SAFE PLACES
Vehicle Management

A COMPREHENSIVE GUIDE FOR OWNERS, OPERATORS AND DESIGNERS

NSW Police Force

Glossary:

CCTV	Closed-circuit television
CTSTC	New South Wales Police Force Counter Terrorism & Special Tactics Command
HVM	Hostile vehicle management
PIDS	Perimeter intrusion detection systems
PMG	Places of mass gathering
VACP	Vehicle access control point
VBIED	Vehicle-borne improvised explosive device
VSB	Vehicle security barriers

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The content in this publication has been developed jointly by the New South Wales Police Force Counter Terrorism & Special Tactics Command (CTSTC) and the Designing Out Crime Research Centre, University of Technology Sydney.

All images in this document depict examples of potential hostile vehicle management designs and devices. However, it is very important to note that each example shown may not necessarily be suitable for every situation, premise or type of infrastructure. Advice should be sought directly from the CTSTC for guidance specific to your situation. See page 39 for more information.

CONTENTS

WHO

WHO SHOULD READ THIS AND WHY

This publication provides an overview of hostile vehicle management in risk situations and is useful to all owners and operators responsible for management of public spaces and buildings.

It offers insight into how protective measures can be integrated into public and private spaces in order to mitigate and/or reduce the impact of vehicles being used as weapons.

In creating this document, we aim to provide those responsible for the management of public spaces and buildings with knowledge to inform security design considerations and decisions. It is not a policy document, nor is it intended to be comprehensive. Rather, it is a starting and referral point for positive and aesthetically complementary designs that help protect public spaces and buildings from hostile vehicles.

KEY HOT SPOTS:

COMMERCIAL HUBS, SHOPPING CENTRES, SPECIAL EVENTS, STADIUMS, HOTELS, CBDs

SECTION 1.

WHEN AND WHERE VEHICLES COLLIDE WITH PEDESTRIANS OR BUILDINGS

ABOUT THIS PUBLICATION

Protecting people and property in places of mass gathering requires attention to the traffic management, urban design and architectural features of a space. This document addresses the ways in which vehicles can directly threaten pedestrians and buildings in public spaces, and how these threats can be mitigated and managed.

Section 1 defines hostile vehicles and the nature of the threats they may pose to people, public spaces and infrastructure.

Section 2 provides guidelines on how to prevent hostile traffic from injuring pedestrians and damaging infrastructure. It provides examples of physical barriers and traffic management solutions to prevent hostile vehicles entering public spaces, as well as architectural considerations for preventing building collapse in the event of security breach by a hostile vehicle.

The concluding section outlines the advantages of early implementation in relation to cost when designing an effective mitigation strategy, and provides contact details for further information.

1.01/ HOSTILE VEHICLES

WHAT IS A HOSTILE VEHICLE?

A hostile vehicle is generally one whose driver is determined to access a restricted or unauthorised area or location in order to cause damage to buildings and structures, cause injury/death to people, disrupt business or effect publicity for a cause.

A hostile vehicle may be used to carry an explosive device or the vehicle itself, travelling at speed, may present the primary danger.

Drivers of hostile vehicles could include the mentally ill, disgruntled customers or employees, political activists, terrorists and criminals.

However, it is important to remember that the definition of a hostile vehicle also includes vehicles that are out of control.

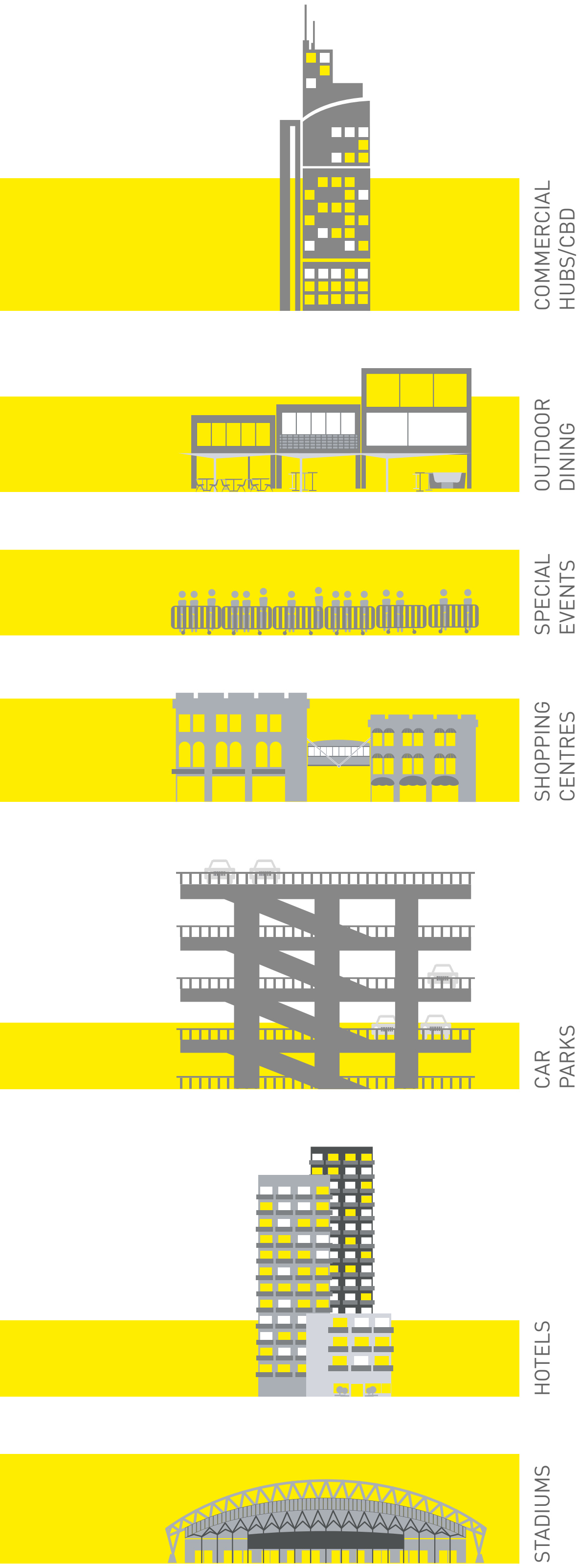
The most likely targets of hostile vehicles are:

- Spaces occupied by a critical mass of people at a particular time [termed Places of Mass Gathering (PMG)], where the aim of an attack is to cause death/ injury to large numbers of people
- Infrastructure that is of high significance for social, political or economic reasons and which may be structurally affected or destroyed by an attack.

A vehicle being used as a weapon will not necessarily obey traffic/road rules. There is an inherent danger in not taking this into account when conducting a site assessment. All too often, security measures have been installed under the assumption that a vehicle will not travel the wrong way down a one-way street.

The recommendations of this document focus on preventing vehicular access to PMGs; however they may also be valuable in smaller-scale situations, such as protecting pedestrians on footpaths from car traffic.

1.02/ PLACES OF MASS GATHERING



SECURITY SHOULD BE PROPORTIONATE TO THREAT

A place of mass gathering may be defined as **a venue or precinct that is open or enclosed**, and is characterised by the **concentration of people on a predictable basis.** (www.nationalsecurity.gov.au)

The following is a list of the kinds of places that could be designated Places of Mass Gathering. Permanent and temporary hostile vehicle mitigation (HVM) protection may be required for a variety of structures and areas.

CATEGORIES OF PMG

COMMERCIAL HUBS/CBDs
Malls
High density footpaths
Outdoor dining
Special events (festivals/celebrations)

SHOPPING CENTRES
Pedestrian entrances
Car parks
Food courts
Special events (displays/concerts)

HOTELS
Main entrance/foyers
Licensed premises
Car parks

STADIUMS
Entry/Exit points (time specific)
Pedestrian movement areas

1.03/ CRITICAL INFRASTRUCTURE

THREATS TO INFRASTRUCTURE FROM HOSTILE VEHICLES

'SECURITY IN DEPTH' APPROACH

Our aim is to introduce a 'security in depth' or 'layered' approach to vehicle management and security.

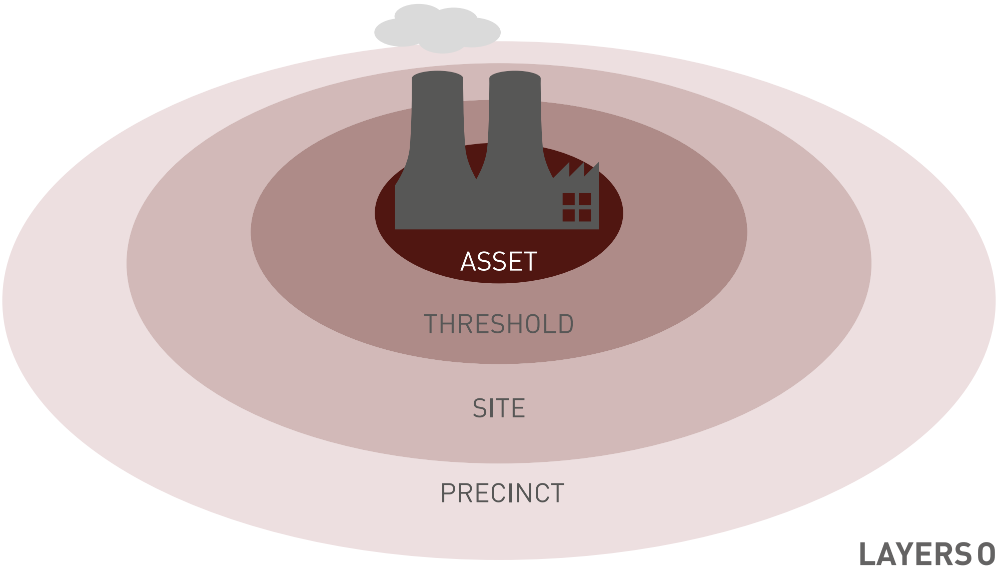
The concept of security in depth has been defined as 'the sum of all security layers, physical and logical which stands between an adversary and a protected target.' Security in depth is founded on the understanding that 'it is difficult to build the perfect layer, and different layers are more or less effective against different threats.'[1]

The security in depth principle offers a well-integrated method for providing multiple levels of protection at a site, and ensures that if one mitigation option is compromised, the other measures in place will continue to provide a level of protection. As such, the options outlined in this document are not to be used in isolation: for a holistic and thorough approach to hostile vehicle mitigation they should all be considered as an integrated model.

If retrofitting vehicle mitigation measures in an existing built environment, it may be difficult to maintain ideal standoff distances, particularly in high-density urban areas. In these more constrained sites, particular attention should be given to site or precinct-wide security, avoiding direct approach routes, managing maximum vehicle approach speed and installing threshold vehicle mitigation measures.

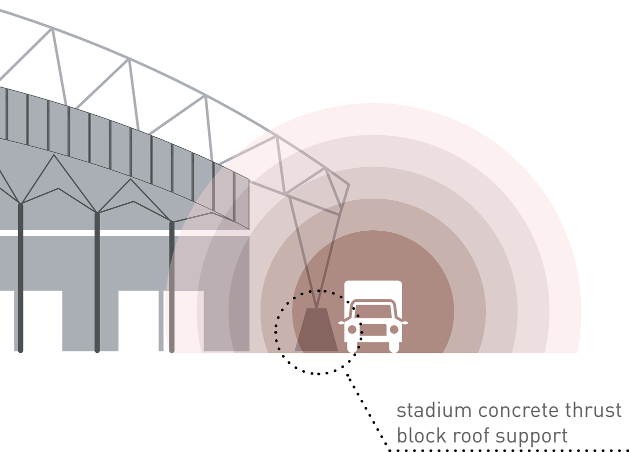
For higher-risk buildings, stronger and more complex defences need to be considered to prevent vehicle access and maintain appropriate standoff distances.

[1] Coole, M., Corkill, J., Woodward, A., (2012), Defence in depth, protection in depth and security in depth: A comparative analysis towards a common usage language. The Proceedings of the 5th Australian Security and Intelligence Conference, 27-35, Perth, Western Australia.

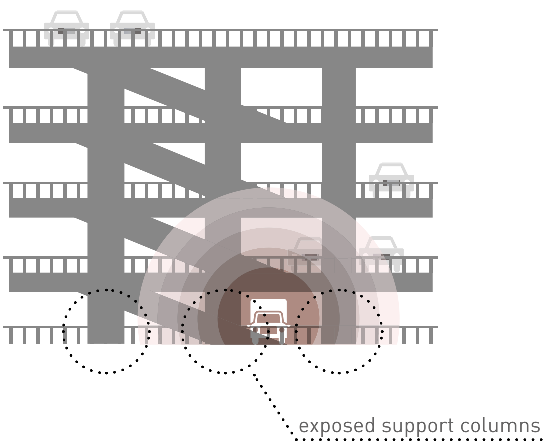


LAYERS OF SECURITY

AREAS OF VULNERABILITY



EXTERNAL
Exposed columns
Facades (masonry and glass)



INTERNAL
Building core (underground car park)

SECTION 2.

HOT SPOTS SUCH AS CAR PARKS, BUSY STREETS, TRUCK ENTRY POINTS, BUILDINGS AS TARGETS

HOW TO SEPARATE HOSTILE TRAFFIC FROM PEDESTRIANS AND BUILDINGS

In designing and applying measures to mitigate hostile vehicle threats in public spaces, it is important to consider equally the needs of the normal users of the space, Spaces must be safe but they must also be aesthetically appropriate and functional, such that the level of security matches the extent of the threat.

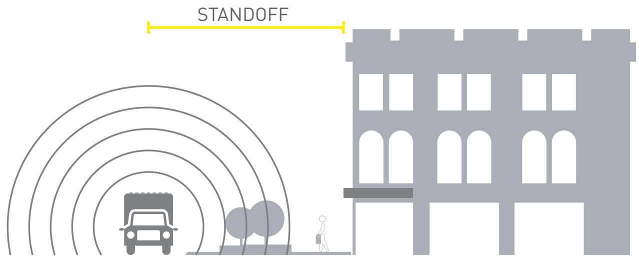
As such, a 'one size fits all' approach is not effective: mitigation solutions must be tailored to the physical and practical context. Additionally, since threat levels and terrorist methods evolve over time (often in response to security methods), both current and future security needs must be taken into account and security measures reviewed periodically for effectiveness.

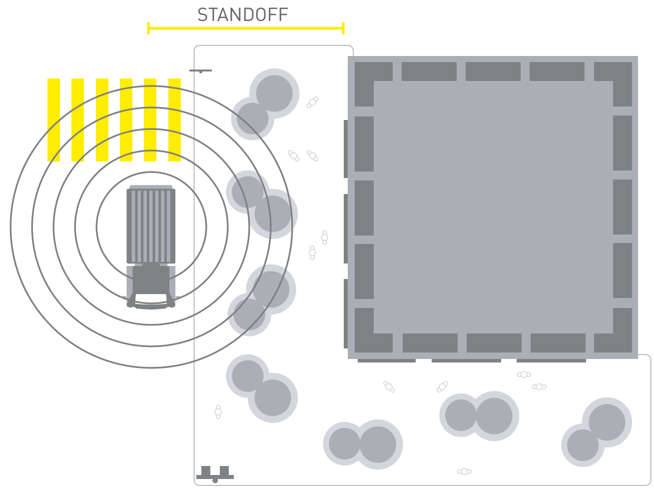
For most existing locations and in some new build designs there will be constraints that limit design and can compromise the effectiveness of HVM measures, such as:

- Business needs (e.g. budget, health and safety)
- Logistics (e.g. traffic management, operational requirements)
- Building (e.g. appearance, planning consent)

In this case a risk management plan of vulnerabilities is needed.

2.01/ STANDOFF DISTANCE





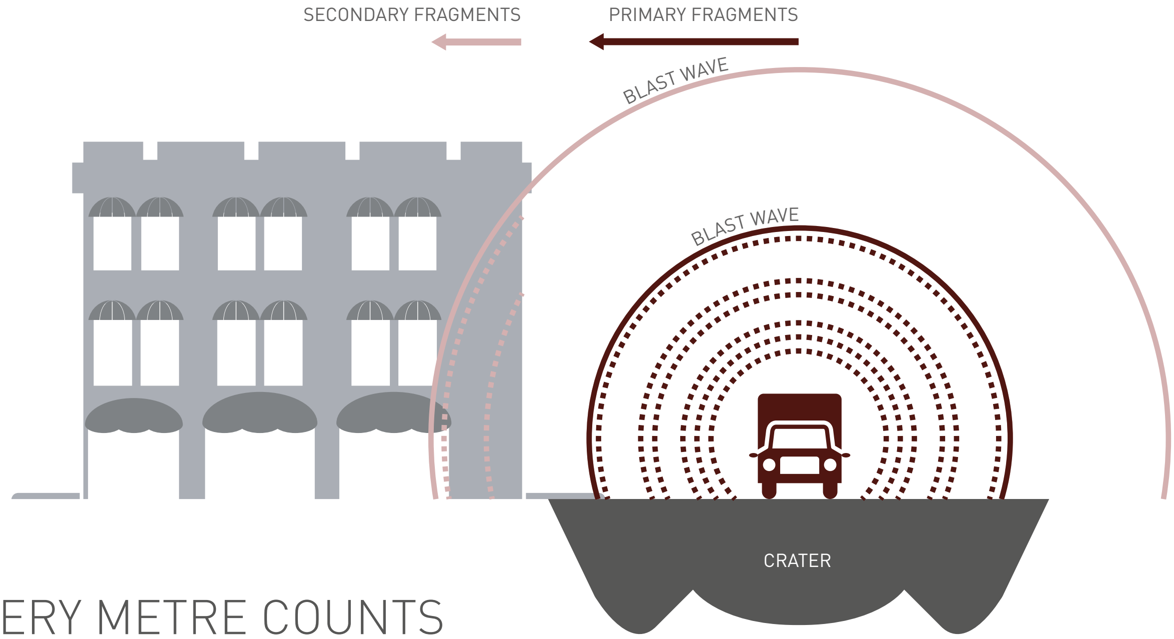
WHAT IS IT AND HOW IS IT ACHIEVED?

The term 'standoff', in the context of this document, refers to **the maximum possible distance that can be kept between an asset and a hostile vehicle.**

Achieving standoff is the single most important factor in reducing the damage caused by a hostile vehicle, regardless of whether the damage results from the blast wave of an explosion or from an out-of-control vehicle. Every metre of standoff counts. Even in sites where existing built features make standoff measures difficult to implement, it is important to ensure that every attempt is made to achieve standoff to protect high volume pedestrian areas.

Each site must be assessed on an individual basis to achieve the maximum standoff possible given the unique circumstances of the site. Addressing standoff in the design stages therefore provides the greatest opportunity for this.

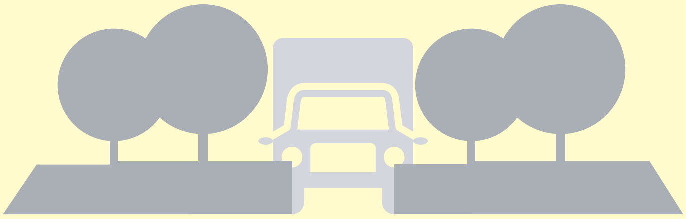
If retrofitting a site to create standoff, it is not necessarily advisable to try to accommodate existing pedestrian traffic (e.g. staff and visitors) patterns, as this can result in more expensive and less effective solutions.



EVERY METRE COUNTS

Where possible, barring vehicular access entirely – thus automatically removing threats to the site - is preferable to more elaborate traffic management designs. This option can also have added operational benefits such as less need for manned guarding and reduced risk of accidents or misuse. This option could use remote car parking for both visitors and staff outside of the enforceable blast standoff perimeter.

In selecting this method, however, consideration should be given to routine and emergency servicing requirements of the asset, as well as surrounding traffic and transport imperatives. The exclusion of traffic from a wide area may increase traffic volumes and congestion in the surrounding local transport network, thus creating a need for wider traffic management plans.



DESIGNING FOR STANDOFF

The strategic integration of steps, columns and sculptures into the building's design offers a good example of how hostile vehicle mitigation can be applied in a subtle way.

A flight of steps leading into a building can restrict access to most conventional vehicles, presenting the building as a less desirable target.

Strategically placed mitigation devices such as spheres, planter boxes, seats or bollards on the pavement surrounding the entrance of the building provides additional protection against unauthorised vehicle intrusion while increasing standoff distance. It is important to ensure that barrier solutions that may not be purpose built (e.g. planter boxes, sculptures) are properly mounted and reinforced against impact. Consult CTSTC for installation guidelines specific to your situation.

The bottom two images on the right are computer-generated images demonstrating how a combination of planter boxes and spherical balls might enhance and protect the area. Please note that these are suggestions only; consult CTSTC for advice specific to your premises.


CURRENT DESIGN


ENHANCEMENTS
Example 1


ENHANCEMENTS
Example 2

2.02/ BARRIERS

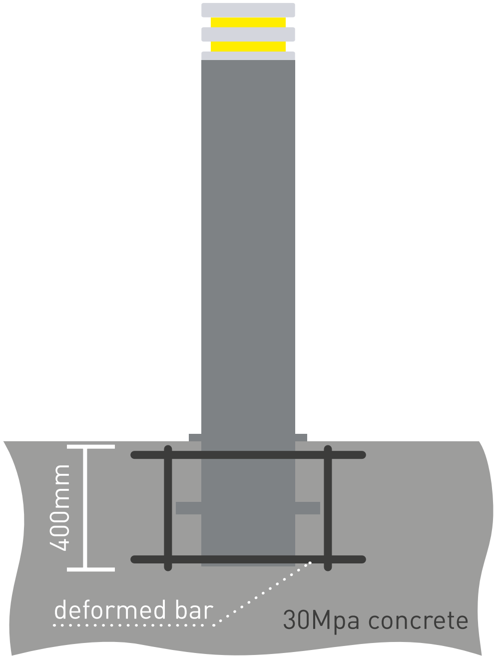
VEHICLE SECURITY BARRIERS (VSBs)

VSBs can be passive (static) or active (functioning/ mechanical) in their operation. Active devices are susceptible to mechanical failures and human error/ deception techniques, and require maintenance and on-going costs; accordingly, passive barriers are preferred wherever possible.

When selecting a barrier the foundation and installation is just as important to consider as the barrier itself. A design that may perform well under high-energy hostile vehicle impact can be let down by a poorly designed foundation.

Manufacturers offering an impact-tested VSB should also be able to offer a tested and approved foundation design for that product. Other considerations when installing a VSB include:

- The presence of underground obstructions
- Ground conditions
- The perceived calculated impact loading
- Protection to underground services in close proximity



FOUNDATION REQUIREMENTS

VSB foundations around underground services
CPNI 2010

PASSIVE BARRIERS

There are a great number of options for creating effective passive barriers around an asset. They need not be costly to install and can easily fulfil aesthetic requirements of the space and its patrons, as well as the requirements of HVM.

A balance should be struck between proportionate security measures, the needs of the local businesses and functionality of public space. It is possible to integrate bespoke HVM measures into most public realm features.

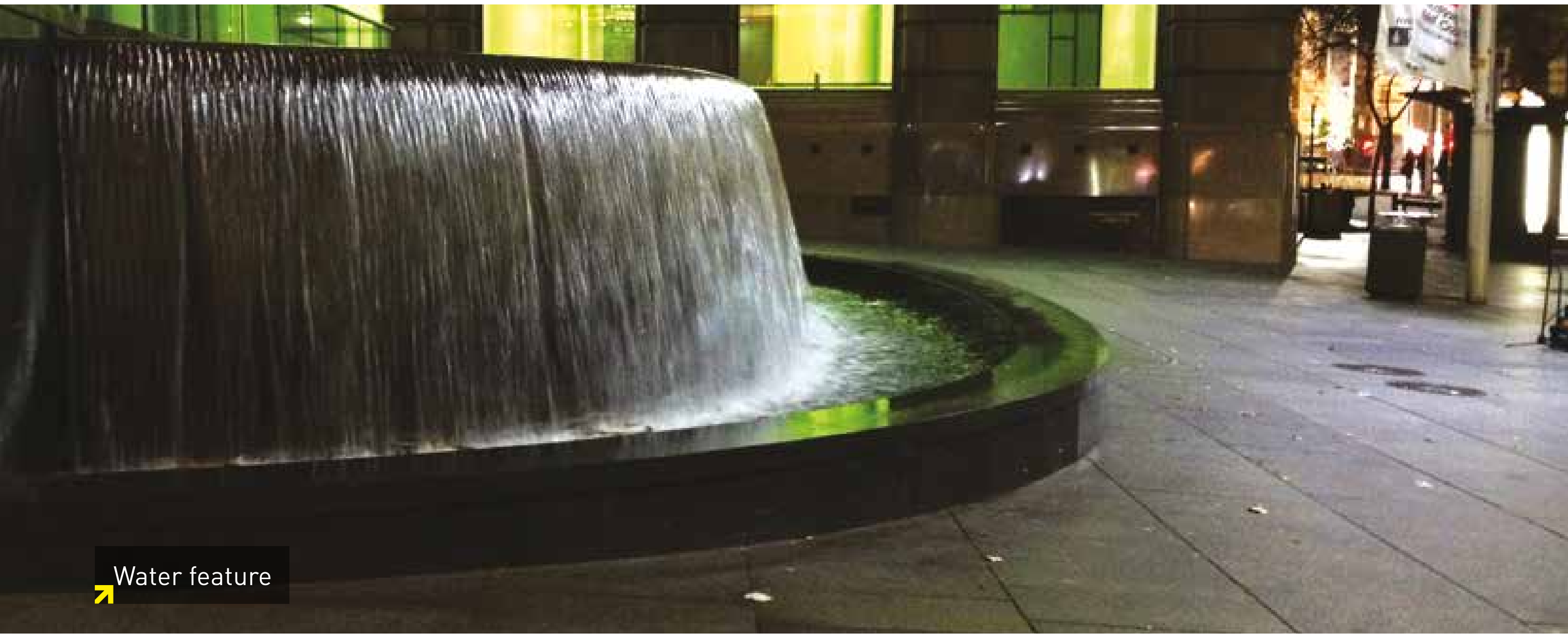
Urban elements that can be used include:

- Landscape features (e.g. sculpted or clad earthworks, steep verges)
- Shrouded bollards (i.e. designed to match local architecture)
- Decorative, structural or energy absorbing planters (i.e. more aesthetically acceptable)
- Strengthened 'light' structures (e.g. bus or smoking shelter, information sign)
- Large immovable landmarks (e.g. statues, walls)
- Integrated street furniture (e.g. lighting column, traffic signal, seating, cycle rack)
- Level changes (e.g. steps, high kerbs)
- Water features (e.g. fountain, pond or pool)

Semi structural bollards

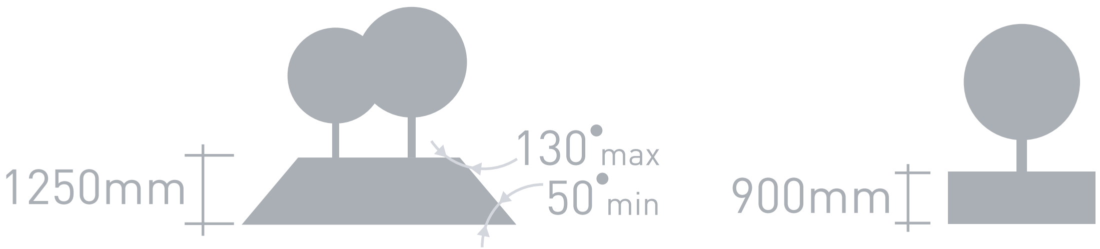
Sculpture and street furniture

Riverside upgrade:
sculptured feature walls



Water feature

Sculptures, street furniture or natural barriers should comply with a few technical details if chosen to mitigate vehicles.



SLOPED FACED FEATURES:

- Approach angle greater than 50°
- Height greater than 1250mm
- Break-over angle smaller than 130°

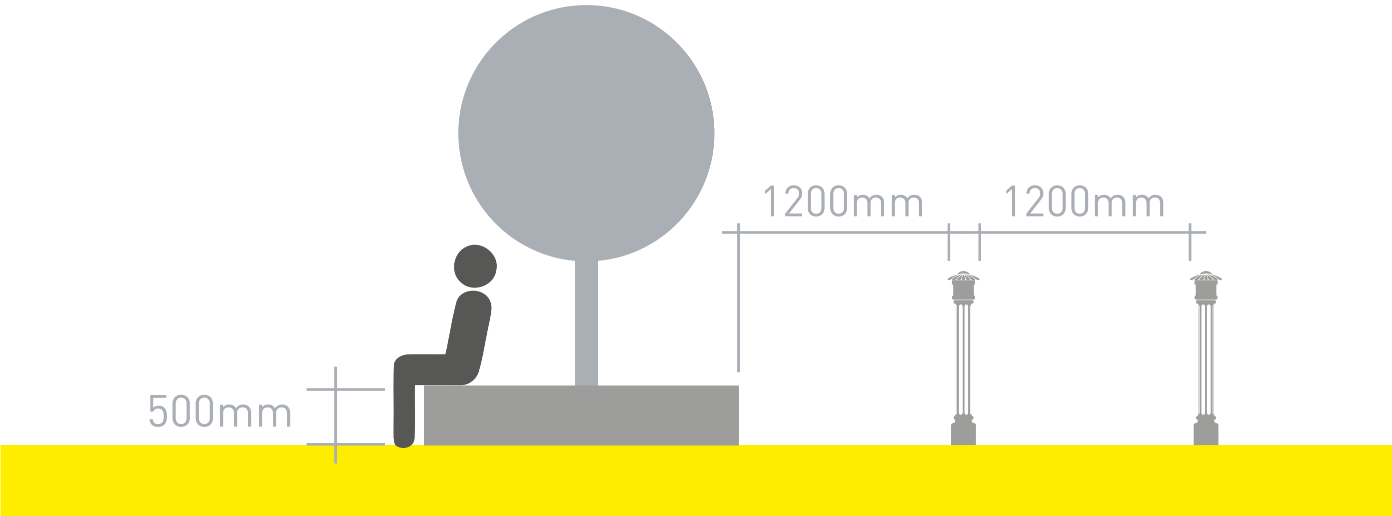
FLAT FACED FEATURES

- Ideal height 900mm

Street furniture as bollards

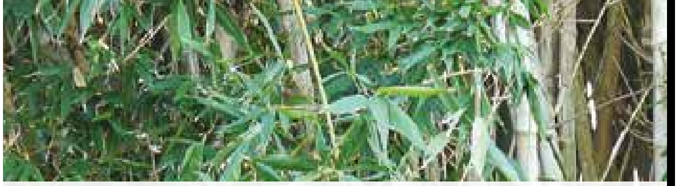
Wurrungwuri sculpture

Steps on a pedestrian street



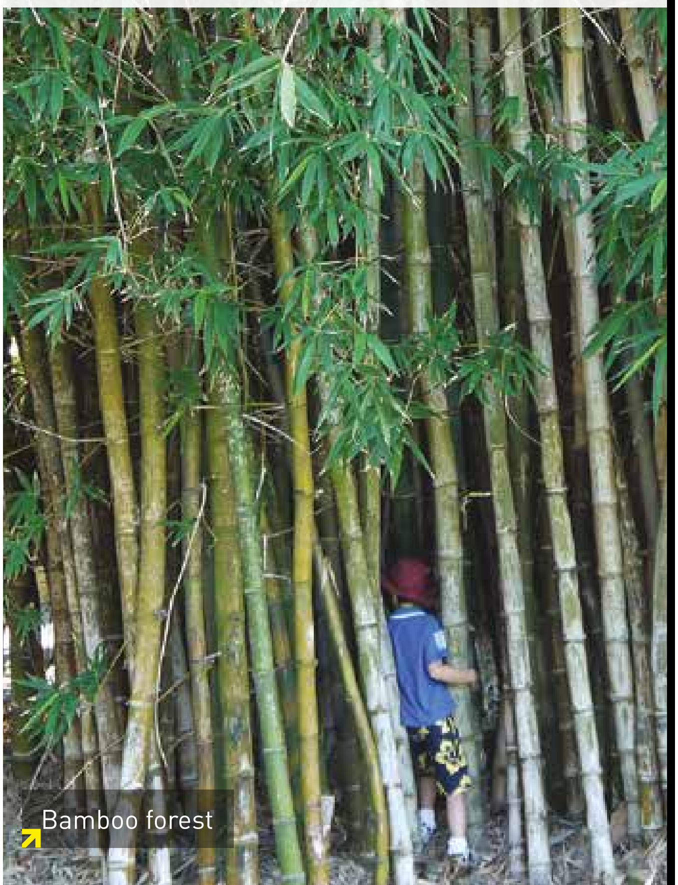
REMEMBER

- For effective barrier placement the maximum clearance between two barriers should be no wider than 1200mm
- The barriers should also have a minimum height of 500mm



There may be naturally formed barriers located around a site that could be used as part of a secure perimeter. Natural barriers could include rivers, ponds, lakes, densely wooded areas, steep slopes or changes in ground level that will either divert attack or preclude vehicle passage.

Where these features do not naturally occur it may be feasible to engineer them. The recommended solutions are to construct a ditch, bund or combination of the two. Considerations such as cost (and long-term cost benefit), availability of materials/production facilities, ground conditions and architectural advantage will influence the choice of options.



Bamboo forest

Trees

The use of individual trees as a VSB is not generally recommended. This is because full-scale impact testing of trees has indicated that trees do not necessarily perform well against a determined hostile vehicle impact. Where an existing tree cannot be moved and forms part of the physical perimeter, a number of factors should be considered:

- Tree health
- Stability of local ground conditions around the tree roots
- Trimming of branches to remove climbing aids (e.g. over a perimeter fence)
- Lines of sight for guard-forces and CCTV surveillance.

Where areas of bush, forest or other densely packed trees are present to form a natural barrier, the combined resistance will likely be more effective against determined vehicular impact. In this instance, any gaps between trees may only require lower grade infill HVM measures to prevent a slow speed encroachment attack.

Community centre fence

Fences

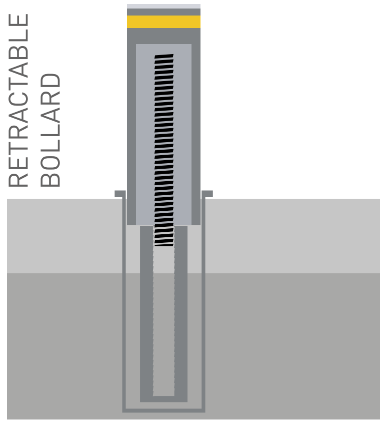
Most conventional fences are not a viable option for a HVM measure; they are easily breached by vehicles at low speeds and should only be used where vehicle speed is restricted by terrain or approach. Fences are better suited to assist in perimeter monitoring by installing perimeter intruder detection systems (PIDS) like motion sensors on the fences. For advice on suitable fences contact NSWPF.

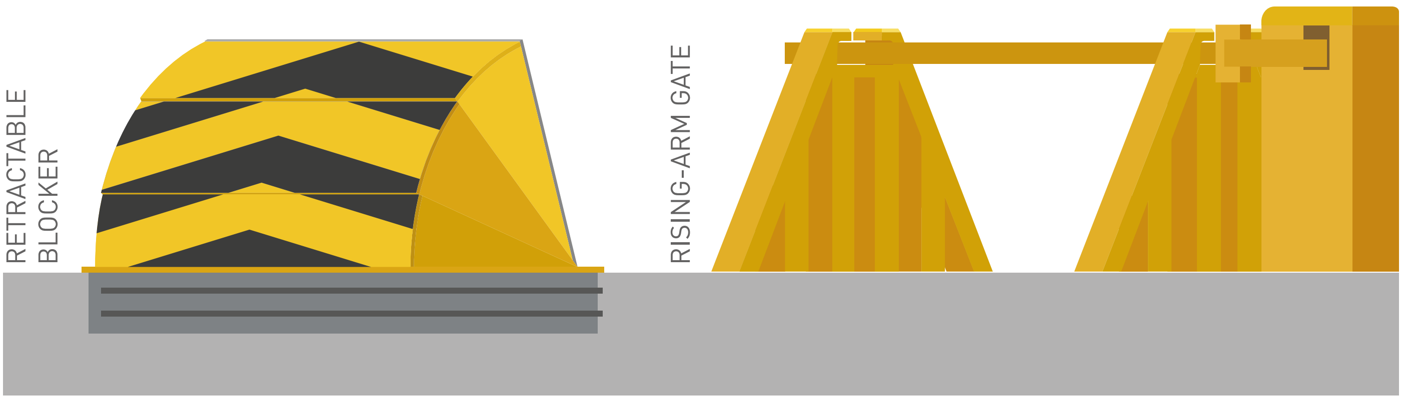
ACTIVE BARRIERS

If vehicle access to the asset is required, then active barriers can be used to identify and monitor vehicles allowed past the standoff perimeter.

Use of an active VSB is required for control of vehicle access. The term "active" refers to the system's ability to operate from closed (secure) to open, and could take a number of forms, such as:

- Retractable bollard
- Retractable blocker
- Folding, sliding, swinging, rising-arm gate

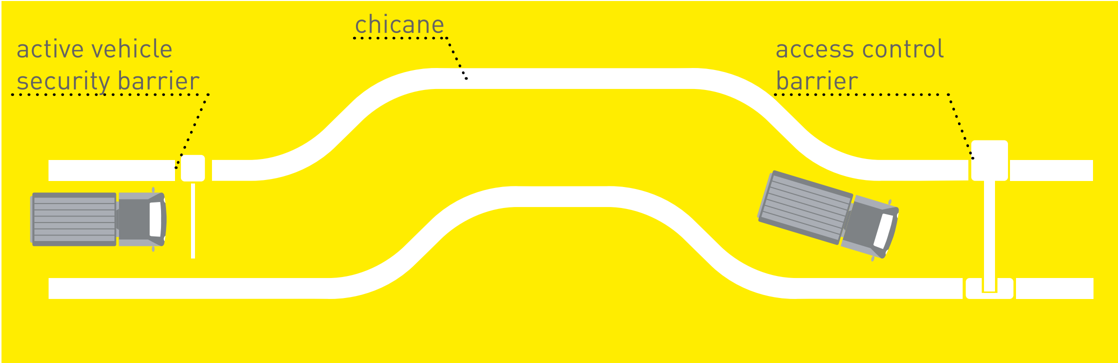




An active VSB can be manually operated by a person or powered (e.g. hydraulic power source). A VSB should be selected not only on the basis of performance or operational requirements, but also cost. Careful consideration should be made by the consultant and purchaser as to the full cost of a VSB, especially post-installation costs and long-term requirements such as:

- Training
- Service requirements
- Maintenance and repairs
- Spare parts

If an active VSB is required then a well-designed vehicle access control point (VACP) should ensure that guards are not put under undue pressure or distracted by traffic management requirements that might prevent their being able to carry out security procedures safely and securely.



VEHICLE ACCESS CONTROL POINT
*note no rejection lanes, search bays or parking facilities have been shown in the diagram above but are important to include

If the asset is high risk the ideal VACP deploys two rows of VSB at the end of a VSB enforced chicane. This creates a contained secure zone that a vehicle cannot enter or leave until authorised by the guard forces or an automatic access control system. This type of VACP uses up a lot of land space and is expensive to install and maintain; thus, while ideal, this type of VACP is only suitable to certain areas.

STANDARDS:

BSI PAS 68 relates to the device itself and the volume of kinetic energy it can absorb 'impact capacity'.

BSI PAS 69 relates to guidance for the selection, installation and use of vehicle security barriers.

Australia does not have standards relating to Hostile Vehicle Mitigation devices; however products that are endorsed by the ASIO SEC catalogue have been tested to the United Kingdom standards of BSI PAS 68 and BSI PAS 69.

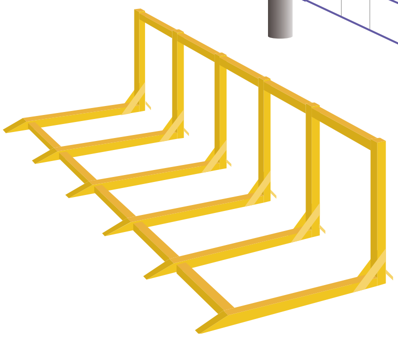
When selecting HVM devices or barriers other relevant legislation must also be considered, e.g. for public access and safety, accessibility for wheelchairs and prams etc.

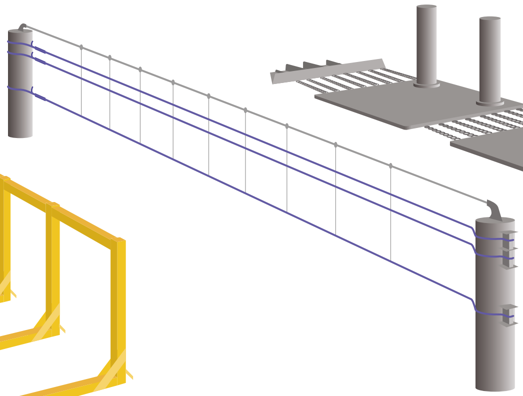
RE-DEPLOYABLE DEVICES

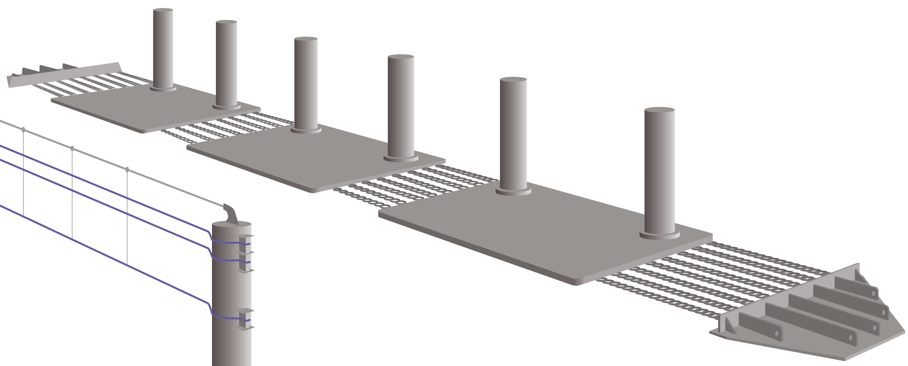
Re-deployable devices are HVM devices that are kept in storage and only put in place once the National Alert Level has increased or a direct threat to a specific target has been identified (this could be a single asset or a chain company such as a shopping centre or hotel). These devices are designed solely as protection measures and are generally not customisable.

There are two significant drawbacks associated with re-deployable HVM devices. The primary disadvantage is the fact that they are intelligence-driven, meaning that they are only effective if the site owner is aware of the threat: they cannot mitigate against a 'no notice' attack. A second disadvantage is their utilitarian appearance and consequent inability to respond to the aesthetic requirements of the surrounding environment, although their appearance is less of a concern if they are only operational for short periods of time, as is usually the case.

These drawbacks illustrate the importance of ensuring that permanent fixtures form part of a HVM strategy.







RAPID VEHICLE DEPLOYMENT BARRIER

- Impact tested:10 tonne at 80km/h
- Temporary installation
- No assembly tools required
- Set up in less than 10 minutes

PORTABLE BARRIER-IN-A-BOX

- Impact tested: 7.5 tonne at 48km/h
- Temporary or permanent installation
- Set up in 7 minutes
- BSI PAS 68 tested

RAPID DEPLOYABLE SURFACE MOUNT

- Impact tested: 7.5 tonne at 48km/h
- Short to mid term installation
- Deployed at a rate of 1 bollard every 5 minutes
- BSI PAS 68 tested

2.03/ GUIDELINES AND STANDARDS FOR BARRIERS

VEHICLE SECURITY BARRIERS (VSB)	MEASUREMENT GUIDELINES	NOTES	COMMENTS
Distance between adjacent VSB elements or other structural elements	≤1200mm	**Tapering VSBs:** measurement must be taken at 600mm from the ground	Prevents encroachment of vehicles beyond the blast stand-off perimeter, whilst maintaining access for pedestrians, wheelchairs and pushchairs.
Vertical fixed structures	≥500mm	Ideal height: 900mm	At 900mm VSBs are more conspicuous, assist the visually impaired and typically reduce the penetration of an impacting hostile vehicle.
Vertical elements	Standard BSI (PAS 68): 'Vehicle security barriers - Performance requirements, test methods and application guidance'	Application standard BSI PAS 69: 'Guidance for the selection, installation and use of vehicle security barriers' **or** CWA 16221	
Located along a highway	≥450mm	Measured from the road kerb edge	Prevents motorcycle handle bars from hitting the barriers

2.04/ DESIGNING PEDESTRIAN AREAS TO CREATE STANDOFF

Designing and protecting pedestrian-only areas around assets is essential not only to protect pedestrians who would ordinarily use the space, but has the added benefit of restricting vehicle access to the buildings, creating standoff and natural barriers.

The best way to protect pedestrians is to create clearly defined pathways separate from vehicles. This can be achieved through the use of barriers along the edge of footpaths or by integrating walkways into new developments that limit vehicle accessibility but maintain easy access for pedestrian ensuring their safety. Designs like these may also help reduce the opportunity for accidental collisions between pedestrians and cars, which are quite common in carparks.

There are various design devices that can help to define and reinforce pedestrian areas.
These include:

- Raised footpath
- Cobbles near gutter
- Lights on the ground (car parks)
- Verge
- Medium strip

Stairs will stop most vehicles and can be used to protect high-pedestrian areas or gathering points. Their main use is in mitigating out-of-control vehicles, or slowing down determined vehicles; they may also act as a visual deterrent (target hardening). However, they should not be solely relied upon to protect critical infrastructure, since some vehicles (short wheel base and high front end) can mount stairs.

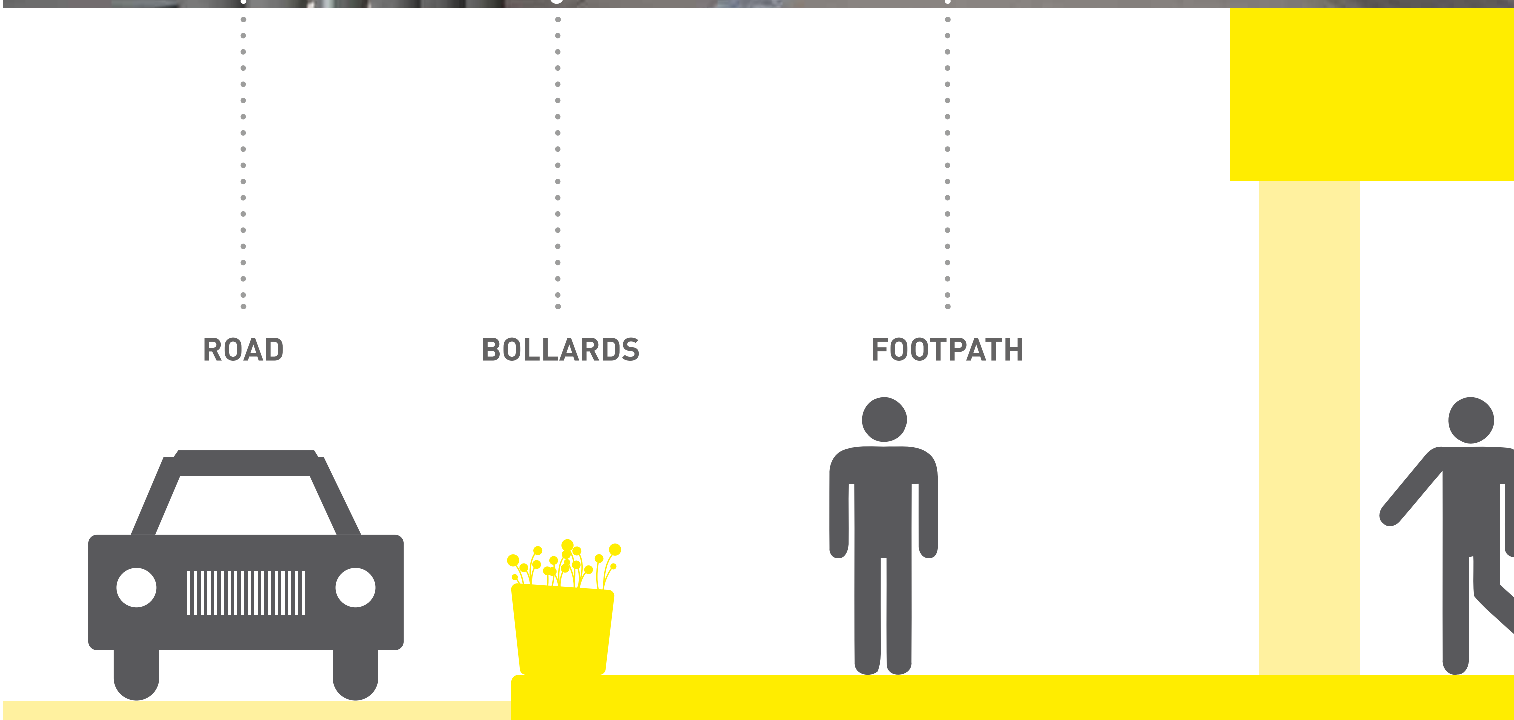
Note that wheelchair access points (see bottom left image) may offer opportunistic access for hostile vehicles, and therefore need to be protected.

The images to the left show Chatswood Library and Civic Pavilion precinct which have incorporated a combination of stairs, a sculptured garden structure and bollards to separate the pedestrian space from vehicles.

Access for emergency and maintenance vehicles into the space is managed through the use of removable bollards.

The venue provides a good example of how effective but subtle vehicle mitigation options can be integrated into the design, establishing a pedestrian environment safe from the risk of hostile vehicles.


Footpath protection


ROAD
BOLLARDS
FOOTPATH

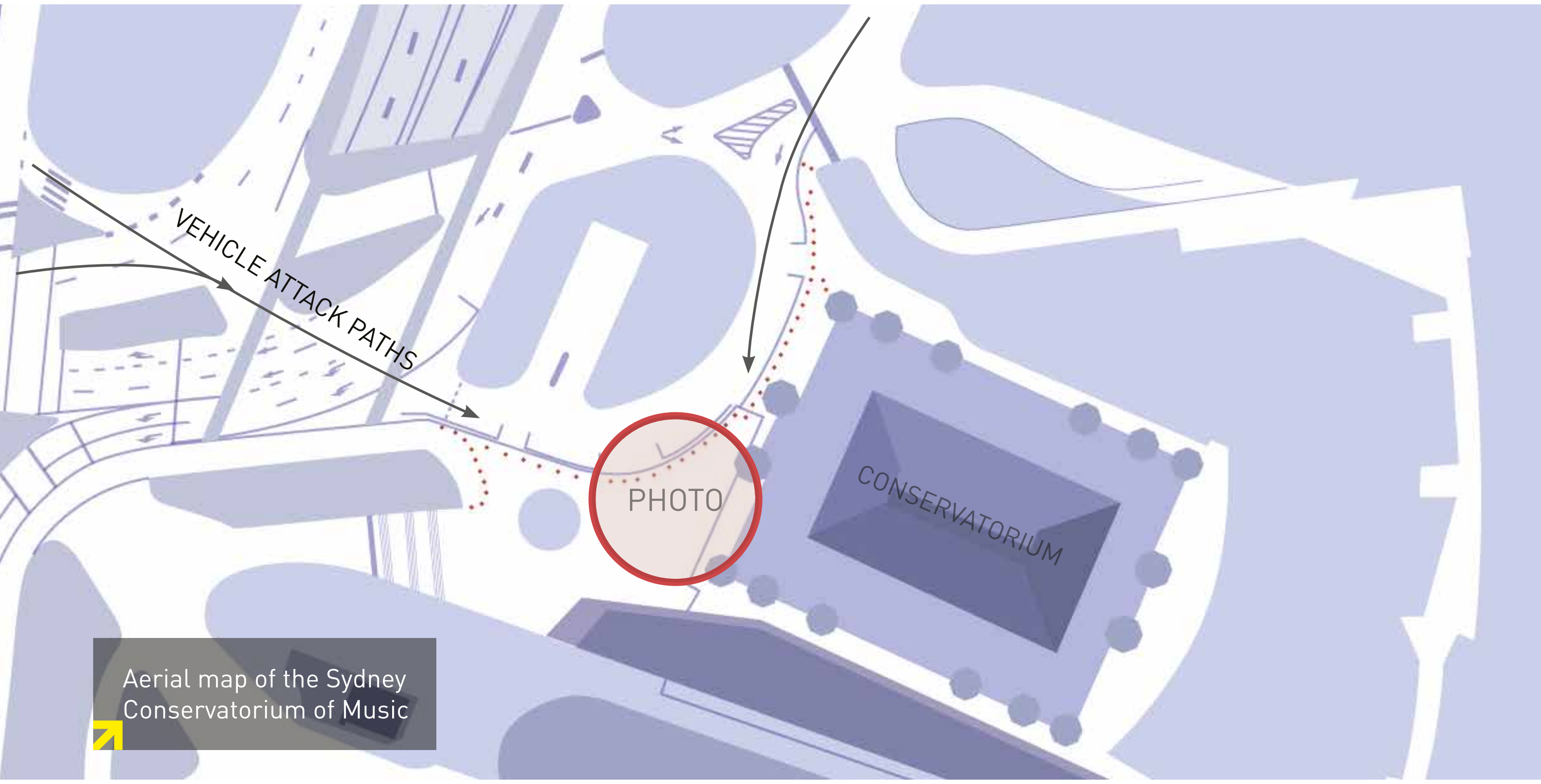
PARTITIONING VEHICLE & PEDESTRIAN SPACES

A good example of partitioning vehicle and pedestrian spaces can be seen at the entrance to the Sydney Conservatorium of Music. The combination of sandstone blocks and metal bollards installed on the edge of the roadway provides good protection for pedestrians against an out-of-control vehicle. Removable metal bollards are necessary to permit access to the space by emergency and maintenance vehicles.

While effective, the same level of protection could also be achieved in a more subtle way through the installation of long, rectangular planter boxes replacing sandstone blocks and bollards, although removable bollards would still need to be utilised at a designated vehicle access area. Planter boxes can complement the aesthetics of the building while ensuring the safety of the space.

The large pedestrian space between the building and roadway creates additional stand-off distance that significantly reduces the building's vulnerability to a vehicle-borne improvised explosive device (VBIED).

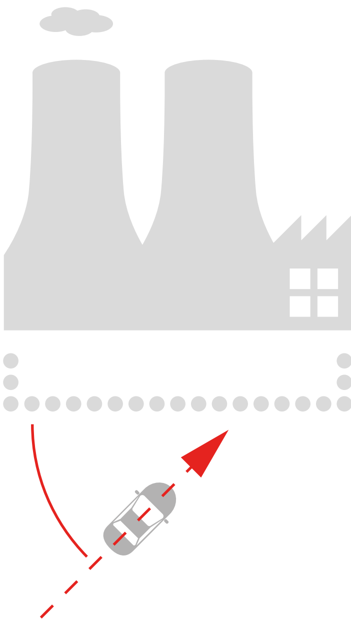
The option of seating as a mitigation device at this location would not be appropriate, since the absence of a raised gutter between the roadway and pedestrian pavement increases the risk of injury to pedestrians in the event of a vehicle impact.



Aerial map of the Sydney Conservatorium of Music


Sandstone and metal bollards restrict vehicle access

2.05/ VEHICLE APPROACHES & TRAFFIC MANAGEMENT OPTIONS



"IMPACT ANGLE"
is measured between the direction of travel of the vehicle and the impact location (between 0°-90°)

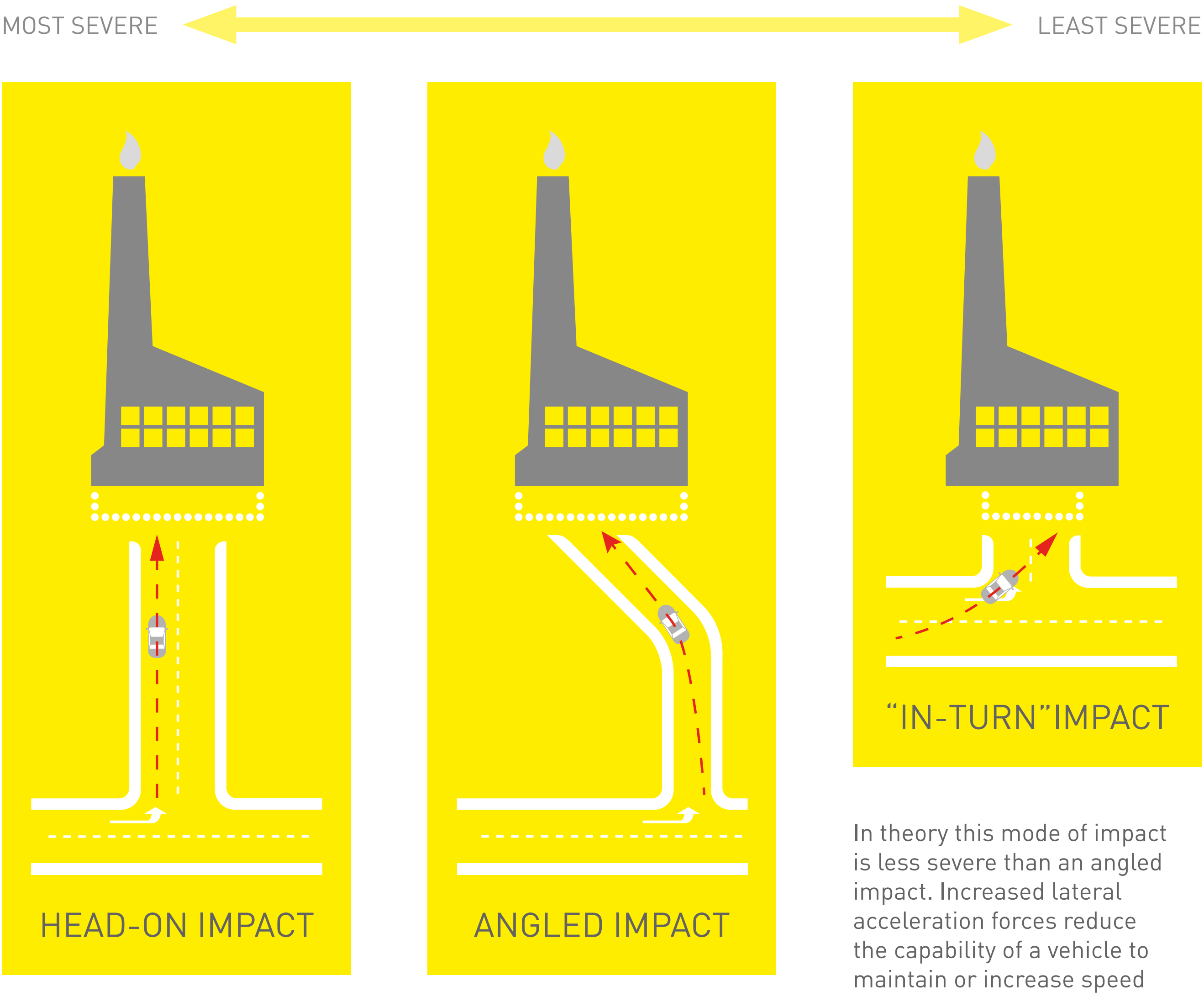
A SMALL DECREASE IN VELOCITY
=
A LARGE DECREASE IN ENERGY
=
REDUCED IMPACT
=
LESS INTRUSIVE BARRIERS
&
POSSIBLE REDUCED COST

Since the desirable standoff distance is rarely achieved, traffic management options in the form of vehicle approaches may be considered. Essentially this means taking measures to reduce the velocity (speed) of a hostile vehicle approaching the asset.

Even a small reduction in the velocity of a hostile vehicle will have a significant decrease in the amount of energy that vehicle is carrying, thus reducing its impact and permitting less intrusive HVM devices, which may reduce costs.

High velocity = high impact = catastrophic result

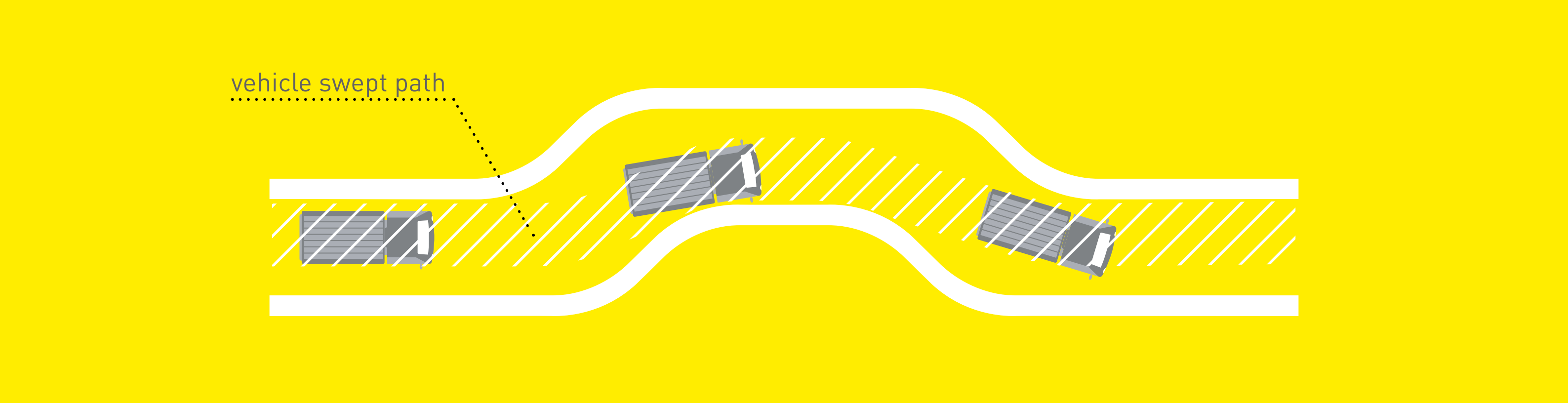
There are a variety of traffic management options to help reduce vehicle speed.



In theory this mode of impact is less severe than an angled impact. Increased lateral acceleration forces reduce the capability of a vehicle to maintain or increase speed during a turn in.

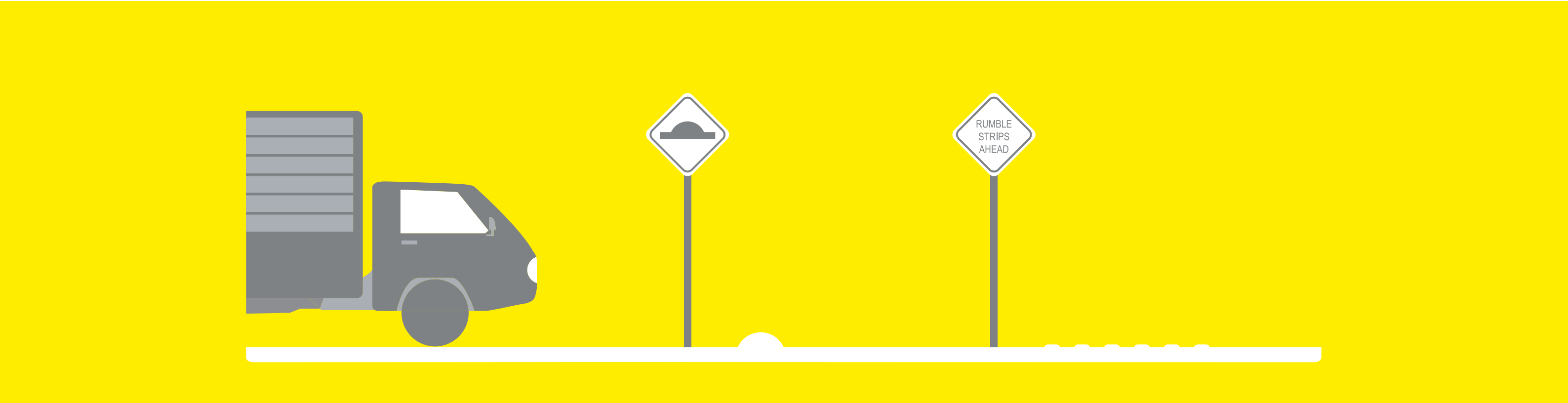
This impact mode is usually the most severe. The vehicle is fully engaged and the resultant force generated by the mass of the vehicle plus its load is directed towards the point of impact.

Theoretically this impact mode is less severe than a head-on approach. The impact typically leads to energy loss by redirection of the vehicle.



LONGITUDINAL DEFLECTIONS

Horizontal deflections, such as bends or chicanes, are often employed in urban or residential areas to encourage drivers to slow down. Drivers reduce vehicle speed in order to maintain ride comfort while making the required direction change; this, in turn, results in improved road user safety. Longitudinal deflections can also be used to limit the maximum speed of a vehicle operated by a determined driver.



VERTICAL DEFLECTIONS

Vertical deflections such as road humps, speed cushions and rumble strips are often employed as a visual deterrent and to disrupt ride comfort, encouraging road users to reduce speed. These, however, typically provide negligible deterrent or speed reduction against a determined hostile vehicle attack.

Wurrungwuri sculpture

INCLINES

Gradient will affect the ability of a hostile vehicle to maintain speed or accelerate toward an asset, especially for larger, heavier vehicles. Steep inclines may also be used to restrict the line of sight along a potential attack route, thus introducing an element of uncertainty to the attacker.

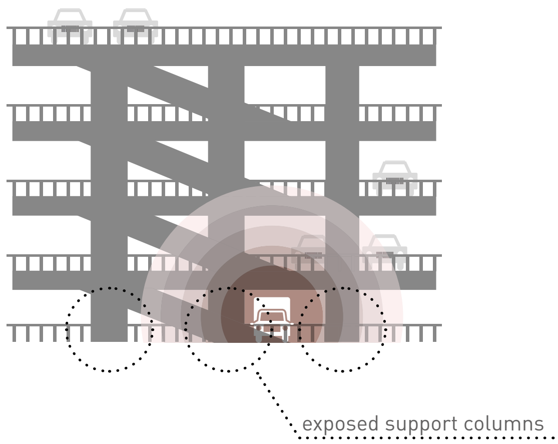
Use of inclines will require a large amount of physical space so may not be an option unless there is natural incline available in the surrounding topography.

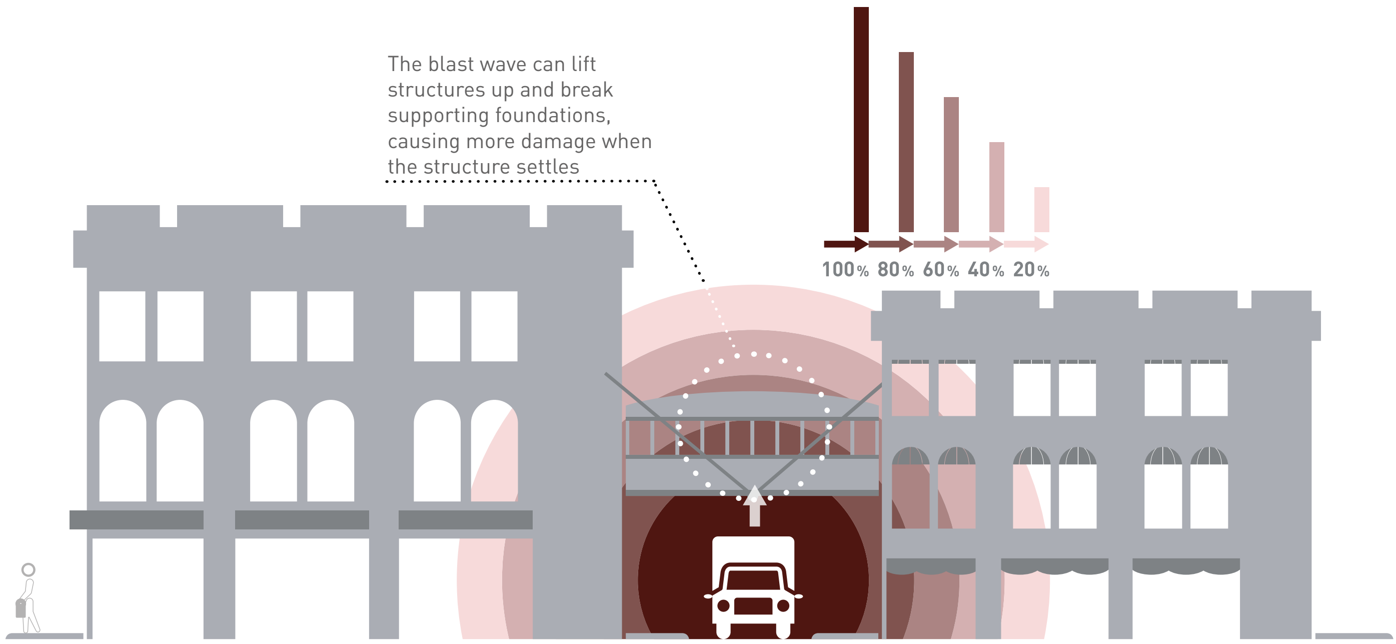
2.06/ EXCLUSION OF VEHICLES FROM STRUCTURAL ELEMENTS

There will be some instances in which, due to the ordinary function of a building, it is not feasible to exclude vehicles from entering the building. In those instances, it is crucial that measures are taken to prevent hostile vehicles from reaching the structural core of the building and causing catastrophic damage.

Underground car parks represent a particular and obvious risk: the 1993 World Trade Center Bombing in New York was effected via the detonation of explosives in a car parked in the parking garage underneath the building.

If a hostile vehicle is able to attack a building's structural core, there is a chance of progressive collapse. Progressive collapse generally results after one or more primary load-bearing structural supports suddenly fail, and relates almost exclusively to blast. This causes the load of the building to be carried by other less robust supporting elements, and as the weight increases on these support structures they progressively collapse onto each other, crushing and destroying everything under them.



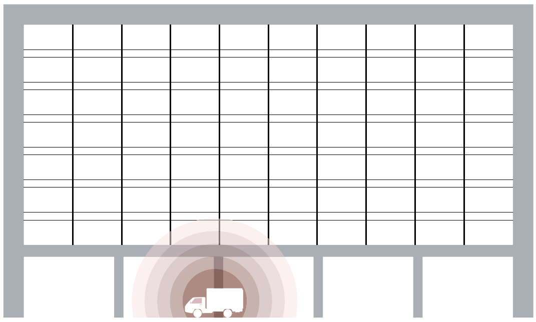


"Progressive collapse results from the failure of one structural component and leads to the failure of one or more further structural components" (Starossek 2009)

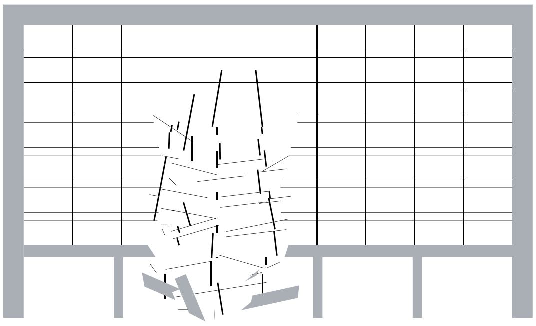
Progressive collapse can cause significant devastation, as international experiences have demonstrated, and is a likely potential outcome from a vehicle-born improvised explosive device (VBIED) attack, as the vehicle can be parked on the street outside the target building without raising undue suspicion.

A well-known example of progressive collapse resulting from a VBIED is seen in the Oklahoma City bombing of 1995, where the Alfred P Murrah Federal Building collapsed killing 161 people after a truck bomb attack.

"According to the structural design concept, every second exterior column was indirectly supported by a continuous transfer girder that ran across the face of the structure at the second floor... It is assumed that the detonation caused the immediate destruction of only one main column. The structure was not able to redistribute the force carried by that column to the neighbouring main columns. This led to a collapse progression that, possibly promoted by impact loading and horizontal forces, spread through the neighbouring spans and eventually affected a major part of the structure."[2]



EXPLOSION
Parked truck takes out a single main column. *



COLLAPSE
The structure was not able to redistribute the force carried by that column to the neighbouring main columns. *

Restricting vehicle impact and access can reduce blast loading from deliberate attack. The White Bay Cruise Terminal demonstrates good vehicle mitigation measures, using large cement seats as bollards and cement garden beds to provide a barrier and guide pedestrian movement.

Contact www.secure.nsw.gov.au for customised advice

[2] Starossek, U. 2009, Progressive Collapse of Structures, Thomas Telford Limited, London, UK

SUMMING UP

WELL-DESIGNED PREVENTION MEASURES THAT ARE BEAUTIFUL AND EFFECTIVE

SMART DESIGN

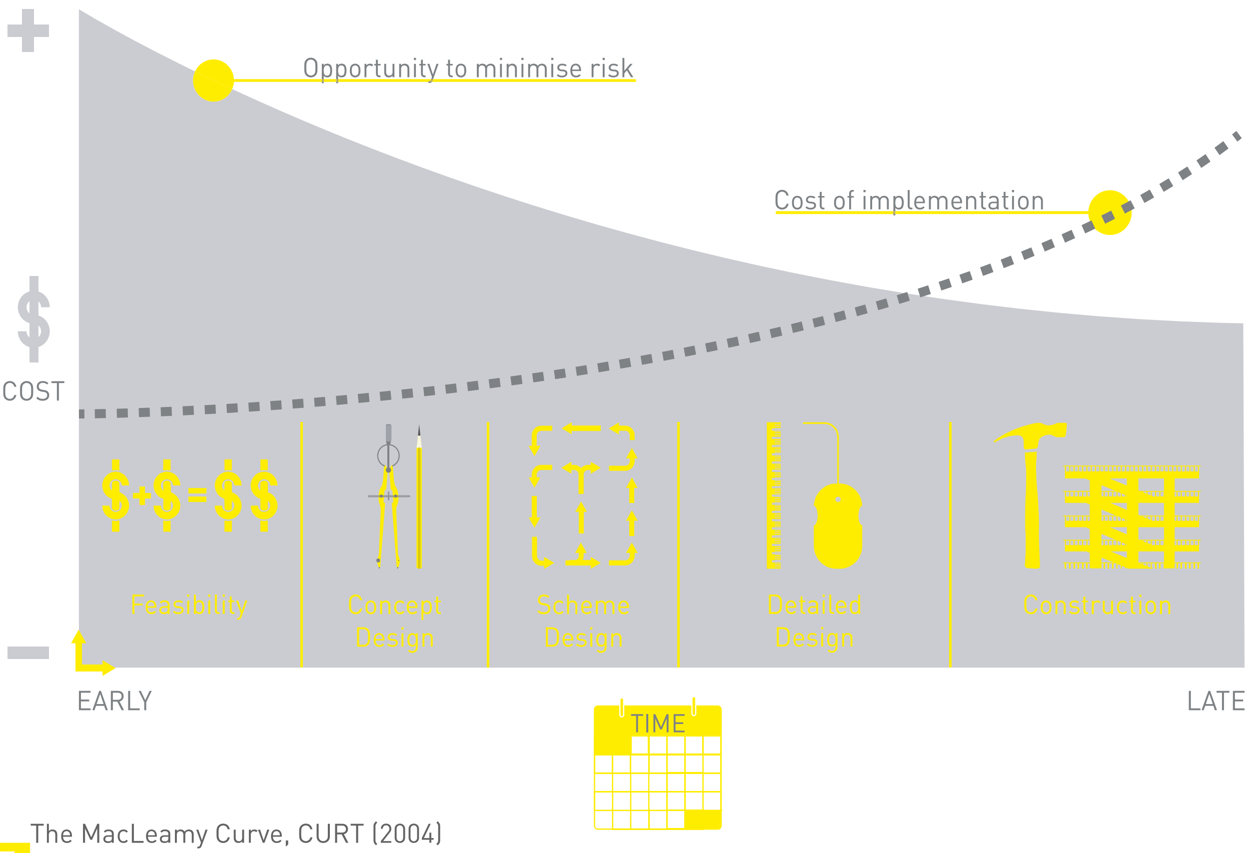
As the nature of hostile vehicles has evolved in recent years with respect to terrorism and criminal activity, so too has our understanding and response. This evolution is reflected in the design and implementation of new and innovative physical protective security measures that help prevent and reduce the consequences of an attack.

No longer must we equate effective physical protective security with cold, sterile measures of austerity. Creative innovation is paving the way for seamlessly integrated protection measures that complement and enhance current needs and desires within public and private spaces.

Equally, common sense needs to be applied to the installation of HVM measures, clearly identifying the areas that need protection, rather than installing devices where it is ordinarily impossible for vehicles to gain access, for example, installing excessive measures not commensurate to the threat or appropriate to the location, such as installing a two-stage vehicle barrier at hotel entrance, for example. It is important not to over-engineer HVM.

EARLY CONSIDERATION
+
CREATIVE THINKING
=
SUCCESSFUL INTEGRATED DESIGN SOLUTIONS

By recognising and acknowledging in the design stages of a building or public space the persisting threat posed by vehicles, it is possible to achieve an optimal, holistic approach to safety and security. This is also the most cost-effective time to implement physical security measures, the MacLeamy Curve below outlines the importance of early considerations.



The MacLeamy Curve, CURT (2004)

WHERE TO GO NEXT

Not all of the options provided in this document will be applicable or achievable at all sites. A specific and unique site assessment will need to be conducted to establish the most suitable device for each site even if an owner/operator has multiple similar asset; the surrounding environment will not be the same in each instance and these differences, no matter how subtle, will impact on the nature of the HVM solutions required.

For further advice please contact the Counter Terrorism and Special Tactics Command.

CONTACTS:

NSW POLICE FORCE COUNTER TERRORISM & SPECIAL TACTICS COMMAND (CTSTC)

www.secure.nsw.gov.au

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NOTES

REFERENCES:

1. Centre for the Protection of National Infrastructure 2010, Hostile Vehicle Mitigation Guide, CPNI, United Kingdom
2. Centre for the Protection of National Infrastructure 2011, Integrated Security: a public realm design guide for hostile vehicle mitigation, version 1.0, CPNI, United Kingdom
3. Starossek, U. 2009, Progressive Collapse of Structures, Thomas Telford Limited, London, UK

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