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Security and resilience — Vehicle security barriers —

Part 2: Application

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 292, *Security and resilience*.

This first edition cancels and replaces IWA 14-2:2013, which has been technically revised.

The main changes are as follows:

— alignment with ISO 22343-1;

— updating of the document in light of changing threat and availability of tested vehicle security barriers (VSBs), i.e. surface-placed and shallow mount systems;

— re-organization of the document for international readability.

A list of all parts in the ISO 22343 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Security and resilience — Vehicle security barriers —

Part 2:
Application

1 Scope

This document gives guidance on the selection, installation and use of vehicle security barrier (VSBs) and describes the process of producing operational requirements (ORs).

It also gives guidance on a design method for assessing the performance of a VSB.

This document is applicable to end users, such as site owners and specifiers, of VSBs, where they are used to protect people in any public or private location from vehicle attacks.

This document does not apply to the performance of a VSB or its control apparatus when subjected to:

— slow speed encroachment;

— slow speed nudging and ramming;

— blast explosion;

— ballistic impact;

— manual attack, with the aid of the vehicle (multiple impacts at slow speed);

— manual attack, with the aid of tools (excluding vehicles);

— electrical manipulation;

— attack on the control systems by any means.

NOTE 1 For manual attack, a variety of test methods exist. For assessing intruder resistance of building components, see LPS 1175[53].

NOTE 2 The VSB is designed and tested on the basis of:

a) vehicle type, mass and speed of the assessed vehicle-borne threat;

b) its geographical application (e.g. climate conditions);

c) intended site location (e.g. rigid or non-rigid soil/finished surface (paving, cobblestone, granite, asphalt).

It does not apply to guidance on design, the operational suitability of a VSB or other impact test methods.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22343-1 , *Security and resilience — Vehicle security barriers — Part 1: Performance requirement, vehicle impact test method and performance rating*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22343-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Introduction to hostile vehicle mitigation

4.1 General

4.1.1 Vehicle-borne threats

Vehicle-borne threats can range from the use of a vehicle for vandalism to determined attacks by adversaries (e.g. criminals and terrorists). The convenience, mobility and payload capacity of a vehicle offers a tactical means to deliver multiple adversaries and weapons (e.g. an explosive device, firearms or other hazardous payloads) closer to their target. Vehicles can also be used as a weapon: to drive into people to cause injury and/or ram into infrastructure to disrupt services.

To conduct such attacks, hostile vehicles can be parked, manoeuvred or rammed into or out of a site, or adversaries can use a deception or duress methodology.

Attacks on the VSB to enable access by the hostile vehicle without damaging the vehicle or occupants can include:

a) physical: forcing/tampering with the VSB or the use of an explosive device;

b) electronic: accessing and manipulation of the VSB control system or interfaced platforms (e.g. access control and building management systems).

A clear definition of the asset(s) (e.g. infrastructure and/or people) to be protected, the threat and how an attack can be manifested should be the foundation of a risk-based mitigation strategy.

4.1.2 Mitigation of vehicle-borne threats

The mitigation of all forms of vehicle-borne threat can be difficult while satisfying other business needs. The following should be considered as a minimum:

a) security:

1) the level of residual risk deemed acceptable by the organization/interested parties;

2) the asset(s) to be protected (see Clause 6):

i) hard target (buildings and infrastructure);

ii) soft target (people and crowded places);

3) the attack method to be mitigated;

4) security measures (their performance, deployment, operational and physical limitations);

5) response to increased threat conditions;

6) enforceable stand-off distance to the asset(s);

   7) security risks induced by safety concerns or systems;

b) business needs:

   1) lifetime cost (training, manning levels, service, maintenance and replacement, procurement options);

   2) traffic management (vehicular and pedestrians);

   3) appearance;

   4) internal and external interested party requirements;

c) engineering constraints:

   1) site topography;

   2) architectural;

   3) VSB technical and performance constraints;

   4) foundations;

   5) buried services;

   6) land ownership and available space;

   7) local authority planning restriction(s) (e.g. height/mass/noise, utilities).

It is important that a security OR (see Clause 16) is developed in conjunction with a user requirement document (URD) and that all key interested parties are involved from the outset.

The considered elements (i.e. security ORs, user requirements) can adversely influence each other. Therefore, early consideration of acceptable compromises should be made, particularly with regard to the security and safety aspects of the VSBs.

Risk assessments should be conducted for safety and security early in the design phase of project planning, during commissioning and after final installation to ensure the level of residual risk is identified and owned by the interested parties (e.g. site and or event owner, security and safety representatives, project manager(s), staff representatives).

These assessments should be shared with or jointly produced by the interested parties and regularly reviewed. Early engagement with the interested parties can facilitate the development of business cases and can help identify potential issues, associated costs and constraints.

There is likely to be a need to allow authorized vehicle movement, to allow the safe, secure and timely transit of legitimate vehicles. Additionally, long-term security issues relating to system reliability and a change in threat level can also compromise the initial ORs.

A change in threat can result in heightened security response levels and VSBs and procedures that cannot operate either safely or securely in that new environment.

Often vehicular access has to be provided through the VSB line. The vehicles can be searched or be of known authenticity before allowing access through the vehicle access control point (VACP). In this instance, a single or multiple access point may be provided through the active security barriers. Where the stand-off measure forms the site boundary or security perimeter, the VACP then typically becomes the first point of challenge for all vehicles.

Regardless of the type of active VSB installed, a secondary access control point should be considered. This is to ensure that where the VSBs fail or there is an incident at the main VACP, traffic can easily be diverted to the secondary location. This location should be able to accommodate the traffic volumes typical to the main VACP while maintaining the same level of operational security.

Where an entrance has more than one VSB (e.g. a separate entry barrier and exit barrier), then each VSB should have independent drive and control systems. This is to prevent a cascade or nodal failure as a result of one VSB developing a fault. They may share the same user interface, hydraulic circuits and electrical systems, but should be designed so that a failure does not disable all VACPs. Provision of an uninterruptable power supply (UPS) or standby generator should also be considered. An unreliable VSB is unacceptable and has additional implications that can include costly compensatory measures to correct the condition.

4.2 Selection of a VSB

The selection of a VSB is dependent on a number of factors, including but not limited to:

a) the threat (see Clause 5);

b) the assets to be protected (see Clause 6);

c) the site (see Clauses 7 and 8);

d) the required performance of the VSB (see Clause 9);

e) the procurement strategy (see Clause 10);

f) deployment and removal of the VSB (see Clause 11);

g) the type of VSB required (see Clauses 12 and 13).

The decision process for the selection of VSBs is illustrated in the flow diagrams in Clause 16, which covers ORs.

5 The threat

5.1 Identify and quantify the threat

Previous and emerging terrorist, criminal or malicious incidents should be reviewed and their relevance to the site considered, regarding the target and attack methods used. Threats can evolve or change with time and it is recommended that periodic reviews of the threat and trends are undertaken, and the results recorded and documented, by the interested parties.

NOTE The national, regional or local security force can be contacted for threat level updates.

There are seven main methods a vehicle-borne threat (e.g. vehicle as a weapon (VAW) or a vehicle-borne improvised explosive device (VBIED)) can be deployed with or without the use of suicide operatives, as follows:

a) Parked vehicles: Unscreened vehicles are parked adjacent to a site, in underground parking facilities or overlooking a site.

b) Encroachment (exploiting gaps in defences): A hostile vehicle negotiates through/round an incomplete line of barriers or an incorrectly spaced line of barriers without the need to impact. An alternative form of encroachment attack is exploitation of an active barrier system at a VACP by a hostile vehicle "tailgating" a legitimate vehicle.

c) Penetrative attacks: The front or rear of the hostile vehicle is used as a ram, either as a single or a repetitive impact, against the VSB.

d) Deception techniques: A "Trojan" vehicle (one whose model, livery or registration is familiar to the site) is used or where hostile occupants negotiate their way through by pretence or by using stolen (or cloned) access control or ID passes. Alternative scenarios include a driver unknowingly delivering an improvised explosive device (IED) or weapon(s) surreptitiously planted in their vehicle by an attacker, or an "insider" bringing an IED/weapon(s) in to their own work site. Deception techniques prey on human and operational weaknesses.

e) Duress techniques: The driver of a legitimate vehicle is forced to carry an IED/weapon(s) or where a guard controlling a VACP is forced to allow a vehicle entry. These are perhaps the most difficult forms of vehicle-borne threat to defend against.

f) Insider: A person with legitimate access willingly facilitates an attack by operating the security measures locally or remotely, managing or issuing access rights or tampering with the security measures.

g) Tamper/sabotage: With the intent of leaving no evidence, this attack facilitates hostile vehicle access at a later time. This can involve altering, weakening or disabling a barrier and/or associated security systems. This can be a physical or cyber-attack that occurs gradually over time or immediately before, in order to facilitate a fast-moving attack.

Consideration should be given to addressing the threat of layered attack scenarios using one or more of the threat types given in this subclause, and how physical and operational security measures should be introduced to counter that threat. For instance, the use of a first hostile vehicle to create a gap by way of penetrative attack or blast which then allows a second to encroach through.

5.2 Deployment considerations

5.2.1 General

The period for which security measures are required (design-life) should be defined.

The threat(s) should be assessed and an identification should be made of whether a permanent, semi-permanent or temporary installation is required as well as the level of protection that the security measure is required to provide.

5.2.2 Installation

For a new installation, the following types should be considered as part of the risk assessment and operating plans:

a) permanent installation, which can require significant civil engineering works and is expected to remain for the life of the asset;

b) semi-permanent installation, which is a hybrid that incorporates some transitory elements that can be retracted or removed leaving any permanent foundation or anchorage *in situ*;

c) temporary installation that may be deployed on the basis that it remains *in situ* for a short period of time. The extent of the remedial measures required upon removal are kept to a minimum.

It is recommended that interested parties consider the advantages of choosing each of the above options where regular events are undertaken at the location, and whether there is a cost benefit to choosing option a) or b) rather than repeated deployment of option c).

It should be decided if, how and from where the system is to be controlled, e.g. controlled locally by guard, from a central control room or through the use of automatic access control systems (AACS).

An assessment and review should be made at regular intervals as to whether the security measures need to be adapted to a change in the threat.

6 Assets

6.1 Identification of the critical assets

The assets and their users to be protected should be identified as soft targets (e.g. people, an area, public event, crowded place) and hard targets (e.g. machinery, infrastructure, equipment, one or more buildings).

If more than one asset is identified, they should be prioritized.

It should be determined whether there is an existing defensible security perimeter and whether there is a need to establish a temporary or permanent perimeter security scheme.

The physical VSB strategy may be coordinated with adjacent interested parties.

6.2 Identification of interested parties

Interested parties should be identified and engaged at the start of the project and include both those who can deliver the solution as well as those affected by the proposed security measures. These include, but are not limited to, management, staff, security, local authorities, public transport, emergency services, utility companies, highway authorities, architects, security consultants, neighbours and landlords.

6.3 Consequence evaluation

The consequences of an attack and the likely disruption in terms of loss of life, damage, and business and financial impact and reputation should be assessed.

Locations or other assets which can suffer short- or long-term disruption to their operations from an attack should be identified. For example:

a) neighbouring buildings (e.g. government, military, residential, business, emergency services, schools, religious sites, other assets);

b) people;

c) major communication networks (above and below ground);

d) control rooms;

e) electricity, water and gas lines or storage facilities (above and below ground);

f) underground tunnels, basements and subways;

g) ventilation shafts;

h) bridges;

i) public transport infrastructure and airports.

Threat displacement should be considered and communicated with all interested parties.

7 Site assessment

7.1 New locations

It should be recognized that the majority of measures to be installed will be retro-fitted to an existing asset, often in an urban environment, with challenges that come with working with existing services and structures, which can limit scope for innovation. When considering a new (green field) location, interested parties should introduce measures which can be specified for the site location, as well as the design of the asset that can incorporate measures from the start of the build. This should minimize any compromise in security and will typically be more cost effective than installing a subsequent retrofit.

7.2 Review of existing security arrangements

Once the site security plans have been implemented that establish the acceptable level of security risk, a change control process should be adopted for any proposed site changes (e.g. site infrastructure, safety related, physical security related, VSB hardware and procedures) to ensure an acceptable level of risk is maintained. As part of the configuration control process, an analysis should be performed that ensures that acceptance of the proposed change does not reduce the effectiveness of the previous site security plans.

The type of vehicles and their frequency of access and egress to the site should be established. The vehicles should also be assigned authorized and unauthorized pre-notified status and the means of access control defined for the different visitor types.

7.3 Site survey

All traversable routes along which a hostile vehicle can challenge a VSB or perimeter should be determined. This includes all carriageways, footways, cycle paths, open spaces and gaps. It should be recognized that there is likelihood that hostile vehicles can travel against the expected direction of traffic. The location and usability of drop kerbs and other adaptations in the streetscape should be considered.

A vehicle dynamics assessment (VDA) should be undertaken as part of the site survey. This provides a formalized evaluation of the speed that a threat vehicle, as identified in ISO 22343-1, can achieve at a specific location round the site. This enables the site to identify products including VSBs that have achieved a performance classification under ISO 22343-1 or an equivalent impact test standard for vehicle security barriers.

In many locations, it can be necessary to incorporate a vehicle swept path analysis to demonstrate the ability of the threat vehicle to access specific location or to ensure that authorized vehicles will not be compromised when accessing the site, by the location of the VSB.

The site survey should incorporate each of the site access locations such that the daily operation of the site is covered and that peak vehicle and pedestrian flow rates can be accounted for in the operation of the VACP and pedestrian barriers where appropriate.

Existing features should be identified that can be integrated into the vehicle mitigation scheme, such as enhanced street furniture and traffic management measures. Consideration should be given to the effect on security of possible future changes to these features.

Any environmental conditions that can arise throughout the year that can be particular to the site should be identified, such as flooding, leaf mulch, frost, snow, ice, high wind speeds, sand storms or extremes of temperature (see 7.5).

The existing road surface, kerbs and verges, gradients, camber or crossfall, at and in advance of, any proposed VSB location should be considered.

Any existing, or proposed road improvements or other works in the immediate area should be confirmed through the local planning office and highways department.

The need for a wider area traffic management plan should be reviewed and the impact of a perimeter security scheme on existing traffic movements should be considered.

If the potential threat exceeds the current security arrangements and any currently deployed VSBs' capability, additional protective measures should be considered.

The presence and location of all underground and above-ground services and utilities should be considered.

7.4 Traffic survey

Where appropriate, traffic surveys should be commissioned to identify traffic patterns and legitimate vehicle types at all proposed entry and exit points for representative periods. The peak traffic times and volumes and any special days/occasions which can create different traffic movements should also be identified.

The survey should consider the various categories of vehicle and their occupants that need to enter the proposed security zone legitimately, including public service vehicles, delivery vehicles, over-sized vehicles, taxis, very important people (VIPs), employees and emergency services. Site design should also accommodate infrequent over-sized vehicle access. Non-motorized vehicles and pedestrian movements should also be included in the survey. Contingency measures (e.g. movable elements of the VSB) can be used for infrequent over-sized vehicles and separate access points can be necessary to handle the volume of delivery vehicles determined by the traffic survey.

NOTE 1 See Clause 8 for additional site design considerations.

NOTE 2 Over-sized vehicles can include cranes, vehicle-mounted plant, multiple trailer vehicles, emergency equipment with extended wheelbase dimensions, etc.

7.5 Civil works

7.5.1 Variations between VSB performance under vehicle impact test conditions and site conditions

Having identified a VSB with a performance classification that meets the requirements of the specific location, it should be recognized that the impact test will be undertaken within specific parameters. Therefore, the site should ensure that the site conditions are recognized when installing the VSB in order that the performance rating is maintained and the VSB will operate reliably.

Factors that should be considered, include but are not limited to:

— urban areas, where utilities are frequently present;

— low temperature locations, i.e. frequently below –10 °C;

— high temperature locations, i.e. frequently above 40 °C;

— desert environments, where soil conditions are significantly different;

— wetland environments, where soil conditions are significantly different.

It is recommended that a suitably qualified engineer determines how the VSB can be affected by non-standard conditions and assess whether the VSB is fit for purpose under site conditions. It is recommended that the engineer has experience in geotextiles, structural and mechanical work.

A process that should be followed to minimize the likelihood of performance variation is shown in Figure 1.

If a VSB is being evaluated for use at a specific site, it can be beneficial to test the VSB in a site-specific construction.

NOTE 1 A suitably qualified and experienced engineer can then evaluate the test result and adapt the installation for the specific site. See EN 1317-1 or Reference [49].

NOTE 2 Reference [51] contains information about soil varieties.

It is known that varying the type of foundation (rigid/non-rigid) in which a VSB is installed or the surface on which it is placed can affect the performance of the VSB. Further testing can be required if the tested conditions differ from the site conditions.

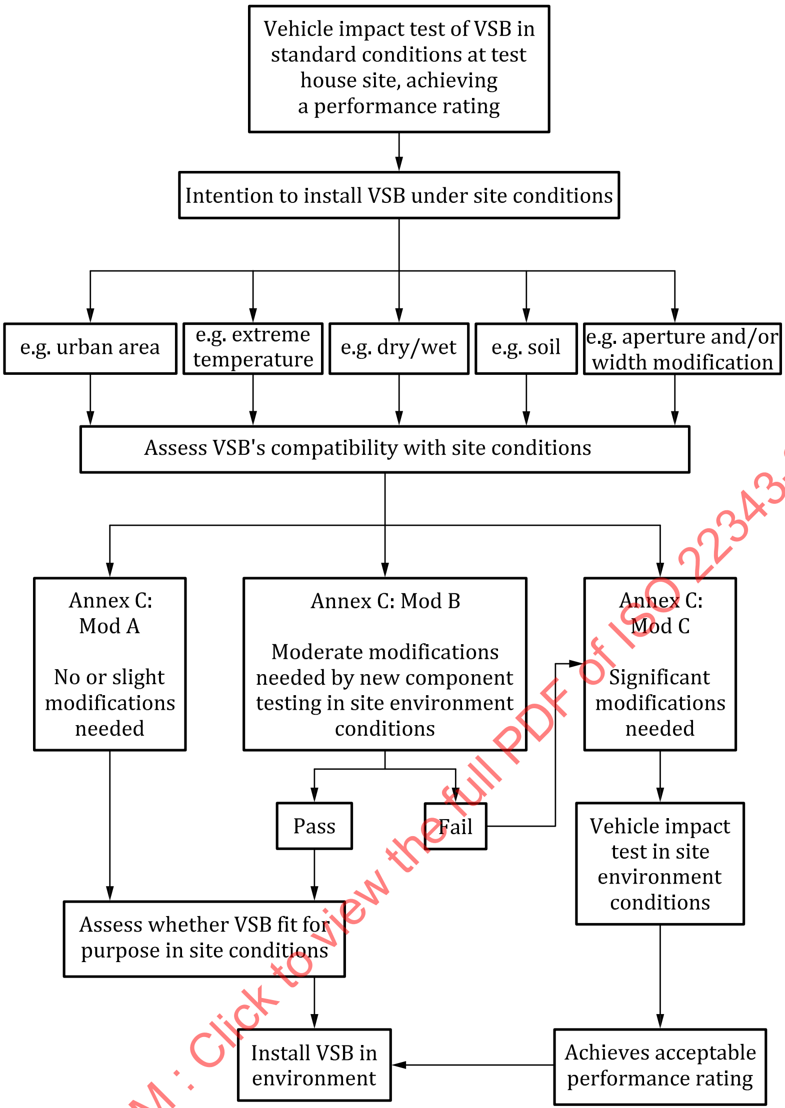


Figure 1 — Process for assessing a VSB for use under site conditions

7.5.2 Ground types

The ground should be assessed for its suitability for fixing to and supporting the selected VSBs.

It is recommended that this be assessed by a suitably qualified and experienced civil/structural engineer and appropriate preparatory or remedial measures taken to ensure suitability. It is recommended that the engineer has experience in structural and mechanical work.

7.5.3 Foundations

The depth required for foundations as well as the supporting ducting infrastructure for foul water drainage, sump pumps, soakaways, power and signal cables and contaminant (oil) collection should be assessed.

The ability of the concrete mix to flow in and around foundation steel (sections and reinforcement) should be considered to minimize voids and aggregate segregation.

In many urban locations, underground services tend to be very close to the surface and often pass through gateways that are to be protected. In such locations, consideration should be given to surface-mounted products, shallow foundations or those with foundations designed to accommodate underground services.

VSBs typically require a stable foundation. Consideration should be given to the suitability of any foundation to provide adequate resistance to the forces applied.

A VSB may be tested in a rigid foundation and/or a non-rigid foundation. When selecting a VSB, the application for which the foundation is designed should be taken into account. Where a VSB has been tested in one type of foundation but its application is considered in a different foundation, an engineering assessment should be made as to whether the VSB is appropriate and will perform as required.

Some VSB systems need to be mechanically secured to the foundation or be made suitably robust by way of using dowels or bolts. Rebating or trenching can be enough by itself or may be combined with additional mechanical fixtures to add strength. Other VSBs are designed to be laterally displaced and rely upon friction against the substructure to dissipate impact energy and resist movement of the VSB.

In general, the larger the force to be resisted, the greater the required size of foundation. Otherwise, there can be insufficient support to enable the VSB to achieve its design requirements and required impact performance.

Foundations are required to satisfy two principal objectives, as follows:

a) To provide adequate support for the VSB. This is usually achieved by the strength of the concrete, the design of the reinforcement and the overall size of the foundation, particularly with regard to its depth.

b) To provide adequate resistance to foundation movement/rotation. This can occur when the VSB remains intact after an impact. If it is not deformed or displaced, then it does not absorb a large proportion of the impact energy. If the foundation is embedded into the subsoil, a concrete foundation is almost always necessary in order to achieve the durability and design-life requirements.

When designing a foundation, prior knowledge of the sub-surface conditions of a site is essential and this should be obtained by site investigations such as ground radar supported by trial pits or inspection trenches. Historic records of site services can be unreliable and desktop method of site survey is not recommended as a replacement for the physical investigation outlined above. The presence of services can limit the available construction depth, and in extreme cases, re-routing of services can be the only option.

It is recommended that any foundation design, including those meeting site-specific requirements, be approved by a suitably qualified and experienced civil/structural engineer.

7.5.4 Surface-placed VSB

Friction between surface-placed, non-anchored VSBs and the supporting surface is key to achieving the performance of the VSB under impact. Placing the VSB on a surface which is harder/softer than the surface used for testing will have a significant effect on the performance classification, such that the performance is not necessarily predictable. Environmental effects such as weather conditions, especially rain, snow or ice, can be detrimental and therefore the possible implications on protection should be considered.

8 Site design

8.1 Traffic management

The requirements for vehicle entry and exit through the security perimeter and the options for access control management should be assessed. The type and frequency of vehicles passing through the security perimeter influences the choice of VSBs.

The following traffic management issues should be considered:

a) the number of entry and exit points during routine operations (including the possibility of limiting traffic to one entry and one exit point during routine operations);

b) the locations of the entry and exit point(s) (same or different locations);

c) the need for a vehicle marshalling, holding and/or search area; the provision of off-site delivery consolidation;

d) the potential risks created by the VSB, cordon (i.e. search procedures) and traffic management scheme (e.g. those with legitimate access becoming at risk from accident or attack if delayed at the perimeter);

e) the arrangements needed for vehicles that are not to be permitted entry (e.g. off-site parking or drop-off areas);

f) the need for rejection routes or lanes;

NOTE 1 This is to avoid the need to open VSBs to grant entry and exit to errant vehicles for the purpose of turning around.

g) the identification of vehicles that require access to the asset and management of their attendance/arrival, and the segregation of staff and visitors;

h) speed management/reduction features necessary to enhance safety and security;

i) warning signs/lights/road markings needed to indicate the presence and status of the VSB;

j) distance needed between warning signs and the VSBs;

k) provision of safety and security lighting (it is recommended that where measures are placed in pedestrianized areas, these be clearly marked);

l) maintenance of sightlines for guard force and road users;

NOTE 2 Ancillary equipment (e.g. hydraulic cabinets) can affect sightlines.

m) reaction time needed for emergency operation of the VSB (it is recommended that the VSB always be deployed so as to keep the site secure and only operated under controlled conditions to enable access to site);

n) prevention of “tailgating” vehicles;

o) traffic types and volumes;

p) the separation of pedestrian and vehicular traffic and the distance of pedestrian crossing points from VACPs;

q) contingency measures (e.g. for VSB maintenance/failure) to provide the same or greater resistance to attacks by the threat applicable to the site;

r) maintenance of access for business-critical vehicle movements at all times;

s) maintenance of access in a timely manner for the emergency services at all times;

t) speed of operation of active VSB(s) for both peak and off-peak access.

Based upon the threat applicable to the site, proposed vehicle access control measures and procedures should be analysed to determine if and how they can be compromised by attack scenarios.

8.2 Aesthetics

It is advisable to consult with the local planning authority at an early stage of the design and procurement process, to gain insight on the acceptability of the project and to identify what documentation needs to be submitted in order to be granted approval under the planning process.

The visual impact, including layout, construction and appearance, of some VSBs can deter an attacker, whereas others can appear less robust despite performing well.

NOTE The appearance and location (e.g. close to a public highway) of the VSB and any associated security devices can be subject to planning, building and highway regulations.

9 VSB performance

9.1 Impact performance

As impact test standards for VSBs have developed, there will be products that have been tested in accordance with standards which include ISO 22343-1, IWA 14-1, PAS 68, CWA 16221 and ASTM F2656. The end user should make sure that they are aware of the differences between the standards in order to make an informed decision on the product to be specified.

Where modifications to the VSB are required for a specific site, these should be reviewed within the context of Annex C.

The end user should ask to see all documentary evidence from the manufacturer relating to the impact test(s) for the VSB(s) that have been identified for the site.

It is recommended that when specifying a VSB, documentation does not restrict choice to a single impact test standard, in order that the maximum product choice is available for the specific location.

It is recommended that when specifying a VSB, the user is aware of the performance of the VSB against slow speed attacks, i.e. nudging, ramming and pushing.

Vehicle impact tests are dependent on the characteristics of the test vehicle and the specified VSB for the location should have a performance classification for the identified threat vehicle and impact speed.

NOTE 1 The award of a performance rating does not imply that a barrier will perform, as rated for this single impact test, in all site applications and against all vehicles types or test options (mass, speed, or impact angle) specified in the impact test document.

NOTE 2 If there are differences between the tested vehicle and threat vehicle, mass, speed and impact angle, it can be necessary to consult a suitably qualified and experienced structural/mechanical engineer to assess the VSBs capability to resist the threat vehicle.

9.2 Vehicle speed

9.2.1 General

ISO 22343-1 tests the performance of a VSB against an impact from a vehicle travelling at a specified speed. Caution should be exercised when specifying a VSB.

EXAMPLE It can be assumed that a rising arm barrier impact tested with a truck can stop all vehicle types up to that mass and speed. However, the rising arm barrier design can allow a smaller vehicle, such as a car, to force the rising arm up and the vehicle to pass under the barrier.

Vehicle speed is an important factor in determining the kinetic energy of a moving vehicle at the point of impact. Physical characteristics of the VSB and threat vehicle as well as the vehicle dynamics and the geometry of the roadway should be taken into consideration when selecting a VSB.

A range of speed reduction features (see 9.2.4) is available and should be considered where appropriate while taking account of any access that can be required for emergency service vehicles.

9.2.2 Vehicle dynamics assessment

A VDA should be undertaken at each specific site/location in order to determine the impact speed for the identified threat vehicles such that risk can be assessed and suitable VSBs can be specified.

9.2.3 Road layout

There is the potential to limit the approach speed of the vehicle, e.g. through changing the approach road layout to induce the driver to slow to an appropriate speed or risk losing control of the vehicle. However, precautions should be taken to provide adequate warning to an errant motorist based on national/local guidance.

9.2.4 Speed reduction features

Speed reduction features (e.g. chicanes, serpentines) should be constructed from vehicle impact rated products. One element of the feature can be removable or retractable to enable over-sized and emergency vehicles' entry if alternate access arrangements are not available.

9.3 Impact angle

The majority of impact tests on currently available VSBs are undertaken at 90° to the approach of the specified threat vehicle and therefore the VSB design and its foundation are optimized for this impact. When the site survey and threat assessment is undertaken, the approach angle of the threat vehicle should be considered and in addition to the ability of the identified product and its foundation to withstand the impact if not at 90°.

Where shallow impact angles are specified, the possibility of the vehicle being redirected rather than stopped should be considered.

9.4 Vehicle penetration distance and major debris distance/coordinates

9.4.1 Vehicle penetration distance

Some physical perimeter security schemes allow for vehicle penetration to be a prescribed distance beyond the VSB datum line. Vehicle penetration distance is recorded for product tests undertaken in accordance with ISO 22343-1.

NOTE Where vehicle penetration exceeds 25 m under ISO 22343-1, the VSB does not receive a performance classification.

9.4.2 Major debris distance/coordinates

Some physical perimeter security schemes allow for major debris dispersal beyond the VSB datum line. Subsequently, several VSB designs allow for major debris dispersal. It is a requirement of the ISO 22343-1 test method to record (as an observation) the major debris distance post-impact.

This aspect of the impact between the vehicle and the barrier can be considered relevant when allowing for a vehicle component breaching a building or, for example, part of its load passing into a sensitive area.

9.4.3 Stand-off distance

The stand-off of the VSB and the asset to be protected should be taken into account when specifying the product for the specific location. A VSB should be positioned at a distance from the asset that exceeds the penetration distance, major debris distance and blast stand-off.

NOTE Having insufficient stand-off distance means there is a risk that the asset is hit by an impacting vehicle, major debris or increased blast loading. To achieve sufficient stand-off distance, it can be possible to specify a VSB with a lower vehicle penetration distance and/or major debris distance, re-position the VSB or relocate the asset.

9.5 Operational performance

9.5.1 Vehicle access control

Often vehicular access has to be provided through the VSB line. The vehicles can be searched or be of known authenticity before allowing access through the VACP. In this instance, a single or multiple access point may be provided through the active security barriers. Where the stand-off measure forms the site boundary or security perimeter, the VACP then typically becomes the first point of challenge for all vehicles.

Regardless of the type of active VSB installed, a secondary access control point should be considered. This is to ensure that where the VSBs fail or there is an incident at the main VACP, traffic can easily be diverted to the secondary location. This location should be able to accommodate the traffic volumes typical to the main VACP while maintaining the same level of operational security.

Vehicle access control measures should be identified as follows:

a) manual: no control system required, physical operation by guard for all movements;

b) semi-automatic: opened or closed by guard using push button control and/or closing automatically via detection loops or similar;

c) fully automatic: opening by an access control system, closing automatically via detection loops or similar;

d) automatic system technologies such as automatic number-plate recognition (ANPR) should not be relied upon as the sole means of identifying and enabling access by a vehicle into a site.

The following factors should be considered at access points:

— prevention of “tailgating” (e.g. by a second set of VSBs located past the first set of VSBs that are closed and only released when the vehicle has been cleared for entry and the initial barrier has been closed);

— remote control override with emergency close/reset;

— VSB working with other equipment (e.g. rising arm barriers or gates);

— security of control unit;

— how the VSB is to operate in the event of a power or system failure.

The ability for an attacker to covertly defeat inductive detection loops to gain access (e.g. by sliding a metal plate over free exit induction loops or activate any free exit detection system) should be considered.

Maintenance, operation and removal costs in conjunction with the development of life cycle costs of both permanent and temporary physical perimeter security schemes should be considered.

9.5.2 Speed of legitimate access

When considering the design of a VACP, it should be noted that most VSBs are only effective at stopping a vehicle when closed. The type of VSB, speed of operation, system duty rating, traffic volumes, mode of operation, safety systems, driver and guard force attentiveness, and system reliability can all compromise the effectiveness of the VSBs in stopping a hostile vehicle.

9.5.3 Power requirement

How a VSB system functions in the event of a power failure should be identified. The following information should be obtained to develop an informed specification or policy:

a) The position of the VSB, upon primary power loss, is acceptable to establish and maintain security;

b) An uninterruptible power (UPS)/generator backup power system is available, if immediate backup power is required to establish and maintain security to an acceptable level. The indication of backup power start-up should be sent to the site security force (or an appropriate monitoring station) in both an audible and visual manner (e.g. by phones, intercom or AACS).

c) The power supply can be from two physically diverse and stable routes (the safety implications of the VSB position/movement given a primary loss of electrical power to the VSB system).

d) The VSB position when switched between power supplies.

e) The VSB does not change position when switched from:

   1) primary power to no power (when no UPS/generator backup is used);

   2) primary power to UPS/generator backup;

   3) UPS/generator backup to primary power;

   4) no power to primary power.

f) Any provision for surge protection for electrically powered security equipment to protect against lightning strikes.

g) How the power failure and source of failure is indicated and if the indication is acceptable.

   NOTE Typically the indication goes to a guard location and emits both audible and visual signals. For high security sites, the indication can go to a primary and secondary alarm station.

h) If after a primary power failure, the manual operation of the VSB system can be accomplished in such a manner that security is maintained at an acceptable level.

i) If alternative security measures have to be applied after primary loss of power to the VSB system, and if the time required to implement them maintains risk to the acceptable level.

9.5.4 Environmental conditions

The durability of the VSB depends on how and where it is deployed. The following factors that affect durability should be considered:

a) low temperature effects (e.g. slippery road surfaces, VSB freezing in position or failing (increase in oil viscosity or freezing of wheels or external gears), increased corrosion due to road salt and grit deployment, potential damage due to snow ploughs);

b) high temperature effects (e.g. overheating of motors, hydraulic systems or control systems, distortion of components parts);

c) VSB system contamination, and accumulation of contaminants (contaminants typically consist of industrial pollutants, sand, dirt, water, saline solution, sediment and/or vegetation);

d) UV radiation specific to site conditions (this can degrade the acceptable performance of signage and coatings or components of the VSB system);

e) lighting conditions (including whether visibility of the VSB, signage and lane is reduced because of seasonal weather conditions such as bright sunlight, fog, rain or other extremes of weather);

f) water management (e.g. VSB drainage system to manage precipitation and/or high-water table conditions and/or flooding);

g) accidental loss of system fluids into the environment (as this can be in violation of local environmental regulations) and/or into the VSB system;

h) the specification for protective coatings (corrosion) and seals (prevention of ingress of detritus and moisture).

9.5.5 Design criteria

The following design factors should be considered:

a) type of entrance (e.g. staff, deliveries, construction, emergency access);

b) number of operations per day;

c) peak operating cycle and time of day;

d) types of vehicles and the loads they apply to the VSB (e.g. vehicle axle loading and the effect of vehicles' acceleration, deceleration and turning);

e) maintenance regime required based on usage (specific to the VSB not the site as a whole);

f) type of access and exit control.

9.6 VSB integrity

9.6.1 VSB damage

The ability of the VSB to operate and be effective following a low-energy impact accidental or deliberate act should be considered.

Consideration should be given to whether the VSB has undertaken multiple impact tests on the same system to evaluate its ability to withstand secondary attack situations and maintain operation post-impact (e.g. to maintain access for emergency services or evacuation).

Guarded or unguarded site of deployment (e.g. precautions against tampering, manipulation and vandalism can be required).

NOTE It is not a requirement of ISO 22343-1 to conduct more than one impact test. Multiple impact testing at low speed can be found in Reference [52].

9.6.2 Remote access to automatic access control system

For VSBs that have separate control systems, it is necessary to situate these in areas where they cannot be accidently or deliberately accessed or damaged.

Drive systems and control cabinets located out of sight of the VSB can, for safety reasons require an additional technician to work on the VSB system, possibly to ensure "eyes on" when the VSB system is being operated or to help facilitate the repair or maintenance process.

Some manufacturers also offer remote (off-site) diagnostics and override capabilities, whereby technicians can access the VSB control system to assess and repair faults, analyse the system and reprogramme. Such capabilities can be very useful but can also provide an avenue to aid attack planning for an adversary. The following should be considered to mitigate any perceived security threat:

a) network security should be considered, in addition to whether the VSB(s) and associated AACS are independent from the main site security and its operation;

b) the security of the communication between the VSB system and the remote off-site technician for site purposes (e.g. communication can require dual redundant paths or encryption to a certain level to ensure security is maintained at an acceptable level);

c) the trustworthiness of those monitoring/servicing the VSB and the need to implement access authorization processes upon them;

d) what information can be downloaded from the VSB system to the remote off-site location;

e) if information can be downloaded, whether the information security provisions applied to it at the remote location are acceptable;

f) whether the VSB can be operated remotely without site authority; if the VSB can be operated remotely without site authority, whether administrative controls and/or hardware controls need to be designed and implemented to ensure the site has authority over any operation of the VSB system;

g) whether safety systems of the VSB can be overridden by the remote off-site communications.

9.6.3 Repairs

In the event of a vehicle impact or system failure, the following should be considered:

a) who is responsible for the VSB (e.g. security department, site facilities);

b) what is the procedure for escalation of the issue to the relevant team;

c) who is responsible for manually overriding the barrier in the event of a system failure;

d) response time of contractor, to arrive on-site and investigate the fault;

e) the training and qualification of the service technician;

f) time to repair the VSB;

g) availability of spare parts;

h) how security or safety procedures can delay contractors gaining access;

i) service contract obligations, management and enforcement of the terms and conditions;

j) the need to deploy temporary security procedures or an alternative VSB.

9.6.4 Staff, skills and availability

As well as the training required for the safe and effective use of the VSBs, staff should also be issued with site-location specific assignment instructions and specific VACP procedures.

These procedures should cover, but are not limited to, traffic management, checking passes, rejection of vehicles, vehicle screening, emergency vehicle access, site evacuation plans, dealing with threats, incident management, shift changes, reporting procedures, breakdown of equipment, accidents, changes in security response levels, and communications between the security control room and other members of the security team.

Staff training and working hours' implications (time of day for specific shifts, number of hours per week, fatigue considerations) and any manual handling issues, such as the force required to lift, lower, swing, pull or push manual VSBs, should be considered. Also, the number of operations that staff are required to undertake in order to operate the VSB should be considered.

Where temporary measures are used, it is recommended that their location be considered in order to enable permanent measures to be deployed without compromising site security.

9.7 Design method

There are an increasing number of VSBs being offered to the end user which state that they meet the requirements impact test standard for VSBs, using the design method. Such products generally have not been subjected to a full-scale impact test and the end users should be cautious of using such products without the full understanding of the associated residual risk in purchasing such products.

It is recommended that the design method is only used to support the modification of an existing VSB where interpolation between two existing full-scale impact tests may be used for evaluation. Finite element analysis (FEA) may be used in support of the evidence presented for the evaluation of the change by a suitably qualified engineer with experience in full-scale impact testing of VSBs.

The use of FEA modelling is not accepted as a standalone tool for the design of a VSB without validation of the final design against a full-scale impact test (see Annex B).

10 Procurement strategy

10.1 General

In addition to the cost of providing the security measure(s), a number of other factors influence procurement strategy. The procurement team should seek evidence that products specified meet both ORs of the site together with current and future requirements of the site's threat assessments.

10.2 Availability and maintenance of the VSB

The following should be considered:

a) the lead time for the design and deployment of the VSB: a temporary measure can be required before a semi-permanent or permanent solution can be implemented;

b) the whole life availability of spares or replacement units in the event of failure/damage;

c) the terms and scope of the warranty period and who is responsible for inspection and maintenance while the warranty is in effect;

d) development of contingency measures when maintenance work is being carried out or when the system has failed [see 9.6.3 h)].

10.3 Quality

The manufacturer of the VSB should operate and conform to an internationally recognized quality control system such as ISO 9001.

10.4 Cost

Life cycle costs should be considered by assessing the following costs over the expected time period of use of the VSB:

a) design;

b) installation costs;

c) service diversions;

d) integration with other security systems;

e) system hardware and software upgrades including licensing;

f) staffing levels;

g) planning consent;

h) liaison with other interested parties;

i) project management;

j) long-term training;

k) maintenance and service;

l) spare parts;

m) warranty period and exclusions;

n) decommissioning, removal and disposal.

10.5 Commissioning and handover

At the outset of the project, consideration should be given to the means of evaluating the operational (non-impact) performance of the VSB at commissioning. The process of defining the commissioning and handover requirements starts with the production of the OR (see Clause 16), the detail of which should then be developed in the performance/purchase specification. In addition to the VSB clients commissioning sheets, consideration should be given to undertaking factory acceptance and site-specific acceptance tests. These should be developed at the specification stage of the project.

A training programme should be developed, documented and implemented to ensure all operators are trained in the safe use of the VSB (see Clause 14).

The VSB should be supplied, where applicable, with installation drawings, cable and circuit diagrams (electrical and hydraulic), foundation and civil engineering drawings, Programmable logical controller (PLC) ladder diagrams, control console diagrams and operation and maintenance (O&M) manuals. The O&M manuals should be site-specific and include the following as a minimum and where required:

— introduction to the VSB;

— list of recommended spare parts;

— training logs and procedures;

— procedures for operating the VSB;

— troubleshooting;

— system isolation and override;

— planned preventative maintenance procedures;

— schedules and logs;

— service and breakdown logs;

— contact details;

— relevant drawings;

— log of drawings;

— design and technical specifications;

— health and safety;

— risk logs;

— component and/or clients literature;

— emergency response plans;

— test and commissioning procedures and reports.

A suitable maintenance and servicing regime should be planned, costed and resourced (see Clause 15).

11 Deployment and removal

11.1 Highway/local authority approval

Discussions with the highway/local authority at the outline planning stage are advisable.

11.2 Logistics of deployment

Logistics of deployment should be assessed for the following:

a) the possible disruption to site and local environment;

b) the time required for deployment;

c) whether specialist transport, tooling or lifting equipment is required for the transportation or installation;

d) the ability of deployment vehicles (in terms of their mass, width, height and turning circle/radius) to reach the site to be protected.

11.3 Installation

Installation should be assessed for the following:

a) the time required for installation;

b) the need for quality control, compliance and site inspections;

c) ease of installation (this is important if the units are to be rapidly assembled without undue complication);

d) subsequent access to services in chambers, cabinets or overhead;

e) compliance with the design drawings (checking/validation).

11.4 Lifting and placement

A pre-deployment and engineering assessment of the site should be conducted.

Lifting and placement issues should be assessed for the following:

a) whether overhead lifting of equipment for installation is necessary (this has health and safety implications and the potential for damaging street furniture and overhead utilities);

b) potential problems with heavy lifting equipment or heavy redeployable units sinking into the road surface or affecting underground services or drains, and the outer environmental enclosures/protection of those underground services or drains being subsequently damaged;

c) containment of hydraulic oil when relocating or moving VSBs (some sites require double containment of oil reservoirs and oil spills from hose disconnections through the development and implementation of specific operating procedures to conduct such activities).

11.5 Removal considerations

The work required to restore the area to a pre-deployment condition upon a VSB's removal should be considered.

12 Types of VSB

12.1 General

VSBs as considered by this document are designed to mitigate the penetration of a vehicle when it is impacted. VSBs can be categorized as being passive (see 12.2) or active (see 12.3) and by foundation type measures (see 12.4 and Figure 2).

12.2 Passive VSBs

Passive VSBs are static in nature and include, but are not limited to:

a) fixed bollards (see 12.6.1);

b) planters and street furniture (see 12.10.1);

c) wire rope systems;

d) fences;

e) landscape features such as trees, bunds, berms, ditches, rivers, lakes and structural walls.

12.3 Active VSBs

Active VSBs are machines which can be identified as requiring either a human operator to open and close, and raise/lower, or by having a fully powered system controlled by a human operator or an AACS.

Active VSBs include, but are not limited to:

a) active bollards (see 12.6.3): rising, hinged or sliding;

b) road blockers (see 12.7);

c) rising arm or lowering beam barriers (see 12.8.1);

g) sliding gates (see 12.9.2);

h) cantilevered (gate or beam);

i) tracked (gate or beam);

j) swing gates (see 12.9.1):

   1) bi-parting hinged gates in a straight or v-shaped closed configuration;

   2) single leaf gates;

   3) bi-fold gates (speed gates);

4) swing arm barriers;

k) restraint systems:

1) nets;

2) straps;

3) fibres.

Consideration should be given to the adoption of high reliability engineering techniques both for software (where used) and hardware to ensure reliable safe, long-term operation.

An active VSB may be operated over an internet protocol (IP) network and in some instances over a corporate network. In these instances, a risk assessment on the security and availability of the network should be undertaken to ensure risks are minimized (to the network and the VSB). Ownership and maintenance of the network is critical and should be factored into the lifetime costs of the VSB.

The gaps around the opening segment of a blocker, bollard or gate when fully open (allowing vehicle passage) should be minimized. When lowered, a blocker or bollard and their surrounds should be flush with the adjoining finished surface.

The design of the VSB should account for heat expansion/contraction.

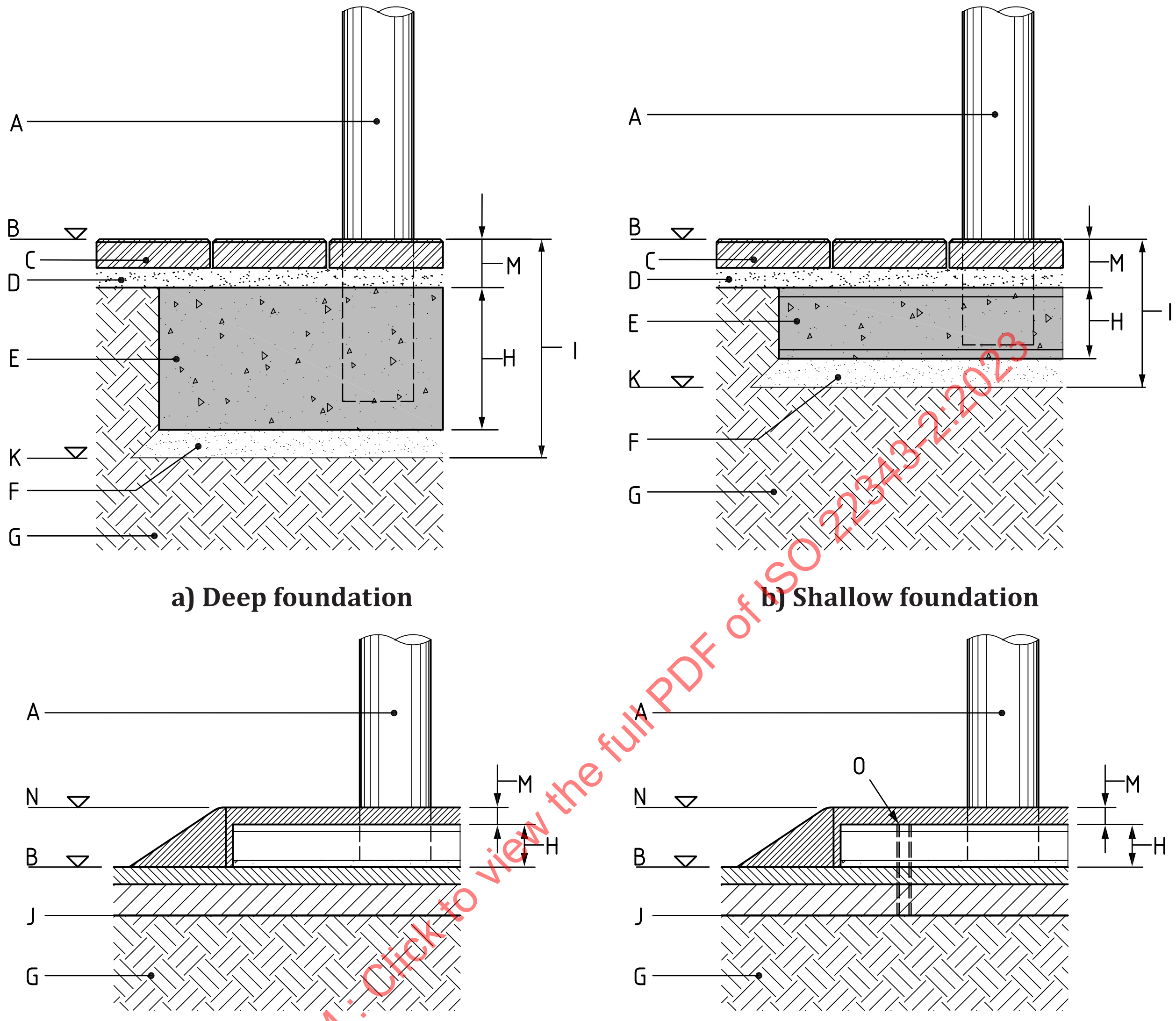
Pedestrians, cyclists and equestrians should have dedicated entrances and exits, which are separate to the VACPs fitted with powered VSBs.

Road blockers, rising bollards and tracked sliding gates are typically installed in locations where they are routinely traversed by vehicles. In such applications, the surface of the VSB should provide adequate grip. The skid resistance of the VSB should be similar to the skid resistance of the surrounding road surface and sudden changes in skid resistance should be avoided. This can be achieved by the application and maintenance of an appropriate surface treatment; the maintenance and repair of which should be covered in the O&M manual. When braking or manoeuvring, two-wheeled vehicles are particularly at risk of sliding on bends and, where appropriate, two-wheeled vehicles and pedestrians should be segregated from other traffic. Further consideration should be given to the axle load and frequency of vehicle traffic, as these can accelerate the polishing or rutting of the running surfaces of the road blockers and rising bollards.

For each site, a risk assessment should be conducted to determine the safety needs of cyclists, motorcyclists, pedestrians and equestrians traversing VSBs that are not supervised/controlled by operators.

12.4 Foundation type

Foundations are categorised as deep (excavation > 0,5 m), shallow (excavation < 0,5 m) or surface placed requiring no excavation (see Figure 2).



a) Deep foundation

b) Shallow foundation

c) Surface placed

d) Surface-placed pinned

Key

A VSB
B existing finished level
C paviors
D pavior bedding
E foundation
F blinding concrete
G natural ground
H foundation thickness
I depth of foundation excavation
J base construction
K formation level
M thickness finish
N new finishes level
O pin

Figure 2 — Foundation terminology

12.5 Foundations and layout

Shallow mount systems can be used in utility rich areas as they require an excavation which generally does not require the utilities to be moved or relocated.

Where the VSB forms part of an integrated solution, any gap between the end of the VSB and other structural features (e.g. additional security measures or building structure) should not exceed 1 200 mm when measured at 600 mm above the finished surface.

Where VSBs are available in sufficient widths to protect (e.g. a 6 m or 7 m wide highway), the VSB should be deployed in each highway lane while ensuring that gaps between VSBs are no greater than 1 200 mm.

12.6 Examples of VSBs — Bollards

12.6.1 General

Bollards are available in a variety of types which can vary in height, cross-section and material and can be either active or passive.

They are suitable for providing protective security where pedestrian permeability is a requirement and are in general installed as passive systems.

NOTE Due to the range of bollard designs available, each installation is individually designed for the specific site location and ground conditions by a suitably qualified and experienced civil/structural engineer.

12.6.2 Fixed bollards

For fixed bollards, consideration should be given to:

a) site ground conditions;

b) type of foundations, e.g. use of continuous or ring beam foundation to provide torsional stiffness;

c) shallow mount systems;

d) bollard spacing: airgap between adjacent bollards to be measured at 600 mm above finished ground surface to impede the vehicle encroachment from smaller vehicles such as micro-vans (e.g. in the United Kingdom and European Union, the maximum airgap is specified as 1 200 mm).

NOTE 1 Bollard spacing and height can be subject to local planning requirements and disability legislation and good practice guidance.

NOTE 2 Alternative measures can be employed to prevent two-wheeled vehicle access between bollards, e.g. chains or rails, but such measures affect pedestrian permeability.

12.6.3 Active bollards

Active bollards are unlike passive bollards in that they are often used as single units or found within a row of passive bollards where access/exit is required. Traditionally, the depth of foundation is at least equal to the height of the bollard when in the raised position. Multiple telescopic, sliding or hinged active bollards are available for areas where deep foundations cannot be accommodated.

Consideration should be given to those issues identified for fixed bollards and to the following:

a) the foundation can be designed for a single unit;

b) the need for a control and operating system (electronic signal control, electrical power, hydraulics, pneumatic);

c) the location of a control point;

d) the type of finish required on exposed surfaces to ensure vehicles do not lose traction, particularly cycles and motorcycles;

e) drainage;

f) the need for regular service and maintenance.

To be successful in performance against impact, the majority of designs need specific foundations designed to resist loading transferred from the active bollard. Foundations may be shallow or deep and may necessitate full width concrete foundations, which in some circumstances can have severe implications on the utilities found within and under the surface of access roads.

12.7 Examples of VSBs — Road blockers

Road blockers (also known as “rising kerbs/curbs” or “wedge barriers”) typically comprise steel wedge-shaped units, hinged at the rear (non-attack face). To permit access, the road blocker lowers into a recess of sufficient depth to accommodate the thickness of the steel surface plate and actuating system.

Selection criteria often include:

a) site ground conditions;

b) vehicle flow;

c) permanent/temporary installation.

Road blockers are available in a variety of types which may vary in height, width, cross-section and resistance to impact. They are generally installed in the roadway to prevent vehicle access to the protected asset. The impact face should be placed facing the direction of threat.

They can be installed as individual units or in pairs, e.g. to form a vehicle interlock system. For two-lane access they may be installed side by side. The majority of designs need specific foundations or fixing detail that is essential for their successful performance against impact.

In certain situations, such as heightened alert status or when temporary protection is required, portable surface-mounted road blockers can be appropriate. These road blockers are typically held in position using pins, driven or drilled, and chemically anchored into the surface of the carriageway up to a depth of up to 150 mm. The road blocker is supplied with an approach and exit ramp of sufficient length to accommodate the total rise to the height of the road blocker plate.

Particular consideration should be given to the types of legitimate vehicles transiting through a VACP fitted with road blockers. For large road blockers, it is possible for the conventional safety systems, typically inductive road loops, not to be able to detect small vehicles that stop directly over the lowered road blocker; suitable additional detection systems should be identified.

The continuous perimeter gap around a road blocker (including the plate and frame) should be minimized, as larger gaps can cause an entrapment hazard for two-wheeled vehicles. Additionally, the perimeter of the road blocker should have, when closed, no material above the finished traffic surface, as this can create a slip hazard to two-wheeled vehicles. The designer should also be aware of components/voids that can trap or injure an individual as the VSB opens or closes.

12.8 Examples of VSBs — Rising arm barriers

12.8.1 General

Rising arm barriers are available in a variety of types which may vary in height, width, beam cross-section and resistance to impact. They are designed to be installed across a vehicle route and are suitable for areas where utilities are located in the carriageway. The operating speed of these barriers can be slower than that of bollards and blockers but is generally equivalent to that of sliding and hinged gates.

The specifier should seek assurance from the manufacturer to ensure that a failure of the hydraulic system, the drive system or other structural components does not allow the beam to fall in a dangerous or uncontrolled manner and that when in the closed position that the arm is prevented from being opened due to accidental impact or malicious use of a slow speed vehicle to force the barrier up and out of the catch post.

12.8.2 Layout

The layout should be assessed for the following:

a) the direction of traffic flow: the design of the latching mechanism for the receiving end of the rising arm may be direction sensitive;

b) overhead restrictions (such as power lines) when calculating the beam length required;

c) the amount of room taken by barrier beam counterweights where fitted and the effort required to lift manually operated rising arm barriers;

d) the clear aperture required for the safe passage of all authorized vehicles; some rising arm barriers do not lift to the full vertical position.

12.9 Examples of VSBs — Sliding and swing gates

12.9.1 General

Sliding and swing gates are available in a variety of types which may vary in height, width, cross-section and resistance to impact.

The following need to be considered when specifying the gate type:

a) run-back space required for sliding/cantilever gates;

b) arc of travel required for swing gates and beams;

c) speed of opening/closing;

d) foundation type: shallow/deep foundation;

e) visual appearance;

f) integration with adjacent perimeter measures (i.e. fencing);

g) manual operation in the event of power or equipment failure;

h) manual locking of gates to an appropriate standard for the security level;

i) safety devices, bearing in mind the range of vehicles transiting and the potential for pedestrian or public injury.

12.9.2 Foundations

Sliding and swing gates usually have specific foundations designed to resist loading transferred from the gate. Foundations may be shallow or deep and may necessitate full width concrete foundations linking the hinge and receptor posts, which in some circumstances can have severe implications on the utilities found within and under the surface of access roads.

Sliding gates can be guided from the “motor post” towards the “receptor” foundation by a rail installed between the foundations. As an alternative, the gate can be supported as a cantilever from the motor post foundation when a ground rail is not practicable.

12.9.3 Layout

Gates offer an additional benefit in that they can often be designed and integrated with an adjacent security fence line. These gates can be either manually operated or powered, although due to their mass it is often better to utilize powered systems.

The drive systems can either be motorized and gear driven or hydraulically operated. Although gates can operate at high-speed, generally for safety reasons it is preferable in normal operations to limit the speed. Provision for emergency close fast action can be designed into a number of gates depending on the drive mechanisms and factoring safety considerations. Gates are not typically as fast in operation as rising bollards or road blockers and are therefore not always suitable for operation in high volume traffic applications.

For security and safety reasons, when designing a gate VSB system, the existing or proposed observation capabilities (e.g. closed-circuit television (CCTV), overwatch) should not be obscured.

The sight lines for the operators or automatic safety systems operating the equipment should be considered to ensure adequate visibility for safe operation.

12.10 Examples of VSBs — Street furniture

12.10.1 General

In order to complement and enhance the urban environment, architecturally aesthetic street furniture products such as planters and seating have been developed to provide stand-off measures which can be integrated with existing street furniture such as lighting, signage, etc., as follows:

a) Surface placed: The VSB rests on the surface and its resistance to movement upon impact is affected by the coefficient of friction between the VSB and the surface on which it is placed. The mass of the unit, the surface the unit is to be set on, the materials the VSB is fabricated from and its displacement when impacted should be considered.

b) Pinned: The VSB rests on the surface and is connected by pins or studs into the ground. These are typically held in position using a chemical epoxy resin. The number, size and material characteristics of fixing pins, the embedded depth of pins, the angle of embedded pins, methods of fixing, the surface into which the pins are fixed and the material the VSB is fabricated from should be considered.

c) Rebated: The VSB is set into a rebate in the surface. The depth of rebate, whether the units require additional anchorage and if the rebate surface is a suitable bearing surface should be considered.

d) Structural: The VSB is engineered with integral foundations. These can be integrated with street schemes and provide, for example, seating areas.

12.10.2 Foundations

The presence of underground services/utilities should be considered at the design stage of the VSB planning activity.

Not only can underground services/utilities restrict the type of street furniture suitable to be installed, but there can be a need to retain access for maintenance of the services.

The degree to which pinning or rebating the street furniture into the surface can supplement the impact resistance it provides depends on a number of factors, as follows:

a) the nature of the sub-grade, paving, asphalt/block work and concrete;

b) the bending and shear strength of the pins;

c) the size, quantity and spacing of the pins;

d) the length of engagement both in the street furniture and in the surface;

e) the depth of rebate.

NOTE When combining measures within the streetscape, it is not always, due to the design of the products, possible to measure the airgap of 1 200 mm at 600 mm above the finished surface. Where measures which are being deployed are less than 600 mm high, the maximum airgap can be measured at the widest point. Adding further elements so as to reduce the risk of the threat vehicle from proceeding beyond the measures can also be taken into account.

12.11 Examples of VSBs — Manually deployable (portable)

In order to temporarily restrict access, manually deployable VSBs which rest on the ground surface have been developed. These VSBs rely upon the surface to provide resistance to movement upon impact either through friction or the system's ability to interact with the surface on which it is placed.

Manually deployable (portable) barriers are usually lighter and are not fixed or anchored to the surface on which they are placed and can have a high penetration rating when impacted by a vehicle at speed. This should be taken into account when planning their deployment location.

Such barriers are likely to be capable of being moved either by persons with hostile intent or by a slow speed vehicle attempting to ram or nudge the barrier, in order to gain access to the protected area and therefore the site should ensure that there is oversight on locations where they are deployed together with a suitable response should this occur.

Deployable VSBs do not have a foundation and rely upon their interaction with the surface, which is critical to their performance, it is therefore important that they are deployed on a similar surface on which they were tested.

13 Vehicle access control points

13.1 General

VACPs are used to control consensual vehicle access into sites or as part of a revenue collection system. Sites should consider the use of vehicle rejection lanes at the first point of challenge such that vehicles can be removed/redirected before entering the vehicle search and screening area for legitimate vehicles particularly at locations with high traffic flows in order that access to the site is not compromised.

Vehicles that do not have a legitimate access to the site should not be allowed to progress beyond the VACP in order for rejection to be achieved.

NOTE Not all barriers at VACPs have performance-classified VSBs. Some barriers can be employed that do not have any inherent structural resilience against unauthorized vehicle access or vandalism. They are often deployed in car parks, business entrances, residential properties and low threat government or military establishments or at the first point of challenge.

Active VSBs are typically installed at VACPs, emergency access points or secondary entrances. There are two types of active VSBs:

a) manually operated VSB: includes a physical barrier and a human operator to physically open and close the VSB;

b) automatic VSB: includes a physical barrier and infrastructure, power supplies, control system, drive mechanism and a user interface, which can be either a human operator or an AACS, see Figure 3.

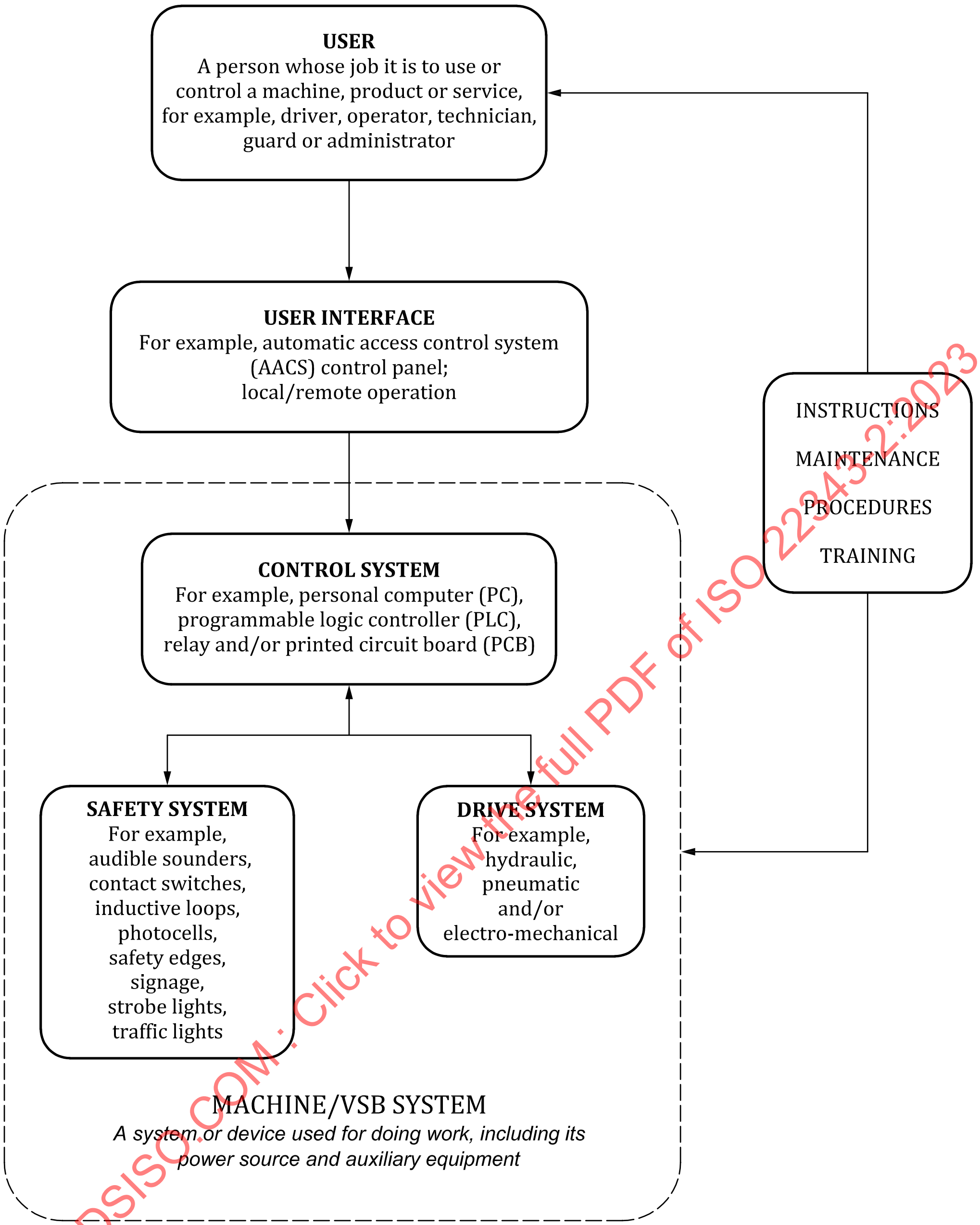
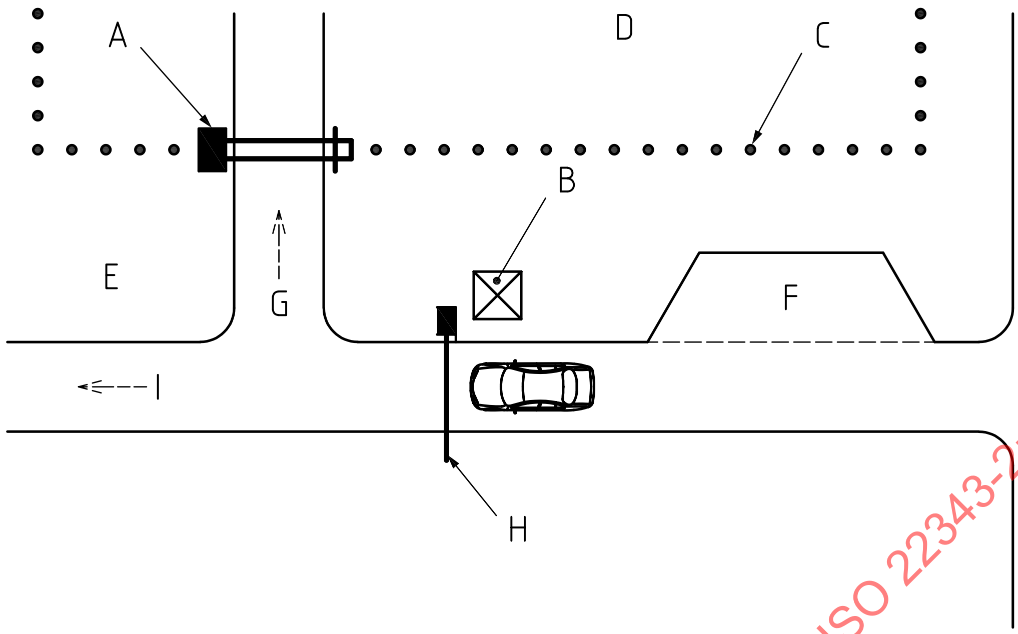


Figure 3 — Commonality of machinery and active VSB

The principle components of a VACP are illustrated in Figure 4. These components should be designed to provide the appropriate level of protective security and control of vehicular access, while also meeting the site's individual operational needs.



Key

A active VSB (e.g. rising arm barrier)
B security kiosk
C passive VSB (to define the approach to barrier A)
D site/protected zone
E unprotected zone
F waiting/search area
G authorized vehicles
H access control barrier
I rejected vehicles

NOTE The layout shows a right-hand drive configuration (i.e. the security kiosk is on the driver's side).

Figure 4 — Principle components of a VACP

13.2 Layout of active VSBs at VACPs

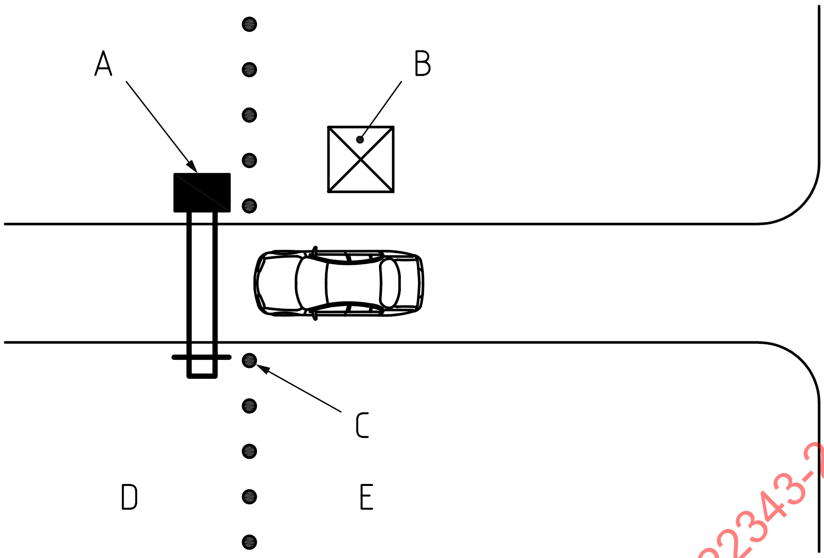
13.2.1 General

VSBs are typically installed in three basic configurations at VACPs: single line of VSBs (see 13.2.2), interlocked VSBs (see 13.2.3) and final denial VSBs (see 13.2.4).

Attack scenarios that use the threat applicable to the site should be analysed when considering where to locate and how to design both guard kiosks and VSB control systems. The goal of these analyses should be to optimize protection efficiency and ensure security is established and risks managed to an acceptable level.

13.2.2 Single line of VSBs

Single line of VSBs (see Figure 5) includes an access control method (e.g. card reader or guard force intervention) and a single VSB in the lane of traffic, such as a set of rising bollards, a road blocker, rising arm barrier or sliding/swing gate.



Key

A active VSB (e.g. rising arm barrier)

B security kiosk

C passive VSB (e.g. fixed bollard)

D site/protected zone

E unprotected zone

Figure 5 — Single line of VSBs

13.2.3 Interlocked VSBs

Interlocked VSBs (see Figure 6) create a secure containment area with inner and outer active VSBs into which vehicles have to drive. At no point during the transit of a vehicle are both sets of active VSBs in the open position. Transit is first through successful verification of occupant and vehicle identity and then operation of either the inner or outer VSBs. The second VSB is only opened when the first is fully secured in the closed position.

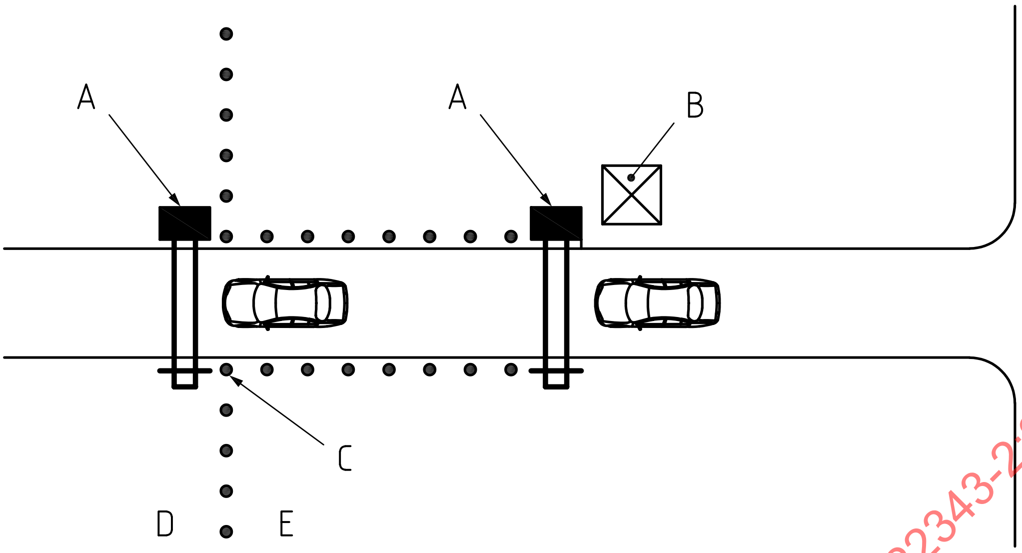
Transit through the interlocked VSBs is only permitted after successful verification of vehicle and occupant vehicle identity.

For deliveries at high security facilities, vehicles may be searched before nearing the interlocked VSBs and only driven into the interlocked VSBs by previously authorized and searched drivers. At other locations, the vehicle may be searched within the interlock and vehicle occupants directed into a personnel search and screening regime.

The first VSB is only opened when the second is fully secured in the closed position. The second VSB is only opened when the first has been fully secured in the closed position. The second VSB is only opened after the vehicle and occupants have been verified.

The interlocked VSB configuration can provide the opportunity for other physical security measures to be deployed if required and for overwatch watch positions being able to initiate emergency.

NOTE This solution is significantly more secure than a single line of VSBs but has cost implications, space requirements and also significantly reduced vehicle throughput (see Table 1).



Key

A active VSB (e.g. rising arm barrier)

B security kiosk

C passive VSB (e.g. fixed bollard)

D site/protected zone

E unprotected zone

NOTE The layout given in this figure is for illustrative purposes only and does not show approach road layouts, traffic calming, search/screening facilities and/or rejection lanes, etc.

Figure 6 — Interlocked VSBs

13.2.4 Final denial VSB

Final denial VSBs (see Figure 7) comprise of two key areas: the pass check location and the final denial VSB a distance away. This approach is often adopted in locations where available room and stand-off distances are not an issue, but traffic throughput is. This solution in theory can be considered very secure on condition that there is a backup guard force over watch facility and sufficient time for the guard force to recognize and correctly interpret a potential threat activity and then to react proportionately in a timely manner to close the final denial VSB. The design of the system is totally reliant on the guard force having sufficient time to activate the VSB before the hostile vehicle reaches the final denial VSB.

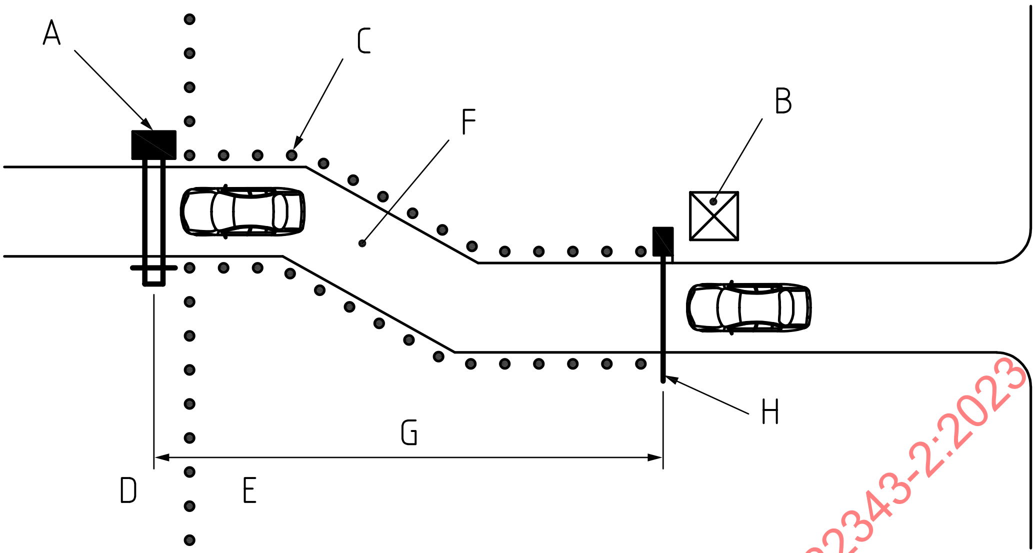
The design of the VACP should allow sufficient response time for vehicle access to be denied when a threat is identified or perceived by security personnel. The response time includes:

— reaction time (time for personnel to react and activate the VSB);

— safety time (time for any signalization and safety systems to operate, time for non-threat vehicles to safely stop prior to the VSB or proceed through);

— VSB deployment time (time for the VSB to fully deploy in an emergency fast operate mode).

The combination of the reaction time, safety time and VSB deployment time are significant factors in the calculations to determine the length of the response zone, since the hostile vehicle can be accelerating and able to cover a long distance during that time. If the final denial VSB is operated in the normally closed mode (i.e. with at least one active VSB in access denied position at all times) the response time can be zero.



Key

A active VSB (e.g. rising arm barrier)

B security kiosk

C passive VSB (to define the approach to barrier A)

D site/protected zone

E unprotected zone

F chicane

G variable distance (dependent on the distance, speed and guard force response)

H access control barrier

NOTE 1 The layout given in this figure is for illustrative purposes only and does not show approach road layouts, traffic calming, search/screening facilities and/or rejection lanes, etc.

NOTE 2 Distance between access control barrier and active VSB depends on the assessed hostile vehicle transit time and the time it takes to close the active VSB.

Figure 7 — Final denial VSBs

When considering the effectiveness and viability of a VSB at a VACP, the threat that is to be mitigated as well as the business needs and engineering constraints should be considered.

EXAMPLE If one of the attack scenarios is considered to be a tailgate attack, then a single line of VSBs cannot be considered effective as it is quite possible, depending on the safety system setup, to tailgate surreptitiously or aggressively a legitimate vehicle into a site.

Equally, if one of the objectives is to deter a hostile vehicle attack, then the final denial VSB is not always considered to be suitable as a deterrent, if it is regularly left in the open position to facilitate traffic throughput.

13.2.5 Traffic throughput

A traffic survey should be carried out to establish the type of vehicles, type of drivers (visitors, contractors, authorized personnel, VIP, emergency services, plant, etc.), number of rejected vehicles, peak flow times and number of vehicles per unit of time (flow rates). Such a survey should be carried out over at least one week. Care should be taken to ensure that the survey is representative and takes into account unusual volumes in traffic (e.g. summer vacations, events, construction traffic). The survey should also take into account drivers who are unfamiliar to the site, those that have lost or misplaced their passes, foreign drivers and weather conditions as well as any potential local traffic constraints that can affect vehicles entering or leaving a site. An estimate of long-term traffic projections should also be carried out to ensure that any proposed system has long-term viability. Further comparison of vehicle transit times through a VACP should be measured and/or estimated to allow designers and specifiers to understand the difference in traffic flow of each VSB configuration.

Vehicle and personnel search procedures can add a significant amount of time to individual vehicle transit times. Table 1 gives examples of the theoretical best-case estimate for vehicle throughput at typical VACP configurations.

NOTE Actual vehicle transit time (see Table 1) depends on the speed of VSB operating cycle and SOPs.

Table 1 — Example of potential effect on traffic throughput for a number of different VACP configurations

VSB	**Estimated vehicle transit time** seconds (±25 %)	**Vehicles per minute** (±25 %)
Nothing	1	60
Visual pass check (no VSB)	4	15
Hands-on pass check	8	7
Single line of VSBs	19	3
Multi-vehicle interlocked VSBs	20	3
Single-vehicle interlocked VSBs	30	2
Final denial VSB	4 to 8	7 to 15

13.3 Safety issues

Regardless of category or type of active VSB, in the context of safety, active VSBs should be considered to be "machinery" and thus the system owners, designers, clients and installers have a duty of care to design a safe environment in which people can work and/or transit on foot or in a vehicle. This equally applies to manually operated active VSBs where the manual force to operate them can exceed sensible or legal limits. Additionally, an inadequately secured or locked manually operated VSBs can result in accidents.

When designing an active VSB installation, consideration should be given to the types of drivers using the system and their familiarity with the entrance or exit procedures and the operation of the VSB.

Safety requirements also differ depending on whether the VSB is situated in a controlled area, or adjacent to public land. The possibility should always be considered that a visitor or member of the public can inadvertently or deliberately approach the VSB and put themselves at risk.

Consideration should be given to the types of vehicles that transit through a VACP. All forms of traffic, whether a cyclist, motorcycle, car, lorry, plant or vehicle with trailer require, different control systems, safety systems and operating considerations. Also, it should be considered whether signage and traffic signals are suitable for all vehicle types as well as any inherent potential for injury due to the design of a VSB, e.g. slippery surfaces, tyre traps.

If, for example, a guard is operating the VSB manually or via a push button control panel and their presence forms part of the safety strategy, it should be considered how safety and security can be compromised as a result of distractions or concentration on other tasks or lack of vigilance.

The threat assessment and potential attack scenarios should be revisited regularly to take a realistic view on the likelihood of a hostile attack versus the likelihood of a legitimate, consensual or careless driver being involved in a collision with the VSB. It may be considered that an accident is far more probable than an attack. The safety systems deployed should reflect this but, in doing so, this should not have an impact on the security requirements. This can be a difficult undertaking when considering site constraints and the numerous threat modus operandi (MO).

In considering safety systems for VSBs, it is extremely important to list the types of legitimate vehicles that can be using the site in the future, as not all safety systems are effective with different types of transport.

Where there is a likelihood that pedestrians can be in close proximity to the VSBs, additional precautions need to be taken to ensure their safety, such as segregation, channelization or delineation.

Advice should be sought from the VSB installer and/or client regarding safety systems' effectiveness and reliability.

Safety systems and procedures include, but are not limited to:

a) signage and warning indicators (i.e. light and sound);

b) operator instructions and procedures;

c) operator training;

d) user instruction signs;

e) road markings;

f) design of the control panel layout;

g) emergency stop buttons;

h) safety edges (e.g. used to protect people, vehicles or other obstructions from accidental injury or damage);

i) photocells;

j) inductive road loops;

k) electronic interlocks;

l) audible sounders;

m) flashing beacons or warning lights;

n) traffic lights;

o) guard rails and pedestrian screens;

p) security screws (e.g. a screw that requires specialist tools or techniques to remove legitimately) and locks.

The number and type of safety systems is dependent on traffic type and frequency, VSB type, risk of pedestrian injury, VSB speed of operation, environment in which the VSB is installed and level of security risk that is acceptable.

There are standards, regulations and guidance notes on the safe design and use of vehicle barriers, plant and machinery.

Some standards applicable to machinery also apply to VSBs. The clients and installers should be able to provide such information.

Consideration should be given to the location, layout and design of the user interface (control consoles/ control panels) which should be secure, clear, simple and intuitive to use in order to reduce the likelihood of staff inadvertently operating the system.

Consideration should be given to the potential need to override the safety systems in the event they have been compromised or failed. In doing so, it should be ensured that the alternative means of operation is safe and has been thoroughly risk assessed.

13.4 Control system

The control system should be assessed for whether:

a) a surface-mounted control system ducting, inspection chambers and VSB itself requires protection against vehicle or manual attack;

b) emergency activation buttons are required, and what functionality they should have;

c) in the event of a power failure, the system can still be operated, and how this is achieved;

d) a service failure between the access control device (e.g. push button or AACS), and the control cabinet compromises the level of security;

e) the VSB is open or closed at its failsafe position or stays in the failed position;

f) safety or security is likely to be compromised if the VSB fails while moving between an open and closed position;

g) the control and hydraulic systems require redundancy and resilience against a failure of a VSB connected to other units.

The operating noise and the vibration of the VSB including the end of travel clunk should be considered. Motors, pumps, drive systems, heating and cooling equipment, and the mechanical operation of the VSB can generate potentially unacceptable noise levels, particularly when situated in a built-up or residential area.

14 Training

As with any machinery, drivers, operators, technicians and owners should, as a minimum, be trained in the safe use of the equipment. Regular refresher training should be scheduled to maintain the proper operation of security equipment and provide for changes in threat or security protocols. This should be achieved through the use of the VSB operation, maintenance and technical manuals.

Consideration should be given to formalized training at the point of handover or when new operators are employed with training logs regularly reviewed, updated and maintained.

Unfamiliarity with an active VSB and its controls, an inadequate design (active VSB and instructions) and inattentiveness can be the cause of accidents or an inadequate response to a security incident.

15 Maintenance, service and inspection

15.1 General

VSBs should be inspected periodically for damage or tampering.

Procedures should ensure that non-fixed VSBs, such as planters, retain the correct spacing (e.g. ≤ 1 200 m at 600 mm above ground level).

Active VSBs require maintenance and servicing during their lifetime and this should be addressed when developing the business case for deploying such equipment. The serviceable lifetime of a VSB and the maintenance regime employed depends on, but is not limited to, the following considerations: type of VSB, the type of drive mechanism, local environmental issues and frequency of operation. The availability of spare components, maintenance regime employed, response agreement and capability of the service provider has a direct impact on the cost of the maintenance contract.

Without addressing the requirement to have a maintenance contract as well as a response time frame for rectifying VSB breakdowns, there is a risk that the VSBs can be left inoperable for long periods of time. This can have an adverse effect on either traffic management or security. To avoid these potential adverse effects, contingency measures should be developed, documented and exercised prior to VSB implementation. Furthermore, in the period when the requirement for a system is being developed, it is critical that a system owner responsible for the VSB post commissioning is identified and engaged. Consideration should be given to implementing service and preventative maintenance key performance indicators in the contract and to have a robust monitoring process.

15.2 Adjacent works

Where adjacent works take place to access underground services/utilities, foundations, etc. should be reinstated correctly and movable VSBs put back correctly.

16 Operational requirements

16.1 General

An OR is a statement of security needs based upon a thorough and systematic assessment of the problems to be solved and the desired solutions.

NOTE To assess the ORs of a site, a proforma has been provided for a VSB OR in Annex A.

There are effectively five sequential stages of planning when defining objectives or ORs for security systems. These are:

a) Level 1 OR (see 16.2);

b) Level 2 OR (see 16.3);

c) technical specification;

d) system commissioning, validation training and handover;

e) lifetime operation (maintenance, service and spare parts).

The first three stages of a) to c) are designed to progressively build the security requirements in increasing detail. The fourth stage of d) is designed to assess deliverables against these requirements. The fifth stage of e) instructs the person responsible for the site and facilities security of the minimum requirements to ensure safe, secure and reliable operation of the VSB.

The production of an OR, particularly the Level 2 OR, helps organizations to develop the performance specifications for security systems and therefore the importance of completing ORs should not be underestimated.

Interested parties who have an interest in the security of the site or building should be involved in the production of the Level 1 OR to ensure that the derived solution is accepted and that they have ownership of it.

NOTE Interested parties can include, but not be limited to, site security managers, building owners, landlords, occupants, budget holders, facilities management, local authorities and emergency services.

16.2 Level 1 OR

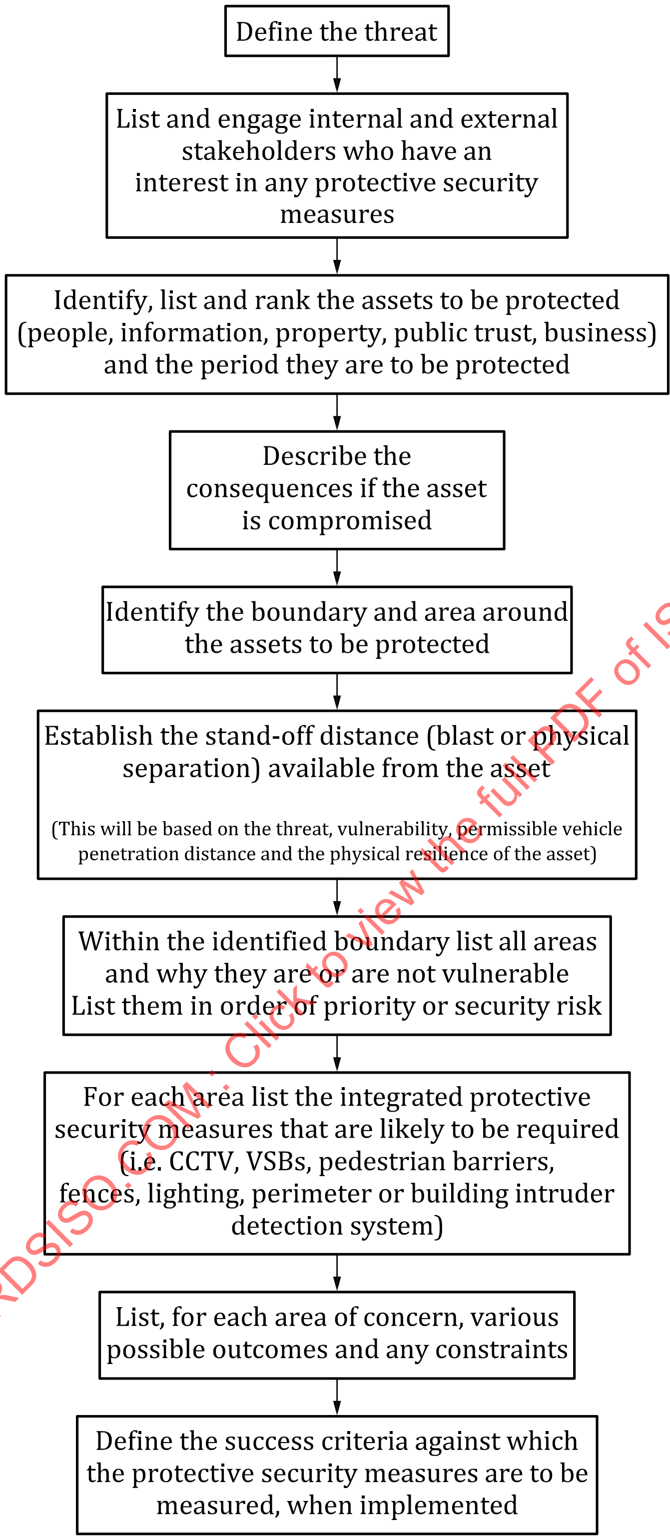
This is a document that outlines requirements based on the threat. A flowchart for Level 1 OR for VSBs is given in Figure 8.

16.3 Level 2 OR

The production of the Level 1 OR helps define the security systems that need to be addressed. These may include CCTV, fencing, VSBs, AACSs, security lighting, intruder detection systems, fencing and security procedures.

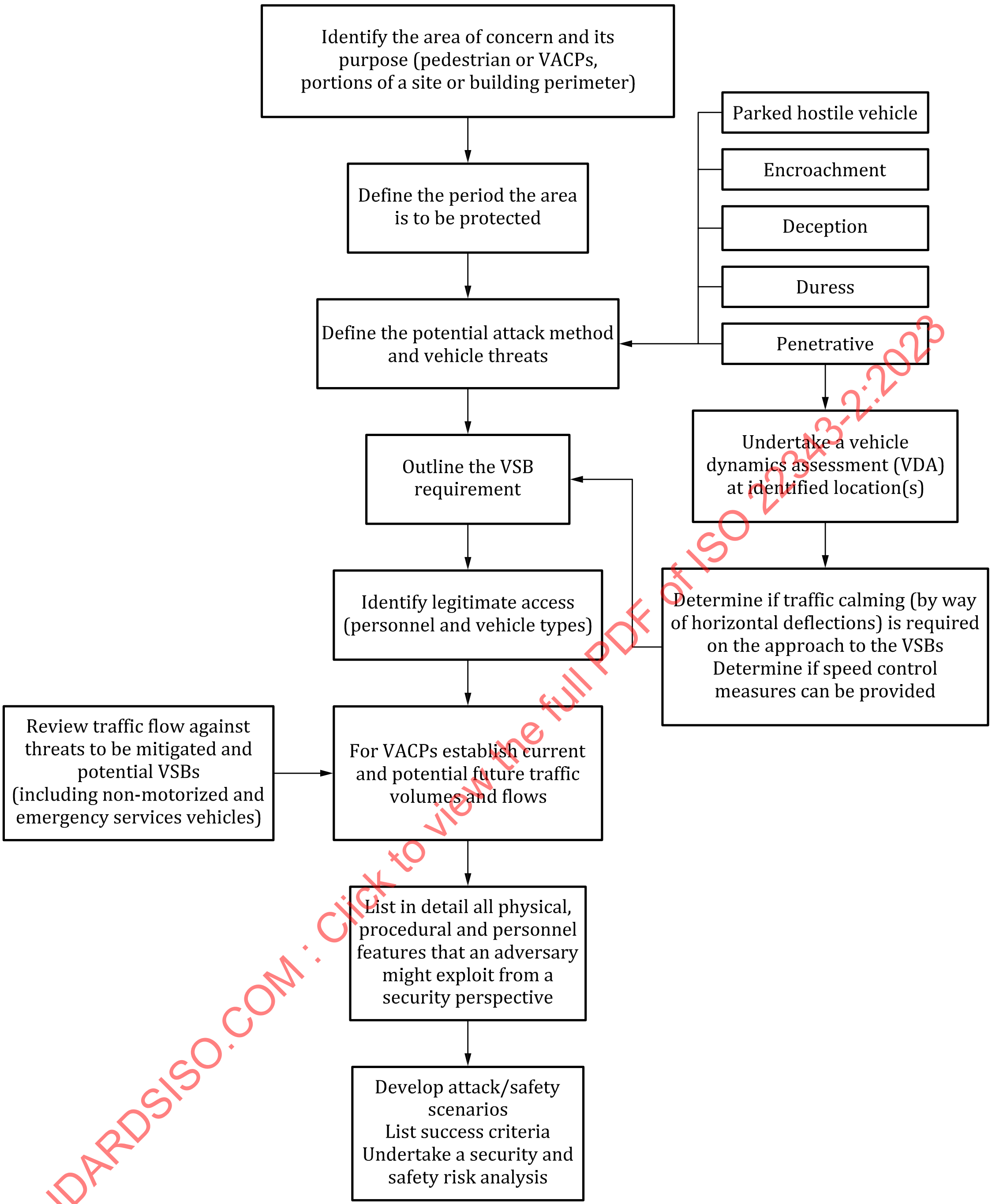
There are multiple Level 2 ORs and they should be produced for each of the relevant systems applicable to the area to be protected in order to provide an integrated security solution. The Level 2 OR is intended to provide greater detail within the specific subject area. For example, a VACP requires a Level 2 OR for the VSB and can also require Level 2 ORs for CCTV, security lighting, access control and fencing.

A flowchart for a Level 2 OR for VSBs is given in Figure 9.



NOTE This list is not prioritized nor exhaustive nor necessarily to be completed sequentially. It acts as a guide only.

Figure 8 — Level 1 OR



NOTE This list is not prioritized nor exhaustive nor necessarily to be completed sequentially. It acts as a guide only.

Figure 9 — Level 2 OR

16.4 Level 2 OR proforma

The Level 2 OR for hostile vehicle mitigation (HVM) purposes follows on from the Level 1 OR to provide a more detailed picture of the HVM scenario and issues faced. The Level 2 OR can be used to investigate both existing and proposed HVM measures and can highlight specific exploitable deficiencies that require mitigation or management attention.

NOTE An example Level 2 OR proforma is given in Annex A.

Annex A
(informative)

Level 2 operational requirement proforma

A.1 Document references

See Table A.1.

Table A.1 — Document references

Location reference/title:
Issue number:
Issue date:
Document reference:

A.2 Level 1 OR references

See Table A.2.

Table A.2 — Level 1 OR references

Project reference/title:
Issue number:
Issue date:
Document reference:

A.3 Level 2 OR references

Other Level 2 OR documents being produced in conjunction with Level 2 OR (16.4) should be indicated, see Table A.3.

Table A.3 — Level 2 OR references

Pedestrian perimeter barrier	Physical delay (building construction)	PIDS (perimeter intruder detection system)	IDS (intruder detection system)
Access control	**CCTV**	**Security lighting**	**Mail screening and security**
Infosec (information security)			

A.4 Area of concern

The boundary or area to be protected should be identified. Separate Level 2 OR reports for each area of concern should be produced, see Table A.4.

Table A.4 — Area of concern

Area (describe)	Tick	Existing/proposed
Wide area perimeter		
Site perimeter		
Building threshold		
Asset protection		
VACP		
Emergency access point		

A.5 Period of concern

The area of concern should be described, when it is at greatest risk, see Table A.5.

Table A.5 — Period of concern

: hour(s)/day(s)/week(s)
: month(s)
: years(s)

A.6 Vulnerabilities

A.6.1 General

The physical features, technology, processes and plans that can make the site vulnerable should be identified, with an explanation of why they can reduce the effectiveness of HVM security, see Table A.6. This work can assist in the development of a security risk assessment. Considerations include:

a) location;

b) existing VSB protection;

c) traffic management;

d) VACP;

e) guard force;

f) procedures and plans.

Table A.6 — General vulnerabilities

Location	Tick	Vulnerability/comment
Land ownership		
Rights of way		
Neighbouring properties		
Distance from critical asset (m)		
Potential hostile vehicle approach routes (e.g. footpaths, cycle paths, grassland areas)		
Topography (e.g. cliff, car park or adjoining building where vehicle access is possible)		
Critical services (e.g. gas, electric, water, cooling, communication)		
Existing VSB protection	**Tick**	**Vulnerability/comment**
Type of VSB protection		
Positioning or gaps		
Hostile vehicle impact rating If yes, to what standard and rating? If no, describe measures.		
Stand-off distance (from protected asset)		

A.6.2 Site vulnerabilities (1)

See Table A.7.

Table A.7 — Site vulnerabilities (1)

Traffic management	Tick	Vulnerability/comment
Traffic inclusion/exclusion		
Peak flow and traffic volumes		
Proximity to public highway		
Queuing traffic		
Vehicle parking (legitimate or otherwise)		
Accident hot-spots (in close proximity that can affect HVM measures or VACP layouts)		
VACP	**Tick**	**Vulnerability/comment**
Type (single line, interlock, final denial)		
Identification/verification method (pin code, swipe card, staff pass, etc.)		
Closure method		
Emergency override		
Automatic or manual system		
Space for queuing vehicles		
Vehicle rejection capability		
Vehicle parking/waiting/queuing/pick-up/drop-off zones		
Search regime (who, what, when, where, why, how)		
Segregation of vehicle and pedestrian traffic		

A.6.3 Site vulnerabilities (2)

See Table A.8.

Table A.8 — Site vulnerabilities (2)

Guard force	Tick	Vulnerability/comment
Guard force presence		
Armed guard force		
Over watch guard force		
Location		
Protection from blast		
Protection from duress		
Duties (control CCTV, access control, search, admin. etc.)		
Lines of sight (e.g. physical obstruction, weather, vegetation)		
Response to attack		
Procedures and plans	**Tick**	**Vulnerability/comment**
Change in threat and security response level plan		
Emergency procedures and plans		
Traffic management plan		
Incident recovery plan		
Procedural vulnerabilities (identification, search, rejection, etc.)		

A.6.4 Site vulnerabilities (3)

Vulnerabilities in the existing or proposed security systems which can be integrated with HVM measures and can compromise security or ORs should be identified, see Table A.9.

Table A.9 — Site vulnerabilities (3)

Security measure	Tick	Vulnerability/comment
Pedestrian perimeter barriers		
Physical delay (building construction)		
PIDS (perimeter intruder detection system)		
IDS (intruder detection system)		
Access control		
CCTV		
Security lighting		
Mail screening and security		
Information security		
Existing HVM and traffic management measures		
Other (specify)		

A.7 HVM measure(s) function

A.7.1 General

The purpose and function of the proposed HVM measure(s) should be specified. The threat stated in the Level 1 OR as well as the organization's risk appetite can help clarify these functions, whether against suicide vehicle-borne terrorism, vehicles being used as weapons, robbery, burglary, vandalism or unauthorized access.

A.7.2 Performance requirements — Attack scenarios

The attack to be mitigated should be identified through attack scenario development and analysis, see Tables A.10 and A.11.

Table A.10 — Attack scenario HVM measures

Purpose (of proposed HVM measures)	Tick	Comment
Deter		
Delay		
Disable		
Stop		
Function	**Tick**	**Comment**
Provide stand-off against: blast/assault/ vehicle penetration		
Control vehicle access		
Mitigate encroachment		
Mitigate penetrative attack		
Other (specify)		

Table A.11 — Attack scenarios

Attack scenarios	Tick
Parked – Vehicle-borne IED (VBIED) in close proximity to the asset or perimeter	
Encroachment (1) – Hostile vehicle negotiates through gaps in perimeter	
Encroachment (2) – Surreptitious vehicle tailgate; vehicle follows closely behind a legitimate vehicle while a VSB is open	
Encroachment (3) – Aggressive vehicle tailgate; vehicle forces leading vehicle(s) out of the way and drives through an open VSB	
Penetrative (1) – Vehicle rams through perimeter: individual vehicle (single or repeated ramming)	
Penetrative (2) – Sacrificial vehicle; rams through the perimeter or VSB to create a gap for encroachment of a second hostile vehicle	
Deception (1) – Pretence; vehicle occupants appear to have legitimate access (with or without use of formal identification)	
Deception (2) – False identification/documentation	
Deception (3) – Trojan vehicle; vehicle either stolen, purchased or modified to match vehicles familiar to site	
Deception (4) – Unwitting mule; legitimate driver unknowingly delivers an IED, weapons or hostile person(s) into site	
Duress (1) – Guard force is forced to allow vehicle entry	
Duress (2) – Driver (legitimate or otherwise) is forced to deliver an IED, weapons or hostile person(s) to the site line	
Insider – Person with legitimate site access facilitates an attack, by either operating or damaging HVM measures	
Tamper – Barriers are tampered with in order to operate, circumnavigate, damage or disable it	
Layered attack scenarios – Using two or more of the above attack modus operandi (MO)	

A.7.3 Impact and performance requirement (hostile vehicle)

HVM measure(s) performance requirements under vehicle impact conditions should be stated, see Table A.12.

Table A.12 — HVM measure(s) performance requirements

Protection level			
Provide minimum enforceable blast stand-off distance			m
Hostile vehicle penetration distance (beyond the VSB datum line of the HVM measure)			m
Maximum allowable dispersal of major debris (beyond the VSB datum line of the HVM measure)			m
The HVM's resistance to blast			
The HVM's resistance to slow speed ramming and nudging			
Threat	**Tick**	**Impact angle** (°)	**Impact speed** (km/h)
1 500 kg car [M1]			
2 500 kg 4x4 crew cab pick up [N1G]			
3 500 kg flat bed single cab [N1]			
7 200 kg, 2-axle rigid vehicle [N2A]			
7 200 kg, 2-axle rigid vehicle [N3C]			
6 800 kg, 2 axle rigid vehicle [N2B]			
12 000 kg, 2-axle rigid vehicle [N3D]			
24 000 kg, 3-axle rigid vehicle [N3E]			
26 000 kg, 3-axle rigid vehicle [N3F]			
30 000 kg, 4-axle rigid vehicle [N3G]			
Other (specify)			

A.8 Performance requirement (normal operation)

A.8.1 General

The HVM measure(s)/VACP performance under normal site operating conditions should be stated, see Table A.13.

Where possible, traffic volumes, by category, should be identified.

Table A.13 — HVM measure(s)/VACP performance under normal site operating conditions

Legitimate site users (i.e. users allowed inside the secure perimeter)	Tick	Comment
Asset owner		
Landlord		
Operator		
Tenants		
Staff/employees		
Guard force		
Visitors		
VIPs		
Post/deliveries		
Waste disposal		
Maintenance staff		
On-site contractors		
Off-site contractors		
Taxi drivers		
Emergency services		
Other (specify)		

A.8.2 Performance requirement

See Table A.14.

Table A.14 — Legitimate site traffic

Legitimate site traffic (i.e. traffic allowed inside the secure perimeter)	Tick
Pedestrian	
Equestrian	
Bicycle	
Motorcycle	
1 500 kg car [M1]	
2 500 kg 4x4 single/ crew cab pick up [N1G]	
3 500 kg flat bed single cab [N1]	
7 200 kg, 2-axle rigid day cab vehicle [N2A]	
6 800 kg, 2 axle rigid vehicle [N2B]	
7 200 kg, 2-axle rigid day cab vehicle [N3C]	
12 000 kg, 2-axle rigid day cab vehicle [N3D]	
24 000 kg, 3-axle rigid day cab vehicle [N3E]	
26 000 kg, 3-axle rigid vehicle [N3F]	
30 000 kg, 4-axle rigid day cab vehicle [N3G]	
Construction/plant (specify)	
Military (specify)	
Emergency services (specify)	
Other (specify)	
Traffic volumes (time of day, vehicle type, user)	

A.9 Physical constraints

Any physical constraint that either precludes the use of certain HVM measures or requires additional engineering should be identified, see Table A.15.

Table A.15 — Physical constraints

Constraint	Tick	Comment
Topography (e.g. gradient or level changes)		
Ground conditions (e.g. type, condition, structure, load and bearing capacity)		
Foundation depth (useable)		
Underground services or other obstructions		
Overhead structures (e.g. type and height)		
Future developments (e.g. own or neighbouring land)		
Deployment/installation/removal (e.g. is there adequate space for heavy equipment on site? Will security be maintained during installation?)		
Other (specify)		

A.10 Environmental constraints

Any significant environmental conditions that can affect the performance or deployment of HVM measures should be described, see Table A.16.

Table A.16 — Environmental constraints

Constraint	Tick	Comment
Wind		
Rainfall		
Snowfall		
Temperature range and cycles		
Daytime hours and natural light levels		
Water table		
Drainage and flood risk		
Local air condition (e.g. acidic, salinity)		
Presence of other matter (e.g. rubbish, foliage, sediment)		
Ground pollution (e.g. fuel, chemical, waste)		
Site of special scientific interest		
Heritage or archaeological areas		
Other (specify)		

A.11 Rules and regulations

Legislation and local regulations that can affect the design, implementation and operation of HVM measures should be identified, see Table A.17, such as:

a) local authority;

b) highways;

c) planning;

d) sites of special scientific interest (SSSI);

e) site-specific;

f) environmental safety and health.