INTERNATIONAL WORKSHOP AGREEMENT

IWA 14-2

First edition
2013-11-15

Corrected version
2014-01-15

Vehicle security barriers —

Part 2: **Application**

Barrières de sécurité de véhicule —

Partie 2: Applications

Reference number
IWA 14-2:2013(E)

Contents

Page

Foreword

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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 documents 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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

International Workshop Agreement IWA 14 was sponsored by UK Government's Centre for the Protection of National Infrastructure (CPNI) on behalf of the international community. The development of this IWA was facilitated by BSI Standards Limited. It came into effect on 15 November 2013.

IWA 14 consists of the following parts, under the general title *Vehicle security barriers*:

— *Part 1: Performance requirement, vehicle impact test method and performance rating*

— *Part 2: Application*

This corrected version of IWA 14-2:2013 incorporates editorial modifications.

Introduction

0.1 Workshop contributors

Acknowledgement is given to the following organizations that were involved in the development of this International Workshop Agreement:

— Allen Total Perimeter Security Limited

— APT Security Systems

— ATG Access Ltd

— BRE Global Limited

— Bristorm, Hill and Smith Ltd

— Centre for the Protection of National Infrastructure (CPNI)

— DELTA BLOC International GmbH

— GME Springs/Safetyflex Barriers

— Heald Limited

— HMS Nelson, Portsmouth Naval base

— Kirchdorfer Fertigteilholding GmbH

— L.I.E.R.

— Marshalls

— MFD International Limited

— Ministry of Commerce and Industry - Director General for Standards and Metrology (DGSM) (Sultanate of Oman)

— MIRA Ltd

— Norwegian Defence Estates Agency

— Perimeter Protection Group

— Perimeter Security Suppliers Association

— Rhino Engineering Ltd

— Royal Military Academy - Civil and Materials Engineering Department

— RSSI Barriers

— Sälzer GmbH

— Scorpion Arresting Systems LTD

— Ministry of Home Affairs (Singapore)

— Sudanese Standard and Metrology Organization (SSMO)

— Syrian Arab Organization for Standardization and Metrology (SASMO)

— Tallwang KVI PTY Ltd t/a AVS-elli

— Technical and Test Institute for Construction Prague
— Texas A&M Transportation Institute
— Transport Research Laboratory (TRL)
— US. Department of State
— US. Nuclear Regulatory Commission
— US. Army Corps of Engineers – Protective Design Center

0.2 Relationship with other publications

The following documents have been used to inform the development of this part of IWA 14:

— ASTM F 2656
— CWA 16221
— PAS 69
— PAS 68

Vehicle security barriers —

Part 2: Application

1 Scope

This part of IWA 14 provides guidance for the selection, installation and use of vehicle security barriers (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.

2 Introduction to hostile vehicle mitigation

2.1 General

2.1.1 Vehicle-borne threats can range from the use of a vehicle for vandalism to determined attacks by adversaries (e.g. criminals and terrorists). The mobility and payload capacity of a vehicle can offer a tactical means to deliver a large explosive device and/or carry adversaries with attack tools. Hostile vehicles can be parked, manoeuvred or rammed in to or out of a site. Entry to, or exit from, a site can also involve surreptitious tampering with VSBs or their control apparatus, or the targeted placement of small explosive charges to breach the integrity of a barrier structure. Clear definition of the threat and the potential attack scenarios should be considered when deciding which methods of attack to defend against and consequently the most appropriate countermeasures.

2.1.2 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 is deemed acceptable by the organization;

  2) attack method to be mitigated;

  3) countermeasures;

  4) response to increased threat conditions;

  5) enforceable stand-off distance;

b) business needs:

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

  2) traffic management;

  3) appearance;

  4) internal and external stakeholder requirements;

   5) security risks induced by safety concerns or systems;

c) engineering constraints:

   1) architectural;

   2) foundations;

   3) buried services;

   4) land ownership and available space;

   5) local authority planning restriction(s) (e.g. height/weight/noise restrictions of area of land, utilities).

2.1.3 It is important that a security operational requirement (OR) (see Clause 12) is developed in conjunction with a user requirement document (URD) and that all key stakeholders are involved from the outset.

2.1.4 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.

2.1.5 There is likely to be a need to prevent unauthorized 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. An unreliable VSB is unacceptable and has additional implications that may include costly compensatory measures to correct the condition. 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.

NOTE See Clause 12 for further information on ORs.

2.1.6 Risk assessments should be conducted for safety and security early in the project design phase of project planning and after final installation to ensure the level of risk acceptable to the site is established and maintained. These assessments should be shared with or jointly produced by the stakeholders (e.g. site owner, security and safety representatives, project manager, staff association). The early engagement with the stakeholders can facilitate the development of business cases and can help identify potential issues, associated costs and constraints.

2.1.7 Often vehicular access has to be provided through the VSB line. The vehicles should be searched or be of known authenticity before arriving at the vehicle access control point (VACP). In this instance a single or multiple access point may be provided through the stand-off barrier line, e.g. rising, swing or sliding gate barriers. Where the stand-off measure forms the site boundary or site secure perimeter, the VACP then typically becomes the first point of challenge for all vehicles.

2.1.8 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.

2.1.9 Where an entrance has more than one VSB, for example 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 its failure does not disable all VACPs. Provision of an uninterruptable power supply (UPS) or standby generator should also be considered.

2.2 Selection of a VSB

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

a) the threat (Clause 3);

b) the assets to be protected (Clause 4);

c) the site (Clauses 5 and 6);

d) the required performance of the VSB (Clause 7);

e) the procurement strategy (Clause 8);

f) deployment and removal of the VSB (Clause 9);

g) the type of VSB required (Clauses 10 and 11).

2.2.2 The decision process for the selection of VSBs is illustrated in the flow diagrams in Clause 12, which covers ORs.

3 The threat

3.1 Identify and quantify the threat

3.1.1 Review any previous terrorist, criminal or malicious incidents and consider their relevance to your site regarding the target and attack methods used.

NOTE Contact your national, regional or local security force.

3.1.2 There are five main types of vehicle-borne threat. All can be deployed with or without the use of suicide operatives.

a) Parked vehicles – where unscreened vehicles are parked adjacent to a site, in underground parking facilities or overlooking a site.

b) Encroachment (exploiting gaps in defences) – where a hostile vehicle is negotiated through 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 vehicle access control point (VACP) by a hostile vehicle "tailgating" a legitimate vehicle.

c) Penetrative attacks – where the front or rear of the hostile vehicle is used as a ram.

d) Deception techniques – a "Trojan" vehicle (one whose model, livery or registration is familiar to the site), or where hostile occupants negotiating their way through by pretence or by using stolen (or cloned) access control or ID passes. Alternative scenarios include an unwitting "mule", a driver unknowingly delivering an Improvised Explosive Device (IED) surreptitiously planted in their vehicle by an attacker, or an "insider" bringing an IED 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 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.

3.1.3 Site design can also accommodate countermeasures for layered attack scenarios using one or more of the threat types given in 3.1.2 a) to e), 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.

3.1.4 Potential threats to be considered:

a) whether the vehicle is parked outside or inside the security perimeter;

b) size of vehicle (both largest and smallest);

c) speed and direction of approach.

3.2 Duration of deployment

3.2.1 The period for which security measures is required (design life) should be defined.

3.2.2 Assess whether the security measures are to be operated continuously or occasionally. Decide whether a permanent, semi-permanent or temporary installation is required and identify the level of protection that the security measure is required to provide. Decide how and where the system is to be controlled from, i.e. controlled locally by guard, from a central control room or through the use of automatic access control systems (AACS).

3.2.3 A permanent installation is a physical measure, which may require significant civil engineering works and is expected to remain for the life of the asset.

3.2.4 A temporary installation is a physical measure 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.

3.2.5 A semi-permanent installation is defined as a hybrid installation that incorporates some transitory elements that can be retracted or removed leaving any permanent foundation or anchorage *in situ*.

3.2.6 Assess and review at regular intervals whether the security measures need to be adapted to a change in the threat.

4 Assets

4.1 Identification of the critical assets

4.1.1 The assets to be protected should be identified, i.e. machinery, infrastructure, equipment, one or more buildings, an area, public event, or crowded place.

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

4.1.3 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.

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

4.2 Identification of stakeholders

The contact information should be obtained for all stakeholders who may be affected by the proposed security measures. These include but are not limited to staff, deliveries, local authorities, public transport, emergency services, utility companies, highway authorities, architects, neighbours and landlords.

4.3 Consideration of collateral damage

4.3.1 The consequences of a successful attack and the likely disruption in terms of loss of life, damage, delays, perception and business and financial impact should be assessed.

4.3.2 Locations or other assets which might suffer collateral damage, short- or long-term disruption to their operations from a successful attack should be identified. For example:

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

4.3.3 Other locations/assets that might become alternative targets if the security strategy being employed at the principal asset is effective should be identified.

5 Site assessment

5.1 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.

5.2 Site survey

5.2.1 All possible approach routes along which a hostile vehicle could challenge a VSB or secure perimeter should be determined. This includes all footpaths, footways, cycle paths, open spaces and gaps and also the likelihood of hostile vehicles travelling against the expected direction of traffic. The location and usability of drop kerbs/curbs and other adaptations for use by disabled persons should be considered.

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

5.2.3 Any environmental conditions that might arise throughout the year that may 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 7.5.4).

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

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

5.2.6 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.

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

5.2.8 The presence and location of all underground and overground services and utilities should be considered.

5.3 Civil works

5.3.1 Variations between VSB performance under vehicle impact test conditions and site conditions.

5.3.1.1 The performance of a VSB is likely to be affected by the site conditions.

5.3.1.2 When assessing the suitability of a VSB at a particular site, the performance of a VSB under site conditions should be assessed.

5.3.1.3 For example, the following site conditions could affect the performance of a VSB:

— 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.

NOTE A suitably qualified engineer should determine how the VSB could be affected by non-standard conditions and should assess whether the VSB is fit for purpose under site conditions. The engineer should have experience in geotextiles, structural and mechanical work.

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

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

NOTE A suitably qualified and experienced engineer could then evaluate the test result and adapt the installation for the specific site. NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features", section 2.2.1, contains information about soil varieties.

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

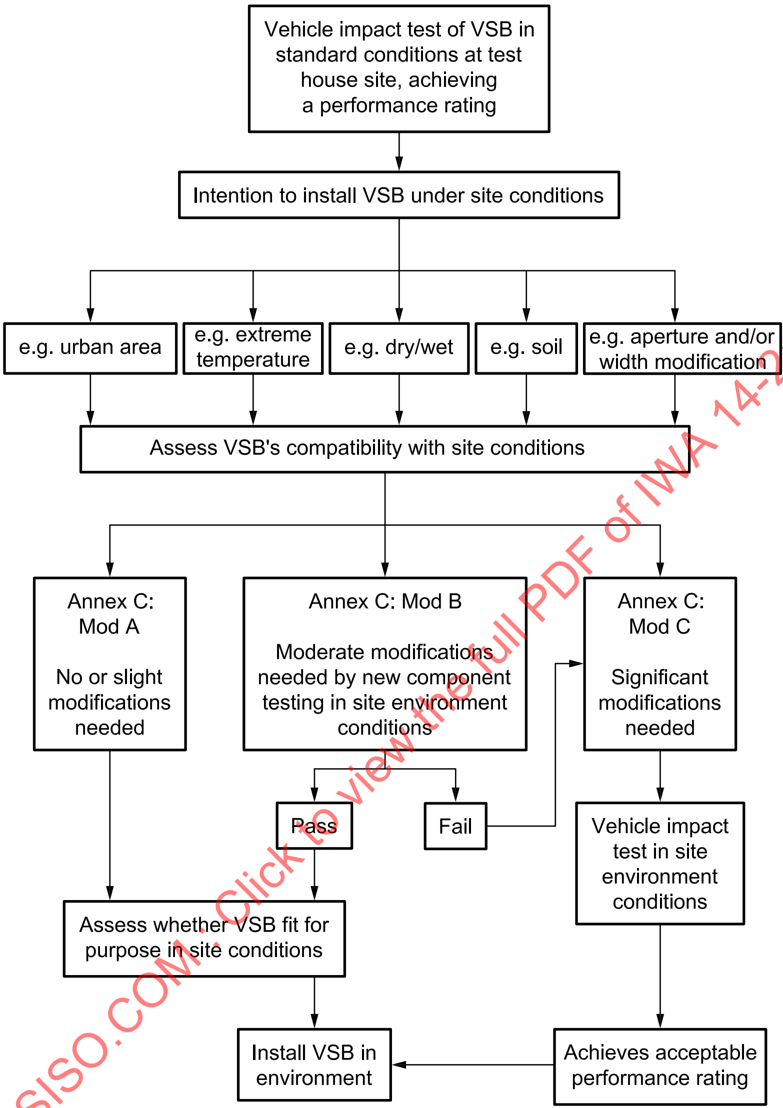


Figure 1 — Process for assessing a VSB for use under site conditions (informative)

5.3.2 Ground types

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

NOTE This should be assessed by a suitably qualified and experienced civil/structural engineer and appropriate preparatory or remedial measures taken to ensure suitability. The engineer should have experience in structural and mechanical work.

5.3.3 Foundations

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

5.3.3.2 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.

5.3.3.3 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.

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

5.3.3.5 A VSB may be tested in a rigid foundation and/or a non-rigid foundation. When selecting a VSB, the foundation for which application it 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 appropriate and will perform as required.

5.3.3.6 Some VSB systems need to be mechanically secured to the foundation or suitably robust by way of using dowels or bolts. Rebating or trenching might 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.

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

5.3.3.8 Foundations are required to satisfy two principal objectives.

a) The first objective is 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) The second objective is to provide adequate resistance to foundation movement/rotation. This could 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.

5.3.3.9 When designing a foundation, prior knowledge of the sub-surface conditions of a site is essential and this needs to 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 desk top 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 may be the only option.

NOTE Any foundation design, including those meeting site specific requirements, should be approved by a suitably qualified and experienced civil/structural engineer.

5.3.4 Surface mounted VSB

Friction between surface mounted, non-anchored VSBs, and the supporting surface is key to achieving the performance of the VSB under impact. This can be compromised by weather conditions, especially rain, snow or ice. The possible implications on year-round security protection need to be considered.

5.4 Traffic survey

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

5.4.2 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, VIPs, employees and emergency services. Non-motorized vehicles and pedestrian movements should also be included in the survey. Site design should accommodate expected and emergency vehicles as well as infrequent over-sized vehicle access. Contingency measures (e.g. movable elements of the VSB) could be used for infrequent over-sized vehicles and separate access points may be necessary to handle the volume of delivery vehicles determined by the traffic survey.

NOTE 1 Refer to Clause 6 for additional site design considerations.

NOTE 2 Over-sized vehicles may include heavy-equipment, buses, multiple trailer vehicles, emergency equipment with extended wheelbase dimensions, etc.

NOTE 3 Tracked vehicles need to be included as they can put a very different load on anything in or on the road surface. Protection against this type of vehicle is not covered by this part of IWA 14.

6 Site design

6.1 Traffic management

6.1.1 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.

6.1.2 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 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, VIPs 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;

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

NOTE Ancillary equipment, e.g. hydraulic cabinets, could affect sightlines.

m) reaction time needed for emergency operation of the VSB;

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.

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

6.2 Aesthetics

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

6.2.2 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 for approval. This aids the planning process.

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

6.2.4 Consider the shape and colour of the VSB and the need for locating signage close to the VSB to signal its presence from a road user’s perspective with the aim of reducing the likelihood of accidental collisions.

7 VSB performance

7.1 Impact performance

7.1.1 General

7.1.1.1 The performance of a VSB that meets the requirements of IWA 14-1 is assessed against:

a) vehicle type;

b) vehicle speed (see 7.3);

c) impact angle (see 7.4).

7.1.1.2 The performance of a VSB that meets the requirements of IWA 14-1 is assessed for:

a) its ability to:

1) resist/restrain/deflect the test vehicle from advancing beyond the VSB; and/or

2) immobilize the test vehicle by trapping it; and/or

3) immobilize the test vehicle by preventing it progressing using its own engine power after the impact;

NOTE If a test vehicle is immobilized, it is prevented from continuing on its course. This can be through the VSB blocking its route [see 2)] or through damage to the test vehicle preventing it from operating [see 3)].

b) vehicle penetration distance (m):

1) dynamic (m); and

2) static (m).

7.1.1.3 Vehicle impact tests are dependent on the characteristics of the test vehicle. A VSB should be tested with a test vehicle similar to the threat vehicle being considered.

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

7.2 Vehicle speed

7.2.1 General

7.2.1.1 IWA 14-1 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. For example, it could be assumed that a rising arm barrier impact tested with a truck can stop all vehicle types up to that mass and speed level, but the rising arm barrier design might allow a smaller vehicle, such as a car, to pass under the rising arm barrier.

7.2.1.2 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 positive determination should be made if any other vehicle types within the region (e.g. national, continental or global) could defeat the VSB.

7.2.1.3 A range of speed reduction features (see 7.2.4) are available and should be considered where appropriate while taking account of any access that may be required for emergency service vehicles. Design and implementation of any speed reduction features should take into account access that may be required for emergency service vehicles.

7.2.2 Vehicle dynamics assessment

A vehicle dynamics assessment (VDA) should be undertaken at each specific site/location in order to determine the impact speed for the identified threat vehicles such that suitable VSBs can be installed.

7.2.3 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 need to be taken to provide adequate warning to an errant motorist.

7.2.4 Speed reduction features

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

7.3 Impact angle

The impact testing of a VSB can be undertaken at a range of specified impact angles. It is therefore important that when a VSB is identified, the impact angle is taken into account, for the specific location and only VSBs that have met the requirement of IWA 14-1 at that impact angle are installed.

The possibility of the vehicle being redirected rather than stopped should be considered.

7.4 Vehicle penetration distance and major debris distance/coordinates

7.4.1 Vehicle penetration distance

Some physical perimeter security schemes allow for vehicle penetration a certain distance beyond the VSB datum line. Subsequently, several VSBs are constructed to deform upon impact to allow hostile vehicle penetration and therefore more gradual dissipation of impact energy. Vehicle penetration distance is recorded for product tests undertaken in accordance with IWA 14-1.

NOTE The term “vehicle penetration distance” is defined in IWA 14–1:2013, 3.6.1.

7.4.2 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 IWA 14-1 test method to record (as an observation) the major debris distance post-impact.

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

NOTE The term “major debris” is defined in IWA 14–1:2013, 3.6.2, “major debris distance” in IWA 14–1:2013, 3.6.3 and “major debris coordinates” in IWA 14–1:2013, 3.6.4.

7.4.3 Standoff distance

When considering the deployment of a VSB, the standoff distance from the VSB to the asset should be taken into account. IWA 14-1 does not give a pass/fail criteria for the vehicle penetration distance or the major debris distance/coordinates but the data obtained is relevant when determining the suitability of a VSB for a specific location.

7.5 Operational performance

7.5.1 Vehicle access control

7.5.1.1 Vehicle access control measures should be identified:

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) prevention of “tailgating” – e.g. by quick acting VSBs or by a second set of VSBs located past the first set of VSBs at a distance that gives response measures enough time to close the second set;

e) remote control override with emergency close/reset;

f) VSB working with other equipment – rising arm barriers or gates;

g) security of control unit;

h) consider how the VSB is to operate in the event of a power or system failure.

7.5.1.2 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.

7.5.1.3 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.

7.5.2 Speed of legitimate access

When considering the design of a VACP note 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.

7.5.3 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) whether the position of the VSB, upon primary power loss, is acceptable to establish and maintain risk at an acceptable level;

b) whether the position of a VSB, given a power failure to the VSB system, varies between specific VSB systems;

An uninterruptible power (UPS)/generator backup power system is necessary, if immediate back-up 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) whether 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) VSB position when switched between power supplies;

The VSB should not change position when switched from: primary power to no power (when no UPS/generator back-up is used); primary power to UPS/generator back-up; from UPS/generator back-up to primary power; or from no power to primary power.

e) provision for surge protection for electrically powered security equipment to protect against lightning strikes;

f) 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 may go to a primary and secondary alarm station.

g) 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;

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

7.5.4 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, and potential damage due to snow ploughs;

b) high temperature effects (e.g. overheating of motors, hydraulic systems or control systems and 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 could 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 could be in violation of local environmental regulations) and/or into the VSB system;

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

7.5.5 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 egress control.

7.5.6 VSB integrity

7.5.6.1 VSB damage

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

7.5.6.1.2 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).

NOTE It is not a requirement of IWA 14–1 to conduct more than one impact test.

7.5.6.2 Remote access to automatic access control system (AACS)

7.5.6.2.1 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.

7.5.6.2.2 Drive systems and control cabinets located out of sight of the VSB could, 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.

7.5.6.2.3 Some manufacturers also provide a remote (off-site) diagnostics and override capabilities, whereby technicians can access the VSB control system to assess and repair faults, analyse the system and re-programme. 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) the security of the communication between the VSB system and the remote off-site technician for site purposes (e.g. communication might require dual redundant paths or encryption to a certain level to ensure security is maintained at an acceptable level);

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

c) what information can be downloaded from the VSB system to the remote off-site location; if information can be downloaded, whether the information security provisions applied to it at the remote location are acceptable;

d) 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;

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

7.5.6.3 Repair time

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

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

d) time to repair the VSB;

e) availability of spare parts;

f) how security or safety procedures may delay contractors gaining access;

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

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

7.5.7 Staff, skills and availability

As well as the training required for the safe and effective use of the VSBs (see 11.5), staff should also be issued with site location specific assignment instructions and specific VACP procedures. These procedures should cover, for example: traffic management, checking passes, rejection of vehicles, vehicle screening, emergency vehicle access, site evacuation plans, dealing with threats, 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.

8 Procurement strategy

8.1 General

A number of factors influence the procurement strategy. These include the availability of a suitable VSB, the product quality, which affects performance and reliability, and the cost.

8.2 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 may 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 7.5.6.3 h)];

e) short and long-term maintenance, repair and inspection responsibilities.

8.3 Quality

NOTE Ensure that the manufacturer of the VSB operates and conforms to an internationally recognized quality control system, such as ISO 9000.

8.4 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) integration with other security systems;

c) system hardware and software upgrades including licensing;

d) manning levels;

e) planning consent;

f) liaison with other stakeholders;

g) project management;

h) long-term training;

i) maintenance and service;

j) spare parts;

k) warranty period and exclusions;

l) decommissioning, removal and disposal.

8.5 Commissioning and handover

8.5.1 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 hand-over requirements starts with the production of the OR (see Clause 12), 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.

8.5.2 A training programme should be developed, documented and implemented to ensure all operators are trained in the safe use of the VSB (see 11.5).

8.5.3 The VSB should be supplied, where applicable, with installation drawings, cable and circuit diagrams (electrical and hydraulic), foundation and civil engineering drawings, 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.

8.5.4 A suitable maintenance and servicing regime should be planned, costed and resourced (see 11.6).

9 Deployment and removal

9.1 Highway/local authority approval

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

9.2 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.

9.3 Installation

Installation should be assessed for the following:

a) the time required for installation;

b) the need for quality control;

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.

9.4 Lifting and placement

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

9.4.2 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.

9.5 Removal considerations

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

10 Types of VSB

10.1 General

VSBs as considered by this part of IWA 14 are designed to mitigate the penetration of a vehicle when it is impacted. VSBs can be categorized as passive or active.

10.2 Passive VSBs

Passive VSBs include, but are not limited to:

a) fixed bollards (see 10.4.1);

b) planters and street furniture (see 10.4.2);

c) wire rope systems;

d) fences;

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

10.3 Active VSBs

10.3.1 Active VSBs include, but are not limited to:

a) active bollards (see 10.5.2) – rising, hinged or sliding;

 1) deep foundation;

 2) shallow foundation;

 3) surface mount;

b) road blockers (see 10.5.3):

 1) deep foundation;

2) shallow foundation;

3) surface mount;

c) rising arm or lowering beam barriers (see 10.5.4);

d) sliding gates (see 10.5.5);

1) cantilevered (gate or beam);

2) tracked (gate or beam);

e) swing gates (see 10.5.5):

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.

f) restraint systems:

1) nets;

2) straps;

3) fibres.

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

NOTE Active VSBs are categorized as machinery and are subject to relevant legislative requirements. Refer to Bibliography for further reading.

10.3.3 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.

10.3.4 An active VSB may be operated over an 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 the maintenance of the network is critical and should be factored into the lifetime costs of the VSB.

10.4 Examples of passive VSBs

10.4.1 Fixed bollards

10.4.1.1 Fixed bollards are available in a variety of types which can vary in height, cross-section and material.

10.4.1.2 They are suitable for providing protective security where pedestrian permeability is a requirement and would in general be installed as passive systems in multiples of not less than three units.

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

10.4.1.3 Consideration should be given to:

a) site ground conditions;

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

c) shallow mount systems;

d) bollard spacing – gap between adjacent bollards to be no greater than 1 200 mm when measured at 600 mm above finished ground surface to impede the vehicle threat from micro-vans.

NOTE 1 Bollard spacing and height may be subject to local planning requirements and the disability legislation and good practice guidance, such as BS 8300.

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

10.4.2 Planters and street furniture

10.4.2.1 General

In order to complement and enhance the urban environment, architecturally aesthetic products have been developed to provide stand-off measures. The impact tested architectural solution generally comprises planters and other street furniture.

a) **Free-standing** – the planter rests on the surface and its resistance to impact is affected by the coefficient of friction between the planter and the ground.

   Mass of unit, surface the unit is to be set on, materials the planter is fabricated from and its displacement when impacted should be considered.

b) **Pinned** – the planter 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 and size of fixing pins, embedded depth of pins, angle of embedded pins, methods of fixing, surface into which the pins are fixed and material the planter is fabricated from should be considered.

c) **Rebated** – the planter 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** – engineered with integral foundations. These can be integrated with street schemes and provide, for example, seating areas.

10.4.2.2 Foundations

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

10.4.2.2.2 Not only may underground services/utilities restrict the type of planter suitable to be installed, but there might be a need to retain access for maintenance of the services.

10.4.2.2.3 The degree to which pinning or rebating the planter into the surface can supplement the impact resistance it provides depends on a number of factors:

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

b) bending and shear strength of the pins;

c) size, quantity and spacing of the pins;

d) length of engagement both in the planter and in the surface;

e) depth of rebate.

10.5 Examples of active VSBs

10.5.1 General

10.5.1.1 The gaps around the opening segment of a blocker or bollard when fully open (allowing vehicle passage) should be minimized and may be subject to local regulations. The blocker, bollard and the sliding gate track and their surrounds should be flush with the adjoining finished road surface.

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

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

10.5.1.4 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 might 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.

10.5.1.5 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.

10.5.2 Active bollards

10.5.2.1 Active bollards are available in a wide range of height, cross-section and material. Unlike passive bollards they are often used as single units or found within a row of passive bollards where access/egress is required. Traditionally, the depth of foundation was 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.

10.5.2.2 Consideration should be given to those issues identified for fixed bollards (see 10.4.1) and to the following:

a) foundation might require to be designed for a single unit;

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

c) location of 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) need for regular service and maintenance.

10.5.2.3 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 may have severe implications on the utilities found within and under the surface of access roads.

10.5.3 Road blockers

10.5.3.1 General

10.5.3.1.1 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.

10.5.3.1.2 Road blockers are used at VACPs and are in three general forms:

a) deep mount – typically requiring 500 mm to 1 800 mm excavation;

b) shallow mount – typically requiring less than 500 mm excavation;

c) surface mount.

10.5.3.1.3 Selection criteria often include:

a) site ground conditions;

b) vehicle flow;

c) permanent/temporary installation.

10.5.3.1.4 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.

10.5.3.1.5 They can be installed as individual units or in pairs, for example, to form a vehicle inter-lock system. The majority of designs need specific foundations or fixing detail that is essential for their successful performance against impact.

10.5.3.1.6 In certain situations, such as heightened alert status or when temporary protection is required, portable surface mounted road blockers may 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.

10.5.3.1.7 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. Consideration should be given to the type of finish required on the top plate to ensure vehicles do not lose traction, particularly cyclists and motorcycles.

10.5.3.1.8 The continuous perimeter gap around a road blocker (including the plate and frame) should be minimized, as larger gaps may 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 creates a tracking hazard to two-wheeled vehicles. The designer should also be aware of components/voids that could trap or injure an individual as the VSB opens or closes.

10.5.3.1.9 Road blockers are typically installed in locations where they are routinely traversed by vehicles. In such applications, the surface of the blocker should provide adequate grip. The skid resistance of the blocker should be similar to the skid resistance of the surrounding road surface and sudden changes in skid resistance should be avoided. This might be achieved by the application of an appropriate surface treatment. When braking or manoeuvring, two-wheeled vehicles are particularly at risk of sliding and, where appropriate, two-wheeled vehicles and pedestrians should be segregated from other traffic.

10.5.3.2 Foundations and layout

10.5.3.2.1 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.

10.5.3.2.2 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.

NOTE The gap is measured at 600 mm above finished ground level.

10.5.3.2.3 Where VSBs are available in sufficient widths to protect 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 m.

10.5.4 Rising arm barriers

10.5.4.1 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 road. The specifier should seek assurance from the manufacturer to ensure that a failure of, the hydraulic system, drive system or other structural component does not allow the beam to fall in a dangerous or uncontrolled manner.

10.5.4.2 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.

10.5.5 Sliding and swing gates

10.5.5.1 General

10.5.5.1.1 Sliding and swing gates are available in a variety of types which may vary in height, width, cross-section and resistance to impact. They are generally installed across the roadway to prevent vehicle access to the asset to be protected.

10.5.5.1.2 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.

10.5.5.2 Foundations

10.5.5.2.1 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 may have severe implications on the utilities found within and under the surface of access roads.

10.5.5.2.2 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.

10.5.5.3 Layout

10.5.5.3.1 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.

10.5.5.3.2 In designing an entrance, allowance should be given to the run-back distance required for sliding gates and the arc of travel for a swing gate or beam.

10.5.5.3.3 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 fast activation can be designed into the gate system. Gates are not typically as fast in operation as rising bollards or road blockers and may therefore not be suitable for operation in high volume traffic applications.

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

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

11 Active VSBs

11.1 General

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

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

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

11.1.2 Powered VSBs by nature of their design should be considered to be machinery and therefore designed, maintained and operated accordingly. This becomes apparent when you look at the commonality of design of machinery and active VSBs, as illustrated in Figure 2.

NOTE In consideration of the site owner's responsibility to meet local and national health and safety regulations for users of work equipment.

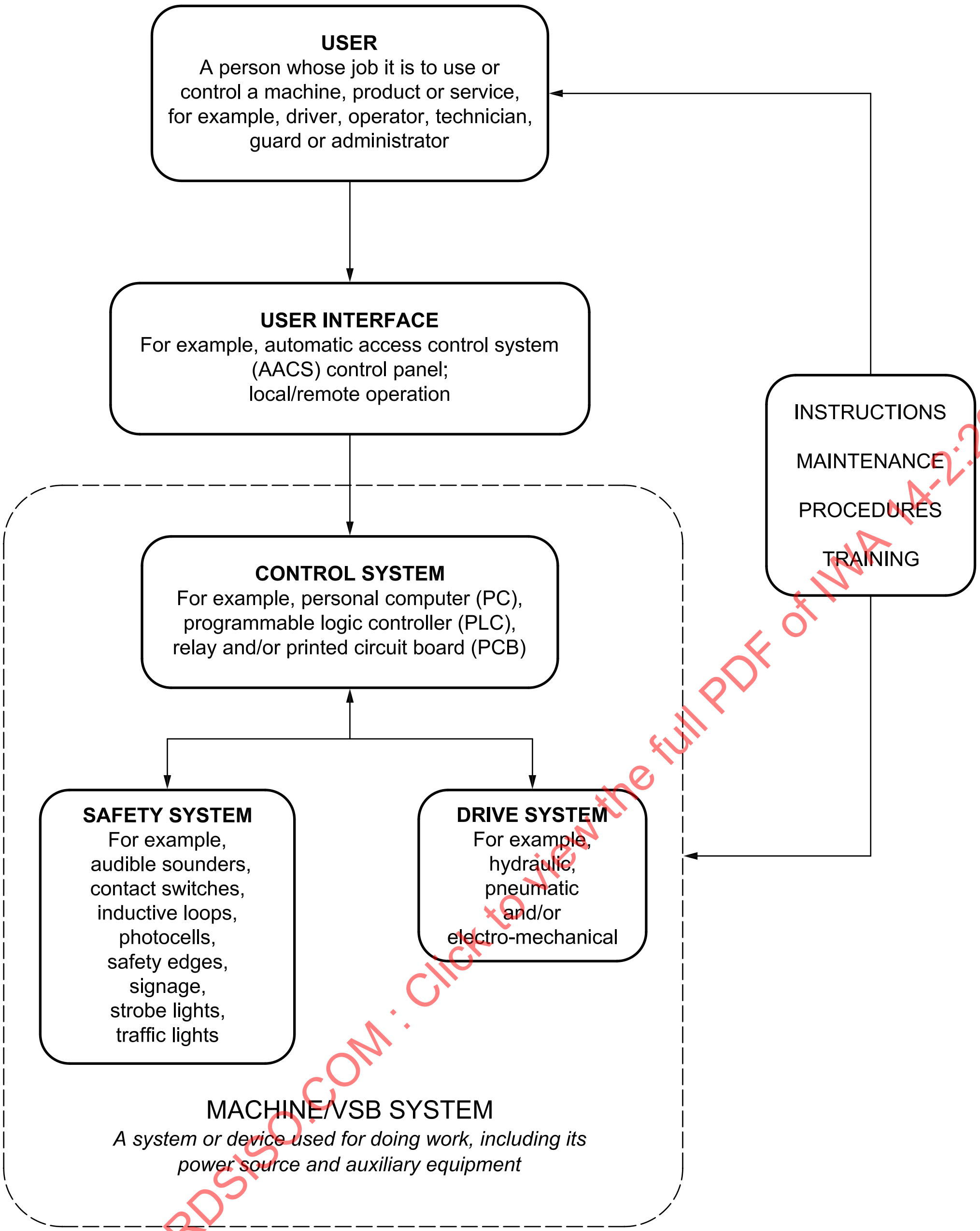


Figure 2 — Commonality of machinery and active VSBs

11.2 Categories of active VSBs

11.2.1 General

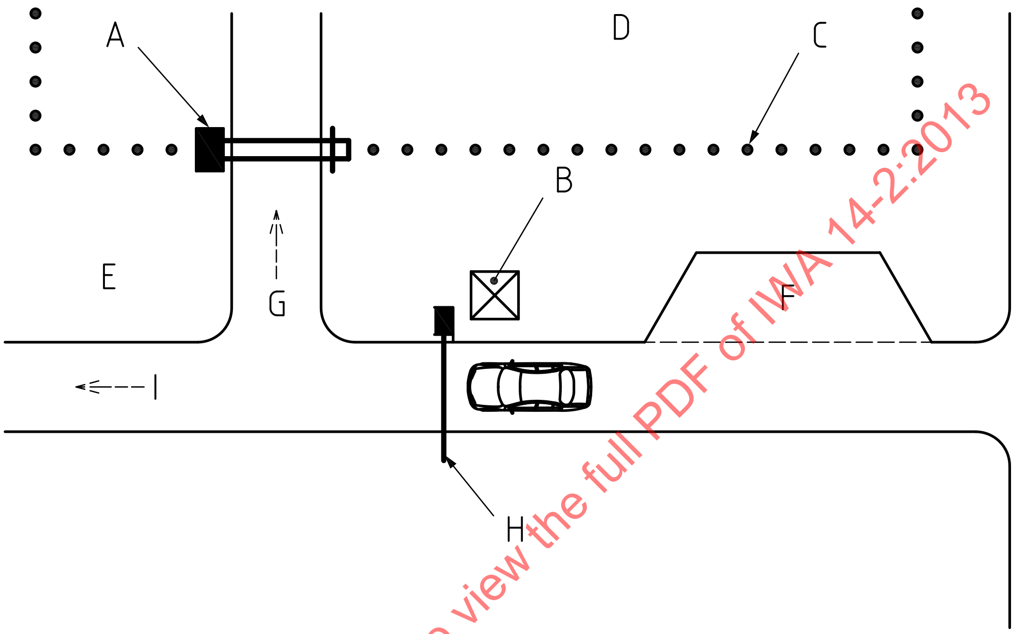
Current threats have led to the rapid development of active VSBs capable of resisting deliberate vehicle impacts. Active VSBs can be categorized as VACP VSB (see 11.2.2), anti-ram VSB (see 11.2.3) and counter-terrorist VSB (see 11.3).

11.2.2 VACP

11.2.2.1 VACPs are used to control consensual vehicle access into sites or as part of a revenue collection system.

NOTE Not all barriers at VACPs have performance classified VSBs. Some barriers may 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.

11.2.2.2 The principle components of a VACP are illustrated in Figure 3. 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)	F	waiting/search area
B	security kiosk	G	authorized vehicles
C	passive VSB (to define the approach to barrier A)	H	access control barrier
D	site/protected zone	I	rejected vehicles
E	unprotected zone		

NOTE Layout is showing right hand drive configuration (i.e. security kiosk is on the driver's side).

Figure 3 — Principle components of a VACP

11.2.3 Anti-ram VSB

11.2.3.1 Anti-ram VSBs are used on sites when there is a need to control legitimate vehicles access but also to deter and prevent unauthorized vehicle access. They tend to be physically robust in appearance and may or may not have been formally tested against vehicle impact.

11.2.3.2 Performance classified VSBs are typically installed in locations where illegal entry or exit is to be deterred (e.g. vehicle rental compounds, prestigious locations, shops with high value assets) and are typically designed to produce a hard stop or delay at the boundary of the site to a vehicle-borne threat. These products tend to be road blockers, rising bollards and heavy-duty slide/swing gates.

11.3 Layout of active VSBs at VACPs

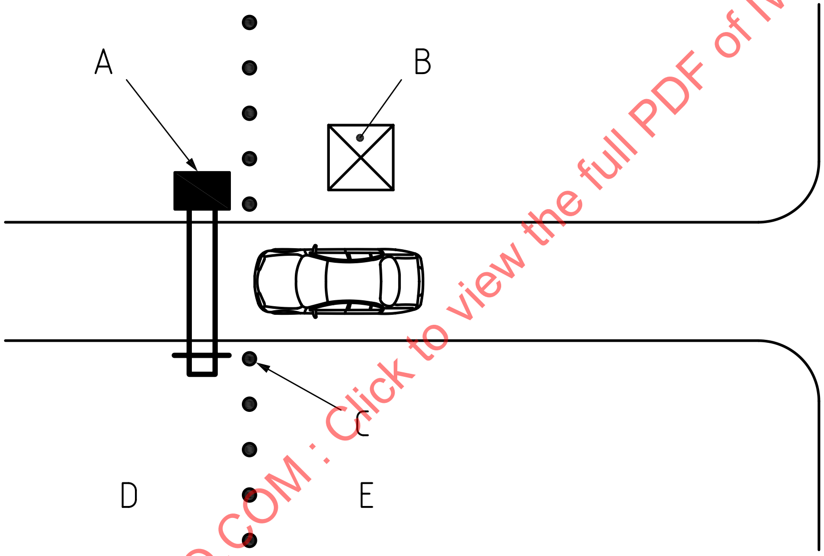
11.3.1 General

11.3.1.1 VSBs are typically installed in three basic configurations at VACPs: single line of VSBs (see 11.3.2), interlocked VSBs (see 11.3.3) and final denial VSBs (see 11.3.4).

11.3.1.2 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.

11.3.2 Single line of VSBs

Single line of VSBs (see Figure 4) 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

NOTE For simplicity, approach road layouts, traffic calming, search/screening facilities and/or rejection lanes, etc. are not shown. Layout is showing right hand drive configuration (i.e. security kiosk is on the driver's side).

Figure 4 — Single line of VSBs

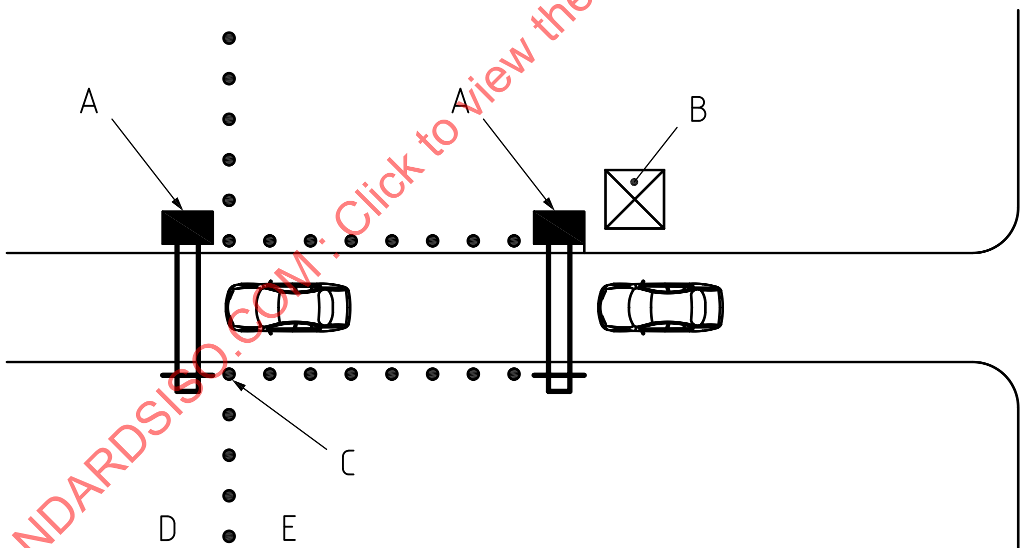
11.3.3 Interlocked VSBs (also known as a "Sally Port" or "Tiger Trap")

11.3.3.1 Interlocked VSBs (see Figure 5) 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.

11.3.3.2 Transit into 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. Upon exit or entry of the facility, past the first VSB, a thorough search of the vehicle can be conducted and the occupants can then be directed into a personnel access portal to be searched as well. 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. Generally, the vehicle and occupants are verified and searched before access into the interlock is authorized.

11.3.3.3 The interlocked VSB configuration can provide the opportunity for other physical security measures as: having adjacent fighting positions that allows for security force personnel to direct fire into the port and over watch positions having emergency lock-down capabilities.

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.

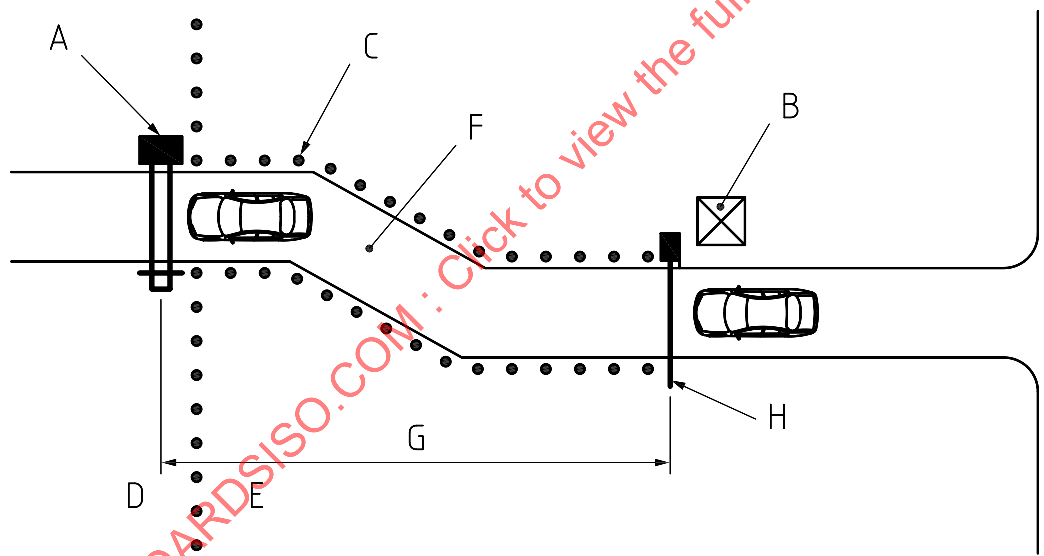
Figure 5 — Interlocked VSBs

11.3.4 Final denial VSB

11.3.4.1 Final denial VSBs (see Figure 6) comprise 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 could be considered very secure on condition that there is a back-up 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.

11.3.4.2 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 signallization and safety systems to operate, time for non-threat vehicles to safely stop prior to the VSB or proceed through), and VSB deployment time (time for the VSB to fully deploy in an emergency fast operate mode).

11.3.4.3 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 could 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 could 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 6 — 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.

NOTE For example, if one of the attack scenarios is considered to be a tailgate attack, then a single line of VSBs may not be considered effective as it is quite possible, depending on 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 may not be considered suitable as a deterrent, if it is regularly left in the open position to facilitate traffic throughput.

11.3.5 Traffic throughput

11.3.5.1 A traffic survey should be carried out to establish 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. 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 (i.e. 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 could 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.

11.3.5.2 Table 1 provides an example theoretical best case estimates of vehicle throughputs for various VACP configurations.

NOTE Vehicle and personnel search procedures can add a significant amount of time to individual vehicle transit times.

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

11.4 Safety issues

11.4.1 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 may exceed sensible or legal limits. Additionally, an inadequately secured or locked manually operated VSBs can result in accidents.

NOTE Active VSBs are subject to machinery and health and safety legislation.

11.4.2 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.

11.4.3 Safety requirements also differ depending on whether the VSB is situated in a controlled area, or adjacent to public land. Always consider the possibility that a visitor or member of the public may inadvertently or deliberately approach the VSB and put themselves at risk.

11.4.4 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, consider 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, i.e. slippery surfaces, tyre traps.

11.4.5 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, consider how safety and security may be compromised as a result of distractions or concentration on other tasks or lack of vigilance.

11.4.6 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 MOs.

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

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

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

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

a) warning signs;

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 (i.e. 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 (i.e. a screw that requires specialist tools or techniques to remove legitimately) and locks.

11.4.11 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.

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

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

11.4.14 Consideration should be given to the layout and design of push button control panels (control consoles/control panels) to reduce the possibility of staff accidently operating a VSB, by, for example, leaning against the console or depressing the wrong button. The design of the control panel should be clear, simple and intuitive to use.

11.4.15 Consider the potential need to override the safety systems in the event they have been compromised or failed. In doing so, ensure that the alternative means of operation is safe and has been thoroughly risk assessed.

11.5 Training

As with any machinery, drivers, operators, technicians and owners should 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. 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. Traffic signalling and signage requirements should be derived from local safety codes.

11.6 Maintenance, service and inspection

11.6.1 Active VSBs

11.6.1.1 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 the type of VSB, type of drive mechanism, quality of the product, local environmental issues, the cost of a service contract and system spares, capability of the service provider.

11.6.1.2 Without addressing the requirement to not only having a maintenance contract but also a response timeframe for rectifying VSB breakdowns, there is a risk that the VSBs might be left inoperable for long periods of time. This could have an adverse affect 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.

11.6.2 Passive VSBs

Passive 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).

11.6.3 Adjacent works

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

11.7 Control system

11.7.1 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.

11.7.2 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.

12 Operational requirements

12.1 General

12.1.1 Introduction

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

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

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

a) Level 1 OR;

b) Level 2 OR;

c) technical specification;

d) system commissioning, validation training and handover;

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

12.1.1.4 The first three stages of 12.1.1.3 a) to c) are designed to progressively build the security requirements in increasing detail. The fourth stage 12.1.1.3 d) is designed to assess deliverables against these. The fifth stage 12.1.1.3 e) instructs the person responsible for site and facilities security of the minimum requirements to ensure safe, secure and reliable operation of the VSB.

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

12.1.1.6 Stakeholders 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 Stakeholders might include but not be limited to site security managers, building owners, landlords, occupants, budget holders, facilities management, local authorities and emergency services.

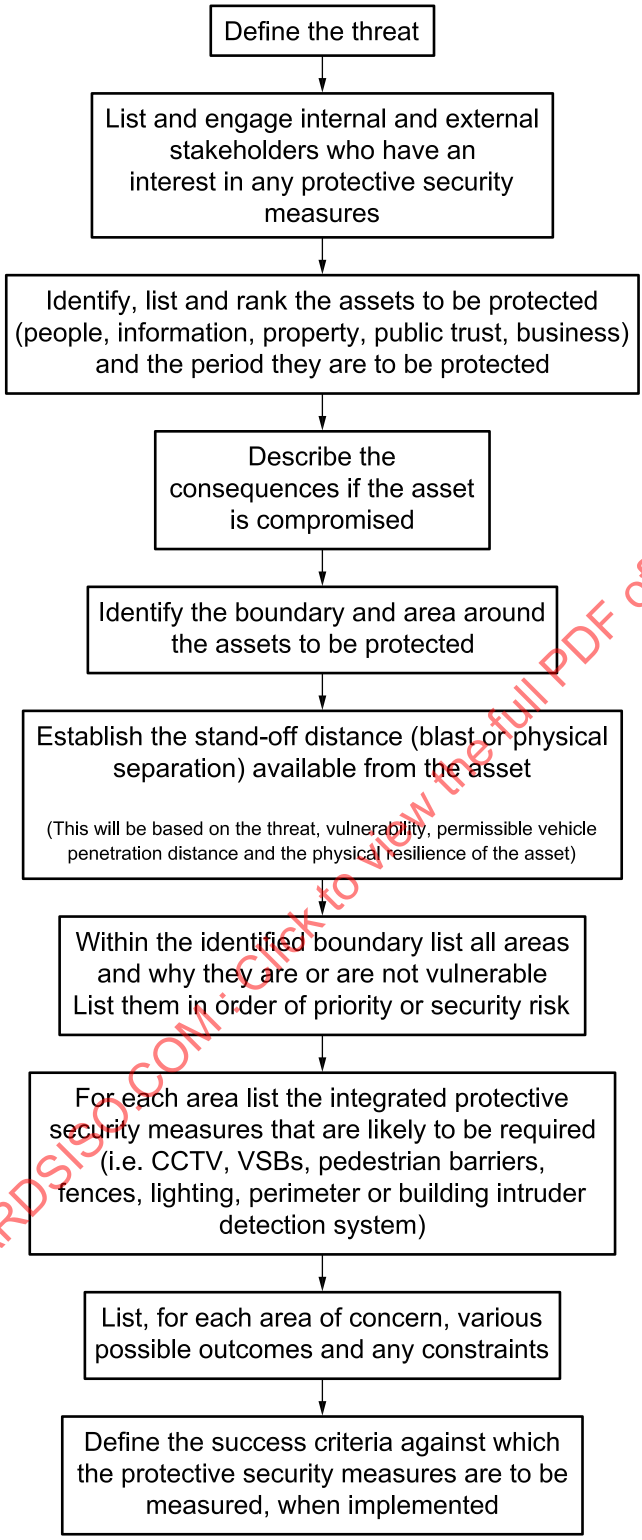
12.1.2 Level 1 OR

This is a document that outlines requirements based on the threat. A flowchart for Level 1 OR for VSBs is given in Figure 7.

12.1.3 Level 2 OR

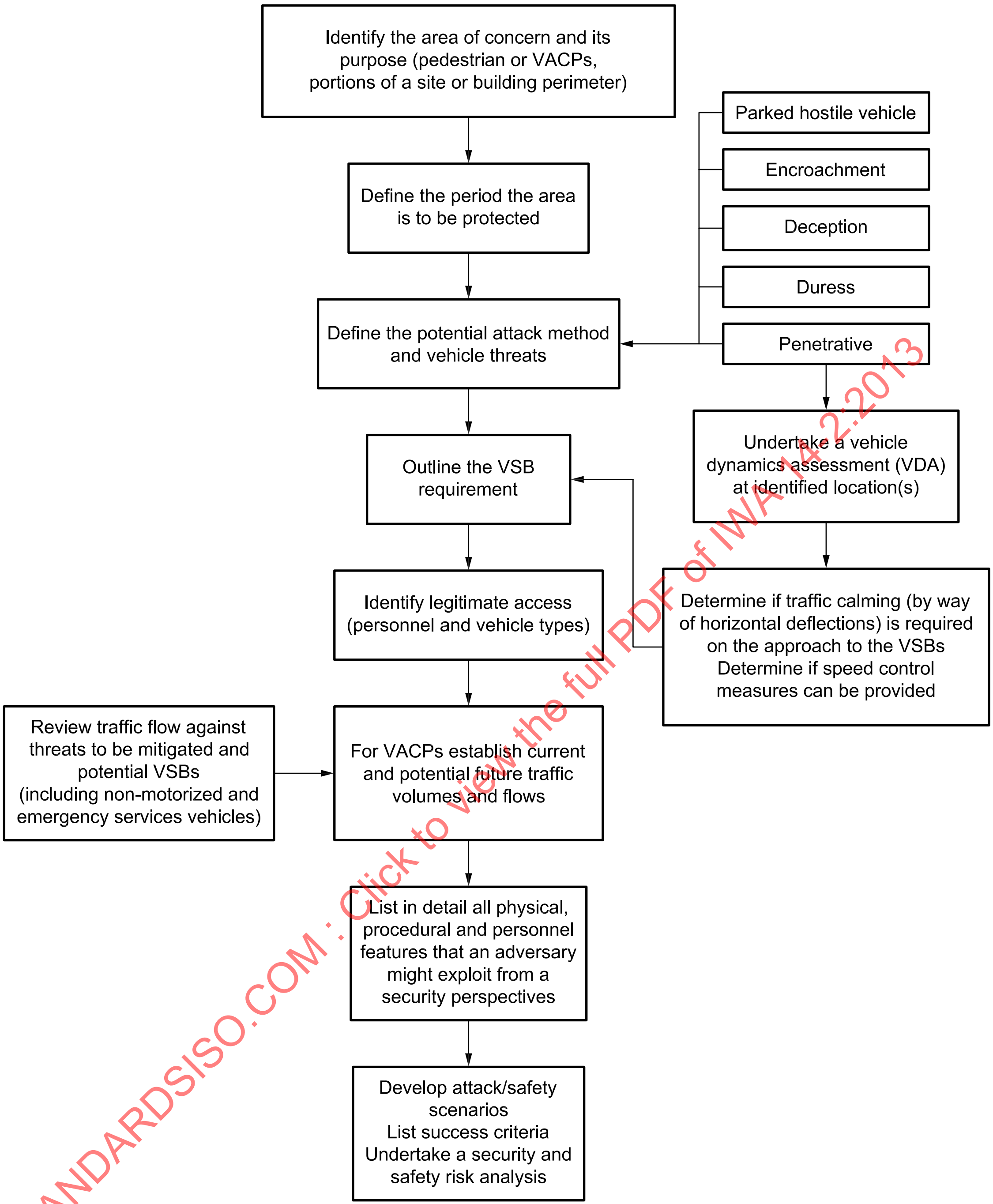
12.1.3.1 The production of the Level 1 OR helps define the security systems that need to be addressed. These may include CCTV, fencing, VSBs, AACSs, security lighting, intruder detection systems, fencing, security procedures. There are multiple Level 2 ORs and they should be produced for each of the 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 might also require Level 2 ORs for CCTV, security lighting, access control and fencing.

12.1.3.2 A flowchart for a Level 2 OR for VSBs is given in Figure 8.



NOTE This list is neither prioritized nor exhaustive nor should it necessarily be completed sequentially. It acts as a guide only.

Figure 7 — Level 1 operational requirement (OR)



NOTE This list is neither prioritized nor exhaustive nor should it necessarily be completed sequentially. It acts as a guide only.

Figure 8 — Level 2 operational requirement (OR)

12.2 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 (OR) proforma

A.1 Document references

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

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 (12.1.3) should be indicated.

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.

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

A.5 Period of concern

The area of concern should be described, when it is at greatest risk.

: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 could make the site vulnerable should be identified; with an explanation of why they may reduce the effectiveness of HVM security. 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.

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)

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 may affect HVM measures or VACP layouts)		
Vehicle access control point (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)

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 could compromise security or operational requirements should be identified.

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, robbery, burglary, vandalism or unauthorized access.

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

A.7.2 Performance requirements – Attack scenarios

The attack to be mitigated should be identified through attack scenario development and analysis.

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) – Single vehicle; rams through the perimeter or VSB line	
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 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 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 MO	

A.7.3 Impact and performance requirement (hostile vehicle)

HVM measure(s) performance requirements under vehicle impact conditions should be stated.

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			
Threat	**Tick**	**Impact angle (°)**	**Impact speed (km/h)**
Motorcycle			
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 day cab vehicle [N2A, 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]			
30 000 kg, 4-axle rigid day cab vehicle [N3F]			
Construction / plant (specify)			
Military (specify)			
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. Where possible, traffic volumes, by category, should be identified.

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