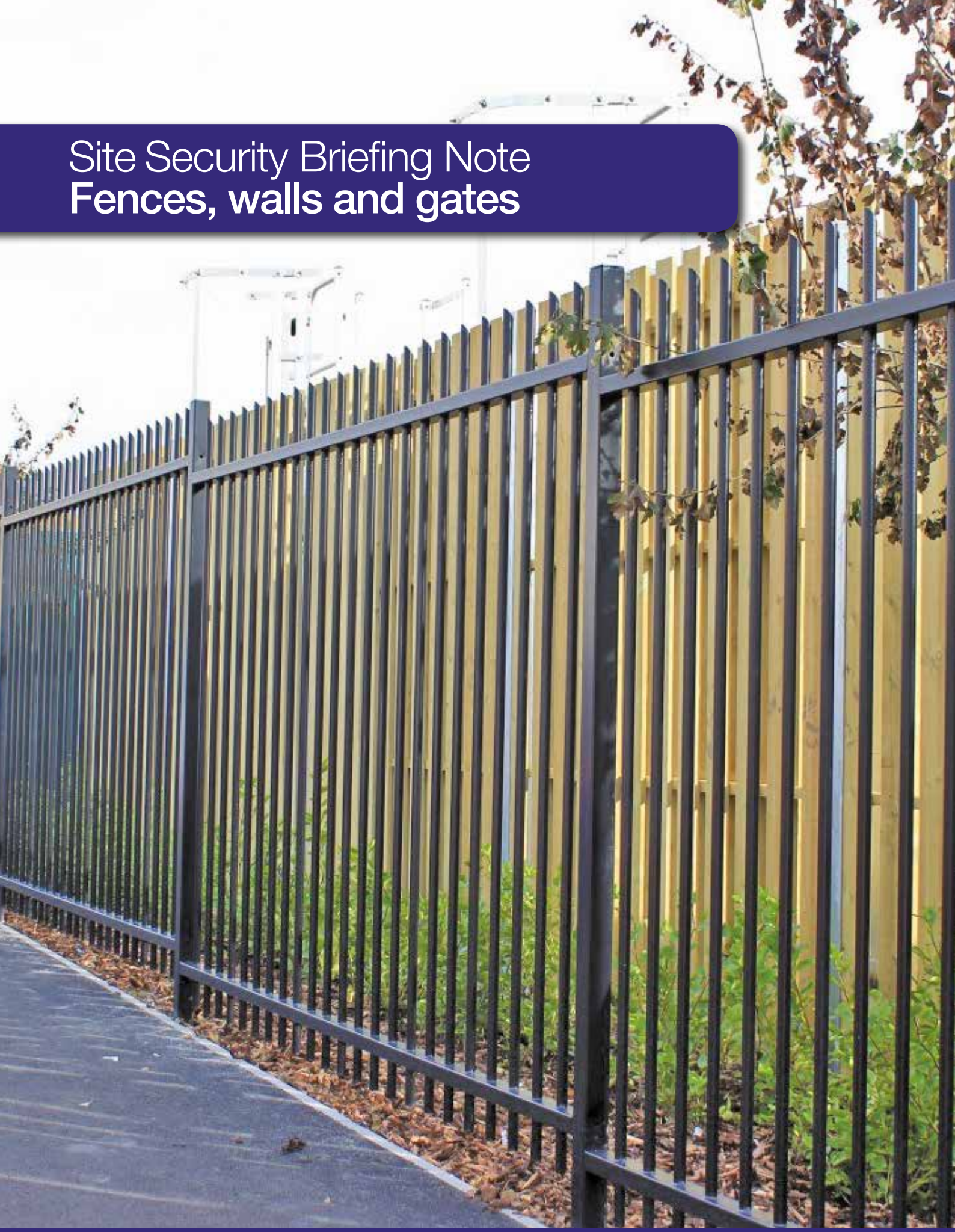
Site Security Briefing Note
Fences, walls and gates



RISCAuthority

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FPA Fire Protection Association

INTRODUCTION

Effective restrictions at the perimeters of areas of land containing buildings, items of value in the open or general hazards can be hard to achieve, especially where it is necessary to facilitate legitimate access by people, goods and vehicles in and out of premises. Nonetheless, it is an important first line of defence when considering site security. This guide covers the main physical barriers which can be used to enclose an area of land requiring protection from trespasses and intruders, e.g.:

- Fences and walls
- Gates
- Movable barriers

Note: Planning permission may be required for certain types of perimeter walls/fences and barriers, this being especially likely if listed building/ conservation area status applies. The relevant planning authority should be consulted.

In addition, occupiers' liability risks need to be taken into account where aggressive solutions such as razor tape and electric fencing (both referenced below) are being considered. Attaching signs to the fence warning those approaching of the possible risk of injury can mitigate the risk of liability attaching by virtue of the Occupiers' Liability Act 1984 and the Health and Safety Act 1974.

FENCES AND WALLS

General recommendations

Visual barriers

A fence which is of open construction allows the enclosed property to be observed from without. Any intruder is exposed to view but, on the other hand, the potential intruder can assess the risks and rewards of unlawful entry. A solid barrier prevents such assessment but allows the intruder to continue unseen.

There are cases for each but, in most applications, the 'open' fence is much to be preferred.

Height

A fence or wall height below 1.5m can only be considered as a demarcation line. At 1.5m and above there is a deterrent factor in that it can become difficult to climb, especially when carrying something. To have real value security fences should be at least 2.4m high to the top of the fencing, and 2.9m to the top of the barbed wire or other enhancement (Fig 1).

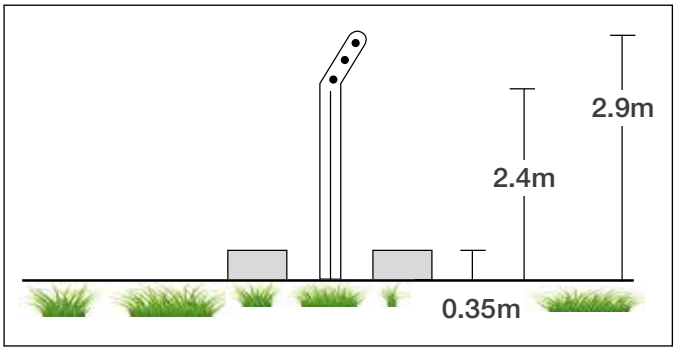

Fig 1.

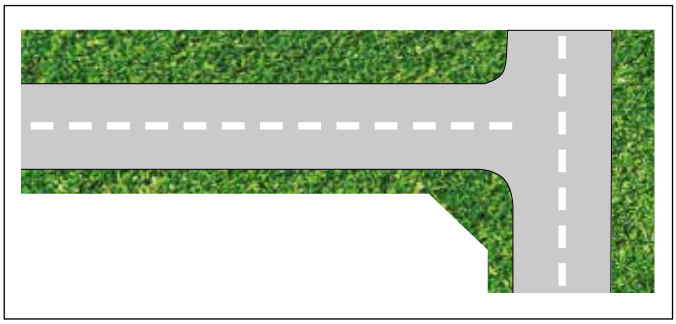

Fig 2.

Corners

- right-angled and acute-angled corners offer the opportunity of bridging across the angle and to prevent this corners should be set at a minimum of 130° (Fig 2).
- corners should be braced

Ideally, installation should be by contractors who have been granted BSI Certificates of Registration as firms of Assessed Capability to BS EN ISO 9001:2015 and which conform to the codes of practice of reputable trade bodies such as the Fencing Contractors Association and the European Fencing Industry Association.

Vehicular approach

Many of the lighter types of fence are quite effective for the exclusion of personnel but do not provide any resistance to vehicles.

By streets and in other vulnerable places, concrete kerbs or blocks should be constructed on one or both sides of the fence of sufficient height (say 350 mm) to help prevent direct attack by vehicles or their passage once a breach has occurred (Fig 1). However, if the risk assessment envisages the possibility of assaults by highly determined attackers with a wide choice of vehicle, expert advice should be obtained as some modern four-wheel drive vehicles (for example) can negotiate obstacles that in the past were assumed to afford a secure perimeter. If this is the case, consideration should be given to more formidable obstacles or the use of landscaping, water features, earth mounds and ditches etc. Alternatively, hostile vehicle mitigation products such as concrete blocks, bollards and crash fences conforming to *British Standard PAS 68 Specification for vehicle security barriers* are available. Specification and installation of these same products is dealt with in PAS 69. Further guidance is to be found in RISCAuthority document 'Guidance for the protection of premises against attacks using vehicles (ram raids)'.

As well as being used by criminals effectively as an assault weapon, vehicles can also be used to aid climbing over fences and walls by serving as a high-level platform.

Maintenance

The maintenance required varies with the position of the fence or wall (e.g. on a street or by a field) and its type. Damage is most likely to be from wind, corrosion, snowdrift, cattle, vehicular contact, vandalism or attempted intrusion.

- fences and walls should be thoroughly inspected regularly
- they should be well maintained, and promptly repaired following any damage

Walls – factors to consider

Brick, stone or concrete walling, provided that the height and depth are sufficient, offers a durable, tough and effective barrier. The initial cost is very high but maintenance is very low. Security at the top of the wall can be enhanced by the addition of visible proprietary electric fencing (see below), spikes, barbed wire, razor tape or anti-climb paint. Rotating fixtures on the top can also be effective. But all these measures tend to detract from appearance and it may be possible for intruders to counteract some of them by covering them with, for example, an old blanket or mattress. Although opaque masonry walling has benefits it suffers from the fact that it allows potential intruders to approach the perimeter undetected. Consequently, construction of a wall rather than fencing is generally not recommended in the security context.

Fence types – factors to consider

Although not recommended, chain-link fencing is commonly available and relatively cheap. Security fences at least 2.4 m high should include proper straining wires at the midpoint as well as top and bottom and be anchored to the ground. It is not a particularly attractive form of fencing but the temptation to 'soften' the line by planting over and around should be resisted if security is to be maintained because it can conceal breaches and make maintenance and inspection difficult. Deliberate intrusions are easily made by cutting holes, flattening sections with a vehicle or various ways of simply pulling them down.

Basic chain-link fences do not offer a substantial barrier to anyone but the most casual or ill equipped intruder. Whilst additional security can be provided by enhancement with barbed wire or barbed tape in the form of the vertical extension to the frame e.g. to deter climbing, this can be negated by blankets or tarpaulins, being draped over the top – or intruders may simply cut a hole or pull the chain link away below to gain entry. A further enhancement involves the use of Y shaped posts with three strands of barbed tape or wire in each arm. As a final deterrent, coils of barbed material can be included in the crutch, but this gives a forbidding appearance which may be socially unacceptable in some locations. The use of such enhancements on lower fence areas readily accessible to the general public is not recommended in view of its potential to cause injury.

Welded mesh is more effective because it is constructed from steel wire or rod electrically welded at every intersection and usually galvanised or PVC coated after manufacture. It is essential that the mesh size is small enough to frustrate cutting and make finger and foot purchase on the fence

Fig 3. Welded mesh fence with barbed tape topping

Fig 4. Palisade fence

seriously difficult. Mesh wire should be 4mm as a minimum. Such fences are favoured by the prison and military authorities. Chain-link and welded mesh can be extended below ground level or fixed to a concrete foundation to increase security by preventing burrowing under the fence line. Best practice for backfilling a buried fence is to fill the trench with shingle.

Palisade is a vertical steel fencing system used on areas that require medium to high security. Costs vary depending on specification, from a general purpose design manufactured to *BS 1722-12 Fences. Steel palisade fences. Manufacturing and installation Specification* through to police preferred 'Secured By Design' and Home Office approved CPNI (Centre for the Protection of National Infrastructure) rated systems for CNI (critical national infrastructure) sites. One benefit of palisade is that it can be installed on sloping ground with greater tolerance for fixings than rigid mesh panels. Climbing is difficult without aids and fairly significant force must be used to overcome the fence.

Palisade should be supplied galvanised as standard offering a maintenance free life span of up to 50 years with polyester powder coated options available in a range of colours. Although ease of dismantling is a potential weakness on general purpose palisade fencing (Fig 5), Secured By Design and Home Office approved designs offer fencing that has been tested and passed various attack standards. Vandal resistant shearnuts should be supplied as standard, with a choice of head toppings available including triple pointed.

Fig 5. Palisade fence 'pendulum' attack

Other forms of security barrier

Proprietary electric security fencing provides an 'active' physical barrier and is designed to administer a disabling (but not harmful) high voltage electrical shock in addition to serving as a detector (typically using a mechanical taught-wire method). The product can be deployed to a desired height at the top of a wall and the protection is maintained across gates.

The electrical shock component of the technology is based on the similar, well established and familiar technology for controlling livestock in the farming industry. Although the providers of this specialised measure hold that the electric shock is not in itself

harmful (they typically make available independent expert evidence in support of this) it is assumed that an unknowing, reckless or intoxicated would-be trespasser is more likely to incur an injury than if tackling a 'passive' fence. The need for adequate warning signs is consequently paramount. Suitable signs are generally supplied with the product and attached at recommended intervals by the installer. Prospective owners may additionally wish to check that their liability insurer is comfortable with what is proposed.

This is a high security perimeter solution, undoubtedly with a credible track record, which offers a specialist solution to protect a high profile target and/or one where the ability of conventional fencing to exclude intruders is in doubt. It is employed at national infrastructure sites and elsewhere and is particularly effective where linked to a CCTV system.

Hedge planting can be used as a demarcation line or as a deterrent to access. The more 'aggressive' species can prevent approach to the base of a wall quite effectively (but beware of obscuring the users' view of attempted/actual breaches or damage). The main problem is one of continuity; for security the planting must have no gaps and in practice it is rarely possible to be sure of this.

Fence standards

Recognised standards exist for commonly specified security fencing of different types and at variable grades of intrinsic security, ranging from 'general-purpose' to 'high security'. The level of security demanded of the fence should be dictated by the conclusions of a security risk assessment carried out by a stakeholder, adviser or reputable provider. This should determine the security rating to be aimed at taking all relevant factors into account such as barrier surveillance in worst-case conditions, the tools that could potentially be employed and the amount of time conceivably available to criminals before discovery.

Typical of the fencing employed where the security need is significant, i.e. exceeding the mere exclusion of children or casual trespasses, includes the following:

- palisading to *BS 1722-12 Fences. Steel palisade fences. Manufacturing and installation. Specification*

Fig 6. '358' welded mesh fence

- open mesh steel panel fencing (including expanded metal and '358' welded mesh panels aka 'prison fencing') to *BS 1722-14:2006 Fences. Specification for open mesh steel panel fences*
- security rated fences, irrespective of type, meeting grades SR1 to SR5 of *LPCB LPS 1175 Requirements and testing procedures for the LPCB approval and listing of intruder resistant building components, strongpoints, security enclosures and free-standing barriers*
- security rated fences, irrespective of type, approved by Secured by Design 'police preferred specification', (usually tested to one of the above standards)
- electric fencing to *BS 1722-17 Fences. Specification for electric security fences. Design, installation and maintenance*

GATES

- A gate should be regarded as a continuation of the fence or wall:
  - when closed it should provide an equivalent degree of security against both vehicular and pedestrian entry
  - it should be the same height as the fence or wall and made of the same or equivalent material
- As wide gates are more difficult to secure than narrow ones, gates should not be wider than the usage demands.

- Double gates can be used, subject to:
  - Effective locking bolts being used to secure the 'dead' leaf of the gate;
  - Securing with a padlock on the inside through fixed security pattern locking bars.

Chains should not be used with padlocks as they constitute weak points and also allow unwanted movement between the closed leaves.

- Guidance on gates and locking devices is to be found in various parts of BS 1722: part 10.

Hinged gates

- Hinges should be of a type that ensures that one edge of the gate is permanently secure:
  - lift-off hinges should not be used – unless a retaining nut or fixture is welded to the hinge pin to hinder/prevent removal by lifting
  - hinges should be permanent fixtures, not capable of being removed easily from either side of the gate
  - the bolts of strap hinges for timber gates should fix through the full thickness of the timber and the ends of the threads should be burred to prevent removal
  - cast iron hinges should not be used as they are relatively brittle and can be smashed
- wider and heavier gates should be fitted with nosewheels requiring tracks in road surfaces to relieve the load taken by the hinges

Hinged gates, especially those needing nosewheels, may be impractical where there is sloping or uneven ground, and the 'parking' space required by hinged gates may be inconvenient where there is manned access control.

Sliding gates

Where the ground is sufficiently level, a sliding gate may be used.

- a sliding gate should rely on the posts at either side for mechanical support when closed
- it should 'park' parallel with the fence or wall when open, when it is less of an inconvenience in an entrance area
- for narrow openings (up to about 4 m) sliding gates which cantilever from top tracks should be considered, as they reduce problems arising from friction

Traditional sliding gates are slow to operate and those which run wholly on the ground may have considerable resistance. They require more effort to move than hinged gates and are more liable to mechanical deterioration and jamming (Fig 7).

Trackless cantilever sliding gates up to 10m wide, or bi folding 'speed gates' up to 4m wide each gate leaf, are available. Bi folding 'speed gates' generally open and close within 15 seconds.

Power operation

Power operation of gates should be provided:

- where gates, because of their size and construction, are heavy and cannot easily be moved by hand
- where remote activation is required
- only after the consequences of machinery failure have been considered

Power operation is ideal for sliding gates and vehicle-only barriers but more problematic to install on hinged gates and continuous reliable operation may be less assured. If the gates are automated they must be CE marked and have a minimum of two forms of safety equipment compliant with the European Machinery Directive. Deaths have occurred through poorly designed/maintained gate automation systems, which is partly why the National Security Inspectorate (NSI) operates an approval scheme whereby installers

Fig 7. Sliding gate

and maintainers of powered gates, barriers and gate automation equipment may have their work certificated for safe operation.

Remote operation using, for example, cable loops buried in the road, may be operated from a gatehouse in conjunction with an access control system (e.g. a card or token reader), or to allow automatic exit.

Turnstiles

These are a most effective way of controlling pedestrian movement in and out of premises. Designs are available in single or multiple form with non-reversible one-way and bi-directional revolving units. They can be manual, card or remote control operated, and are also lockable.

The 'full height' units must have their roof section enhanced with barbed wire or similar barriers to inhibit climbing by intruders.

When a turnstile is installed, satisfactory provision may have to be made by means of a securely supervised gate adjacent to the turnstile, for access by the disabled, goods deliveries and evacuation of the premises in an emergency.

See RISCAuthority guide: 'S29: Guide to electronic access control systems'.

MOVABLE BARRIERS

The exclusion or control of vehicles is a most important part of the security plan, even if pedestrians are allowed relatively free access. Vehicles provide concealment, shelter, light and power in addition to the obvious facility to transport tools and stolen goods.

In order to control the flow of traffic satisfactorily a barrier should:

- usually open and close faster than a whole gate of the traditional kind
- extend across the full width of the roadway
- impose discipline on the traffic, often in association with a manual checkpoint. (Most barriers are not intended to provide sufficient resistance to prevent vehicles breaking through)

Fig 8. Turnstile

Barriers should be complemented by gates designed to close access completely, so that full security can be imposed during unattended periods.

Types available

The main types of barrier are:

- lifting poles (Fig 9)
- slewing poles
- one-way plates
- rising steps (Fig 10)

Lifting poles (aka rising arm barrier)

A manually operated counterbalanced single pole across the width of the road is probably the most common barrier in use. The fitting of a lightweight rigid wire skirt can hinder unauthorised pedestrians.

Power operation allows remote actuation of the poll and is also commonly available in a number of forms. Lengths are limited to about 5m because of inertia and wind forces, and care must be taken in the vicinity of overhead cables and trees. They are easy to damage.

Slewing poles

These are usually manually operated and there are no restrictions to headroom. They can be used to a limited extent to channel traffic from one lane to another. As with lifting poles they are limited to a maximum length of about 5m, but as they can include some bracing they can be more difficult to damage.

Fig 9. Typical powered lifting pole barrier

Fig 10. Rising step barriers (raised left, lowered right)

One-way plates

Where one-way traffic flows are imposed it may only be necessary to check and control traffic at either the access or the exit point. The unattended flow can be controlled passively by the use of these plates, which effectively bar passage in one direction to small and medium-sized vehicles although larger vehicles could overcome them without great difficulty. They require no power and are highly resistant to damage but it has been suggested that they present a hazard to pedestrians, especially at night.

Rising step barriers (aka rising kerb, rising blocker)

Most vehicles can be effectively stopped by using barriers housed in the road surface. Some have sheer-pins included to protect the mechanism, so that if they are rammed the steps collapse. The barriers require power and adjacent traffic lights. Inductive cable loops are buried in the road surface and there must be sufficient depth available to house the lowered step. Vandal resistance is high – the most vulnerable component being the traffic lights – but as the device is relatively complicated, reliability is sometimes lacking and regular maintenance is necessary. As an alternative to the 'step', similar barriers using steel 'dragon's teeth' are available.

Because rising step barriers may be unsuitable in a roadway used by fire appliances in an emergency, the local fire brigade must be consulted when consideration is being given to an installation of this type.

Perimeter alarm protection

The security of walls and each of the fence types described in this guide can be enhanced by mounting penetration alarm detection devices on them (although electric security fencing usually already incorporates a form of alarm detection). The scope of this guide does not extend to an examination of the wide variety of state-of-the-art technologies available, but the majority of methods employ discrete or linear sensors to detect and analyse mechanical disturbance typical of an attempt to penetrate the barrier (e.g. shock sensors, microphonic cable etc). The protection can be arranged across any gate(s) in the barrier, and alarm devices are fitted that traditionally detect opening by normal means. It is vital that fences carrying intrusion detection devices of this kind are rigid, robust and well maintained.

Note that external alarm systems of all kinds, not least alarm protected fences, are subject to false alarms from a wide range of causes. For that reason, external alarm systems are not allowed to generate an automatic signal that summons the public police service and outputs must be evaluated by a human intelligence (such as an on-site manned security facility) before the police are contacted.

The value of alarm protected fencing is multiplied where a layered approach is adopted whereby the perimeter consists of at least two parallel lines of fencing. This has several benefits. If both fence lines are alarm protected, signals generated by both fence

systems within a time window can be accorded special credibility/priority. Even if only the inner fence line is alarm protected, it is at least protected to a worthwhile extent by the outer fence from many sources of false alarms, such as wildlife, and the challenge to potential intruders is plainly magnified. In addition, the so-called 'sterile' zone between the two fence lines can be exploited by adding CCTV or three-dimensional (movement) detection devices, which any intruder who may have penetrated the outer fence will find difficult to evade while preparing to tackle the inner fence. Expanded information on this topic is to be found in RISCAuthority publication: *Site security: external alarm protection.*

For more information see RISCAuthority guides:

BDM10 Code of practice for the protection of empty buildings - Fire safety and security

S10 Guidance for the protection of premises against attacks using vehicles (ram raids)

S20 Essential principles for the protection of property

S21 Measures for the control of metal theft

S23 Guidance for specifiers of CCTV in security applications

S29 Guide to electronic access control systems

S30 Terrorism – sources of guidance and support

S31 Unauthorised occupation of non-residential premises – guide to managing the risk

Site Security Briefing Note: security lighting

Site Security Briefing Note: site layout

Site Security Briefing Note: external alarm protection

Site Security Briefing Note: manned guarding

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Notes

Notes

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