenboschstraat	Veldzicht	De Stede	Total
questionnaires distributed	107 (100%)	120 (100%)	135 (100%)	144 (100%)	506 (100%)
questionnaires completed	64 (59.8%)	54 (45.0%)	104 (77.0%)	92 (63.9%)	314 (62.1%)
refusals repeatedly not at home	19 (17.8%)	39 (32.5%)	22 (16.3%)	29 (20.1%)	104 (20.6%)
vacant dwellings	15 (14.0%)	22 (18.3%)	9 (6.7%)	23 (1.6%)	69 (13.6%)
language problems	6 (5.6%)	2 (1.7%)	-	-	8 (1.6%)
other problems (blank forms submitted, no bell)	3 (2.8%)	-	-	-	3 (0.6%)
	-	3 (2.5%)	-	-	3 (0.6%)

whole population in those areas. Figure 6 illustrates the distribution of the respondents and non-respondents in the De Stede location.

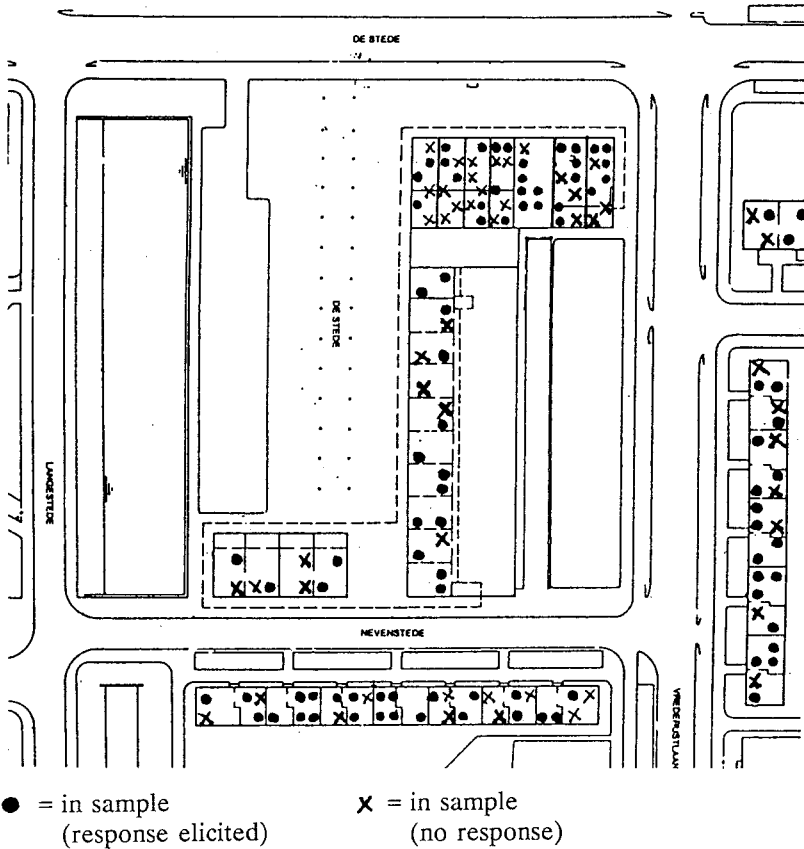
Results

Figures 7 and 8 give a picture of the location of expected and actual safe and unsafe places within the De Stede estate.

Much of the De Stede estate has a negative score. Above all the entrance to the balcony-accessed dwellings (1) scores very negatively on account of its being a focus of little interest by the public, mediocre visibility, the presence of many vulnerable elements and a lack of attractiveness. The Zuidplein (2) scores negatively particularly under the awnings on account of low public interest in this space, poor visibility and the limited presence of people. The car park behind the supermarket (3) has three negative characteristics: the absence of people, lack of tenant's involvement and the lack of appeal of this space. A positive total score has been awarded to the areas along the houses in Nevenstede (4) and Vrederustlaan (5).

Concentrations of vandalism may be found above all at the entrance to the tower block (1) and at the entrance to the balcony-accessed dwellings (2). In addition, a number of vulnerable objects along the De Stede straat (3) have suffered damage, such as a telephone box, a bus shelter, a statue, the police box and shops. Small amounts of graffiti are further to be found on some end walls of residential buildings (4) and on the back wall of the supermarket (5). Compared with break-ins into dwellings many break-ins into shops occur on the De Stede estate. This regularly happens to the fabric shop under the balcony-accessed dwellings (6) and a man's fashion shop on the corner of Vrederustlaan and De Stedestraat (7). In private basement storage areas a total of fifteen break-ins have occurred. Communal storage areas have been broken into on no less than seven occasions. This happened six times in the tower block (9) and

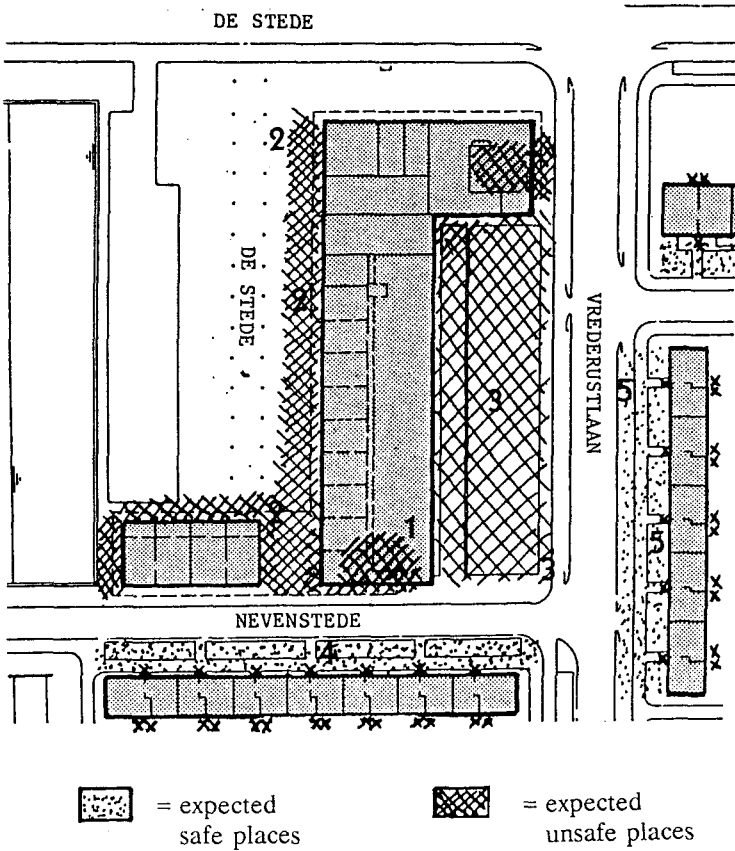
Figure 6 Response and non-response on the De Stede estate



once in the balcony-accessed dwellings (10). In total, dwellings were broken into fourteen times during the period covered by our research, and five of these occurred in the tower block. The feelings of lack of safety relate above all to spots with boarded-up premises and vacant shops, and also to the Zuidplein, which presents an empty and deserted appearance in the evening.

If we compare this picture with the expected distribution of safe and unsafe places (Figure 7), a somewhat ambiguous picture becomes apparent. As regards vandalism, expectation and reality agree reasonably well. Above all the entrances to housing blocks with a relatively large number of dwellings per entrance, and objects such as bus shelters or telephone boxes are targets. As regards break-ins into dwellings the tower block gets off relatively lightly. The staircase-accessed dwellings along the Nevenstede are burglarized more often than one would expect. The expected vulnerability of the basement corridors is confirmed. Corners of blocks (easy escape route) and shops (attractive targets) are found to be particularly vulnerable. Cars prove to have been broken into

Figure 7 Expected safe and unsafe places in De Stede

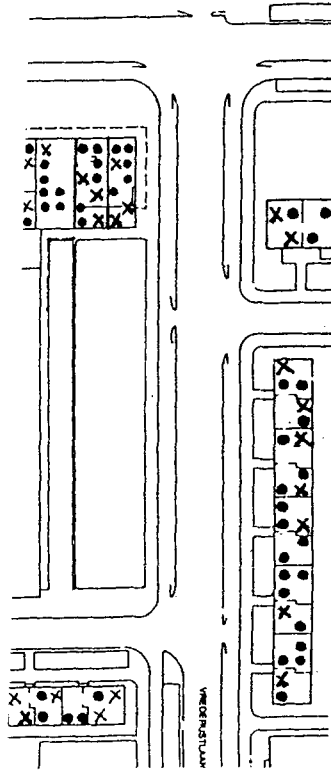


everywhere, though the car park behind the supermarket was the scene of a relatively large number of break-ins. This tallies with our vulnerability analysis, which suggested that this place would be unsafe. The eleven cases of threatening behaviour and violence display a fairly capricious pattern of distribution, in which there appears to be no clear relationship to spatial environmental characteristics. That above all quiet, badly lit spots and places where groups of young people congregate are regarded as unsafe coincides with the spots that are regarded as 'scary' in the checklist.

For the other three locations comparable vulnerability maps and distribution pictures have been plotted. The results of the comparison between expected and actual scenes of offences and places regarded as unsafe by the residents give similar pictures for each of the four locations. The results may be summarized as follows.

In each of the four locations petty crime proves to occur on a fairly large scale. In the physical distribution of offences actually committed a number of clear

De Stede estate



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objects such as bus shelters and telephone boxes are located. Presence of perpetrators, absence of onlookers, inadequate visibility and openness, and the use of vulnerable materials are the main explanatory factors here.

In comparison with vandalism the connection between the pattern of distribution of expected and actual scenes of break-ins is clearly weaker. Nevertheless, some obvious points of concentration stand out in the otherwise rather capricious distribution pattern of this type of offence. In particular there are many break-ins into basement storage rooms and staircase-accessed flats, into corner premises, into residential buildings with poor hinges and locks on the doors, and into shops and business premises. Ground-floor dwellings of staircase-accessed blocks, surrounded by public greenland, also prove to be extra vulnerable. Here the perpetrator easily effects an entry via the balcony at the rear. In comparison with the other three locations, there are a relatively large number of break-ins on the Bloemfonteinstraat estate. The main explanation for this, apart from its location in an area of urban renewal, seems to be the many access and escape routes. The estate has no fewer than six staircases for seventy-four dwellings, a feature which certainly does not induce controllability. Although the literature - and thus also the checklist - often speaks of the preventive effect of the small scale, there proved to be an unexpectedly large number of break-ins into the single-family dwellings investigated. These are rows of dwellings surrounded by public greenland, with inadequate lighting. Evidently the negative factors (poor visibility, relatively easy access via the gardens at the rear, and the presence of several escape routes) weigh more heavily here than the positive effect of the greater involvement of the residents in their residential environment. Conversely, there proved to be an unexpectedly small number of break-ins into the balcony-accessed dwellings and the tower block on the De Stede estate. Inasmuch as they occurred they often involved break-ins into or theft from the communal storeroom. By way of explanation one may point to the positive effect of closing off the entrance hall, the presence of a concierge and good maintenance, as a result of which the building gives an impression of having been well-cared for and radiates a certain involvement on the part of the occupants. With regard to break-ins into buildings, a clear preventive effect therefore proves to result from physical and social thresholds.

With regard to the theft of and from cars and theft of bicycles or mopeds there proves to be a fairly weak link between the expected vulnerable places and the distribution of the actual scenes of offences. Cars are stolen everywhere, above all from places where many cars are parked. In so far as points of concentration occur, inadequate visibility and absence of the public seem to be the principal explanatory variables. Bicycles too are stolen above all from places where many bicycles are parked, e.g. in and around the De Stede shopping centre. Conversely, in residential neighbourhoods where the residents have a private storeroom on private land at their disposal, strikingly few bicycles are stolen. Storage places concentrated on semi-public land in poorly lit places, poorly visible from dwellings, prove to be considerably more vulnerable. Thus bicycles and other things are regularly stolen from the storage facilities at the site of the

covered passage on the Bloemfonteinstraat estate.

The comparison between the physical distribution of expected and actual scenes of offences did not prove feasible for that of threatening behaviour and violence. For each location the number of offences is fairly limited, while in some cases no information is available on the location of the offence. Only bag snatching and pickpocketing are of common occurrence, notably at the market. The hustle and bustle, which brings in its train both many potential perpetrators and many potential victims, along with the anonymity of the crowd, are clearly factors which increase the risk. This is in accordance with what was expected.

With regard to fear of crime an obvious agreement has emerged between the places where people actually feel unsafe and the expectations regarding this on the basis of the checklist. Above all, quiet dark spots that are poorly visible from dwellings and their surroundings are regarded by many residents as unsafe. But places where 'undesirables' hang around are also often mentioned. What likewise plays a role is the degree of freedom of choice. In particular, cycle and pedestrian routes which were regarded as unsafe and yet for which there were no alternatives strengthened the feeling of uneasiness. In addition to highlighting specific locations many of the residents of the Transvaal we questioned often regarded 'the whole neighbourhood' as unsafe. Social environmental factors prove so dominant here that any differentiation on the basis of physical environmental characteristics is as it were pushed out of the picture.

Discussion

In the above we have attempted to give a description of the research set-up, how we determined the locations of the expected safe and unsafe areas and where offences actually occurred, and finally to compare expectations with reality. We now wish to consider in more detail two particular aspects:

- a. the research methodology used (notably the reliability of the data and the quantifiability of the various criteria)
- b. the effect of specific design variables on susceptibility to crime.

The research methodology used

Expected safe and unsafe places

The expected safe and unsafe places have been determined by reference to the six criteria from the checklist and the subcriteria or indicators derived from these.

In most cases collecting the information required did not prove to be a problem. An exception to this was the variable 'presence/absence from home' which was used as an indicator for the criterion 'presence of people'. Being employed, being tied to the house by the need to care for young children, frequency of going out for entertainment etc. are factors that influence this. But obtaining data on these matters requires a detailed survey which was not feasible within the scope of this investigation.

The same applied to the variable 'social cohesion', one of the indicators of the

criterion 'involvement'. A good operationalization of this concept calls for detailed information. On practical grounds this variable has been measured only approximately (on the basis of talks with key persons).

On the strength of the information collected we can estimate where the most or least vulnerable places from the point of view of public safety will be found. Although the indicators used can usually be described well, operationalization in a quantitative sense is not feasible. Hence for each criterion a qualitative description has been opted for in the case of each of the indicators, resulting in a positive (+), neutral (0) or negative valuation (-). On the basis of the valuation per indicator a further appraisal per criterion has been given, resulting in a three-point scale, with +1 = expected to be safe, 0 = neutral and -1 = expected to be unsafe. In order to obtain a sufficient degree of objectivity the valuations have been made by two teams each containing two researchers. This approach proved to work well during the investigation. In the appraisals a large degree of consensus emerged. Later this consensus was further confirmed during a workshop in which representatives of housing associations appraised one of the locations, also using the checklist, as to the expected vulnerability to vandalism, break-ins and fear of crime. Besides this point there is the problem of assigning weights to the six factors. It is difficult to predict the final total effect of the various factors because the criteria do not all carry the same weight. On the basis of the material collected it was our impression that the criteria 'presence of people' and 'visibility' significantly affected the possibility of offences being committed and thus these factors weigh heavily. Conversely, a criterion such as 'attractiveness of the surroundings' weighs less heavily for all types of offences investigated. Criteria such as 'accessibility' and 'vulnerability of materials used' are extremely relevant with regard to the offences of break-in and vandalism respectively, but are hardly important for crimes of violence, for instance, and also in the case of fear of crime. The overall map as it currently stands compiled in this research project is based on an unweighted summation, as described earlier. Further research will be directed towards gathering more information on those factors that ought to be given more weight.

The actual safe and unsafe areas

We have endeavoured by using a combination of data from various sources to arrive at as complete as possible a picture of the spatial distribution of the offences investigated. The assumption that the various sources of information supplement each other and together give a reasonable picture of the extent and distribution of crime does in fact seem to be confirmed by the data collected. The number of offences which have been detected by the various sources of information indicate fairly well which source(s) of information is (are) the most suitable for measuring the extent of each type of crime (Table 2).

Thus information relating to break-ins into buildings proves to be largely obtained from police records. The proportion of thefts from buildings recorded in police records is less high, but supplementation by means of a survey of residents gives a reasonable picture of the total extent. The same applies to car

estate.

tribution of expected and actual scenes of threatening behaviour and violence. is fairly limited, while in some cases it is of the offence. Only bag snatching is common, notably at the market. The hustle and bustle of the crowd, are clearly factors that contribute to the crime with what was expected.

An agreement has emerged between the police and the expectations regarding this on the market. Dark spots that are poorly visible from the street are often mentioned by many residents as unsafe. But these are also often mentioned. What like-ness of choice. In particular, cycle and pedestrian theft are unsafe and yet for which there were no clear reasons of uneasiness. In addition to highlighting the unsafe areas of the Transvaal we questioned often about the reasons for unsafe. Social environmental factors are taken into account on the basis of physical environment out of the picture.

a description of the research set-up, the identification of expected safe and unsafe areas and finally to compare expectations with actual observations in detail two particular aspects:

1. the reliability of the data and the validity of the information on susceptibility to crime.

2. the subcriteria or indicators derived from the research.

The subcriteria required did not prove to be a problem. The subcriteria 'presence/absence from home' which was derived from 'presence of people'. Being employed, being a parent, care for young children, frequency of visits to family members are factors that influence this. But obtaining a representative survey which was not feasible within the scope of the research.

'Social cohesion', one of the indicators of the

Table 3 Testing the correlation between expected and actual scenes of vandalism

Expected	Actual			Total
	+	0	-	
+	20	3	3	26
0	12	8	9	29
-	18	6	25	49
Total	50	17	37	104

+ = safe, hardly any vandalism
 0 = neutral
 - = unsafe, considerable vandalism

chi-square = 16.9
 df = 4
 p = 0.002
 contingency coefficient = 0.4

Using these considerations a total of 104 places have been distinguished for vandalism and 55 for break-ins.

Table 3 shows that the close similarities identified earlier between predicted and actual scenes of vandalism are also confirmed statistically ($\chi^2 = 16.9$; $p = .002$). Deviations between predicted and actual places occur above all in the case of the staircase-accessed dwellings. The expected vulnerability to vandalism of the entrance hall or basement corridors is not borne out by the facts. Although the connection between predicted and actual (un)safe places for break-ins is likewise statistically significant ($\chi^2 = 10.4$; $p = 0.05$), the relationship is less significant than in the case of vandalism. One explanation for this must be sought in the presence of a large number of other factors influencing the pattern of break-ins. In addition it should be remarked that in assessing whether we expected places to be safe or unsafe a general picture was assumed of the lack of safety rather than one which concentrated on break-ins. Viewed after the event, it may be observed that fear of crime, vandalism, and threatening behaviour and violence have played a dominant role in assessing expectations about the safety of places. If we had concentrated on the risk of break-ins the similarity between expected and actual locations of break-ins would most probably have been considerably greater.

The influence of specific design variables

It has been established that the criteria from the checklist form a reasonable basis on which to screen building plans for their contribution to public safety. In this section we wish to go a step further, in the direction of design itself, by interpreting the criteria as possible effects of design choices. For a designer does not design 'visibility' or 'involvement', but structural forms, buildings, roads, and other features of sites. This means that it must be asked which design choices best satisfy the criteria laid down. We shall consider this question in terms of six design variables, about which in the literature and at workshops explicit opinions (and prejudices) often prove to exist. The collected research material makes it possible to make critical comments on prevailing ideas about the relationship

Table 4 Testing the correlation between expected and actual scenes of residential burglary

Expected	Actual			Total
	+	0	-	
+	1	8	3	12
0	1	4	5	10
-	9	6	18	33
Total	11	18	26	55

+ = safe, hardly any vandalism
 0 = neutral
 - = unsafe, considerable vandalism

chi-square = 10.4
 df = 4
 p = 0.05
 contingency coefficient = 0.4

between these design aspects and public safety. It should at the outset be admitted that since different variables vary at the same time, the following argument is of a somewhat speculative nature.

Type of structure and form of housing

In various local authorities a discussion is now taking place about the extent to which public safety is improved by the use of closed blocks of buildings (Amsterdamse Raad voor de Stedebouw, 1988). The variation in type of structure in the four locations investigated makes it possible to contribute to this discussion.

The Bloemfonteinstraat estate may be interpreted as a closed block which has been 'broken open' by means of the covered passage and the stairs at the ends of the block. The result of this is that the distinction between public (street) side and private (rear) side has disappeared. The buildings around the estate consist mainly of flats with the well-known Hague open staircase form of access and at various places shops at ground level. The Stellenboschstraat estate consists of two closed blocks, with clear fronts and backs of dwellings. The inner court is private and is accessed by a semi-private rear path, restricted to residents. In the Veldzicht location terraced housing (single-family row houses) and detached blocks situated in green spaces (staircase-accessed and balcony-accessed flats) have been opted for. The De Stede estate consists largely of dwellings above shops in the form of balcony-accessed flats, with along the edges blocks of staircase-accessed flats.

The variation in type leads to great differences in terms of 'visibility' and 'accessibility/escape routes'. The inside balcony on the Bloemfonteinstraat estate can be accessed by no less than eight different staircases, which means an equal number of escape routes. It seems that this design feature is partly responsible for the relatively large number of break-ins on the estate. The rows of single-family houses in Veldzicht likewise have relatively high rates of burglaries. Here too the ease of access and the presence of escape routes seem important explanatory variables. Other vulnerable features are the backs of the blocks of staircase-accessed flats, which in many cases are easily reached from semi-public

land and at the same time are poorly visible from the surrounding buildings. Conversely, there prove to be fewer break-ins on the Stellenboschstraat estate than in the other locations. The burglary statistics thus do in fact seem to point to a certain preventive effect of a closed block structure, provided it is well designed. With regard to other types of offence, this preventive effect seems barely present.

Traffic access

The four locations contain both quiet residential streets and busy shopping streets and through routes. In general busy routes prove to be characterized by a somewhat higher crime level than elsewhere, notably as regards break-ins into basement storage rooms and shop premises, and theft of/from cars. It can not therefore automatically be concluded that a busy route, because it is busy, is necessarily safe. In the first place, busy routes are busy for only a limited part of the day and through their size often convey an impression of abandonment at quiet times. Secondly, busy routes are also intensively used by potential offenders. Their very presence increases the chance of an offence being committed. Moreover, studies have suggested that above all casual burglars prefer to operate in places with which they are familiar (Brantingham and Brantingham, 1981). Thirdly, there are many objects of interest to potential offenders to be found in these busy areas (bicycles, cars, shops). Furthermore, the fact that busyness and massiveness go hand in hand with anonymity also plays a part. Strangers attract attention less quickly and the general public are less prepared to intervene when they see a crime taking place.

Mix of functions

On the strength of our research results the frequently-heard argument that a mix of functions leads to reductions in crime (inter alios Jacobs, 1961) also calls for some comment. The Stellenboschstraat and Veldzicht locations both consist almost exclusively of dwellings. The Bloemfonteinstraat estate is likewise a residential block, but is surrounded by dwellings and shops, a community centre and a few schools. The De Stede location is a clear example of functional heterogeneity, with dwellings and shops above and next to one another. Nevertheless, there is no question of there being a lower crime rate in the latter two locations. The relatively large number of burglaries on the Bloemfonteinstraat estate and in its surroundings seems - apart from such factors as too great an ease of access, and being situated in a vulnerable area - to be caused precisely by the functional mix there. The location of an enclosed football area beside the residential block gives rise to considerable nuisance from young people, particularly on warm summer evenings. Only with considerable effort - for instance by talking to them, raising the wall that separates the gardens at the end of the block from the surroundings, protecting walls from graffiti and more regular maintenance - does the residents' association succeed in restricting this nuisance. During the daytime the De Stede estate is a reasonably safe area, both objectively and subjectively. Nevertheless (during the day too) bicycles are regularly

stolen and (in the evening) shops frequently broken into. Moreover, the functional mix here seems, particularly in the evening, to result in an extra lack of safety: awnings that block the view of public open spaces from the dwellings, a shopping square that, because of its size, conveys a particularly deserted impression, stockrooms of shops that present a typically 'backstage' character and thus result in an empty and dark side to one of the car parks, etc. Finally, amenities also attract 'undesirables', who can give a residential district a distinctly negative image. It will therefore be clear that the relationship between functional mix and public safety is complex. Both the scale of the area and the nature of the functions characteristic of the area are important, while the effect of functional mix per type of offence may be very different.

Scale of the buildings

In numerous studies on public safety in relation to the urban environment we read that large-scale housing units, on account of the anonymity and lack of mutual social involvement, entails an increased risk of crime (see Newman, 1972; Coleman, 1985). The larger the number of storeys, dwellings per block and dwellings per entrance, the greater the chance of vandalism and break-ins. The results of the present study show that the reality is rather more subtle. It is true that vandalism tends to be concentrated at the entrances to large residential buildings (we noted graffiti on the front of the balcony-accessed flats on the Veldzicht estate and the tower block on the De Stede estate), but in comparison with for instance the relatively small-scale Bloemfonteinstraat estate the difference was not striking. As regards break-ins into dwellings it is noticeable that the rows of single-family dwellings on the Veldzicht estate are burglarized relatively often, as is the comparatively small-scale Bloemfonteinstraat block. In the balcony-accessed flats in Veldzicht and in the tower block in De Stede, on the other hand, there are few break-ins. Only in the communal storage room of the De Stede block of flats do burglaries and thefts regularly occur.

This incidentally does not mean to say that the ideas of Newman and Coleman are necessarily inapplicable here. It rather seems that other factors are also of influence and evidently carry greater weight than the size of the buildings. Thus with respect to vandalism the risk-increasing effect of deficient visibility and the vulnerability of such things as blind walls or poor hinges and locks seem at least as important as size or anonymity and lack of involvement. The susceptibility to burglary of the single-family houses has already been mentioned and seems above all a consequence of the relative ease of access (notably via the back) and the deficient visibility. The balcony-accessed flats in Veldzicht, on the other hand, are accessible only via a closed doorway (though the door is not locked) and offer potential burglars only two escape routes: via the staircase or lift, or via the fire escape, which is open and therefore fairly well visible. In addition there are only twenty-five dwellings, nearly half of which are occupied by old people. As a result, residents are almost always present.

The tower block on the De Stede estate likewise has a number of characteristics that have a preventive effect on crime. The block is accessed by a locked door.

There is a concierge present. The communal spaces such as the hall, the staircase, the lift and the balconies are well maintained. The block is occupied exclusively by one- and two-person households without children. It is known that vandalism and casual burglary are committed mainly by young people. These facts, taken in combination, make it clear that there is little chance of crime on the estate being committed by residents themselves. In addition to scale, therefore, dwelling differentiation and allocation policy play an important role. All these factors together explain why, despite the large-scale nature of the tower block, relatively little vandalism and few burglaries occur. These results echo those of a comparable investigation in the Rotterdam district of Schiemond (Starmans et al., 1988). This too proved that in the tower (ten-storey) blocks vandalism and burglaries were less frequent than in the medium-high-rise blocks (four to five storeys).

Type of storeroom and location

To judge from the information gathered, storerooms prove to be particularly susceptible to burglary. The basement storage rooms of the staircase-accessed dwellings in Veldzicht and De Stede and the communal storage room in the De Stede tower block are regular targets of burglars. The detached storage sheds on the Bloemfonteinstraat estate have also proved to be vulnerable. The storage rooms on the Stellenboschstraat estate, on the other hand, are rarely broken into. The location of the latter on private land closed off from the outside and within view of the residents certainly has a preventive effect here. A location out of sight of the residents and outside their direct sphere of influence, more or less detached from the dwellings themselves and often in dark, poorly visible spots, results in greater vulnerability.

Layout of public open spaces

This design variable refers to such things as the location and design of street 'furniture' and bus shelters, public green spaces and street lighting. It has been clearly proven that above all street lighting has a great effect on the perception of danger. Dark routes are most frequently mentioned as places where people feel unsafe, notably in combination with the absence of people or the presence of persons and groups presenting a threatening appearance. The semi-dark covered passage on the Bloemfonteinstraat estate makes this spot even more susceptible to vandalism. Tall hedges and trees can likewise lead to feelings of insecurity, because they restrict visibility and openness. In particular the cycle paths past the hospital and round the back of the Veldzicht estate are regarded as unsafe. With respect to shelters, it has been noticed that both the bus shelter by De Stede and the tram shelter on the Hoflandplein are regular targets of vandalism. Here it is not so much that the location seems to present a greater risk (both shelters are in reasonably visible and open places), but the vulnerability of the materials used (both have much glass) plays a part. An additional consideration is that a shelter is a public object and is regarded by many as 'belonging to nobody'.

Concluding remarks

Despite our comments concerning research methodology, it seems justifiable to conclude that the overall maps of expected locations of offences and spots regarded as unsafe sufficiently meet the prevailing academic criteria of verifiability and validity. It has, however, clearly emerged that a differentiation by type of crime can considerably increase the validity of the vulnerability analyses. The combination of different sources of information has enabled a reliable picture to be obtained of the extent and spatial spread of vandalism, break-ins into buildings and the perception of danger. For various other types of offence this reliability is limited.

On the strength of this it can be argued that a comparison of the spatial spread of expected and actual safe and unsafe places largely contributes to a better insight into the validity of the checklist. On account of the complexity of the many variables that are of influence, an in-depth investigation has been opted for. Quantification of the variables is in many cases not feasible at the moment. Our conclusions concerning the reliability of the checklist are therefore chiefly qualitative in nature.

As regards the usefulness of the checklist, it may be said that it may usefully be used to determine the location of places most vulnerable to vandalism or which are perceived as dangerous. With regard to burglaries, thefts and acts of violence, its predictive value is limited. The checklist proves to be an excellent aid to identifying risk-increasing environmental factors and the design factors which can help prevent crime, but it is difficult to use it to provide adequate predictions of the final result of these factors.

The following recommendations for improving the checklist can be made:

- development of the theoretical framework, to include greater consideration of type of offence;
- broadening/refinement of the criteria by the addition of the criterion 'attraction of the target' and distinguishing within the criterion 'presence of people' between the 'presence of perpetrators' and the 'presence of bystanders';
- indicating the (ordinal) weightings to be given to each of the criteria per type of offence;
- considering public safety at the district or city level;
- the inclusion of examples of successful and less successful design solutions.

It is advisable to develop these criteria further in terms of goals, derived objectives and design means, and where necessary broken down by type of offence. In this way a sharper distinction can emerge between spatial and architectural factors and social factors. The checklist then takes on more the character of a design manual. These developments are the subject of current research being undertaken by the authors.

Although the investigation has clearly contributed to a better understanding of the relationship between physical environmental characteristics and public safety, a number of questions still remain unanswered. Future research should be directed particularly towards:

- the influence of different design choices at the level of land-use allocation

- plans (concentration or mix of functions, traffic access systems);
- the influence of different design choices with regard to specific features (garages, large shopping centres);
- a greater consideration of the criterion 'vulnerability of use of materials', both with a view to the prevention of break-ins and with regard to their susceptibility to vandalism.

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