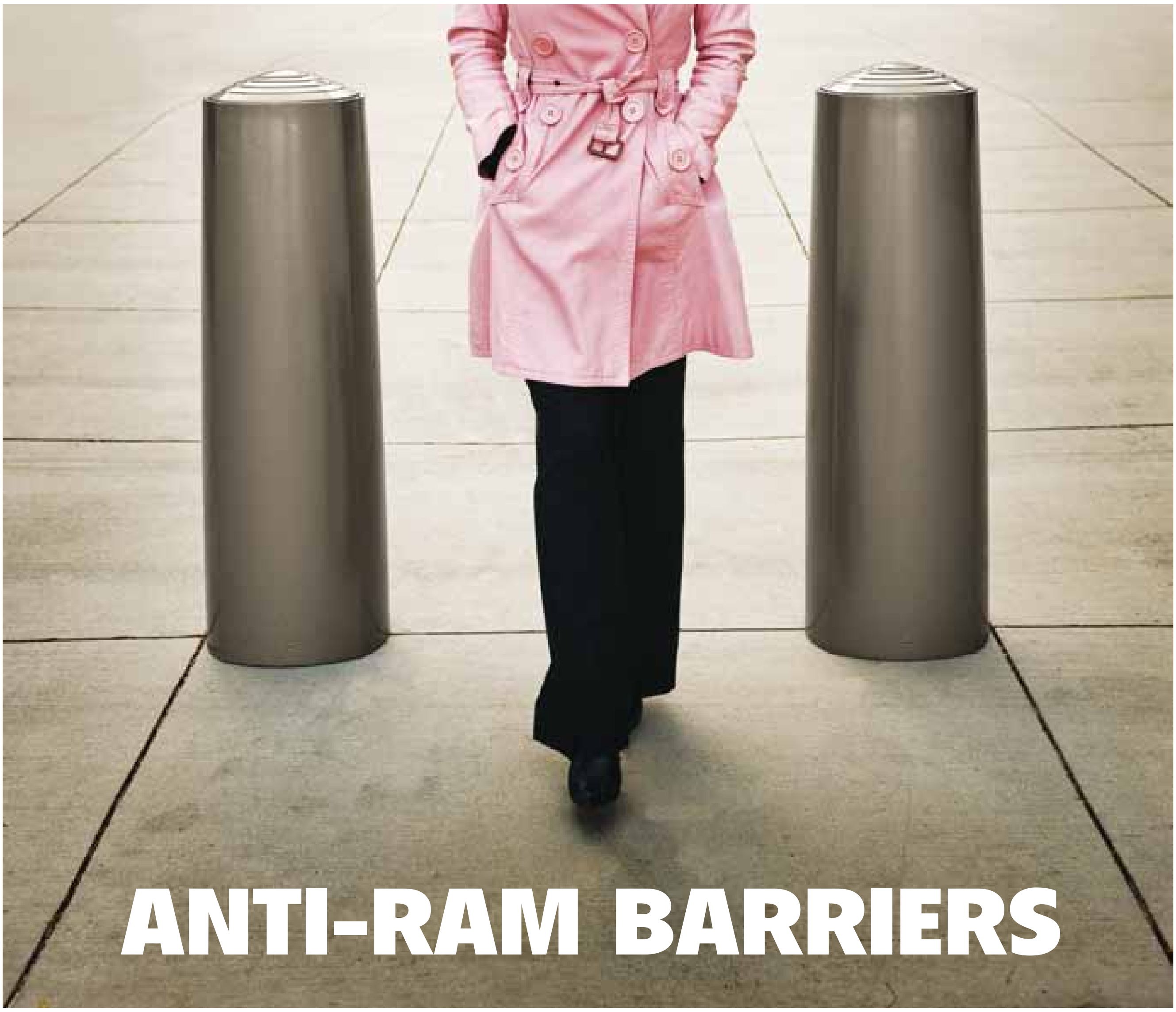

Photo – Landscape Forms INC

ANTI-RAM BARRIERS

BOLLARD MOUNTING TECHNIQUES

Joanna TOMCZAK

As we promised in the first issue of SEC&AS magazine we are coming back to the subject of mounting techniques of anti-ram & anti-terror protective elements. We had a possibility to share experience in this area with Fredric Reeder, designer of many landscape security solutions based, between others, on anti-ram bollards. He describes his work as artful force protection. His company designStream is involved in landscape security product design. Their best designs have been exhibited in the NY Museum of Modern Art (MoMA). Several of their designs have been patented and some have received prestigious Red Dot Product Design Award for creativity. Rick's firm designs custom force protection on commission and also have standard, non-custom line of landscape security products. One of them is Sentinel bollards line produced by, and available from, Landscape Forms, in Kalamazoo Michigan, US. Among their range we can find dedicated anti-ram solution we will show as an example to describe techniques of putting protective bollards in place. When we look at the Polish city landscape we can see many different types of protective barriers. But the question is whether these products are really effective anti-ram solutions or even if they are, were they properly fitted. We can read in trade press that they should seat in the ground even at a depth of 1,5 m! Let's look at the original Rick Reeder's photo made before putting the last layer under the pavement. In figure 1. you can see metal bar reinforcements done before pouring the

Fig. 1. Custom anti-ram bollard designed by Rick Reeder, fitted in reinforced concrete

Photo – designStream Rick Reeder

Fig. 2. Non-custom Sentinel bollard designed by Rick Reeder, produced & offered by Landscape Forms INC

Photo – Landscape Forms INC

concrete. This structure secure the bollard and gives it anti-ram protective force. It is very important when considering anti-terror solutions devised to withstand a big lorry impact i.e. as in the situation which occurred recently in Berlin. Every anti-ram solution should be strong, heavy and properly fixed in the ground. In our country this subject is taboo. We can see bollards preventing cars from parking on the pavement that some people call "anti-ram". Or even ones looking like anti-terror bollards but improperly designed or fitted in the ground. We should change our national lax attitude towards regulations and start securing our cities properly.

In figure 2. we can see one of Rick Reeder's designs offered by an American company Landscape Forms. When we take off external cast aluminium sleeve we can see real anti-ram structure of the bollard – steel pipe with strong metal plate inside (placed parallely to attacking vehicle direction) filled with concrete. Figure 3. shows correct fitting of anti-terror bollard in reinforced concrete. We are not showing this to teach how to make this kind of reinforcement (this is constructor's know-how) but to give readers an idea of creating real anti-terror bollard protection.

Terrorists aim to a achieve maximum casualties during a short surprise attack. All crowded places are particularly vulnerable. Among them we can list: airports, underground transport, shopping malls, office buildings, restaurants, spectacle venues, shows and visitor attractions. There is a special acronym for vehicles which can be used for terrorists' attacks – VBIED. Vehicle Borne Improvised Explosive Device (VBIED) this is a car or truck in which improvised explosive device was placed and then detonated. "It is commonly

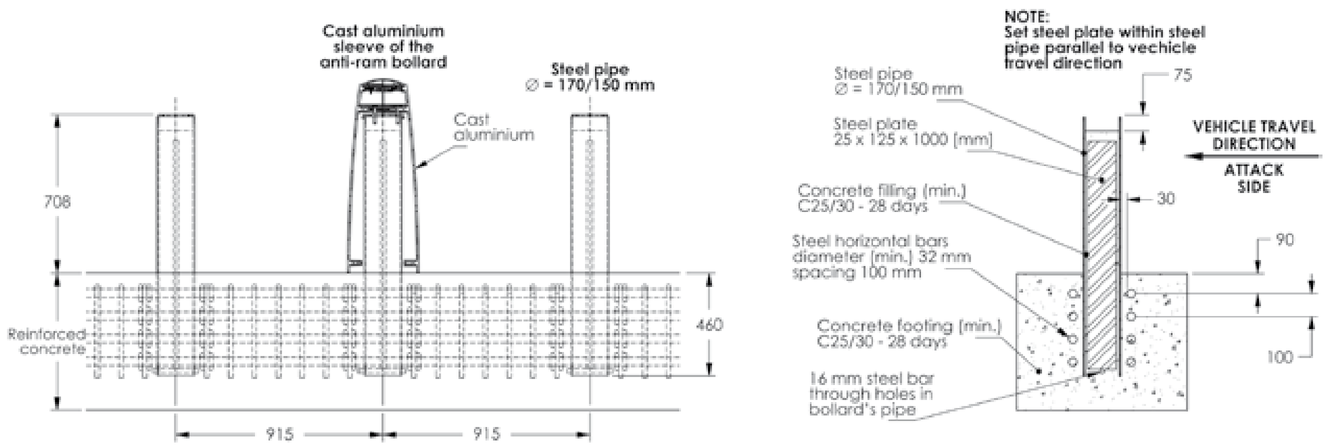

Fig. 3. Proposal of correct anti-terror bollard fitting in reinforced concrete

Based on Landscape Forms INC. drawings

Fig. 4. Real VBIED in London City Centre 2005 and Glasgow Airport 2007
Based on Frontier Pitts Guide To Impact Testing

used as a weapon of terrorism and normally kills the occupants of the vehicle (suicide bombers), people near the blast site, and/or causes damage to buildings or other property. A vehicle bomb acts as its own delivery mechanism and can carry a relatively large amount of explosives without attracting suspicion.”[1] In figure 4. you can see real consequences of VBIED.

[1] Frontier Pitts White Paper – *Frontier Pitts Guide To Impact Testing*

At the end a few words about Anti-Terrorism Force Protection (ATFP) barrier testing. Different ATFP barriers are shown in figure 5. and real crash test situation is in figure 6. There are some standards of vehicle barrier performance testing. Historically in the United States it was *US Department of State Crash Testing rating: SD-STD-02.01*. “Original perimeter barrier test methods were first published in 1985 by the Bureau of Diplomatic Security (as SD-STD-02.01 – *author's note*) to assess the crash performance of perimeter barriers and gates.(…) In that standard, the test vehicle was specified as a medium-duty truck weighing 6800 kg (15 000 lbs.). The payload was to be securely attached to the frame and nominal impact velocities were 50 km/h (30 mph), 65 km/h (40 mph), and 80 km/h (50 mph).Penetration limits were 1 m (3 ft.), 6 m (20 ft.), and 15 m (50 ft.) and were measured from the attack face of the perimeter security device to the final resting position of the front of the frame rails of the test vehicle (K4, K8 & K12 rating – *author's note*). In 2003, the U.S. State Department, Bureau of Diplomatic Security issued an updated standard (SD-STD-02.01, Revision A) for the testing of perimeter barriers.(…) The foremost reason for the change was that limited setback distances precluded the use of any devices at their facilities or compounds that did not meet the highest test level, that is, those allowing more than 1-m (3-ft.) penetration distance.”[2] Currently, ASTM International F2656-15 *Standard Test Method for Vehicle Crash Testing of Perimeter Barriers*, is used. This standard superseded the Department of State K ratings in the way explained below:

K12 = M50 – Medium duty truck 15,000lbs [6,8 t] with 50mph [ca. 80 km/h] velocity
K8 = M40 – Medium duty truck 15,000lbs [6,8 t] with 40mph [ca. 65 km/h] velocity
K4 = M30 – Medium duty truck 15,000lbs [6,8 t] with 30mph [ca. 50 km/h] velocity

[2] ASTM International F 2656-07 *Standard Test Method for Vehicle Crash Testing of Perimeter Barriers* revised in 2015

Fig. 5. Different ATFP barriers
Based on Frontier Pitts Guide To Impact Testing & different manufactures photos

Besides US standards we can find other International, European and British norms & guidelines as follows:

- ISO IWA 14-1 & 14-2 (2013) International Workshop Agreement for Vehicle security barriers; performance and application[3]
- CEN CWA16221 (2010) The European Workshop Agreement for vehicle barrier performance[4]
- BSI PAS 68 (versions 2005, 07, 10 & 13) which is the British Standards Institution's (BSI) Publicly Available Specification for vehicle security barriers[5]
- BSI PAS 69 (versions 2006, 2013) provides guidance on the installation of PAS 68 equipment[6]
- DfT-TAL 2/13: *Bollards and pedestrian movement* – GOV.UK Department for Transport
- DfT TAL 1/11 *Vehicle security barriers within the streetscape* – GOV.UK Department for Transport
- NaCTSO – *Crowded places guidance* – GOV.UK National Counter Terrorism Security Office

As you could notice there are various specifications for impact testing of Vehicle Security Barriers (VSB). However, from the beginning of 2014, the UK Government accepted that VSB should be impact tested under ISO IWA 14 standards (which are very closed to PAS 68&69 standards). So International ISO IWA 14 replaced the BSI's Publicly Available Specification PAS 68&69 standards. And now we can talk about US – ASTM F2656-15[2], International Workshop Agreement – ISO IWA 14-1 & 14-2[3] and European Workshop Agreement – CEN CWA 16221[4]. In figure 7. we can see short & simple comparison between International (IWA 14) and US (F2656-15) tests.

Let me end with this conclusion -- from my point of view – we are in the middle of nowhere when it comes to Anti-Terrorism Force Protection. Even PKN (Polish Committee for Standardization) have not noticed CEN European Workshop Agreement or ISO IWA International Workshop Agreement. And paraphrasing expert's statement: this is not a question of IF, this is a question of WHEN. Will we continue living up to the Polish adage: a Pole is wise only after the damage is done?

Fig. 6. Anti-ram bollards tests – the truck after crush test
Photo – Gunnebo Polska

[3] ISO IWA 14-1:2013 *Vehicle security barriers -- Part 1: Performance requirement, vehicle impact test method and performance rating,* ISO IWA 14-2:2013 *Vehicle security barriers – Part 2: Application*

[4] CEN Workshop Agreement CWA 16221:2010 *Vehicle security barriers – Performance requirements, test methods and guidance on application*

[5] BSI PAS 68:2013 *Impact test specifications for vehicle security barrier systems*

[6] BSI PAS 69:2013 *Guidance for the selection, installation and use of vehicle security barrier systems*

	UK TEST 7.5t	INTERNATIONAL TEST 7.2t	US TESTS 6.8t
Test method	PAS 68	IWA 14	ASTM-M50/DOS-K12
Vehicle category	Truck with 7.5 t gross vehicle weight	Truck with 7.2 t gross vehicle weight	Truck with 6.8 t gross vehicle weight
Vehicle weight in tons, kilograms and pounds	7.5 tons 7500 kg 16500 lbs	7.2 tons 7200 kg 15880 lbs	6.8 tons 6800 kg 15000 lbs
Vehicle speed (km/h)	80	80	80
Vehicle speed (mph)	50	50	50
Impact energy in kJ	1852	1778	1680

Fig. 7. Sample comparison between UK (PAS 68), International (ISO IWA 14) and US (ASTM F2656-15 & DOS SD-STD-02.01) requirements
Table based on Frontier Pitts Guide To Impact Testing