



**DEPARTMENT OF DEFENSE
US ARMY CORPS OF ENGINEERS
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**DoD ANTI-RAM VEHICLE BARRIER
LIST**

List Date: September 2024

The Department of Defense physical security concept is to create a layered or tiered defensive system that may include both active and passive perimeter barriers to delay, defeat or otherwise mitigate potential intruders. The Department employs several testing standards and testing procedures for both active vehicle barriers and passive vehicle barriers designated as “vehicle security barriers”, “vehicle-impact rated barriers”, or “anti-ram vehicle barriers”. The testing standards include ASTM International F2656 and Department of State (DOS) SD STD-02.01, Specification for Vehicle Crash test of Perimeter Barriers and Gates.

The ASTM F2656-18 test standard rates barriers based on vehicle type, impact velocity and penetration. Barriers that were tested to ASTM F2656-07 and assigned a penetration rating of P4 are not included in the DOD Anti-Ram Vehicle Barriers List. The P4 penetration rating has been removed from ASTM F2656 in subsequent versions.

Barriers tested to DOS STD 02.01, ASTM F2656-07, ASTM F2656-15, ASTM F2656-18 and ASTM F2656-18a have penetration ratings based on measurement from the trailing edge of the barrier. Barriers tested to ASTM F2656-19 and all subsequent versions will have penetration ratings based on measurement from the leading edge of the impacted barrier element.

The following list of barriers includes active barriers for allowance or denial of vehicle access, and passive or fixed barriers to prevent circumvention of active vehicle barriers or for other perimeter applications. This list will be updated quarterly in January, April, July and October. A compliant report must be received one month prior to the list being published to be included on the next quarterly list.

Note: If the requirements of the test standard (ASTM, DOS) are not met and/or are not included in the test report, the tested product will not be added to this list and the report will be rejected for revision and resubmittal. The most common reason for rejection of submittals is a lack of comprehensive information about the test article (engineering drawings, dimensions, specifications, and material properties).

Note: This DOD Anti-Ram Vehicle Barrier List supersedes all previous versions. Please refer to the date above to ensure you have the most up to date list. Neither this list nor any previous list represents an overall endorsement of any product or design or addresses its operational suitability or maintainability. The list merely

verifies that a particular vehicle barrier has been certified in accordance with the performance standards in ASTM F2656 or previously tested to the DOS SD-STD-02.01 standard and that the appropriate test reports have been submitted to, and validated by, the Protective Design Center. **This list does not attempt to discern whether the barriers listed meet other contractual requirements.** All listed barriers have been impact tested. Each vehicle barrier system has its own distinct characteristics that must be considered and weighed against the needs and conditions of the individual installation. Some barrier characteristics are associated with vulnerabilities. These vulnerabilities may not be readily apparent to the end users. See appendix A for a list of demonstrated characteristics. Careful consideration should be given to clearances and geometric characteristics when utilizing barrier systems of varying widths. For examples of ratings see appendix B. The PDC is available to discuss barrier characteristics, and other barrier issues or questions at PDC.Web@usace.army.mil

Barrier Type: <u>Active Bollard</u>				
Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M30	P1	Ground Retractable Bollard – Model RB-400	Barrier1 Systems, Inc. http://www.barrier1.us/	Single bollard
M30	P1	J355 HA-M30 (KH) Bollard	FAAC International, Inc. http://www.faacusa.com/	Single bollard
M30	P1	Movable Bollard M30	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	Single bollard
M30	P1	Movable Bollard, “AU1A – 348”	TiSO Production https://tiso.global/	Single bollard
K4	L2	SP Defender	ATG Access, Inc. http://www.atgaccessinc.com/	3-bollard array
K4	L2	DSC 800 Bollard Type Barricade	Delta Scientific Corporation http://deltascientific.com/	3-bollard array
K8	L3	XT-1208-RB, Xact Series Retractable Bollards - (fka-Eagle Series Bollards, K8)	Harden Architectural Security Products, LLC https://www.hardensecure.com/	3-bollard array, hydraulic bollards

K8	L2	DSC 701 Crash Certified Bollard Type Barricade	Delta Scientific Corporation http://deltascientific.com/	3-bollard array
K8	L1	ARMR B-30 Bollard Assembly	B&B ARMR http://www.bb-armr.com/	3-bollard array, hydraulic bollards
M50	P1	SP1000 Rising Bollard	ATG Access, Inc. http://www.atgaccessin0.com/	single hydraulic bollard
M50	P1	DSC720 1M	Delta Scientific Corporation http://www.deltascientific.com	3-bollard array, pneumatic bollards
M50	P1	HT1 Raptor	Heald Ltd http://www.heald.uk.com/	Single bollard
M50	P1	HRB-Protector Crash Tested Rising Bollard	Optima Engineering http://www.optima-engineering.com/	Single bollard
M50	P1	AUIA-342	TiSO Production https://tiso.global/	Single bollard
K12	L3	SP Titan	ATG Access, Inc. http://www.atgaccessinc.com/	3-bollard array
M50	P2	TITAN MKII Hydraulic Bollard	ATG Access, Inc. http://www.atgaccessinc.com/	3-bollard array, hydraulic bollards
M50	P2	BLG-05 Foundations Protection System	EL-GO TEAM Parking and Security Systems http://www.elgoteam.com/	Single Pneumatic/ Hydraulic/ Electric Bollard
M50	P2	Movable Bollard M50	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	Single Hydraulic Bollard

M30	P1	RSS4003R	RSSI http://www.rssi.com/	3-bollard array
K12	L2	Movable Bollard K12	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	single hydraulic bollard
K12	L2	NBI Hydraulic Bollard Barrier	Nasatka Barrier, Inc. http://www.nasatka.com/	3-bollard array
K12	L2	XT-1200-RB, Xact Series Retractable Bollards - (fka-Eagle Series Bollards, K12)	Harden Architectural Security Products, LLC https://www.hardensecure.com/	3-bollard array, hydraulic bollards
M50	P3	SW1700 (EM)	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	3-bollard array, electromechanical
M50	P3	PASS PM 275/M50-1200A	Pilomat Srl http://www.pilomat.com	Single hydraulic bollard
K12	L1	B40 Retractable Bollard	B&B ARMR http://www.bb-armr.com/	3-bollard array, hydraulic bollards
C750	P2	Fixed bollard, RB343-68-GH-15-0.1/0.1-032/100-140	TiSO Production https://tiso.global/	Single bollard
M30	P1	Model 303 Single High Impact Operable Bollard	B&B Roadway and Security Solutions https://bbrss.com/	Single bollard 3.28' clear spacing would result from two adjacent as tested bollards 4' centerline spacing would result from two adjacent as tested bollards 48" wide foundation

M50	P2	G-1752 Active Bollard	Gibraltar Perimeter Security http://www.gibraltarmaterials.com/	Single 12” bollard 4.67’ clear spacing would result from two adjacent as tested bollards 5.73’ centerline spacing would result from two adjacent as tested bollards 68.75” wide foundation
M50	P2	RollC Retractable Bollard	Rollc Company http://www.rollcksa.com/	Single 12.8” bollard 6.81’ clear spacing would result from two adjacent as tested bollards 7.87’ centerline spacing would result from two adjacent as tested bollards 94.5” wide foundation
M40	P1	Hydraulic Bollard, HBD 275 H90	Ozak Access Technologies Inc. https://ozak-t.com	Single 10.63” bollard 4.04’ clear spacing would result from two adjacent as tested bollards 4.92’ centerline spacing would result from two adjacent as tested bollards 59.1” wide foundation
M50	P3	Hydraulic Tandem Bollard HBD 275 H 90	Ozak Access Technologies Inc. https://ozak-t.com	2-bollard array with 10.63” diameter bollards 2.62’ clear spacing would result from two adjacent as tested bollards within the 2-bollard array 3.51’ centerline spacing would result from two adjacent as tested bollards within the 2-bollard array 4.04’ clear spacing would result between two adjacent as tested 2-bollard arrays 101.18” wide foundation

Barrier Type: Active Drop-Arm Beam

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M30	P1	M530 12-foot Drop Arm Assembly	Apex Fabrication & Design, Inc. http://www.apexfab.com/	12 foot clear opening
M30	P1	Shallow Foundation Gate System 909050102601-26FT M530	Apex Fabrication & Design, Inc. http://www.apexfab.com/	26 foot clear opening
M30	P1	M-30 VP-SF	Autogate, Inc http://www.autogate.com/	15 foot clear opening
M30	P1	Model 773 Series Drop Arm Barrier	B&B Roadway Security Systems https://www.bbrss.com/	24 foot clear opening
M30	P1	StrongArm M30	HySecurity Gate, Inc. http://www.hysecurity.com/	12 foot clear opening
M30	P1	Sono Tube Barrier Arm	Logical Decisions, Inc. http://ldi.com/ldi-crash-gate.html	20 foot clear opening
M30	P1	RSS-3000 Drop Beam System	RSSI Barriers http://www.rssi.com/	11.5 foot clear opening
M30	P1	Drop Arm Barrier	Tymetal Corporation http://www.tymetal.com/	14 foot clear opening
M30	P1	Model DSC7090-M30	Delta Scientific Corporation http://deltascientific.com/	12' (3.66m) clear opening 4.02' (1.23m) clear spacing would result between two adjacent as tested barriers 21.04' (6.41m) foundation width
K4	L3	Satyr-4 Crash Beam	Perimeter Security Partners, LLC http://www.perimetersecuritypartners.com/	11.5 foot clear opening

K4	L3	Bosik Bar VBS Shallow Foundation Barrier (SP VBB) K4	ATG Access, Inc. http://www.atgaccessinc.com/	14 foot clear opening
K4	L3	ARMR Model 730 Crash Gate	B&B ARMR http://www.bb-armr.com/	
M30	P2	Model 773 Drop Arm	B&B ARMR http://www.bb-armr.com/	24 foot clear opening
M30	P2	G-2300S Surface Mount Vehicle Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	12 foot clear opening
M30	P2	Barrier Arm Crash Gate	Logical Decisions http://ldi.com/ldi-crash-gate.html	Approx 12.5 foot clear opening
K4	L2	IP500 Transportable Beam for Quick Deployment	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening, surface mounted
K4	L2	TT212EC Drop Arm Beam Barrier System	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening
M30	P3	G-2300P Portable Vehicle Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	12 foot clear opening
M30	P3	G-4033P Portable Drop Arm	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	12 foot clear opening
K8	L3	VPL-CB-24	Autogate, Inc http://www.autogate.com/	14.5 foot clear opening
M50	P1	TCRB12 Pivot Arm/Beam	Tymetal Corporation http://www.tymetal.com/	14 foot clear opening
M50	P1	Satyr-12 Crash Beam	Perimeter Security Partners, LLC http://www.perimetersecuritypartners.com/	12.9 foot clear opening
M50	P2	Satyr-12 Crash Beam	Perimeter Security Partners, LLC http://www.perimetersecuritypartners.com/	28 foot clear opening

K12	L3	Bosik Bar VBS Deep Foundation Barrier (SP VBB) K12	ATG Access, Inc. http://www.atgaccessinc.com/	14.25 foot clear opening
K12	L3	VPL-CB-24	Autogate, Inc http://www.autogate.com/	14.5 foot clear opening
K12	L3	DSC 7000 Barrier	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening
K12	L3	NMSB XII Crash Beam Barrier - 12 ft	Nasatka Barrier, Inc. http://www.nasatka.com/	12 foot clear opening
K12	L3	NMSB XII Crash Beam Barrier - 18 ft	Nasatka Barrier, Inc. http://www.nasatka.com/	18 foot clear opening
M50	P2	24-ft Patriot Rising Beam Barrier	Ameristar Perimeter Security Systems http://ameristarsecurity.com/	24 foot clear opening
M50	P2	Horizontal Crash Beam or Horizontal Cable Barrier (HCB) Ground Retractable Active Vehicle Barrier	Barrier1 Systems, Inc. http://www.barrier1.us/	15'-10" span - interpolation with 40'-10" span barrier is acceptable
M50	P2	Horizontal Crash Beam or Horizontal Cable Barrier (HCB) Ground Retractable Active Vehicle Barrier	Barrier1 Systems, Inc. http://www.barrier1.us/	47'-10" foot net width - interpolation with 15'-10" barrier is acceptable
M50	P2	Drop Arm Crash Beam Model FCB-1200	Barrier1 Systems, Inc. http://www.barrier1.us/	13'-9" clear opening
M50	P2	StrongArm M50	HySecurity Gate, Inc. http://www.hysecurity.com/	12 foot clear opening
M50	P3	Drop Arm Vehicle Barrier - KBVB	Barrier1 Systems, Inc. http://www.barrier1.us/	
M50	P3	Active Drop Arm Swing Gate, Surface Set Mobile Crash Beam Barrier, 14'0" Span, Model #DASG-SSM	Barrier1 Systems, Inc. http://www.barrier1.us/	14 foot clear opening, interpolation with 34 foot width acceptable

M50	P3	Active Drop Arm Swing Gate, Surface Set Mobile Crash Beam Barrier 34'-0" Span, Model #DASG-SSM	Barrier1 Systems, Inc. http://www.barrier1.us/	34 foot clear opening, interpolation with 14 foot width acceptable
M50	P2	24' Drop Arm	Black Security Products http://www.blacksp.com/	24.0' (7.315 m) Clear Opening 29.58' (9.016 m) Foundation Width

Barrier Type: Active Gate

Barrier Rating	Penetr ation Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M30	P1	K4 Shield Crash Gate	AutoGate http://www.autogate.com	15'-8" clear opening
M30	P1	AR-266 - 12 ft	Heavy Duty Gate, Inc. (fka Morrison Equipment) http://heavydutygates.com/	12 foot clear opening
M30	P1	TCG4 Sliding Gate Barrier	Tymetal Corporation http://www.tymetal.com/	14 foot clear opening
K4	L2	ARMR Model 400 Sliding Gate	B&B ARMR http://www.bb-armr.com/	12 foot clear opening
M50	P1	Terrablock Crash Gate	Betafence http://www.betafenceusa.com/	16.4 foot clear opening, must be installed with Terrablock M50 passive barriers in configuration
M50	P1	DSC 288	Delta Scientific Corporation http://deltascientific.com/	20 foot clear opening
M50	P1	Tracked Gate TG M50	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	7.2 meter clear opening
M50	P1	SR 466 Anti-Ram Vehicle Barrier	Heavy Duty Gates, Inc. (fka Morrison Equipment) http://www.heavydutygates.com/	12.75 foot clear opening
M50	P1	AR 466 Anti-Ram Vehicle Barrier - 16.5 ft	Heavy Duty Gates, Inc. (fka Morrison Equipment) http://www.heavydutygates.com/	16.5 foot clear opening

M50	P1	K12 Cable Restraint Barrier - 24 ft	Neusch Innovations, LP	24 foot clear opening
M50	P1	Terrablock Vehicle Access Gate	Praesidiad NV http://www.praesidiad.com/	16.4 foot clear opening, must be installed with Terrablock XV passive barriers in configuration
K12	L3	CG12 Gate	Bad Day Fabrication https://baddayfab.com/	12 foot clear opening
K12	L3	DSC 7500 Barrier	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening
K12	L3	K12 Cable Crash Gate	Betafence http://www.betafenceusa.com/	24 foot clear opening
K12	L3	AR 446 Anti-Ram Vehicle Barrier - 40 ft	Heavy Duty Gates, Inc. (fka Morrison Equipment) http://www.heavydutygates.com/	40 foot clear opening
K12	L3	Modified Interlocking Finger Gate	Logical Decisions http://ldi.com/ldi-crash-gate.html	V shape, 13 foot clear opening
M50	P2	G-5500 Anti-Ram Sliding Gate	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	24 foot clear opening
M50	P2	G-5550 Anti-Ram Sliding Gate	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	28 foot clear opening
M50	P2	K12 Cable Restraint Barrier - 50 ft	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	50 foot clear opening
M50	P2	Crash Gate System Barrier	Logical Decisions, Inc. http://ldi.com/ldi-crash-gate.html	
M50	P2	Crash Gate System Barrier	Jamieson Manufacturing Co. https://jamiesonfence.com/	24 foot clear opening
M50	P2	K12 Cable Restraint Barrier - 50 ft	NEU Security Systems http://www.neusecurity.com/	50 foot clear opening

DoD Anti-Ram Vehicle Barriers

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M50	P2	32' Articulating TCRB Crash Gate	Tymetal Corporation http://www.tymetal.com/	32 foot clear opening
M50	P2	26' x 7' Box Frame Cantilever Slide Gate w/Crash Beam Model TCGR-12	Tymetal Corporation http://www.tymetal.com/	26 foot clear opening - No interpolation with 16' version
K12	L1	ARMR Model 450 Anti-Climb High Security Vehicle Access Control Cantilever Gate System	B&B ARMR http://www.bb-armr.com/	12 foot clear opening
M30	P1	BM530 12' Gate Barrier	Apex Fabrication & Design, Inc. http://www.apexfab.com/	12 foot clear opening

Barrier Type: **Active Net**

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M40	P1	GRAB-400 - 12 ft <u>SEE APPENDIX A</u>	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	12 foot clear opening - interpolation with 60 foot barrier is acceptable with a P2 penetration. Barrier has a demonstrated characteristic. <u>See appendix A.</u>
M40	P2	GRAB-400 - 60 ft <u>SEE APPENDIX A</u>	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	60 foot clear opening - interpolation with 12 foot barrier is acceptable. Barrier has a demonstrated characteristic. <u>See appendix A.</u>
M50	P1	Swing Gate Access Control Barrier	Barrier1 Systems, Inc. http://www.barrier1.us/	18' 3" clear opening
M50	P2	30' Retractable Net Vehicle Barrier System <u>SEE APPENDIX A</u>	Barrier1 Systems, Inc. http://www.barrier1.us/	30 foot clear between stanchions - interpolation with 90 foot barrier is acceptable with P3 rating <u>See appendix A.</u>

M50	P3	90' Retractable Cable Net Vehicle Barrier System SEE APPENDIX A	Barrier1 Systems, Inc. http://www.barrier1.us/	90' clear opening between stanchions - interpolation between 30' and 90' is acceptable See appendix A.
M50	P2	Retractable Cable Net Vehicle Barrier System - 20 ft 4 Horizontal Cables	Barrier1 Systems, Inc. http://www.barrier1.us/	19' 9.5" clear opening between stanchions - interpolation between 19' 9.5" and 52' 5" is acceptable
M50	P2	Retractable Cable Net Vehicle Barrier System - 52.5 ft 4 Horizontal Cables	Barrier1 Systems, Inc. http://www.barrier1.us/	52' 5" clear opening between stanchions - interpolation between 19' 9.5" and 52' 5" is acceptable
M50	P2	Vehicle Arrestor 2.0-NET-400 Net Based Active Vehicle Barrier – 80' SEE APPENDIX A	Barrier1 Systems, Inc. http://www.barrier1.us/	80' clear opening between stanchions - interpolation between 29' 3" and 80' is acceptable. Barrier has a repeatedly demonstrated characteristic. See appendix A.
M50	P2	Vehicle Arrestor 2.0-NET-400 Net Based Active Vehicle Barrier – 29' 3" SEE APPENDIX A	Barrier1 Systems, Inc. http://www.barrier1.us/	80' clear opening between stanchions - interpolation between 29' 3" and 80' is acceptable. Barrier has a repeatedly demonstrated characteristic. See appendix A.
M50	P2	GRAB-300 - 14 ft SEE APPENDIX A	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	14 foot net width - interpolation with 62 foot barrier is acceptable. Barrier has a repeatedly demonstrated characteristic. See appendix A.
M50	P2	GRAB-300 - 62 ft SEE APPENDIX A	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	62 foot net width - interpolation with 14 foot barrier is acceptable. Barrier has a repeatedly demonstrated characteristic. See appendix A.
M50	P3	Modified Vehicle Arresting System (VAS)	Engineered Arresting Systems Corporation http://www.esco.zodiacaerospace.com/	24 foot tested width

M50	P2	Defender Net 21'	Black Security Products	21.29' (6.49m) tested width 12.67' (3.86m) clear spacing would result between two adjacent as tested barriers (as measured between major abutment elements) 6.34' (1.93 m) clear space exists between edge of foundation and the major abutment elements 35.96' (10.96m) foundation width
M50	P2	Defender Net 72'	Black Security Products	72.0' (21.95m) tested width 2.0' (0.61m) clear spacing would result between two adjacent as tested barriers (as measured between major abutment elements) 1.0' (0.31m) clear space exists between edge of foundation and the major abutment elements 87.0' (26.52m) foundation width

Barrier Type: Active Post and Beam

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
K4	L3	Barrier Lift System K4	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	9 m (29.5 foot) clear opening
M30	P3	Portable Beam Barricade Model: DSC 1500	Delta Scientific Corporation http://deltascientific.com/	16 foot clear opening
M50	P1	XT-4200-HB Post & Beam Gate	Ross Technology Co. http://www.rosstechnology.com/	24 foot clear opening
K12	L2	Barrier Lift System K12 – 10m	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	10 m width
K12	L3	SP Patriot	ATG Access, Inc. http://www.atgaccessinc.com/	12 foot clear opening

K12 L3 Barrier Lift System – 6m [Perimeter Protection Germany GmbH](http://www.perimeterprotection.net/) 6 m clear opening
<http://www.perimeterprotection.net/>

Barrier Type: Active Wedge

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
PU40	P3	DSC 1000 Barrier	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening, portable wedge
M30	P1	HD200	Delta Scientific Corporation http://deltascientific.com/	9 foot clear opening
M30	P2	Pyramid Barrier	Mifram Security http://www.miframsecurity.com/	3 – 1 m wide pyramid shapes bolted together
M30	P3	MNSB XV Mobile Barrier	Nasatka Barrier, Inc. http://www.nasatka.com/	12 foot clear opening, mobile wedge
K4	L3	DSC 1200 Barrier	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening
K4	L2	DSC 1100 Quick Beam Deployment Barrier System	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening, surface mounted
K4	L2	XS-2000-PW, Xpress Series Portable Wedge Barrier - (fka-Osprey Series Portable Wedge)	Harden Architectural Security Products, LLC https://www.hardensecure.com/xt-1208	12 foot clear opening, portable wedge
K4	L1	ARMR Model 850 Portable/Towable Barrier	B&B ARMR http://www.bb-armr.com/	Portable wedge
K4	L1	MP5000 Mobile Barrier	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening, portable wedge
M40	P1	SHS3110-8	Secure USA, Inc. http://www.secureusa.net/	10 foot tested width
M40	P3	MP5000 Mobile Barrier - 16 feet	Delta Scientific Corporation http://deltascientific.com/	16 foot clear opening, mobile wedge

M50	P3	MP5000 16' Barricade	Delta Scientific Corporation http://deltascientific.com/	16 foot clear opening, mobile wedge Chained To 6 Delta Passive Barriers
M40	P3	MP5000 Mobile Barrier - 20 feet	Delta Scientific Corporation http://deltascientific.com/	20 foot clear opening, mobile wedge
M40	P3	MNSB XVI Mobile Barrier	Nasatka Barrier, Inc. http://www.nasatka.com/	16 foot clear opening, mobile wedge
M40	P3	NMSB XVX 20 ft Clear Opening Barrier	Nasatka Barrier, Inc. http://www.nasatka.com/	20 foot clear opening, mobile wedge
K8	L1	DSC 1100 Quick Beam Deployment Barrier System	Delta Scientific Corporation http://deltascientific.com/	12 foot clear opening, surface mounted
M50	P1	Electric Wedge Barrier	Barrier1 Systems, Inc. http://www.barrier1.us/	10 foot tested width
M50	P1	Model 828 Wedge Barrier	B&B ARMOR http://www.bb-armr.com/	10 foot tested width
M50	P1	DS 2000S Road Blocker	Digital & Security Technology Co., LTD	8.2 foot (2.5 m) tested width
M50	P1	DSC 207S	Delta Scientific Corporation http://deltascientific.com/	9 foot wide plate
M50	P1	HD2055	Delta Scientific Corporation http://deltascientific.com/	12 foot tested width
M50	P1	HD 300	Delta Scientific Corporation http://deltascientific.com/	9' 1" tested width
M50	P1	Road Block DS-3000S	Digital and Security Technology Co. http://www.dnst.co.kr	12.5 foot tested width
M50	P1	A-120-C/A-260 Optimus	EL-GO TEAM Parking and Security Systems http://www.elgoteam.com/	8.1 foot tested width

M50	P1	9 ft Wedge Barrier	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	9 foot tested width; interpolation with 16 foot width acceptable
M50	P1	16-ft Wedge System	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	16 foot tested width; interpolation with 9 foot width acceptable
M50	P1	G-2000 M50-P1 8'0" Wedge Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	8'0" clear opening; interpolation with 14'6" width acceptable
M50	P1	G-2000 M50-P1 14'6" Wedge Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	14'6" clear opening; interpolation with 8'0" width acceptable
M50	P1	Road Blocker Model GBRH50 Wedge Barrier	Guardian Industries Co. http://www.guardianind.com/	10' 1" tested width
M50	P1	Viper RBSM 1000	Heald Ltd. http://www.heald.uk.com/	9.83' plate
M50	P1	HydraWedge SM50	HySecurity http://www.hysecurity.com/	6.5 foot tested width
M50	P1	NSMB-IIID-E - 8 ft	Nasatka Barrier, Inc. http://www.nasatka.com/	8 foot plate
M50	P1	Model III D-E 10' Barrier System	Nasatka Barrier, Inc. http://www.nasatka.com/	10 foot tested width
M50	P1	Model III D-E 11' Barrier System	Nasatka Barrier, Inc. http://www.nasatka.com/	11 foot tested width
M50	P1	Model 3 D-E 12' Barrier System	Nasatka Barrier, Inc. http://www.nasatka.com/	12 foot tested width

M50	P1	Model III D-E 14' Barrier System	Nasatka Barrier, Inc. http://www.nasatka.com/	14 foot tested width
M50	P1	ElkostaWedge II	Perimeter Protection Germany GmbH www.perimeterprotection.net	6.5 foot (1.98m) tested width
M50	P1	RSS-2000VI	RSSI http://www.rssi.com/	6 post configuration - interpolation with 4 post configuration is acceptable, 5 post configuration acceptable
M50	P1	SHF3610-12	SecureUSA, Inc. http://secureusa.net/	10 foot wide plate
M50	P1	SHF3614S	SecureUSA, Inc. http://secureusa.net/	14 foot wide plate
K12	L3	Phoenix Wedge Barrier	Perimeter Security Partners, LLC (PSP) http://perimetersecuritypartners.com/	8 foot plate
K12	L3	SP Sentinel	ATG Access, Inc. http://www.atgaccessinc.com/	8 foot plate
K12	L3	ARMR Shallow Mount Plate Barrier Model 820	B&B ARMR http://www.bb-armr.com/	9 foot tested width
K12	L3	DSC 2000 Barrier	Delta Scientific Corporation http://deltascientific.com/	3 - 2 foot wedges with 18 inch spacing
K12	L3	Model DSC501 - Phalanx Type Barricade	Delta Scientific Corporation http://deltascientific.com/	9 foot wide plate
K12	L3	Road Blocker DSP K12	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	4.6 meter tested width
K12	L3	MSB II Barrier	Nasatka Barrier, Inc. http://www.nasatka.com/	12 foot clear opening
K12	L3	Wedge K12	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	4 meter tested width

K12	L3	XT-1000-W, Xact Series Wedge Barrier - (fka-Eagle Series Wedge Barrier)	Harden Architectural Security Products, LLC https://www.hardensecure.com/	9 foot wide plate
K12	L3	RSS-2000	RSSI http://www.rssi.com/	4 post configuration - interpolation with 6 post configuration is acceptable, 5 post configuration acceptable
C730	P1	Road Blocker, Speedbump "AUIA – 359-04	TiSO Production https://tiso.global/	14.35' (4.068 m) tested width
M50	P1	Road Blocker "AUIA – 333 Automatic"	TiSO Production https://tiso.global/	9.42' (2.87 m) tested width
M50	P3	Rollc Company "RRB 5100 Road Blocker"	Rollc Company http://www.rollcksa.com/	16.34' (4.98 m) tested width 2.71' (0.83m) clear spacing would result between two adjacent as tested barriers 19.05' (5.806m) foundation width
M50	P1	DSC550	Delta Scientific Corporation http://deltascientific.com/	9.67' (2.95 m) tested width 3.5' (1.07m) clear spacing would result between two adjacent as tested barriers 13.17' (4.01m) foundation width
M50	P1	NMSB III-D	Nasatka Barrier, Inc. http://www.nasatka.com/	14.0' (4.27m) tested width 2.44' (0.74m) clear spacing would result between two adjacent as tested barriers 16.44' (5.01m) foundation width
M30	P1	AUIA-313 Automatic Barrier	TiSO Production https://tiso.global/	9.42' (2.87 m) tested width 4.36' (1.33m) clear spacing would result between two adjacent as tested barriers 13.78' (4.20 m) foundation width

M50	P1	G-2500 14' Wedge Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	14.0' (4.27 m) tested width 2.00' (0.61 m) clear spacing would result between two adjacent as tested barriers 16.0' (4.88 m) foundation width interpolation with G-2500 8' Wedge Barrier is acceptable
M50	P1	G2500 8' Wedge Barrier	Gibraltar http://www.gibraltarmaterials.com/	8.0' (2.74m) tested width 2.00' (0.61 m) clear spacing would result between two adjacent as tested barriers 10.0' (3.05m) foundation width interpolation with G-2500 14' Wedge Barrier is acceptable
H30	P2	Heavy Road Block Barrier	Digital and Security Technology Co. http://www.dnst.co.kr	11.48' (3.50 m) tested width 4.20' (1.28 m) clear spacing would result between two adjacent as tested barriers 15.68' (4.78 m) foundation width
M50	P1	OZAK Road Blocker, HRB 30 R 90	Ozak Access Technologies Inc. https://ozak-t.com	9.84' (3.00m) tested width 4.59' (1.40m) clear spacing would result between two adjacent as tested barriers 14.44' (4.40m) foundation width
M50	P1	DSC550-10'	Delta Scientific Corporation http://deltascientific.com/	9.67' (2.94m) tested width 2.83' (0.863m) clear spacing would result between two adjacent as tested barriers 12.5' (3.81m) foundation width Interpolation with 16.67' foot width acceptable

M50	P1	DSC550-16'	Delta Scientific Corporation http://deltascientific.com/	16.67' (5.08m) tested width 2.83' (0.863m) clear spacing would result between two adjacent as tested barriers 19.5' (5.94m) foundation width Interpolation with 9.67' foot width acceptable
M50	P1	NMSB 3B-2020	Gibraltar http://www.gibraltarmaterials.com/	14.0' (4.27m) tested width 2.09' (0.637m) clear spacing would result between two adjacent as tested barriers 16.0' (4.88m) foundation width

Barrier Type: Active Cable

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M40	P2	RSSI Cable Trap System	RSSI http://www.rssi.com/	4 - 1" diameter cables, 100' tested total length

Barrier Type: Passive Bollard **See note 4 in Appendix A**

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
PU50	P2	DSC 650 Shallow Foundation Bollard Array	Delta Scientific Corporation http://deltascientific.com/	2-bollard array 3.61' clear spacing (gap between bollards) 52" centerline spacing 108" wide foundation
M30	P1	M30 Shallow Foundation Modular Bollard System Test#CV0077	Barrier1 Systems, Inc. http://www.barrier1.us/	3-bollard array 3.75' clear spacing (gap between bollards) 54" centerline spacing 168" wide foundation

M30	P1	Set and Pour Bollard	Barrier1 Systems, Inc. http://www.barrier1.us/	Single bollard 4.33' clear spacing would result from two adjacent as tested bollards 5.00' centerline spacing would result from two adjacent as tested bollards 60" wide foundation
M30	P1	Shallow Foundation Modular Bollard System Test #TR2627	Barrier1 Systems, Inc. http://www.barrier1.us/	Single modular bollard 13.28' clear spacing would result from two adjacent as tested bollards 14.00' centerline spacing would result from two adjacent as tested bollards 168" wide foundation
M30	P1	Removable Bollard Model RB151	BP (Systems) Engineering Pte Ltd http://bpsystems.com.sg/	3-bollard array 3.70' clear spacing (gap between bollards) 4.59' centerline spacing 165.4" wide foundation
M30	P1	Fixed Bollard Model FB151	BP (Systems) Engineering Pte Ltd http://bpsystems.com.sg/	3-bollard array 3.87' clear spacing (gap between bollards) 4.59' centerline spacing 165.4" wide foundation
M30	P1	M30 P1 Shallow Mount Bollard	Gibraltar https://gibraltarus.com	3-bollard array
K4	L3	Shallow Bollard System Barrier	Atlas Security Products, Inc. http://atlasbarriers.com/	5-bollard array
K4	L3	RB80 Bollard	Weathers Manufacturing, Inc. http://www.weathersmfg.com/	48" OC, 3-bollard array
K4	L3	SP1000 Static Shallow Mount Barrier	ATG Access, Inc. http://www.atgaccessinc.com/	3-bollard array

K4	L3	Shallow Bollard System	SecureUSA, Inc. http://secureusa.net/	5-bollard array 3-bollard array 8.625" Diameter Bollards 3.78' (1.15 m) clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.5' (1.37 m) centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 8.28' (2.52 m) clear spacing would result between two adjacent as tested 3-bollard arrays 224" wide foundation Must be installed with 4' sidewalk behind the foundation.
M30	P1	Shaw Stainless & Alloy Shallow Bollard	Shaw Stainless & Alloy https://stainlessandalloy.com/	3-bollard array 3.28' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.00' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 3.28' clear spacing would result between two adjacent as tested 3-bollard arrays 144" wide foundation
M30	P2	8" SM Removable K4 Shallow Mount Bollard	Calpipe Security Bollards http://www.calpipebollards.com/	3-bollard array 4-25' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.50' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 3.75' clear spacing would result between two adjacent as tested 3-bollard arrays 168" wide foundation
M40	P1	M40 Shallow Foundation Modular Bollard System Test#CV0068	Barrier1 Systems, Inc. http://www.barrier1.us/	

M50	P1	M50 Shallow Foundation Single Bollard ASPI-SB-120	Atlas Security Products, Inc. http://atlasbarriers.com/	Single bollard 3-bollard array 4-50' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5-40' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 5.31' clear spacing would result between two adjacent as tested 3-bollard arrays 204" wide foundation
M50	P1	G-1350 – 3 Bollard Layout	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	3-bollard array 4-50' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5-40' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 8.96' clear spacing would result between two adjacent as tested 3-bollard arrays 248" wide foundation
M50	P1	M50 Shallow Foundation Bollard	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	3-bollard array 3.70' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.90' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 3.80' clear spacing would result between two adjacent as tested 3-bollard arrays 177.6" wide foundation
M50	P1	Fixed Bollard M50	Perimeter Protection Germany GmbH http://www.perimeterprotection.net/	

K12	L3	DSC 600 Shallow Frame Bollard Array	Delta Scientific Corporation http://deltascientific.com/	2-bollard array 3-44' clear spacing would result from two adjacent as tested bollards within the 2-bollard array 4-33' centerline spacing would result from two adjacent as tested bollards within the 2-bollard array 3.77' clear spacing would result between two adjacent as tested 2-bollard arrays 108" wide foundation
K12	L3	Model 6 Bollards - 4-bank shallow mount	Nasatka Barrier, Inc. http://www.nasatka.com/	4-bollard array, 2.10' clear spacing would result from two adjacent as tested bollards within the 4-bollard array 3.00' centerline spacing would result from two adjacent as tested bollards within the 4-bollard array 4.60' clear spacing would result between two adjacent as tested 4-bollard arrays 174" wide foundation
K12	L3	Shallow Mount Bollards	Sandia National Laboratories http://www.sandia.gov/	3-bollard array, 3.10' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.00' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 15.10' clear spacing would result between two adjacent as tested 3-bollard arrays 288" wide foundation
M50	P2	Single Bollard Vehicle Barrier System TR2450	Barrier1 Systems, Inc. http://www.barrier1.us/	Single bollard 7.10' clear spacing would result from two adjacent as tested bollards 8.00' centerline spacing would result from two adjacent as tested bollards 96" wide foundation

M50	P2	Set and Pour Fixed Bollard	Barrier1 Systems, Inc. http://www.barrier1.us/	Single bollard 5.10' clear spacing would result from two adjacent as tested bollards 6.00' centerline spacing would result from two adjacent as tested bollards 72" wide foundation
M50	P2	K12 Shallow Mount Bollard	Calpipe Security Bollards http://www.calpipebollards.com/	3-bollard array 10" Diameter Bollards 4-10' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5.00' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 4.10' clear spacing would result between two adjacent as tested 3-bollard arrays 180" wide foundation
M50	P3	FB-K12 Fixed Bollard System	Weathers Manufacturing, Inc. http://www.weathersmfg.com/	?
M50	P3	M50 Shallow Foundation Bollard - 40	Gibraltar Cable Barrier Systems, L.P. http://www.gibaltarmaterials.com/	3-bollard array 4-49' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5-40' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 8.96' clear spacing would result between two adjacent as tested 3-bollard arrays 248" wide foundation
M50	P3	HBD High Security Fixed Bollard Model HBD 275 S 100	Ozak Access Technologies Inc. https://ozak-t.com	Single bollard 10" Diameter 4.04' clear spacing would result from two adjacent as tested bollards 4.92' centerline spacing would result from two adjacent as tested bollards 59" wide foundation

M30	P1	SFB-M30 Single Bollard	Apex Fabrication & Design, Inc. http://www.apexfab.com/	Single bollard 8" Diameter 11.28' clear spacing would result from two adjacent as tested bollards 12.00' centerline spacing would result from two adjacent as tested bollards 144" wide foundation
M50	P1	Shallow Mount Bollard Single Stand Alone Model SMB-1200-SA	Barrier1 Systems, Inc. http://www.barrier1.us/	Single bollard 10" Diameter 14.27' clear spacing would result from two adjacent as tested bollards 15.17' centerline spacing would result from two adjacent as tested bollards 182" wide foundation
M50	P3	TB150 Ten Bollard Chained Array	Delta Scientific Corporation http://deltascientific.com/	10 bollard array, Overall length 40.75', 1.75' Clear spacing 4.25' Centerline spacing No foundation
M40	P2	G-1442 Ultra-Shallow Bollard	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Single Bollard 10" Diameter 13.44' clear spacing would result from two adjacent as tested bollards 14.33' centerline spacing would result from two adjacent as tested bollards 172" wide foundation
M40	P1	G-1441 Ultra-Shallow Bollard	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Single Bollard 12" Diameter 13.27' clear spacing would result from two adjacent as tested bollards 14.33' centerline spacing would result from two adjacent as tested bollards 172" wide foundation

M50	P2	Shallow Mount Bollard PDT1400SMF	Calpipe Security Bollards http://www.calpipebollards.com/	3-bollard array 10.25" Diameter Bollards 4.15' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5.00' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 5.15' clear spacing would result between two adjacent as tested 3-bollard arrays 192" wide foundation
M30	P1	DSC630	Delta Scientific Corporation http://deltascientific.com/	Single Bollard 8" Diameter 3.45' clear spacing would result from two adjacent as tested bollards 4.17' centerline spacing would result from two adjacent as tested bollards 50" wide foundation
M50	P2	DSC635	Delta Scientific Corporation http://deltascientific.com/	Single Bollard 10.75" Diameter 5.6' clear spacing would result from two adjacent as tested bollards 6.5' centerline spacing would result from two adjacent as tested bollards 78" wide foundation
M50	P2	RSSM50B	RSSI Barriers, LLC http://www.rssi.com/	3-bollard array 10" Diameter Bollards 3.10' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.0' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 7.10' clear spacing would result between two adjacent as tested 3-bollard arrays 192" wide foundation

M30	P2	Shallow Mount Bollard	1-800-Bollards https://www.1800bollards.com	Single Bollard 8.625" Diameter 9.28' clear spacing would result from two adjacent as tested bollards 10.0' centerline spacing would result from two adjacent as tested bollards 120" wide foundation
M30	P1	DSC633	Delta Scientific Corporation http://deltascientific.com/	Single Bollard 8.625" Diameter 3.45' clear spacing would result from two adjacent as tested bollards 4.17' centerline spacing would result from two adjacent as tested bollards 50.0" wide foundation
M30	P1	Single Bulwark Shallow Mount Bollard	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	Single Bollard 8.625" Diameter 11.28' clear spacing would result from two adjacent as tested bollards 12.0' centerline spacing would result from two adjacent as tested bollards 144" wide foundation
M30	P2	3 Bollard Array Bulwark Shallow Mount Bollards	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3-bollard array 8.625" Diameter Bollards 4.0' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.72' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 1.84' clear spacing would result between two adjacent as tested 3-bollard arrays 144" wide foundation

M50	P2	BBRSS 315 3 Bollard Array	B&B Roadway and Security Solutions https://bbrss.com/	3-bollard array 12.75" Diameter Bollards 4.0' clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5.06' centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 6.94' clear spacing would result between two adjacent as tested 3-bollard arrays 217.5" wide foundation
M50	P2	Shaw Stainless & Alloy Shallow Bollard	Shaw Stainless & Alloy https://stainlessandalloy.com/	3-bollard array 10.75" Diameter Bollards 4' (1.22 m) clear spacing would result from two adjacent as tested bollards within the 3-bollard array 4.92' (1.50 m) centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 8.94' (2.72 m) clear spacing would result between two adjacent as tested 3-bollard arrays 236" wide foundation Must be installed with 4' sidewalk behind the foundation.
M50	P2	Fixed 3 Bollard Array	Nasatka Barrier, Inc. http://www.nasatka.com/	3-bollard array ?" Diameter Bollards 4.52' (1.38 m) clear spacing would result from two adjacent as tested bollards within the 3-bollard array 5.42' (1.65 m) centerline spacing would result from two adjacent as tested bollards within the 3-bollard array 4.10' (1.25 m) clear spacing would result between two adjacent as tested 3-bollard arrays 190" wide foundation

SC40 P1	Bollard 150/C40RM 900 removable	Ontario Bollards https://ontariobollards.com/	Single Bollard 6.61" Diameter 1.96' clear spacing would result from two adjacent as tested bollards 2.51' centerline spacing would result from two adjacent as tested bollards 30.12" wide foundation
SC30 P1	Bollard 150/C40FX 900	Ontario Bollards https://ontariobollards.com/	Single Bollard 6.61" Diameter 1.96' clear spacing would result from two adjacent as tested bollards 2.51' centerline spacing would result from two adjacent as tested bollards 30.12" wide foundation
SC40 P1	Reliance Foundry R-1040-C40	Reliance Foundry https://www.reliance-foundry.com	Single Bollard 6.30" Diameter 1.97' clear spacing would result from two adjacent as tested bollards 2.50' centerline spacing would result from two adjacent as tested bollards 30" wide foundation
SC40 P1	Reliance Foundry Removable Bollard	Reliance Foundry https://www.reliance-foundry.com	Single Bollard 6.60" Diameter 1.95' clear spacing would result from two adjacent as tested bollards 2.50' centerline spacing would result from two adjacent as tested bollards 30" wide foundation

M50	P1	14' Bent Pipe Barrier	NON Proprietary Contact PDC For Engineering Details	Single Bent Pipe 10" Diameter No interpolation with 34' 0.00' clear spacing would result from two adjacent as tested bollards within the 1-bollard array 0.00' centerline spacing would result from two adjacent as tested bollards within the 1-bollard array 2.10' clear spacing would result between two adjacent as tested 1-bollard arrays 204" wide foundation (1)
M50	P1	34' Bent Pipe Barrier	NON Proprietary Contact PDC For Engineering Details	Single Bent Pipe 10" Diameter No interpolation with 14' 0.00' clear spacing would result from two adjacent as tested bollards within the 1-bollard array 0.00' centerline spacing would result from two adjacent as tested bollards within the 1-bollard array 2.10' clear spacing would result between two adjacent as tested 1-bollard arrays 120" wide foundation (2)

Barrier Type: Passive Cable

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M30	P1	M30 High Performance Post, Rail, and Structural Stand System - 73 ft (1" cable)	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3 - 1" diameter cables, 72' tested length (post to post)

M40	P2	M40/P2 High Performance Post, Rail, and Structural Stand System - 73 ft (1.25" cable)	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3 - 1.25" diameter cables, 72' tested length (post to post)
M40	P2	Cable Trap System	RSSI http://www.rssi.com/	4 - 1" diameter cables, 96' tested length (end post to end post)
M50	P1	Ameristar High Performance Post, Rail, and Structural Strand System (1.5" cables)	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	40 foot tested length end post to end post; 3 – 1.5" cables
M50	P1	M50/P1 Cable Barrier System	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3 - 1.5" diameter cables, 40' tested length (post to post)
M50	P1	M50 Wire Rope, Post, and Channel Rail Anti-Ram Fence	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	16' post spacing, 2 cables
M50	P1	Barrier Fence System, Model ASPI-CF-M50/P1	Atlas Security Products, Inc. http://atlasbarriers.com/	3 – 1.25" diameter cables, 64' system tested length
M50	P1	M50 P1 28ft. Cable Crash Fence	Betafence http://www.betafenceusa.com/	3 strand cable barrier, 168' Tested Length, 28' Crash Line Post Spacing
M50	P1	Bristorm Zero Wire Rope Barrier	Hill & Smith Ltd. https://hillandsmith.com/	50 foot tested length
M50	P2	High Performance Post, Rail, and Structural Stand System (1.5" cable)	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3 - 1.5" diameter cables, 56' tested length (post to post)
M50	P2	Cable Barrier Surface Set – Short Span Model CBSS-1200	Barrier1 Systems, Inc. http://www.barrier1.us/	18.1' clear cable span, 8 blocks
M50	P2	M50 Post and Cable System – 50 ft	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	tested length - 50 foot, center of end post to center of end post, interpolation with 200ft barrier is acceptable

M50	P2	M50 Post and Cable System – 200 ft	Global GRAB Technologies (fka FutureNet Security Solutions, fka Smith & Wesson Security Solutions, fka Universal Safety Response) https://www.grabglobal.com/	tested length - 200 foot, center of end post to center of end post, interpolation with 50ft barrier is acceptable
M50	P2	M50 P2 Cable Crash Fence	Betafence http://www.betafenceusa.com/	3 strand cable barrier, 600' between terminal posts, 200' between line posts
M50	P3	High Performance Post, Rail, and Structural Stand System - 41 ft (1.25" cable)	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3 - 1.25" diameter cables, 40' tested length (post to post)
M50	P3	Cable Barrier Surface Set Model CBSS-1200 Three Strand Cable Barrier – Long Span	Barrier1 Systems, Inc. http://www.barrier1.us/	67' 8" clear cable span, 8 blocks
M50	P2	BSP M50 Cable Barrier	Black Security Products http://www.blacksp.com/	90' tested length, 30' intermediate post spacing, 10' line post spacing.
M30	P1	BSP M30 Cable Barrier	Black Security Products http://www.blacksp.com/	90' tested length, 30' intermediate post spacing, 10' line post spacing.
M50	P2	Typhon Cable Barrier 40' Span	Perimeter Security Partners, LLC http://www.perimetersecuritypartners.com/	40.0' tested length, 10.0' line post spacing. Interpolation with 200.0' barrier is acceptable
M50	P2	Typhon 200' Post and Cable Barrier	Perimeter Security Partners, LLC http://www.perimetersecuritypartners.com/	200.0' tested length, 10.0' line post spacing. Interpolation with 40.0' barrier is acceptable
M30	P2	192' Post and Cable Fence Barrier	Atlas Security Products, Inc. http://atlasbarriers.com/	192' tested length, 10' line post spacing

M50 P2 600' 2 Strand Cable Fence Black Security Products
<http://www.blacksp.com/> 600' tested length, 200' line post spacing, 13'4" intermediate post spacing.

Barrier Type: Passive Portable

<i>Barrier Rating</i>	<i>Penetration Rating</i>	<i>Barrier Model/Description</i>	<i>Manufacturer/Designer/Distributor</i>	<i>Remarks</i>
PU30	P3	FMB Barrier	Mifram Security http://www.miframsecurity.com/	7.142 m tested width
M30	P2	G-6532 M30 P2 20ft Modular Vehicle Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 20'
M30	P3	TB 100 Five Bollard Array	Delta Scientific Corporation http://deltascientific.com/	Five Bollard Array
M30	P3	K2600 Mobile/Portable VSB	Rologard Global Company https://www.rologard.com/	2 Complete Assemblies Necessary for Rating Tested Spacing between assemblies 9.84' Tested Length for each assembly 86"
M30	P2	Modular Portable Protection Device	Black Security Products http://www.blacksp.com/	System consisted of 3 42' spans with ballast between each span and at each end of the system. Tested only for impact on center 42' span. Listing applies to the center 42' span.
M30	P2	Cable Block Barrier Model CBB-400	Barrier1 Systems, Inc. http://www.barrier1.us/	Five 72" Block System. Tested for impact at center of system. Listing applies for impact at center of 4 - 72" blocks portion of the 5 block system which are separated by synthetic rope connection of 12".
M40	P2	Sentry II Security Barrier	TraFFix Devices Incorporated https://www.traffixdevices.com/	31 Water Filled, cable linked modules arranged in 3 rows. Tested for impact at the center of the 31-module system.

SC30	P2	Meridian Archer 1200 Portable Barrier	Meridian Rapid Defense https://www.meridianrapiddefense.com	System composed of 4-24” modules connected by wire rope. Tested for impact at the center of the 4 module system.
PU30	P2	Portable Security Barrier	Munio Technologies LLC https://muniotechnologies.com/	Barrier width 22’. Metal assemblies spaced at 16” on center.

Barrier Type: Passive Post and Beam

Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
FS30	P1	Non-Proprietary M30 P1 Barrier	Surface Deployment and Distribution Command Traffic Engineering Agency https://www.sddc.army.mil/sites/TEA/Pages/default.aspx	Tested length 177’ guard rail
M30	P1	G-Force M30 Post and Beam	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 140’ 9” end post to end post
M30	P1	G-Force M30 Post and Beam	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 28’9” Centerline terminal post to centerline terminal post.
M30	P1	Non-Proprietary M30 P1 Barrier	Surface Deployment and Distribution Command Traffic Engineering Agency https://www.sddc.army.mil/sites/TEA/Pages/default.aspx	Tested length 177’ SPECIALIZED guard rail
M40	P2	G-Force M40 Post and Beam	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 492’ end post to end post
M50	P1	G-Force M50 Post and Beam	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 140’ 9” end post to end post

M50	P1	G-Force Post and Beam Barrier	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 140' 9" end post to end post
M50	P1	G-Force Combination Fence 90 Meter Run	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	Tested length 90 m, 3 m post spacing
M50	P1	ARFS 466	Morrison Equipment http://heavydutygates.com/	Tested length 30.9 m, 10.3 m post spacing
Barrier Type: Passive Fence				
Barrier Rating	Penetration Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
K8	L1	Perimeter Security Fence with One-Inch Cable and Diagonal	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	
K8	L2	Impasse Perimeter Security Fence	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	2 - 1" diameter cables, 162 foot tested length
K8	L2	Perimeter Security Fence with 1 in Cable and Bollard Anchorage	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	2 - 1" diameter cables; 32.67' between posts
K8	L2	Perimeter Security Fence with One-Inch Cable and Bollard Anchorage	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	2 - 1" diameter cables, 162 foot tested length
M50	P1	RSS-F501D Tube Beam Fence	Ross Security Systems LLC http://www.rosssecuritysolutions.com/	Tube beam sections, 30 ft post spacing
M50	P2	M50 P2 Gibraltar Cable Crash Fence	Gibraltar Cable Barrier Systems, L.P. http://www.gibraltarmaterials.com/	200 foot span main post to main post
K12	L3	Impasse Security Fencing	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	2 – 1" diameter cables; 32.67 ft between posts
K12	L3	Cable Crash Fence	Betafence http://www.betafenceusa.com/	60 foot span, terminal post to terminal post
M50	P2	Perimeter Security Stalwart Shield	Ameristar Perimeter Security Systems http://www.ameristarfence.com/	3 – 1.25" diameter cables. 40'10" tested length.

Barrier Type: Passive Inertial

Barrier Rating	Penetr ation Rating	Barrier Model/Description	Manufacturer/Designer/Distributor	Remarks
M50	P1	Terrablock M50	apexfence http://www.betafenceusa.com/	Sand filled barrier with fence
M50	P1	Terrablock XV	Praesidiad NV http://www.praesidiad.com/	Sand filled barrier with fence
K12	L3	Expeditionary Earth Filled Barrier	DefenCell http://www.defencell.com/	Earth filled barrier
K12	L3	RDFW Mk. 4	Geocell Systems Inc. http://www.geocellsystems.com/	Earth filled barrier
K12	L3	HESCO SL 3636 (fka-C-3315 Flood Barrier)	HESCO Bastion Ltd. http://www.hesco.com/	Earth filled barrier

Appendix A

Important vehicle barrier characteristics:

1. **GRAB Net** type active vehicle barriers that utilize shear pins.

Demonstrated Characteristic: Lower shear pins have broken during low speed impact, which resulted in a circumvention of the system.

Possible Resolution: Currently under development. No resolution currently available.

Products do not currently meet the requirements contained in the Army Standard for Access Control Points/Army Standard Design for Access Control Points

Contact AFCEC prior to using these barriers for Air Force projects.

Demonstrated Characteristic: Upper shear pins have broken during low speed impact, which resulted in a circumvention of the system.

Resolution: Net Retraction System (NRS) developed. Net Retraction System tested and validated.

Products MUST include Net Retraction System (NRS) for use at Army Access Control Points (ACPs). Verbiage not relevant until resolution to the Demonstrated Characteristic above is provided and validated.

2. **Barrier 1 Vehicle Arrestor 2.0-NET-400**

Demonstrated Characteristic: Net has failed to engage lower profile vehicles which has repeatedly resulted in circumvention of the system. No resolution currently available.

Products do not currently meet the requirements contained in the Army Standard for Access Control Points/Army Standard Design for Access Control Points

Contact AFCEC prior to using these barriers for Air Force projects.

3. **Barrier 1 Retractable Net Vehicle Barrier System**

Demonstrated Characteristic: Net has failed to engage lower profile vehicles which has repeatedly resulted in circumvention of the system. No resolution currently available.

Products do not currently meet the requirements contained in the Army Standard for Access Control Points/Army Standard Design for Access Control Points

Contact AFCEC prior to using these barriers for Air Force projects.

4. Bollard spacing

Demonstrated Characteristic: Some manufacturers are testing single bollards with foundations having significant width. Use of these products in the as tested configuration may not be feasible. To retain their rating, DOS tested and ASTM tested products are to be fielded in the as tested configuration. Single bollards with wide foundations cannot be fielded in the as tested configuration without resulting gaps large enough for vehicles to circumvent the system.

Resolution: Utilize products that can be fielded in the as tested configuration. Many bollards are tested in sets and some have compliant spacing.

5. Active bollards where adjacent surface includes sharp angular particles or aggregate.

Demonstrated Characteristic: Small angular particles have moved into the sleeve of the bollard and prevented either deployment or retraction of the bollard(s)

Possible Resolution: Avoid use of bollards where sharp angular particles or aggregate are found on or adjacent to the roadway. This includes sand and gravel. Also applicable in areas where snow/ice require application of sand or gravel to roadways.

6. All active vehicle barriers that include below grade components or pits.

Demonstrated Characteristic: Sump systems have been deactivated when active vehicle barriers were shut off. Barriers filled with water and were compromised.

Possible Resolution: Place sump systems on a separate circuit or otherwise ensure that sump systems are not deactivated.

7. All active vehicle barriers spanning more than one roadway lane.

Demonstrated Characteristic: Activation of detection devices in any lane will prevent barrier deployment and result in open corridor(s) for a potential threat vehicle to utilize.

Possible Resolution: Utilize individual active vehicle barrier installed in each lane. If a detection device is activated it will prevent deployment of the active vehicle barrier for that lane only. The rest of the corridor will be blocked by active vehicle barriers and the lane with the activated detection device will be partially blocked by the vehicle that activated the detection device.

8. Drain openings and drain lines for active vehicle barrier pits.

Demonstrated Characteristic: Drain lines for active vehicle barrier pits (whether sump pump or gravity drained) are often of insufficient diameter. Drain lines clog with debris often and active vehicle barrier pits fill with water.

Possible Resolution: Ensure that drain lines and inlets are a minimum of 4” in diameter. Reduce surface water and storm water drainage into the active vehicle barrier pit through use of storm drains and flumes.

Appendix B

Example Ratings

ASTM F2656

Kinetic Energy Designation (Relevant Examples):

FS30 = 4,630# Full-size Sedan at 30mph (203,000 ft-lbs of kinetic energy)

FS40 = 4,630# Full-size Sedan at 40mph (342,000 ft-lbs of kinetic energy)

FS50 = 4,630# Full-size Sedan at 50mph (519,000 ft-lbs of kinetic energy)

FS60 = 4,630# Full-size Sedan at 60mph (810,000 ft-lbs of kinetic energy)

M30 = 15,000# Truck at 30mph (450,000 ft-lbs of kinetic energy)

M40 = 15,000# Truck at 40mph (800,000 ft-lbs of kinetic energy)

M50 = 15,000# Truck at 50mph (1,250,000 ft-lbs of kinetic energy)

Penetration Ratings

P1 = Less than 3.3' of penetration

P2 = 3.31' to 23.0' of penetration

P3 = 23.1' to 98.4' of penetration

Example Ratings:

ASTM F2656-18a FS 30 P3 (Full-size Sedan at 30mph with a penetration of 23.1' to 98.4')

ASTM F2656-18a M50 P1 (Standard Test Truck at 50mph with a penetration less than 3.3')

DOS SD-STD 02.01

Kinetic Energy Designation:

K4 = 15,000# Truck at 30mph (450,000 ft-lbs of kinetic energy)

K8 = 15,000# Truck at 40mph (800,000 ft-lbs of kinetic energy)

K12 = 15,000# Truck at 50mph (1,250,000 ft-lbs of kinetic energy)

Penetration Ratings

As of 2003 all barriers will have penetration of 3.3' or less

Example Ratings:

K12 (15,000# Truck at 50mph with less than 3.3' of penetration)

PAS 68

Kinetic Energy Designation (Relevant examples):

V/2 500 (M2)/64/90 = 2500kg Pickup at 64kph at 90 degrees (291,000 ft-lbs of kinetic energy)

V/2 500 (M2)/80/90 = 2500kg Pickup at 80kph at 90 degrees (455,300 ft-lbs of kinetic energy)

V/2 500 (M2)/96/90 = 2500kg Pickup at 96kph at 90 degrees (655,600 ft-lbs of kinetic energy)

V/2 500 (M2)/112/90 = 2500kg Pickup at 112kph at 90 degrees (892,400 ft-lbs of kinetic energy)

V/7 500 (N2)/48/90 = 7500kg 2-axle truck at 48kph at 90 degrees (491,700 ft-lbs of kinetic energy)

V/7 500 (N2)/64/90 = 7500kg 2-axle truck at 64kph at 90 degrees (874,100 ft-lbs of kinetic energy)

Penetration Ratings

Penetration rating is actual penetration distance

Example Ratings:

Bollard V/2 500 (M2)/80/90: 2.0/2.8 = 2500kg Pickup at 80kph at 90 degrees with 2.0 meters of penetration.

CEN 16221

See PAS 68. Methods are similar.