VALTIR

ENERGITE® III / FITCH® UNIVERSAL MODULE SYSTEM

PRODUCT DESCRIPTION MANUAL

PN 620097B
REVISION A NOVEMBER 2022

Energite® III Fitch® Universal Module Systems

Product Description Manual

15601 Dallas Parkway
Suite 525
Addison, Texas 75001

Important: These instructions are to be used only in conjunction with the assembly, maintenance, and repair of the Energite® III/Fitch® Universal Module Systems. These instructions are for standard assembly specified by the appropriate highway authority only. In the event the specified system assembly, maintenance, or repair would require a deviation from standard assembly parameters, contact the appropriate highway authority engineer. This system has been accepted by the Federal Highway Administration for use on the national highway system under strict criteria utilized by that agency. Valtir representatives are available for consultation if required.

This Manual must be available to the worker overseeing and/or assembling the product at all times. For additional copies, contact Valtir at (888) 356-2363 or download from websites below.

The instructions contained in this Manual supersede all previous information and Manuals. All information, illustrations, and specifications in this Manual are based on the latest Energite® III/Fitch® Universal Module Systems information available to Valtir at the time of printing. We reserve the right to make changes at any time. Please contact Valtir to confirm that you are referring to the most current instructions.

Part No. 620097B
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Customer Service Contacts

Valtir is committed to the highest level of customer service. Feedback regarding the Energite® III/Fitch® Universal Module Systems, its assembly procedures, supporting documentation, and performance are always welcome. Additional information can be obtained from the contact information below:

Valtir:

Telephone:	(888) 356-2363 (USA) +1 (214) 589-8140 (International)
Fax:	(888) 770-6755 (USA) +1 (214) 589-8423 (International)
Internet:	www.valtir.com

Important Introductory Notes

Proper assembly of the Energite® III/Fitch® Universal Module Systems is essential to achieve performance of the system under appropriate federal and state criteria. These instructions should be read in their entirety and understood before assembling the Energite® III/Fitch® Universal Module Systems. These instructions are to be used only in conjunction with the assembly of the Energite® III/Fitch® Universal Module Systems and are for standard assemblies only as specified by the applicable highway authority. In the event your system assembly requires or involves deviation from standard parameters or, during the assembly process a question arises, please contact the appropriate highway authority that specified this system at this particular location for guidance. Valtir is available for consultation with that agency. These instructions are intended for an individual who is qualified to both read and accurately interpret them as written. They are intended for the individual who is experienced and skilled in the assembly of highway products which are specified and selected by the highway authority.

A set of product and project shop drawings will be supplied by Valtir. The shop drawings will be for each section of the assembly. These drawings should be reviewed and studied thoroughly by a qualified individual who is skilled in interpreting them before the start of any assembly.

Important: Read safety instructions thoroughly and follow the assembly directions and suggested safe practices before assembling, maintaining, or repairing the Energite® III/Fitch® Universal Module Systems. Failure to follow this warning can result in serious injury or death to workers and/or bystanders. It further compromises the acceptance of this system by the FHWA. Please keep these instructions for later use.

Warning: Ensure that all of the Energite® III/Fitch® Universal Module Systems Warnings, Cautions, and Important Statements within the Energite® III /Fitch® Universal Module Systems Manual are completely followed. Failure to follow this warning could result in serious injury or death in the event of a collision.

Recommended Safety Rules for Assembly

*** Important Safety Instructions ***

This Manual must be kept in a location where it is readily available to persons who are skilled and experienced in the assembly, maintenance, or repair of the Energite® III/Fitch® Universal Module Systems. Additional copies of this Manual are available from Valtir by calling (888) 356-2363 or by visiting www.valtir.com. This Manual may also be downloaded directly from the websites indicated below. Please contact Valtir if you have any questions concerning the information in this Manual or about the Energite® III/Fitch® Universal Module Systems.

Always use appropriate safety precautions when operating power equipment, mixing chemicals, and when moving heavy equipment or the Energite® III/Fitch® Universal Module Systems components. Gloves, safety goggles, steel toe boots, and back protection shall be used.

Safety measures incorporating traffic control devices specified by the highway authority must be used to provide safety for personnel while at the assembly, maintenance, or repair site.

Safety Symbols

This section describes the safety symbols that appear in this Energite® III/Fitch® Universal Module Systems Manual. Read the Manual for complete safety, assembly, operating, maintenance, repair, and service information.

Symbol	Meaning
	Safety Alert Symbol: Indicates Danger, Warning, or Caution. Failure to read and follow the Danger, Warning, Safety, or Caution indicators could result in serious injury or death to the workers and/or bystanders.

Warnings and Cautions

Read all instructions before assembling, maintaining, or repairing the Energite® III/Fitch® Universal Module Systems.

Warning: Do not assemble, maintain, or repair the barrier system until you have read this Manual thoroughly and completely understand it. Ensure that all Warnings, Cautions, and Important Statements within the Manual are completely followed. Please call Valtir at (888) 356-2363 if you do not understand these instructions. Failure to follow this warning could result in serious injury or death.

Warning: Safety measures incorporating appropriate traffic control devices specified by the highway authority must be used to protect all personnel while at the assembly, maintenance, or repair site. Failure to follow this warning could result in serious injury or death.

Warning: Use only Valtir parts that are specified herein for the Energite® III/Fitch® Universal Module Systems for assembling, maintaining, or repairing the Energite® III/Fitch® Universal Module Systems. Do not utilize or otherwise comingle parts from other systems even if those systems are other Valtir systems. Such configurations have not been tested, nor have they been accepted for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with an UNACCEPTED system.

Warning: Do NOT modify the barrier system in any way. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Ensure that the barrier system and delineation used meet all federal, state, specifying agency, and local specifications. Failure to follow this warning could result in serious injury or death in the event of a collision.

Warning: Ensure that your assembly meets all appropriate Manual on Uniform Traffic Control Devices (MUTCD) and local standards. Failure to follow this warning could result in serious injury or death in the event of a collision.

Limitations and Warnings

The Energite® III/Fitch® Universal Module Systems have been tested and evaluated per recommendations of the National Cooperative Highway Research Program (NCHRP) Report 350 for Test Level 3, non-redirective impact conditions. The Energite® III/Fitch® Universal Module Systems, as currently designed, with the proper array, are capable of decelerating and stopping light and heavy weight vehicles (820 to 2000 kg, 1810 to 4410 lbs.) when impacted head-on or at angles from 0 degrees to 15 degrees and at 100 km/h (62 mph). Tests were conducted on slopes less than 5% and without curbs. The Energite® III/Fitch® Universal Module Systems is certified to the Test Level(s) as shown below:

Test Level 3: 100 km/h [62 mph]

The Energite® III/Fitch® Universal Module Systems are non-redirective crash cushions and should be used appropriately.

Warning: Installations have not been tested, evaluated, or accepted on curbs and should not be permitted.

Valtir, in compliance with the National Cooperative Research Highway Program 350 (NCHRP Report 350) “Recommended Procedures for the Safety Performance of Highway Safety Features”, contracts with FHWA approved testing facilities to perform crash tests, evaluation of tests, and submittal of results to the Federal Highway Administration for review.

These FHWA directed tests are not intended to represent the performance of systems when impacted by every vehicle type or every impact condition existing on the roadway. This system is tested only to the test matrix criteria of NCHRP 350 as approved by FHWA.

Valtir does not represent nor warrant that the results of these controlled tests show that vehicle impacts with the products in other conditions would necessarily avoid injury to person(s) or property. Impacts that exceed the specifications of the system may not result in acceptable crash performance as outlined in NCHRP Report 350, relative to structural adequacy, occupant risk, and vehicle trajectory. Valtir expressly disclaims any warrant or liability for injury or damage to persons or property resulting from any impact, collision, or harmful contact with products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled by or under the direction of Valtir or by third parties.

Important Introductory Notes

Proper deployment and maintenance of the Energite® III/Fitch® Universal Module Systems is critical to achieve performance under appropriate state and federal guidelines. Take the time to review this Manual including the Limitations and Warnings section thoroughly before performing the necessary work. Do not attempt to assemble any longitudinal Energite® III/Fitch® Universal Module Systems without the proper plans and assembly Manual from the manufacturer.

If you require additional information, or have questions about the Energite® III/Fitch® Universal Module Systems, please contact Valtir' Customer Service Department. See Customer Service Contacts on Page 3 of this Manual.

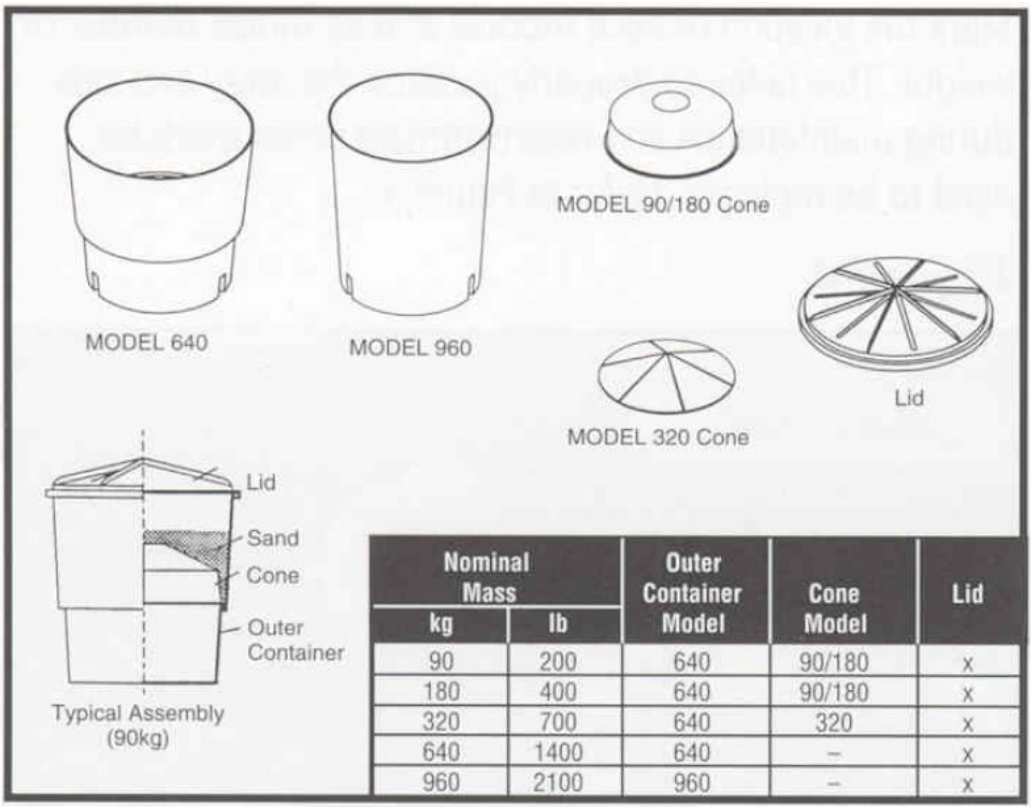
System Overview

The Energite® III/Fitch® Universal Module systems are non-redirective, easy-to-assemble crash cushions consisting of a number of sand-filled modules that are assembled in a specific geometric array in front of a hazard.

Each module of the Energite® III system consists of a one-piece barrel, a lid, and in some cases a cone insert. The cone insert is used to adjust the sand height or center-of-mass and the overall weight of the barrel. The barrel's weight requirement is determined by its place within the array.

Each module of the Fitch® Universal Module consists of one set of walls, one core, one lid and four zip strips. These components will make any weight module 90k 180, 320, 640, 960 kg (200, 400, 700, 1400 and 2,100 lb.) required.

The Energite® III/Fitch® Universal Module system modules are available in 90, 180, 320, 640 and 960 kg (200, 400, 700, 1400 and 2,100 lb.) sizes. Refer to Figures 1A/B and 2A/B.



Nominal Mass		Outer Container Model	Cone Model	Lid
kg	lb			
90	200	640	90/180	x
180	400	640	90/180	x
320	700	640	320	x
640	1400	640	–	x
960	2100	960	–	x

Figure 1A-Energite® III

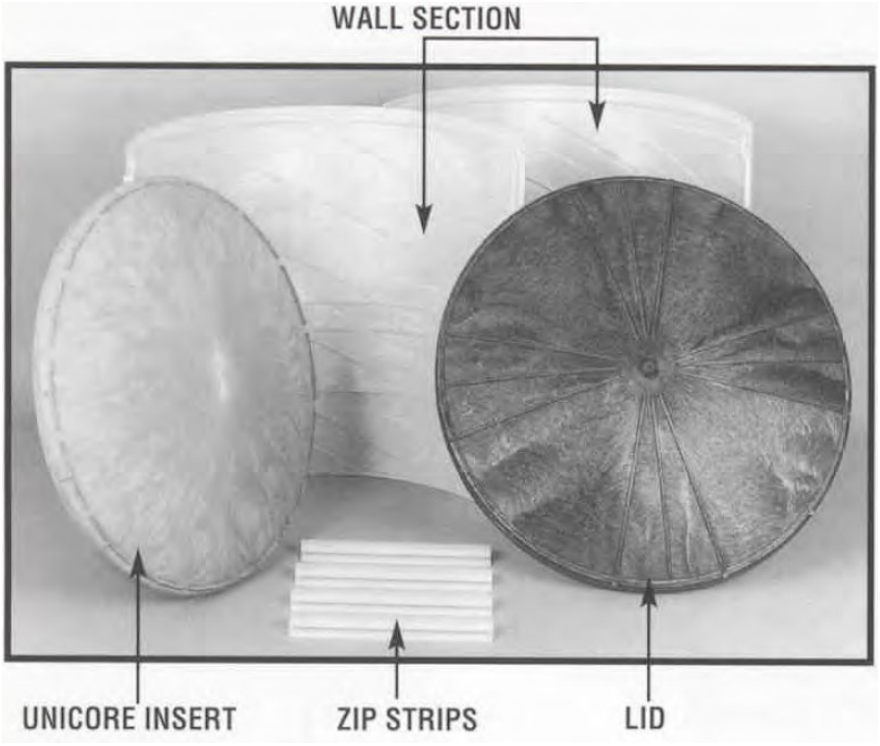


Figure 1B-Fitch® Universal Module System

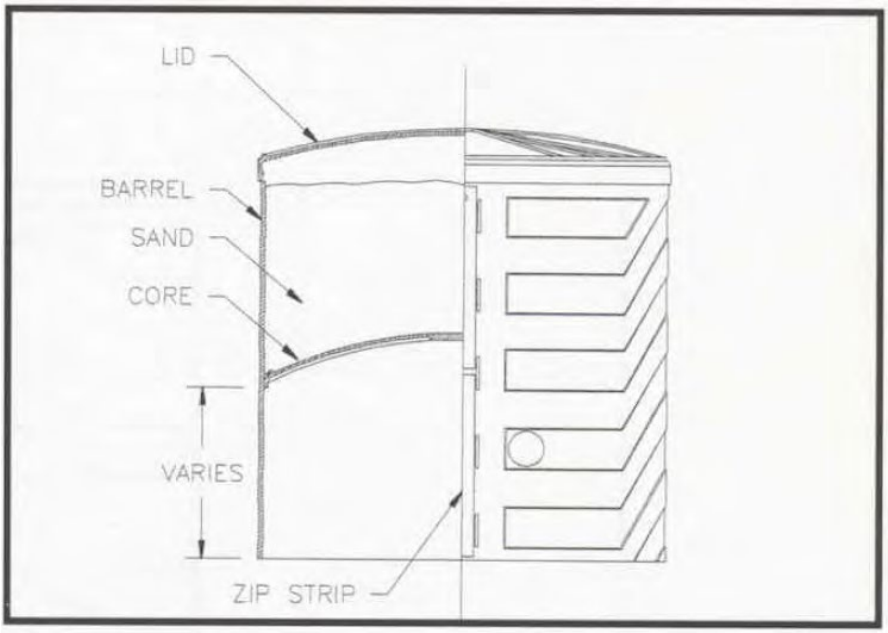


Figure 1C-Fitch® Universal Module System

Energite III® System Dimensions

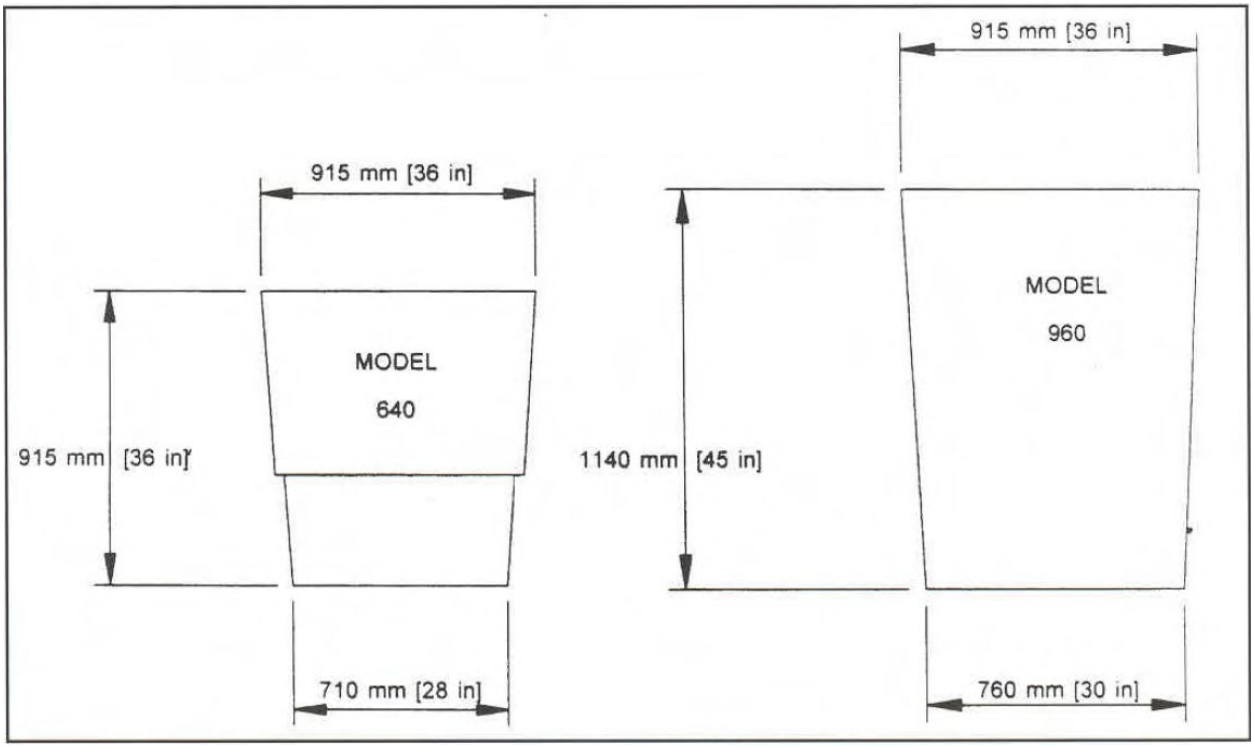


Figure 2A-Energite® III

Fitch® System Dimensions

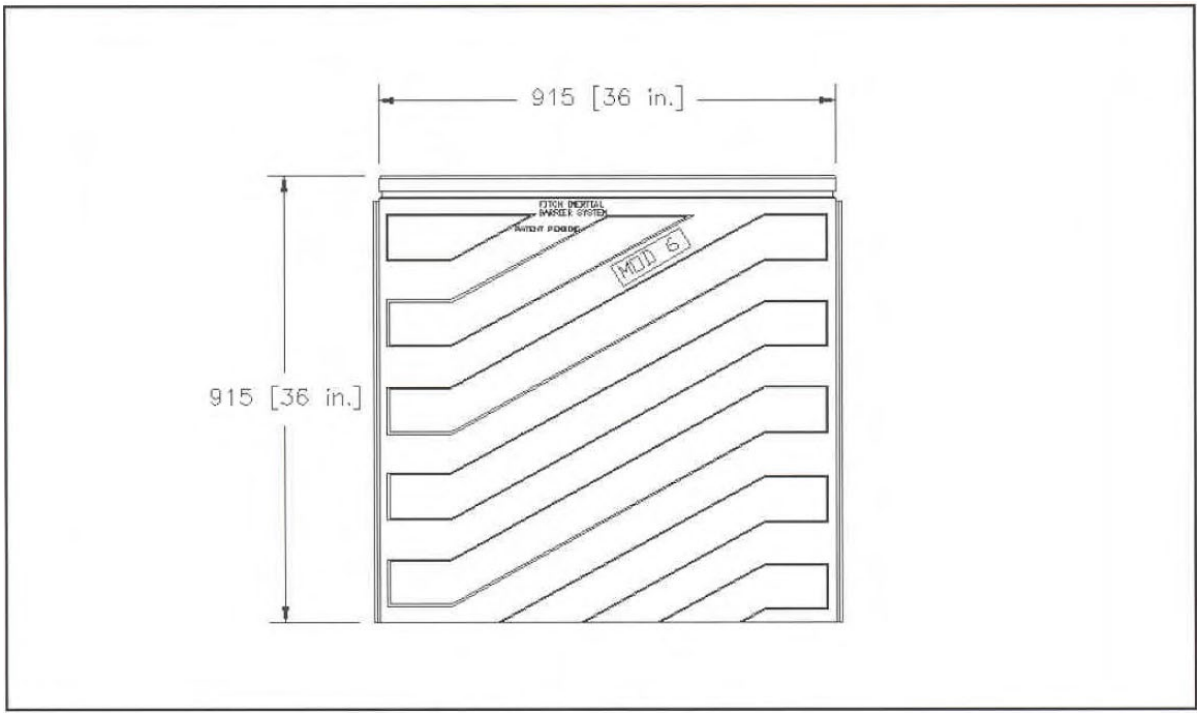


Figure 2B-Fitch® Universal Module System

Design Criteria

Before selecting inertial barriers as the attenuator for any given site, certain conditions of the site must be taken into consideration. Figure 3 lists the recommendations of the Federal Highway Administration (FHWA) and Valtir, for these conditions.

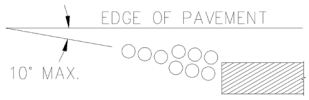
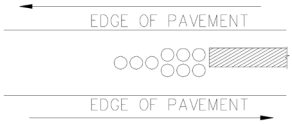
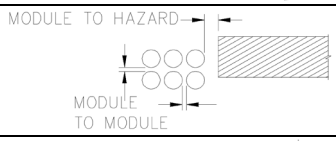
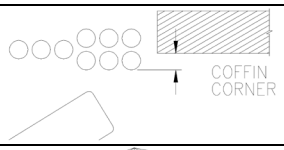
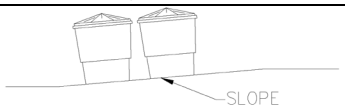
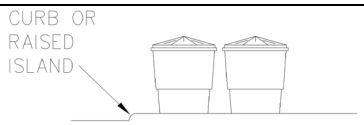
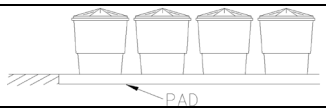
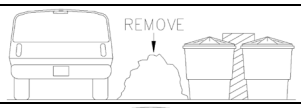
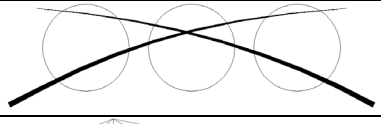
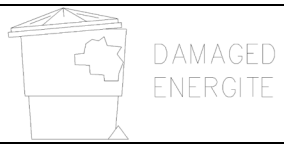
Conditions	FHWA Recommendations	Recommendations	Sample
1. Angle of array in relation to center line of obstacle	Not recommended for more than 10°	Same as FHWA	
2. Bidirectional traffic	Offset array to avoid impact to the rear module from wrong-way vehicles	Same as FHWA	
3. Module spacing: module to module to hazard	None given	0 – 150 mm [6'] width 150 mm [6"] min. length	
4. "Coffin" corner	Shield 760 mm [30'] outside of hazard	Same of FHWA	
5. Sloping sites (lateral and longitudinal	5% grade maximum	Same of FHWA	
6. Curbs and raised islands or pallets for temporary sites	No more than 100 mm [4'] high	Same of FHWA	
7. Foundation pads	Flat surface; concrete or asphalt	Same of FHWA	
8. Intermixing of brands of modules	Approved – As long as modules are federally approved and array meets design criteria.	Same of FHWA	
9. Maintenance	Keep site clear of debris and snow	Same of FHWA	
10. Sand densities	1600 kg/m^3 [100 lbs/cf]	Same of FHWA	
11. Single rows of modules	Not recommended	Same of FHWA	
12. Vandalism	Check Periodically for damage.	Same of FHWA	

Figure 3 Site Conditions and Recommendations

Arrays

Special Site Considerations

Other special considerations warrant consideration in the configuration and assembly of inertial barrier systems. The following conditions and recommendations for treatment are based on performance.

1) Freezing Temperatures

In cold climates, sand (having a moisture content of 3% or more) should be mixed with 5% rock salt (by weight) to prevent the sand from freezing into potentially dangerous solid blocks.

2) Modules Place on Structures

On structures where the vibrations from moving traffic may cause modules to shift, steel or formed-in-place asphaltic concrete half-rings placed on the downhill side of the modules will prevent such movement. Also, nails or bolts through the bottom of the outer container and into the roadway will prevent module movement.

3) Partial Impacts

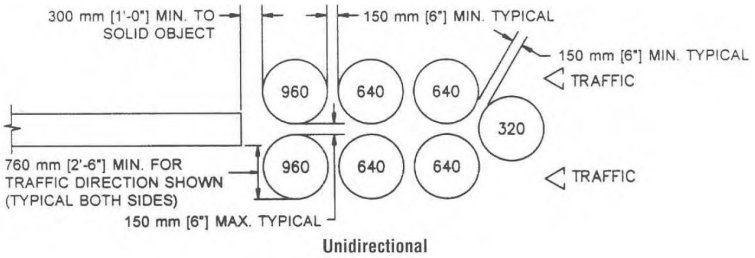
When a vehicle contacts less than the full width of a module, the module's deceleration effectiveness is equivalent to the percentage of the module contacted. If half of a module is impacted, then only 50% of that module's weight is effective and should be kept in mind when placing an array.

4) Other Unique Conditions

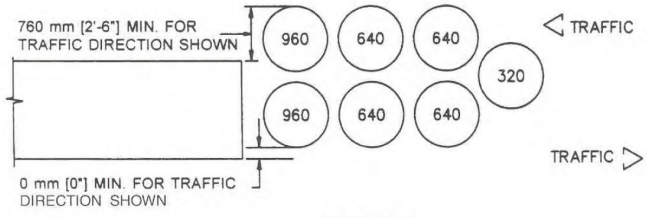
You may find that there are other conditions unique to a particular site that must be considered to ensure a properly designed and functional inertial barrier system.

Standard Arrays

Following are several standard arrays for the Energite® III/Fitch® Universal Module Systems. They will perform as indicated in the calculations only if hit head-on. Arrays are provided using both metric and English units. Below are typical arrays showing unidirectional and bidirectional configurations. These are minimum arrays and more barrels are recommended and should be used when conditions permit.



Unidirectional

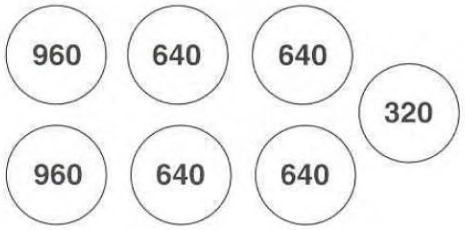


Bidirectional

Arrays Based on Metric Units

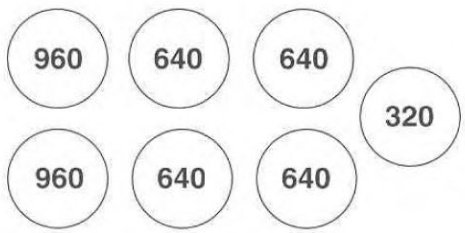
DESIGN VELOCITY 50 km/h (31 mph)

ROW	SAND MASS (kg)	820 kg vehicle EXIT VEL (km/h)	820 kg vehicle AVE G'S FOR ROW	820 kg vehicle IMPULSE TIME (sec)	2000 kg vehicle EXIT VEL (km/h)	2000 kg vehicle AVE G'S FOR ROW	2000 kg vehicle IMPULSE TIME (sec)
0		50.0			50.0		
1	320	36.0	5.2	0.08	43.1	2.8	0.07
2	1280	14.0	4.7	0.13	26.3	5.0	0.09
3	1280	5.5	.7	0.34	16.0	1.9	0.16
4	1920	1.6	.1	.92	8.2	.8	0.27



DESIGN VELOCITY 60 km/h (37 mph)

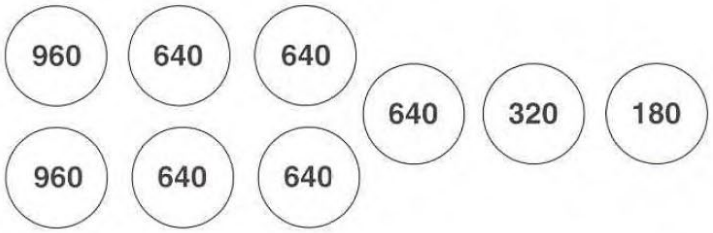
ROW	SAND MASS (kg)	820 kg vehicle EXIT VEL (km/h)	820 kg vehicle AVE G'S FOR ROW	820 kg vehicle IMPULSE TIME (sec)	2000 kg vehicle EXIT VEL (km/h)	2000 kg vehicle AVE G'S FOR ROW	2000 kg vehicle IMPULSE TIME (sec)
0		60.0			60.0		
1	320	43.2	7.5	0.06	51.7	4.0	0.06
2	1280	16.9	6.8	0.11	31.5	7.2	0.08
3	1280	6.6	1.0	0.28	19.2	2.7	0.13
4	1920	2.0	.2	.77	9.8	1.2	0.23



Arrays Based on Metric Units (cont.)

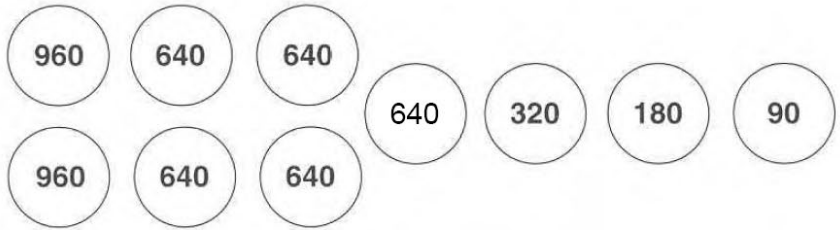
DESIGN VELOCITY 70 km/h (43 mph)

		820 kg vehicle			2000 kg vehicle		
ROW	SAND MASS (kg)	EXIT VEL (km/h)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (km/h)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		70.0			70.0		
1	180	57.4	6.9	0.05	64.2	3.3	0.05
2	320	41.3	6.8	0.07	55.4	4.6	0.06
3	640	23.2	5.0	0.10	41.9	5.6	0.07
4	1280	9.1	2.0	0.20	25.6	4.7	0.10
5	1280	3.5	.3	0.52	15.6	1.8	0.16
6	1920	1.1	.0	1.43	8.0	.8	0.28



DESIGN VELOCITY 80 km/h (50 mph)

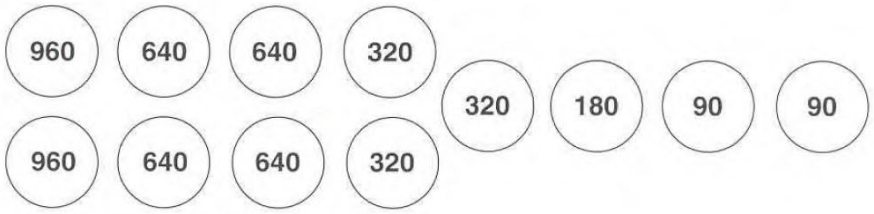
		820 kg vehicle			2000 kg vehicle		
ROW	SAND MASS (kg)	EXIT VEL (km/h)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (km/h)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		80.0			80.0		
1	90	72.1	5.2	0.04	76.6	2.3	0.04
2	180	59.1	7.3	0.05	70.2	4.0	0.04
3	320	42.5	7.2	0.06	60.5	5.4	0.05
4	640	23.9	5.3	0.10	45.9	6.7	0.06
5	1280	9.3	2.1	0.20	28.0	5.7	0.09
6	1280	3.6	.3	0.51	17.1	2.1	0.15
7	1920	1.1	.1	1.39	8.7	.9	0.26



Arrays Based on Metric Units (cont.)

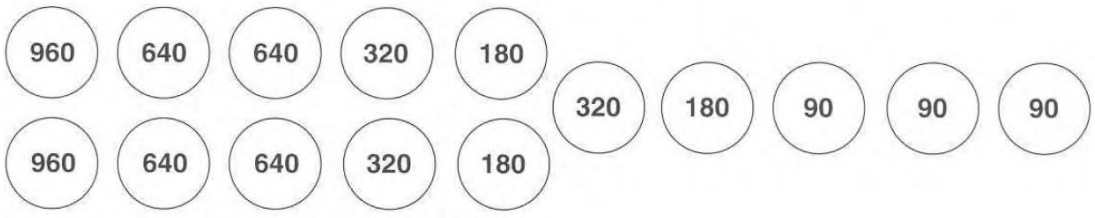
DESIGN VELOCITY 90 km/h (56 mph)

ROW	SAND MASS (kg)	820 kg vehicle EXIT VEL (km/h)	820 kg vehicle AVE G'S FOR ROW	820 kg vehicle IMPULSE TIME (sec)	2000 kg vehicle EXIT VEL (km/h)	2000 kg vehicle AVE G'S FOR ROW	2000 kg vehicle IMPULSE TIME (sec)
0		90.0			90.0		
1	90	81.1	6.6	0.04	86.1	2.9	0.04
2	90	73.1	5.3	0.04	82.4	2.7	0.04
3	180	59.9	7.5	0.05	75.6	4.6	0.04
4	320	43.1	7.5	0.06	65.2	6.3	0.05
5	640	24.2	5.5	0.10	49.4	7.8	0.06
6	1280	9.5	2.1	0.20	30.1	6.6	0.08
7	1280	3.7	.3	0.50	18.4	2.4	0.14
8	1920	1.1	.1	1.37	9.4	1.1	0.24



DESIGN VELOCITY 100 km/h (62 mph)

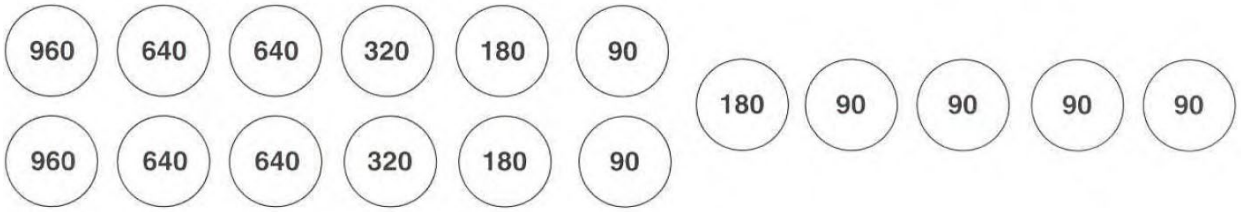
ROW	SAND MASS (kg)	820 kg vehicle EXIT VEL (km/h)	820 kg vehicle AVE G'S FOR ROW	820 kg vehicle IMPULSE TIME (sec)	2000 kg vehicle EXIT VEL (km/h)	2000 kg vehicle AVE G'S FOR ROW	2000 kg vehicle IMPULSE TIME (sec)
0		100.0			100.0		
1	90	90.1	8.1	0.03	95.7	3.6	0.03
2	90	81.2	6.6	0.04	91.6	3.3	0.04
3	90	73.2	5.3	0.04	87.6	3.0	0.04
4	180	60.0	7.5	0.05	80.4	5.2	0.04
5	320	43.2	7.5	0.06	69.3	7.1	0.04
6	360	30.0	4.1	0.09	58.7	5.8	0.05
7	640	16.8	2.6	0.14	44.5	6.3	0.06
8	1280	6.6	1.0	0.28	27.1	5.3	0.09
9	1280	2.6	.2	0.72	16.5	2.0	0.15
10	1920	.8	.0	1.97	8.4	.9	0.26



Arrays Based on Metric Units (cont.)

DESIGN VELOCITY 110 km/h (68 mph)*

		820 kg vehicle			2000 kg vehicle		
ROW	SAND MASS (kg)	EXIT VEL (km/h)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (km/h)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		110.0			110.0		
1	90	99.1	9.8	0.03	105.3	4.4	0.03
2	90	89.3	8.0	0.03	100.7	4.0	0.03
3	90	80.5	6.5	0.04	96.4	3.7	0.03
4	90	72.5	5.2	0.04	92.2	3.4	0.03
5	180	59.5	7.4	0.05	84.6	5.8	0.04
6	180	48.8	5.0	0.06	77.6	4.9	0.04
7	360	33.9	5.3	0.08	65.8	7.3	0.05
8	640	19.0	3.4	0.12	49.8	7.9	0.06
9	1280	7.4	1.3	0.25	30.4	6.7	0.08
10	1280	2.9	.2	0.64	18.5	2.5	0.13
11	1920	.9	.0	1.75	9.5	1.1	0.24

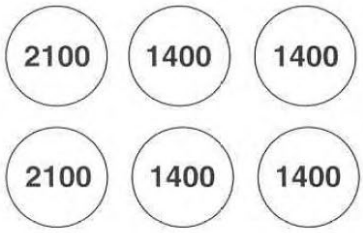


A 110 km/h (68 mph) design speed exceeds NCHRP Report 350, Test Level 3 impact conditions. Typical impacts into this array may not result in acceptable crash performance as described in NCHRP Report 350 relative to structural adequacy, occupant risk, and vehicle trajectory and should not be permitted.

Arrays Based on English Units

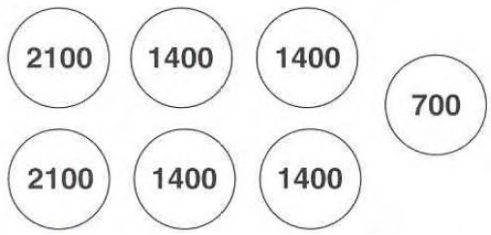
DESIGN VELOCITY 25 mph (40 km/h)

		1800 lb vehicle			4500 lb vehicle		
ROW	SAND MASS (lbs)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		25.0			25.0		
1	2800	9.8	5.9	0.12	15.4	4.3	0.10
2	2800	3.8	.9	0.30	9.5	1.6	0.16
3	4200	1.1	.1	0.82	4.9	.7	0.28



DESIGN VELOCITY 30 mph (48 km/h)

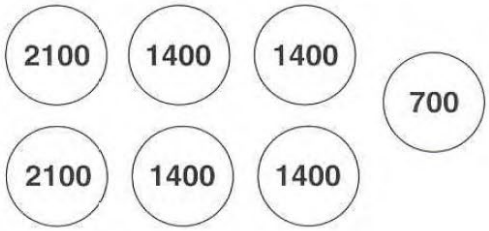
		1800 lb vehicle			4500 lb vehicle		
ROW	SAND MASS (lbs)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		30.0			30.0		
1	700	21.6	4.8	0.08	26.0	2.5	0.07
2	2800	8.5	4.4	0.14	16.0	4.7	0.10
3	2800	3.3	.7	0.35	9.9	1.8	0.16
4	4200	1.0	.1	0.95	5.1	.8	0.27



Arrays Based on English Units (cont.)

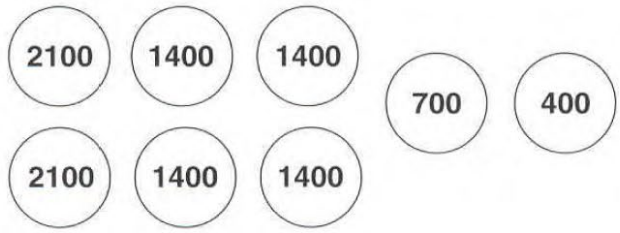
DESIGN VELOCITY 35 mph (56 km/h)

ROW	SAND MASS (lbs)	1800 lb vehicle EXIT VEL (mph)	1800 lb vehicle AVE G'S FOR ROW	1800 lb vehicle IMPULSE TIME (sec)	4500 lb vehicle EXIT VEL (mph)	4500 lb vehicle AVE G'S FOR ROW	4500 lb vehicle IMPULSE TIME (sec)
0		35.0			35.0		
1	700	25.2	6.6	0.07	30.3	3.4	0.06
2	2800	9.9	6.0	0.12	18.7	6.3	0.08
3	2800	3.9	.9	0.30	11.5	2.4	0.14
4	4200	1.2	.2	0.82	6.0	1.1	0.23



DESIGN VELOCITY 40 mph (64 km/h)

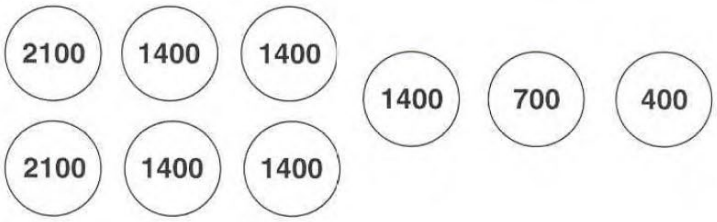
ROW	SAND MASS (lbs)	1800 lb vehicle EXIT VEL (mph)	1800 lb vehicle AVE G'S FOR ROW	1800 lb vehicle IMPULSE TIME (sec)	4500 lb vehicle EXIT VEL (mph)	4500 lb vehicle AVE G'S FOR ROW	4500 lb vehicle IMPULSE TIME (sec)
0		40.0			40.0		
1	400	32.7	5.9	0.06	36.8	2.8	0.05
2	700	23.6	5.7	0.07	31.8	3.8	0.06
3	2800	9.2	5.2	0.12	19.6	7.0	0.08
4	2800	3.6	.8	0.32	12.1	2.7	0.13
5	4200	1.1	.1	0.87	6.2	1.2	0.22



Arrays Based on English Units (cont.)

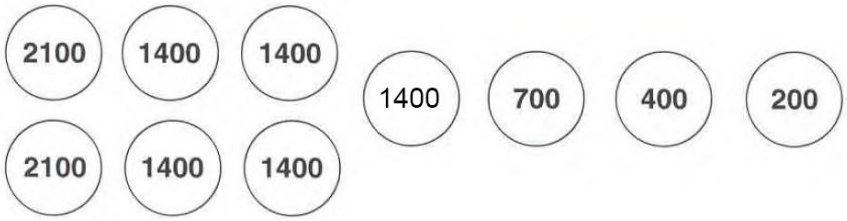
DESIGN VELOCITY 45 mph (72 km/h)

		1800 lb vehicle			4500 lb vehicle		
ROW	SAND MASS (lbs)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		45.0			45.0		
1	400	36.8	7.5	0.05	41.3	3.5	0.05
2	700	26.5	7.3	0.06	35.8	4.8	0.05
3	1400	14.9	5.4	0.10	27.3	6.0	0.06
4	2800	5.8	2.1	0.20	16.8	5.1	0.09
5	2800	2.3	.3	0.50	10.4	2.0	0.15
6	4200	.7	.1	1.38	5.4	.9	0.26



DESIGN VELOCITY 50 mph (80 km/h)

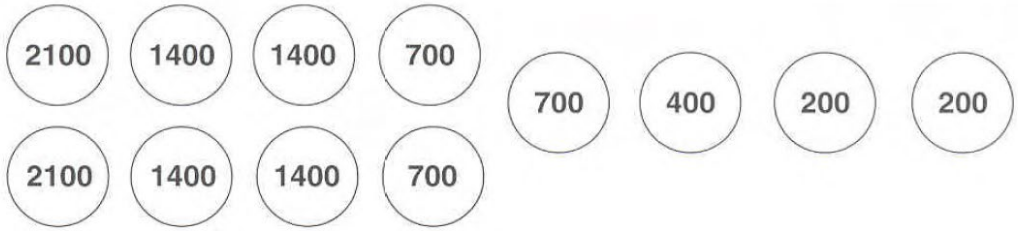
		1800 lb vehicle			4500 lb vehicle		
ROW	SAND MASS (lbs)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		50.0			50.0		
1	200	45.0	5.3	0.04	47.9	2.3	0.04
2	400	36.8	7.5	0.05	44.0	4.0	0.04
3	700	26.5	7.3	0.06	38.1	5.4	0.05
4	1400	14.9	5.4	0.10	29.0	6.7	0.06
5	2800	5.8	2.1	0.20	17.9	5.8	0.09
6	2800	2.3	.3	0.50	11.0	2.2	0.14
7	4200	.7	.1	1.38	5.7	1.0	0.24



Arrays Based on English Units (cont.)

DESIGN VELOCITY 55 mph (88 km/h)

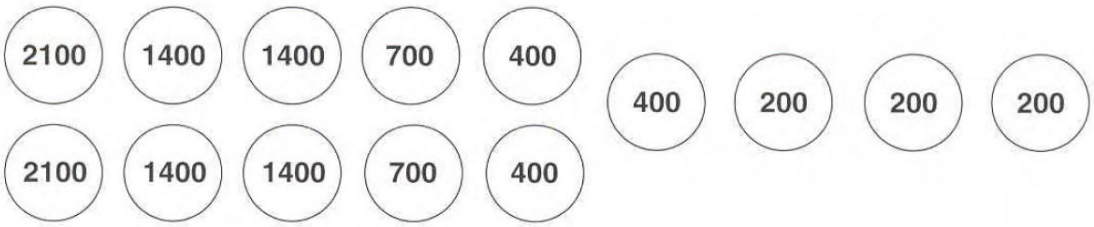
ROW	SAND MASS (lbs)	1800 lb vehicle EXIT VEL (mph)	1800 lb vehicle AVE G'S FOR ROW	1800 lb vehicle IMPULSE TIME (sec)	4500 lb vehicle EXIT VEL (mph)	4500 lb vehicle AVE G'S FOR ROW	4500 lb vehicle IMPULSE TIME (sec)
0		55.0			55.0		
1	200	49.5	6.4	0.04	52.7	2.8	0.04
2	200	44.6	5.2	0.04	50.4	2.6	0.04
3	400	36.5	7.3	0.05	46.3	4.4	0.04
4	700	26.2	7.1	0.07	40.1	6.0	0.05
5	1400	14.8	5.2	0.10	30.6	7.5	0.06
6	2800	5.8	2.1	0.20	18.8	6.5	0.08
7	2800	2.3	.3	0.51	11.6	2.5	0.13
8	4200	.7	.1	1.39	6.0	1.1	0.23



Arrays Based on English Units (cont.)

DESIGN VELOCITY 60 mph (96 km/h)

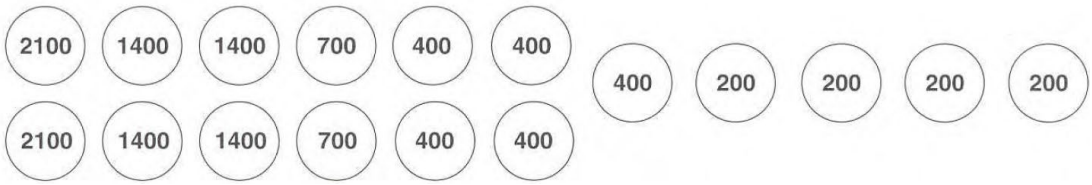
		1800 lb vehicle			4500 lb vehicle		
ROW	SAND MASS (lbs)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)	EXIT VEL (mph)	AVE G'S FOR ROW	IMPULSE TIME (sec)
0		60.0			60.0		
1	200	54.0	7.6	0.04	57.5	3.3	0.03
2	200	48.6	6.2	0.04	55.0	3.1	0.04
3	200	43.7	5.0	0.04	52.7	2.8	0.04
4	400	35.8	7.0	0.05	48.4	4.8	0.04
5	800	24.8	7.4	0.07	41.1	7.3	0.05
6	1400	13.9	4.7	0.11	31.3	7.9	0.06
7	2800	5.5	1.8	0.21	19.3	6.8	0.08
8	2800	2.1	.3	0.54	11.9	2.6	0.13
9	4200	.6	.0	1.47	6.2	1.2	0.23



Arrays Based on English Units (cont.)

DESIGN VELOCITY 65 mph (104 km/h)*

ROW	SAND MASS (lbs)	1800 lb vehicle EXIT VEL (mph)	1800 lb vehicle AVE G'S FOR ROW	1800 lb vehicle IMPULSE TIME (sec)	4500 lb vehicle EXIT VEL (mph)	4500 lb vehicle AVE G'S FOR ROW	4500 lb vehicle IMPULSE TIME (sec)
0		65.0			65.0		
1	200	58.5	8.9	0.03	62.2	3.9	0.03
2	200	52.7	7.2	0.04	59.6	3.6	0.03
3	200	47.4	5.9	0.04	57.1	3.3	0.04
4	200	42.6	4.8	0.05	54.6	3.0	0.04
5	400	34.9	6.7	0.05	50.2	5.2	0.04
6	800	24.2	7.1	0.07	42.6	7.8	0.04
7	800	16.7	3.4	0.10	36.2	5.6	0.05
8	1400	9.4	2.1	0.16	27.6	6.1	0.06
9	2800	3.7	.8	0.31	17.0	5.3	0.09
10	2800	1.4	.1	0.80	10.5	2.0	0.15
11	4200	.4	.0	2.18	5.4	.9	0.26

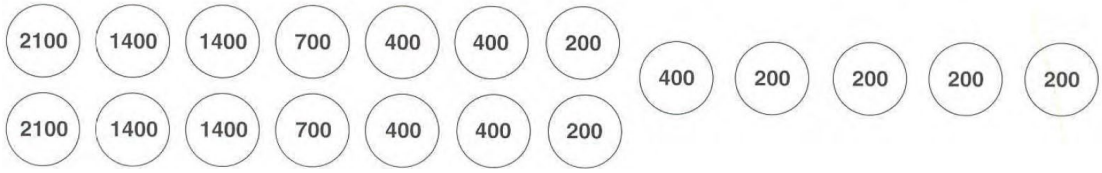


A 104 km/h (65 mph) design speed exceeds NCHRP Report 350, Test Level 3 impact conditions. Typical impacts into this array may not result in acceptable crash performance as described in NCHRP Report 350 relative to structural adequacy, occupant risk, and vehicle trajectory and should not be permitted.

Arrays Based on English Units (cont.)

DESIGN VELOCITY 70 mph (113 km/h)*

ROW	SAND MASS (lbs)	1800 lb vehicle EXIT VEL (mph)	1800 lb vehicle AVE G'S FOR ROW	1800 lb vehicle IMPULSE TIME (sec)	4500 lb vehicle EXIT VEL (mph)	4500 lb vehicle AVE G'S FOR ROW	4500 lb vehicle IMPULSE TIME (sec)
0		70.0			70.0		
1	200	63.0	10.4	0.03	67.1	4.5	0.03
2	200	56.7	8.4	0.03	64.2	4.2	0.03
3	200	51.1	6.8	0.04	61.5	3.8	0.03
4	200	45.9	5.5	0.04	58.9	3.5	0.03
5	400	37.6	7.8	0.05	54.0	6.0	0.04
6	400	30.8	5.2	0.06	49.6	5.1	0.04
7	800	21.3	5.5	0.08	42.1	7.7	0.04
8	800	14.7	2.6	0.11	35.8	5.5	0.05
9	1400	8.3	1.7	0.18	27.3	6.0	0.06
10	2800	3.2	.6	0.35	16.8	5.1	0.09
11	2800	1.3	.1	0.91	10.4	2.0	0.15
12	4200	.4	.0	2.48	5.4	.9	0.26



A 113 km/h (70 mph) design speed exceeds NCHRP Report 350, Test Level 3 impact conditions. Typical impacts into this array may not result in acceptable crash performance as described in NCHRP Report 350 relative to structural adequacy, occupant risk, and vehicle trajectory and should not be permitted.

Wide Hazard Protection

Energite® III/Fitch® Universal Module systems are effective for shielding very wide hazards where redirective properties of the crash cushions are not a consideration. The array may be kept wide at the front to achieve optimum protection across the full width. Arrays may be tampered to maximize available recovery area for gore areas. The array design depends on the site conditions and expected vehicle trajectories (See Figure 4).

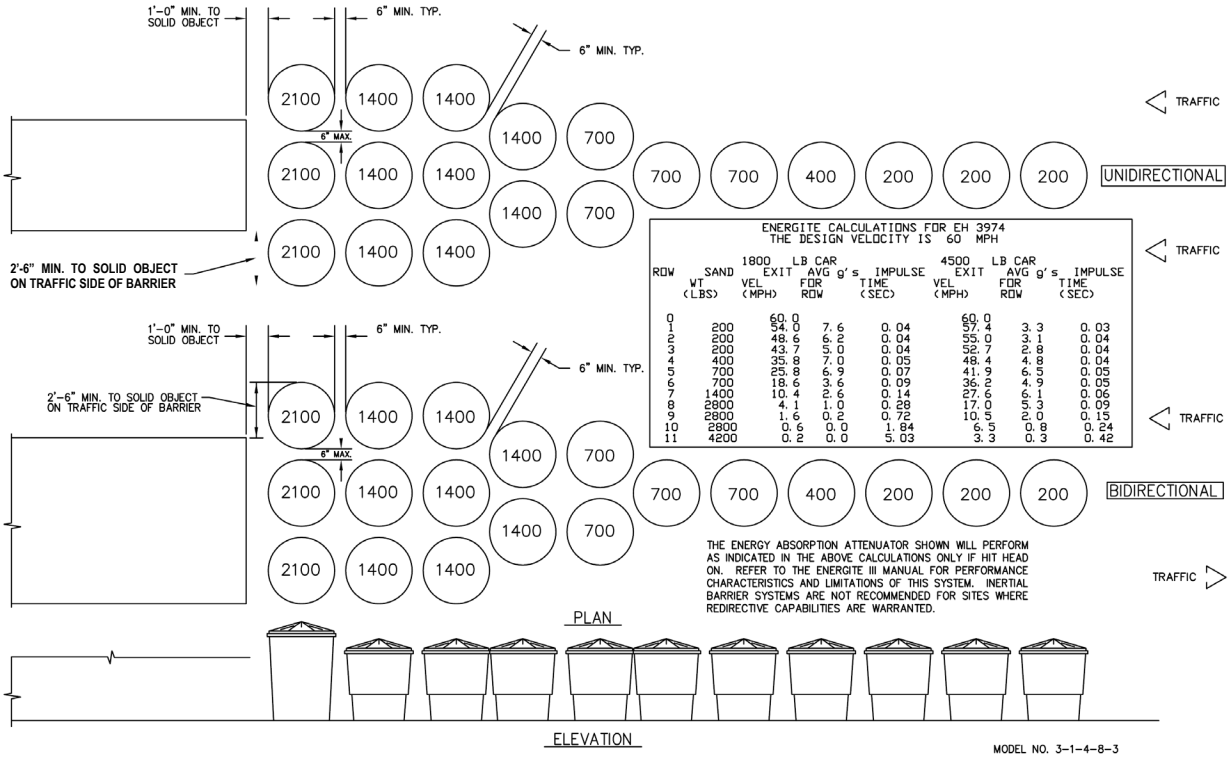


Figure 4 Wide Hazard Example

Wide arrays are actually several narrow arrays placed side by side to provide the required width.

Notes:

Notes:

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