HOARE LEA

DRAFT

Dewsbury Bus Station. Dewsbury. Wilmot Dixon.

SECURITY
VEHICLE DYNAMICS ASSESSMENT

REVISION 01 – 22 FEBRUARY 2024

STAGE 4

Audit sheet.

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Contents.

1. Context.

The Hoare Lea Security team have been engaged to undertake a Threat and Risk Assessment (TARA) (Reference A) for Dewsbury Bus Station, which is undergoing a refurbishment and update to the existing site structure and layout. The TARA did not identify Vehicle As a Weapon (VAW) as a credible threat, however it is understood that there have been ram-raid thefts (Vehicle as a Tool (VAT)) from ATMs in the region, VAT has therefore been deemed as a credible risk. Due to the planning condition requested by West Yorkshire Police requiring a Vehicle Dynamics Assessment (VDA) to be undertaken and a delay in ability to consult with them prior to first issue likely vehicle attack routes for VAW have been included[1]. The planning conditions included the requirement for a VDA to be undertaken by a member of the RSES (Register of Security Engineers and Specialists) and to propose the relevant mitigation measures. This VDA will determine the performance requirements of the Hostile Vehicle Mitigation (HVM) measures to allow development of a HVM Strategy and WYCA (West Yorkshire Combined Authority) to instruct the project team.

2. Aim.

The aim of this document is to present the findings of the VDA, which encompasses the main vehicle access points into the site and the publicly accessible pedestrian entrance points into the building. These will produce recommendations for appropriately rated HVM measures to mitigate against potential VAT and VAW attacks.

3. References.

A. 2525580-HLE-XX-XX-RP-SC-754001– Dewsbury TARA - Threat and Risk Assessment (Rev01 issued 22nd February 2024)
B. Commercial DOCO response 2023-92141 Dewsbury Bus Station, Aldams Road, Dewsbury, WF12 8AR CONDITIONED (issued 18th September 2023)

4. Site Description.

The site location and the adjacent sites can be seen in Figure 1. This VDA relates to the entire site, which is shown in the landscape GA in Figure 2, and considers hostile vehicles approaching from Aldams Rd, South St and Wilton St. A visual impression of the site from Aldams Road is shown in Figure 3.

[1] Consultation with the CTSA (Counter Terrorism Security Advisor) is being scheduled to further define the local risk from a vehicle.

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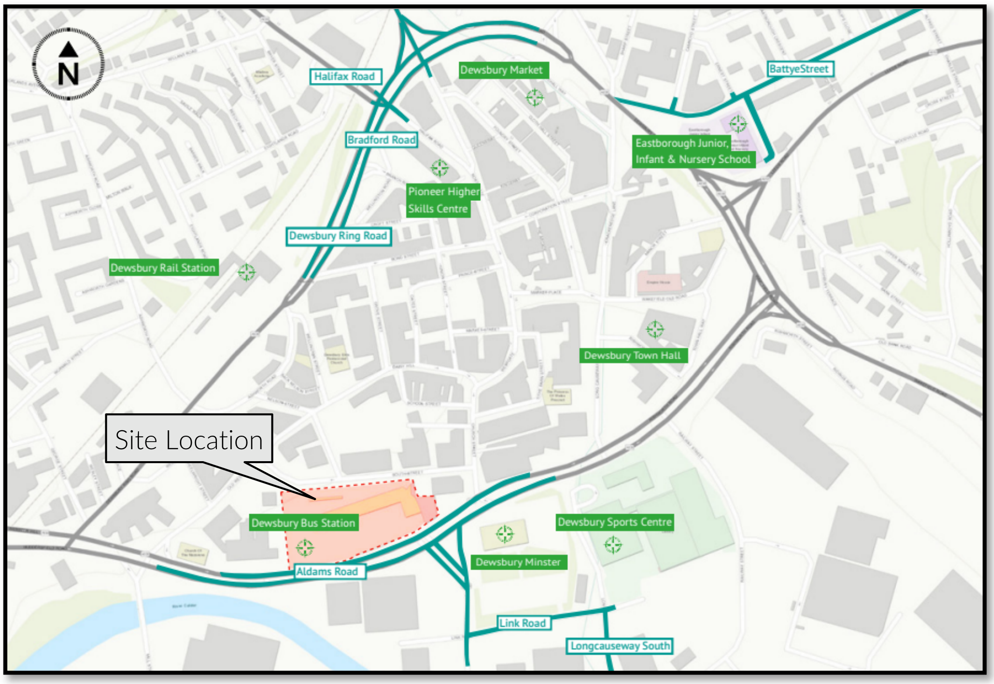
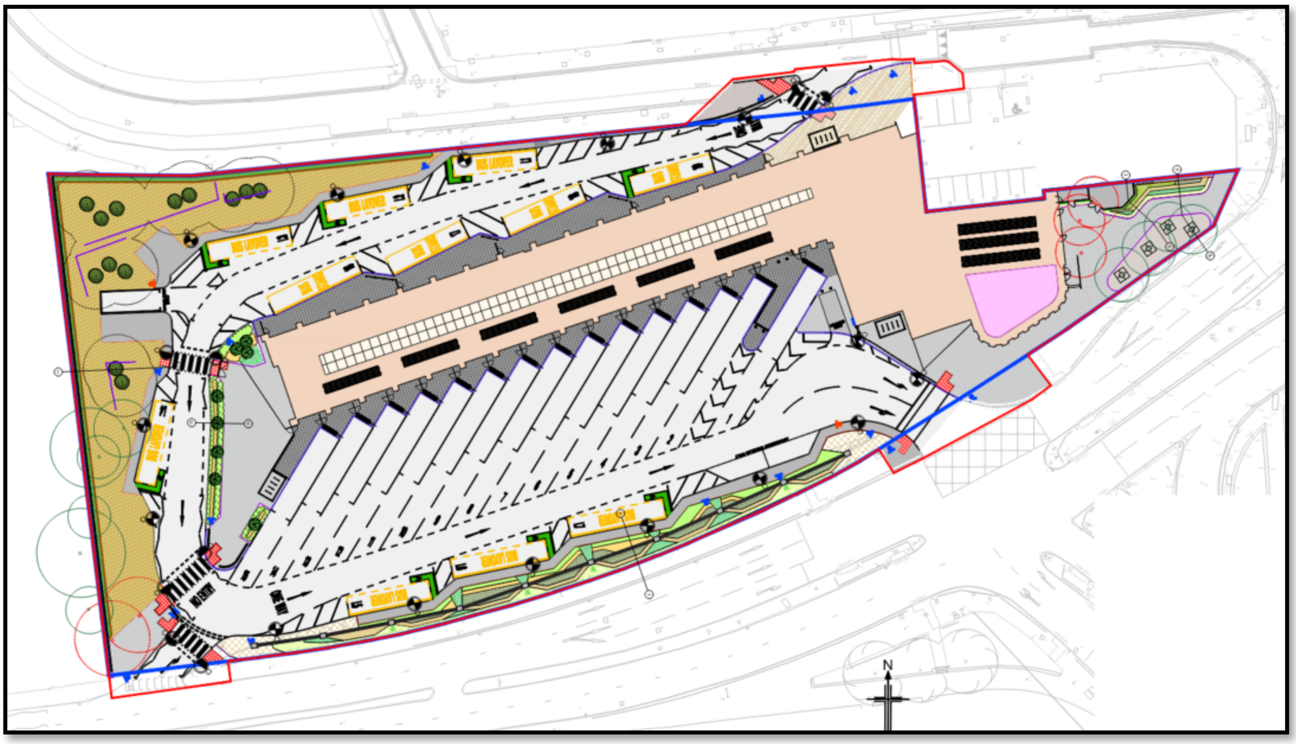
Figure 1. Site Location



Source: WYCA

Figure 2. Landscape General Arrangement



Source: Jacobs

Figure 3. Visual impression from Aldams Road

Source: Jefferson Sheard Architects

5. Constraints and assumptions.

5.1 5.1 Risk acceptance.

The recommended HVM performance requirements highlighted within this Design Note are based on the guidance and calculations in accordance with the National Protective Security Authority (NPSA) calculation methodology, the national technical authority for protective security. If the performance requirements are deviated from, in accordance with risk management best practice it is recommended justification and associated client risk acceptance is recorded.

5.2 Design constraints and assumptions.

The following design constraints and assumptions have been made for this VDA:

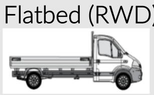
1. For the purpose of this assessment the normal rules of the road, all traffic congestion, signage, and road markings are ignored for hostile vehicles, and all possible approach paths are considered.
2. The influence of any measures which could impact the approach and speed of a vehicle such as trees, street furniture, kerbing or installations have, in line with NPSA guidance, been discounted in the assessment when determining the performance requirements of the HVM measures.

6. HVM Impact Rated Barriers.

There are two test standards used in the UK to specify the impact rating for Vehicle Security Barrier (VSB) products these being PAS 68 and/or IWA-14-1:2013. VSB tested to these standards should be installed in accordance with their corresponding standards, PAS69 and/or IWA-14-2:2013.

PAS 68 and IWA-14 refer to the categories of vehicle shown in Table 1.

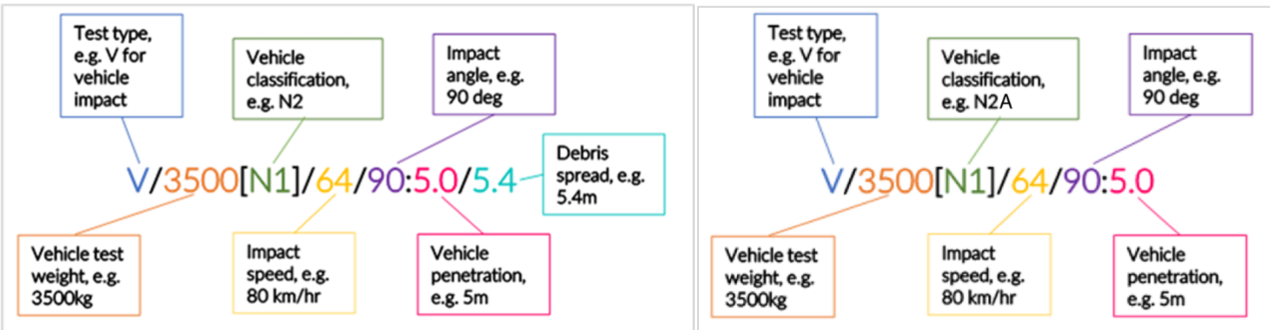
Table 1. Vehicle Categories for Impact Rated Barrier Test Standards

Vehicle Type	Car 	4x4 Pickup 	Flatbed (RWD) 	2-axle rigid lorry 	2-axle rigid lorry 	4-axle rigid lorry 
PAS 68 Designation & Weight	M1 1.5 tonne	N1G 2.5 tonne	N1 3.5 tonne	N2 7.5 tonne	N3 18 tonne	N3 32 tonne
IWA-14 Designation & Weight	M1 1.5 tonne	N1G 2.5 tonne	N1 3.5 tonne	N2 7.2 tonne	N3 18 tonne	N3 32 tonne

There are two main differences between the standards. The first is that PAS 68 tests are conducted using a 7.5 tonne vehicle for the N2 category (2-axle rigid lorry) whereas the IWA-14 tests use a 7.2 tonne vehicle. The second is that IWA-14 does not measure the projection of debris and the distance travelled.

A description of a typical vehicle barrier performance rating for each standard is shown in Figure 4.

Figure 4. Test standard performance requirements – PAS 68 (left) IWA-14 (right)



7. Credible threats.

Whilst the N3 class vehicles shown in Table 1 generally have energies greater than the other vehicle types by virtue of their weight, it should be noted that vehicles in these categories, 18 and 30 Tonne, require specialist driving licences. Although this does not prohibit access to these vehicles, it does increase the complexity of accessing them. Those in the categories N1, N1G and M1 can be driven by anyone with a full driving licence, and anyone that held a full-driving licence prior to the beginning of 1997 is entitled to drive the N2 category (7.5 Tonne). However, based upon the assumption that the most likely threat is from a VAT style attack which will most likely use a 4x4 / Pickup / SUV, the N1G category is deemed the most likely credible threat for this VDA.[2]

8. Vehicle dynamics assessment.

8.1 Analysis Approach.

In order to determine the appropriate impact rating for the HVM measures a VDA has been conducted. The VDA has considered the surrounding area to determine viable approaches for potential penetrative vehicle attacks and the maximum speed and angles of attack achievable by a hostile vehicle. It is recommended the site assessment is periodically reviewed to consider any changes to the environment or road layout since the previous review. To summarise the VDA has been conducted in two parts:

- **Site analysis**. The site analysis identified the physical constraints to an attacking vehicle's approach. It includes a vehicle approach path analysis that identifies credible attack routes. For the purpose of this assessment it has been assumed that the main pedestrian entrance points form the target of a vehicle attack, these have then been divided into 'impact points' where a vehicle would first impact the building / HVM line.
- **VDA calculations**. The VDA applies the data gained during the site analysis and quantifies the maximum possible vehicle approach speed across a standardised range of vehicles. From this the vehicle energy at the point of attack can be calculated, and barrier performance requirements defined. Potential barrier types which can meet the requirements are shown at Appendix A.

8.2 Site Analysis - Vehicle Dynamics Assessment Approach Routes.

Four overarching impact points (IP) were identified; these have been grouped from several impact points that fall on the same aspect of the perimeter. The associated approach routes to each of the impact points are shown in Figure 5 and Figure 6, along with the impact points. The approach roads for the different routes are:

- Impact Point 1 – Route A – Aldams Rd
- Impact Point 2 – Route A – Aldams Rd
- Impact Point 3 – Route B – South St
- Impact Point 4 – Routes C, D and E – Aldams Rd and Wilton St

[2] Though the N1 and N2 vehicle categories have not been deemed credible at this time they have been included for future reference should the threat environment change or credible risks are identified by the CTSA.

Figure 5. Impact Points & Approach Routes (local view)

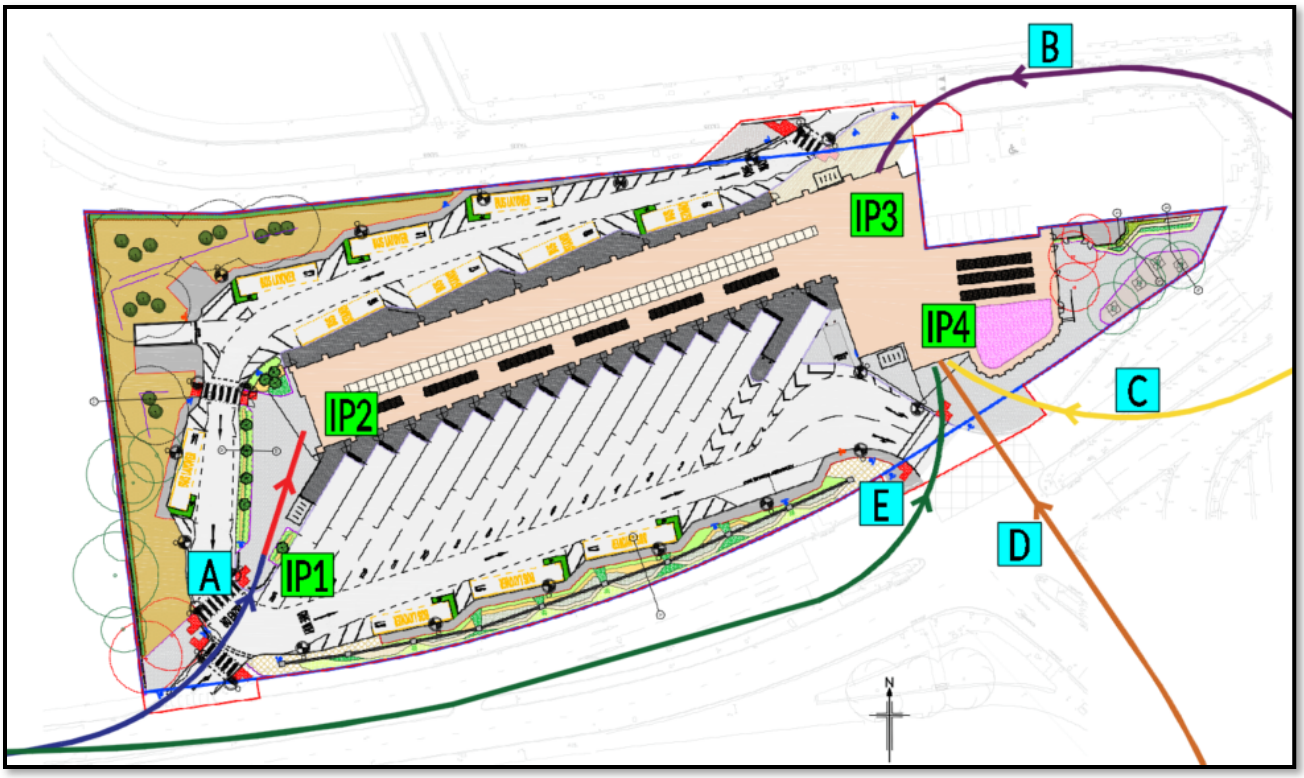
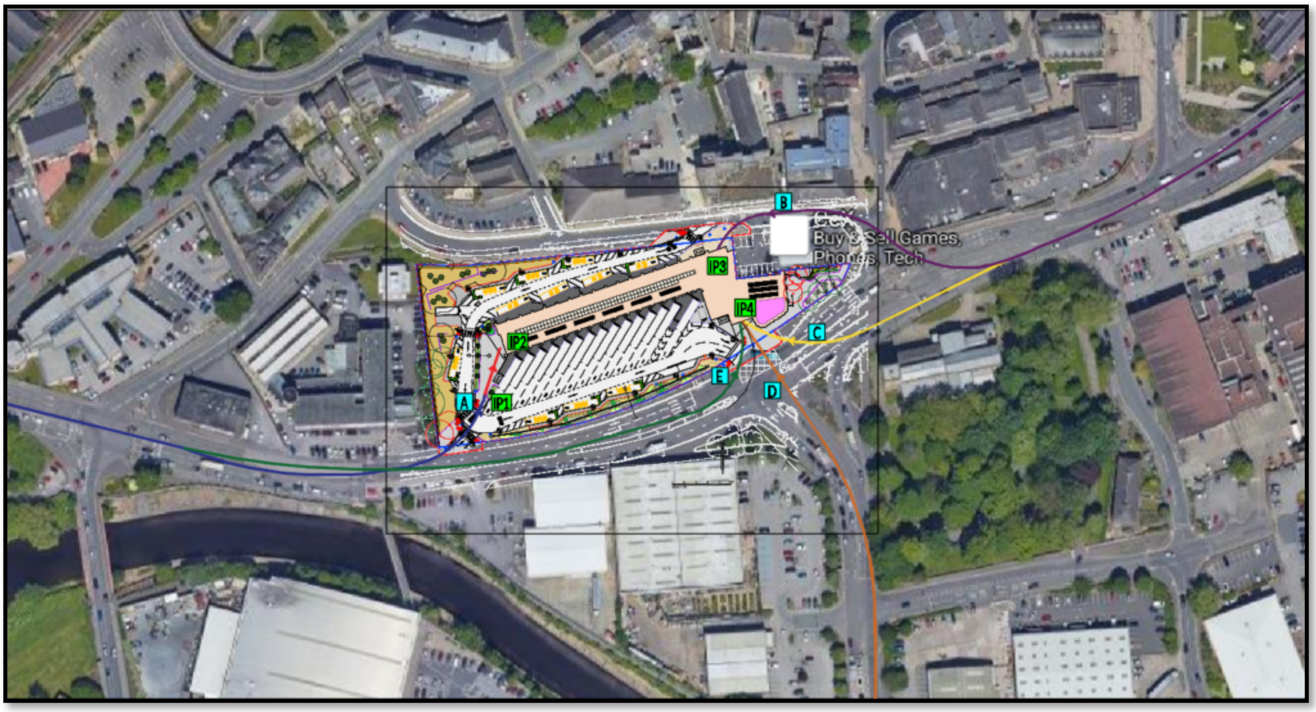


Figure 6. Approach Routes (far view)

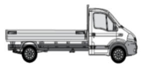


8.3 VDA Calculations.

The velocity at impact at the impact points for the each of the approach routes shown in Figure 5 and Figure 6 were calculated using the NPSA Hostile Vehicle Velocity Assessment (HoVVA) App for all the vehicles. From this information and the mass of the potential threat vehicle the kinetic energy was calculated. The results of these calculations for those vehicles that are deemed to be credible threats are summarised in Table 2, Table 3, Table 4 and Table 5, with the worst-case scenario for the credible threat vehicle highlighted in green.

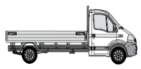
8.3.1 Approach Route A – IP1

Table 2. IP1 VDA results

Approach Route	Impact Point	VDA Data	Vehicle mass & type			
			N2 (7.5t) 2-axle rigid lorry 	N1 (3.5t) Flatbed (RWD) 	N1G (2.5t) 4x4 Pickup 	M1 (1.5t) Car 
A	IP1	Velocity on impact	53 kph (33 mph)	58 kph (36 mph)	51 kph (32 mph)	61 kph (38 mph)
		Angle of attack	90 degrees	90 degrees	90 degrees	90 degrees
		KE (kJ)	4084	2268	1280	1083

8.3.2 Approach Route A – IP2

Table 3. IP2 VDA results

Approach Route	Impact Point	VDA Data	Vehicle mass & type			
			N2 (7.5t) 2-axle rigid lorry 	N1 (3.5t) Flatbed (RWD) 	N1G (2.5t) 4x4 Pickup 	M1 (1.5t) Car 
A	IP2	Velocity on impact	55 kph (34 mph)	61 kph (38 mph)	56 kph (35 mph)	68 kph (42 mph)
		Angle of attack	90 degrees	90 degrees	90 degrees	90 degrees
		KE (kJ)	4335	2527	1532	1323

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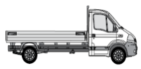
8.3.3 Approach Route B – IP3

Table 4. IP3 VDA results

Approach Route	Impact Point	VDA Data	Vehicle mass & type			
			N2 (7.5t) 2-axle rigid lorry 	N1 (3.5t) Flatbed (RWD) 	N1G (2.5t) 4x4 Pickup 	M1 (1.5t) Car 
B	IP3	Velocity on impact	40 kph (25 mph)	43 kph (27 mph)	40 kph (25 mph)	45 kph (28 mph)
		Angle of attack	90 degrees	90 degrees	90 degrees	90 degrees
		KE (kJ)	2344	1276	782	588

8.3.4 Approach Route C, D and E – IP4

Table 5. IP4 VDA results

Approach Route	Impact Point	VDA Data	Vehicle mass & type			
			N2 (7.5t) 2-axle rigid lorry 	N1 (3.5t) Flatbed (RWD) 	N1G (2.5t) 4x4 Pickup 	M1 (1.5t) Car 
C	IP4	Velocity on impact	60 kph (37 mph)	64 kph (40 mph)	58 kph (36 mph)	68 kph (42 mph)
		Angle of attack	90 degrees	90 degrees	90 degrees	90 degrees
		KE (kJ)	5134	2800	1620	1323
D	IP4	Velocity on impact	80 kph (50 mph)	90 kph (56 mph)	89 kph (55 mph)	117 kph[3] (73 mph)
		Angle of attack	90 degrees	90 degrees	90 degrees	90 degrees
		KE (kJ)	9375	5488	3782	3997
E	IP4	Velocity on impact	47 kph (29 mph)	50 kph (31 mph)	45 kph (28 mph)	53 kph (33 mph)
		Angle of attack	90 degrees	90 degrees	90 degrees	90 degrees
		KE (kJ)	3154	1682	980	817

[3] Due to products not being readily available above 80 kph the recommended performance rating has been based on the equivalent impact energy of a 3.5t vehicle at 80 kph and a 7.2t vehicle 64 kph.

8.4 VDA results

Five different approach routes have been analysed for Dewsbury Bus Station which all assume an unimpeded approach to the point of impact. This therefore discounts any rules of the road or obstructions along the approach route such as kerbs or kerb side obstructions e.g. bus stops, signage etc. The results shown in the approach route tables indicate that routes A, B and D are the worst-case approaches in terms of vehicle size and speed and thus the highest impact energy.

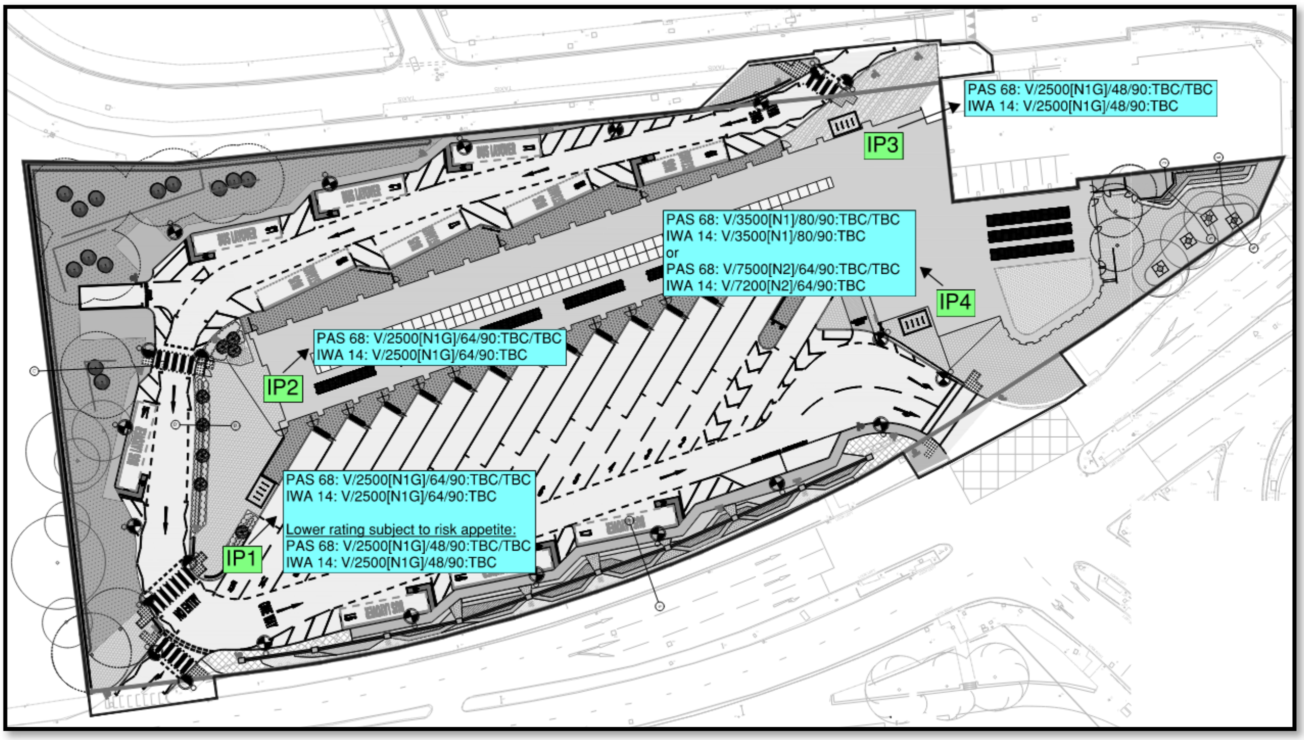
9. Recommendations.

9.1 Suggested ratings.

The suggested HVM measure designation in terms of either the Publicly Available Specification (PAS) or the International Workshop Agreement (IWA) for the worst-case scenario for each impact point are shown in Figure 7.

Suitable barriers meeting these ratings can be found in the NPSA Catalogue of Security Equipment (CSE) under the HVM – Impact Rated category.

Figure 7. Suggested VSB performance ratings



Note: The specified vehicle penetration and debris throw will depend upon where the measure is to be located and therefore has not been included in the above (note that distances stated are the maximum). Though the penetration for PAS 68 and IWA-14 are noted in the same format, the datum line for each is different; IWA-14 measures the distance from the front of the product, whereas PAS 68 measures the distance from the back face of the product, this should be accounted for when selecting products. The difference may be negligible for bollards; however it will have a more significant impact if deeper measures i.e. blockers are included in the HVM Strategy.

9.2 Next Steps.

Consultation with the CTSA is being arranged to clarify the local threat environment, after which the VDA will be updated. Once this has been undertaken and the VDA reviewed it is recommended that the Client decide where the HVM measures will be located so that the appropriate rating can be chosen. For instance, should they be placed at the kerb or the building perimeter.

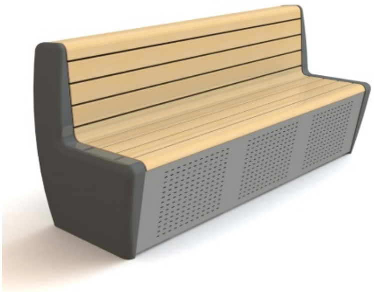
Hoare Lea are available to liaise with the Client and/or design team to agree a preferred option (and levels of risk acceptance) and develop an indicative scheme with the design team using appropriate components (bollards/planters/street furniture).

Appendix A - Crash rated product options

There are various products from different manufacturers which can achieve the required crash rating. Several options are shown in Table 3 for each type, these are available in both shallow and deep foundation configurations to cater for situations where there may or may not be existing underground services.

Table 6. Static and shallow mount HVM products

Option	Description	Image	Discussion (pro's and con's)
1	Removable bollards		Manually operated. Not suitable for high flow through areas. Less expensive. Bollards need to be appropriately stored when not in use. Risk of injury with lifting heavy equipment
2	Collapsible bollard		Bollards can be manually operated via a drill Bollards secured underneath 'coffin'. Can be secured via security screws.
3	Static planters		Planters may be surface mounted, or surface pinned. Can be attractive and non-aggressive options but generally quite expensive.
4	Cycle stands		Cycle stands can be crash rated and also perform a useful alternative function. Can be expensive for the higher crash rating.

Option	Description	Image	Discussion (pro's and con's)
5	Benches and seating		Crash rated benches can be both surface mounted or surface pinned. They are available in a number of sizes and styles but can be expensive.
6	Bins		Products such as these can be crash rated and perform another useful function. If available for a higher crash rating they will be expensive.
7	Static bollards		Static bollards can come in a number of sizes, colours and designs and can be rated up to 7.5t at 80kmh. Some are more aggressive looking than others and the design is often influenced by planning input.

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