



PSS
Innovations for Safety®

CrashGard® Sand Barrel System Product Guide



CrashGard® Sand Barrel System

General Information

PSS CrashGard® Sand Barrel System is a non-redirective, gating sand barrel or crash cushion. Sand barrels are designed to protect fixed objects, whether permanent or temporary. Sand barrels are designed to reduce the likelihood of a vehicle impacting the object.

Function of a Sand Barrel:

As the AASHTO* *Roadside Design Guide* states, sand barrels absorb energy. AASHTO also states:

- Sand barrels stop the impact vehicle in a short distance and at a controlled rate.
- The controlled rate reduces the potential for injury to the occupants.
- Sand barrels allow the vehicle to pass through the array, but they do not redirect the vehicle.

*Association of American State Highway and Transportation Officials

This manual provides the information necessary to specify, purchase and install CrashGard Sand Barrel System.



US Patent Nos. D542,685 and 8,282,309.



MASH and CrashGard® Sand Barrel System

FHWA Letters:

In March 2007, the Federal Highway Administration, FHWA, issued PSS Acceptance Letter CC-97 for CrashGard® Sand Barrel System. CC-97 acknowledges that CrashGard passed NCHRP-350 Crash Tests 3-40 through 3-44. The letter also confirms that CrashGard meets the criteria of NCHRP-350 Test Level 3 for non-redirective, gating crash cushions.

In March 2009, FHWA issued CC-97A, an amendment to the original letter. The amendment accepts the use of CrashGard in “mixed array” configurations. Please see Page 10 for correct placement of CrashGard in mixed arrays.

AASHTO MASH* test requirements supersede NCHRP-350 test requirements. Crash cushions are required to comply with MASH test guidelines by December 31, 2018.

PSS tested CrashGard to MASH Test Level 3 in Spring 2018. FHWA issued Eligibility Letter CC-145 for CrashGard in September 2018.

In CC-145, FHWA agrees CrashGard meets MASH test and evaluation requirements. CC-145 also states FHWA finds CrashGard eligible “for reimbursement under the Federal-Aid Highway Program.” For a copy of CC-145, please visit pss-innovations.com or <http://bit.ly/2Q9NjRz>.

See Page 11 for a summary of CrashGard MASH tests.

*Manual for Assessing Safety Hardware

Use of Existing CrashGard® Inventory:

PSS did not change the design or function of CrashGard to meet MASH requirements.

Users can confidently install any CrashGard Sand Barrel System purchased prior to the issuance of CC-145 and still meet MASH requirements.

However, users must comply with one change we made to the sand-fill procedures. Under NCHRP-350 requirements, our 1,400 lb. barrel did not require use of CrashGard Insert. Users simply filled barrels to the 1,400 lb. fill mark.

To meet MASH requirements, users must now install CrashGard Inserts in 1,400 lb. barrels, and then fill with sand to the “1,400 lbs. fill to top mark.”

Barrels shipped until the end of March 2019 will show the “1,400 lbs. fill mark,” as per the example below left.

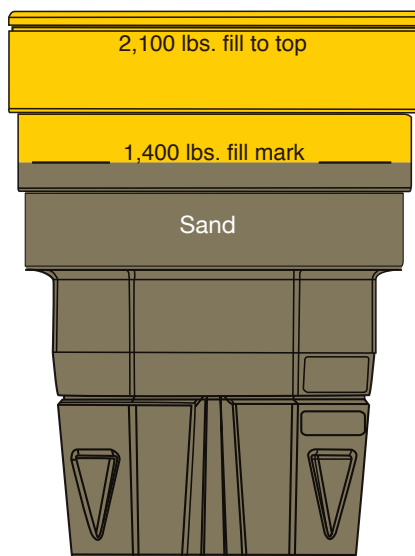
Beginning April 2019, barrels shipped will show the “1,400 lbs. fill to top mark,” as per the example below right.



Mash Test Level 3-45, Spring 2018.

Sand-Fill Measurements, 1,400 lbs. Barrel ONLY

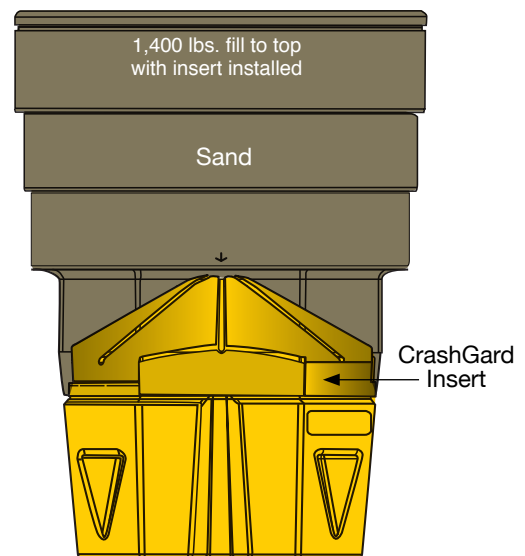
To Meet NCHRP-350 Requirements



Fill to Line - No Insert

We will ship barrels with this “1,400 lbs. fill mark” through March 2019.

To Meet MASH Requirements



Fill to Top - With Insert

We will ship barrels with the “1,400 lbs. fill to top mark” beginning April 2019.

CrashGard® Sand Barrel System

Specifications and Limited Warranty

PSS designed CrashGard® Sand Barrel System for the intended use as a gating, non-redirective crash attenuator.

Description of System:

CrashGard® Sand Barrel System consists of three pieces:

Barrel, P/N CC-48:

Overall dimensions: 36.0" diameter, 48.0" height.

Configuration of lower portion: configured in a square profile, which creates lifting shelves at the intermediate section of the barrel.

Design function of lifting shelves: provide support for forklift transport.

Configuration of upper portion: configured in a straight wall. Groove in top of barrel allows for snap-on lid. Barrels will easily nest when empty of contents and with insert and lid removed.

Design function of straight wall: allows for easy application of retro-reflective sheeting, and supports the CrashGard Hoist lift ring used for transport.

Maximum ballast: 2,100 lbs. of sand.

The barrel is marked externally with the following fill marks: 200, 400, 700, 1,400 and 2,100 lbs.

Molding process and material: blow-molded from high molecular, high-density polyethylene (HDMI-HDPE) material, which includes UV stabilizer agents. Safety Yellow in color.

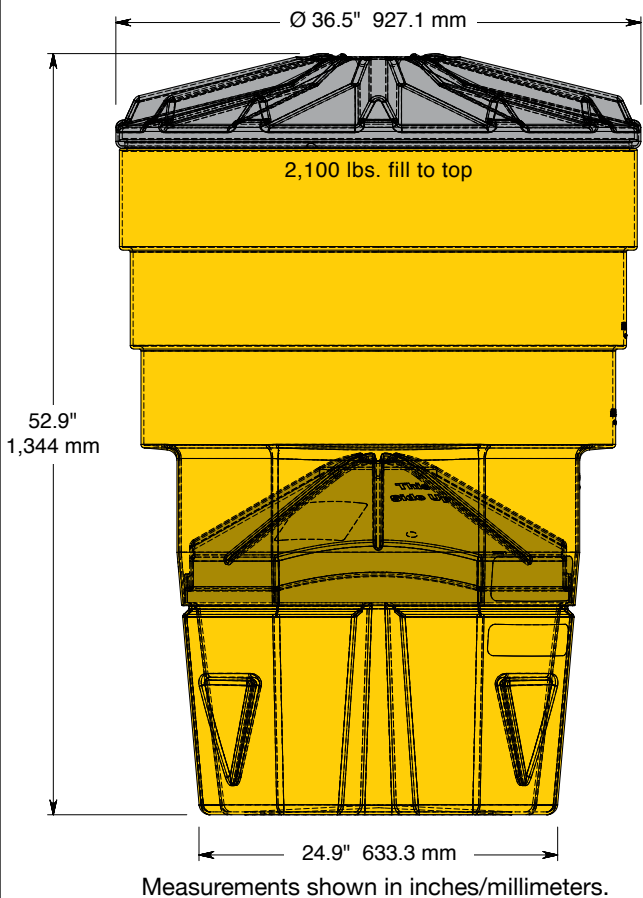
Insert, P/N CC-I28:

Overall dimensions: 27.0" square, 10.8" height.

Configuration: conical in shape. Inserts will nest.

Design function: allows for ballast of either 200, 400, 700 or 1,400 lbs. of sand when installed on the ledge molded into the internal, lower portion of the barrel. Install conical side up, as indicated.

Molding process and material: rotationally molded from high-density polyethylene (HDPE) material.



Lid, P/N CC-L36:

Overall dimensions: 36.5" diameter, 6.6" height.

Configuration: round in shape. Lids will nest.

Design function: tamper-resistant fit on top of barrel. Reduces vandalism and infiltration of water. Lip of lid snaps into a groove in the top of the barrel.

Molding process and material: blow-molded from high-molecular, high-density polyethylene (HDMI-HDPE) material, which includes UV stabilizer agents. Black in color.

Design and Placement of Arrays:

Design and placement of arrays will adhere to guidelines established in:

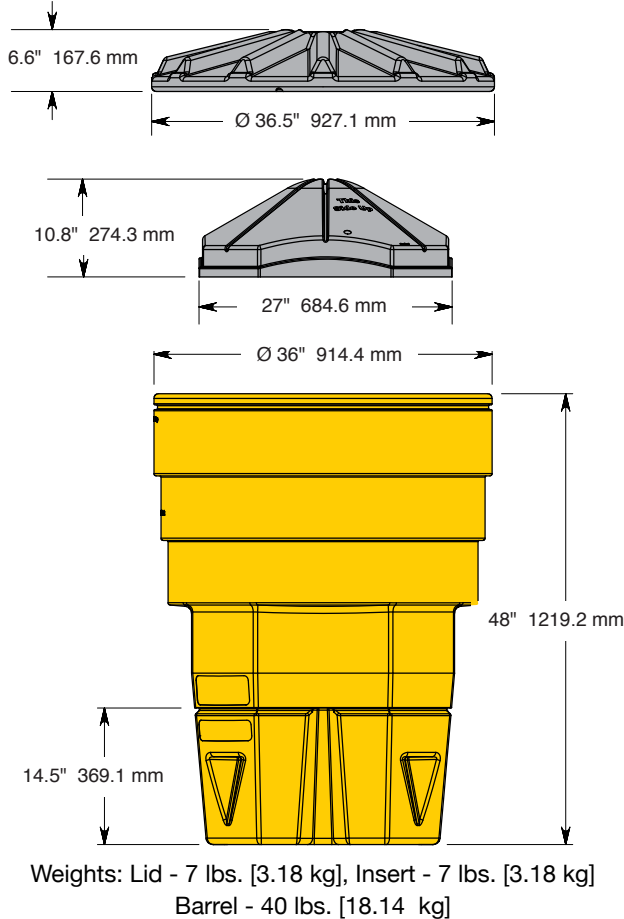
- AASHTO *Roadside Design Guide*
- FHWA Report N5040.16, *Crash Cushions, Selection Criteria and Design*

Properly designed arrays (as described on Page 10) will decelerate the vehicle within the parameters described in MASH Certification.

PSS has tested the CrashGard® Sand Barrel System to the requirements set forth in MASH Certification, Test Level 3.

See Page 3 for more information.

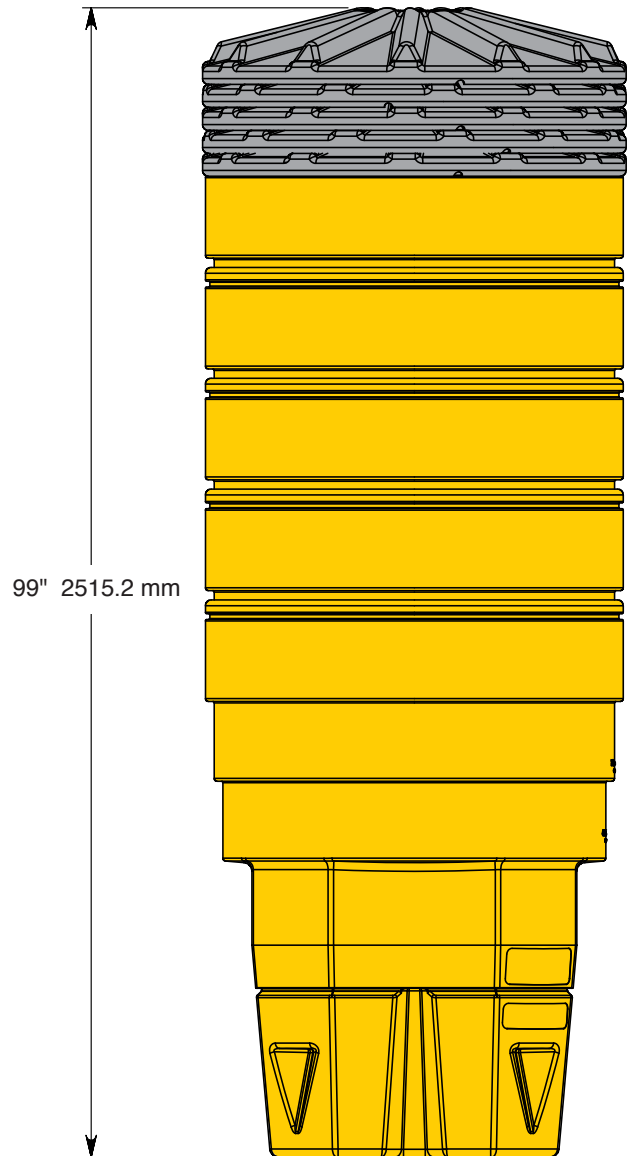
Weights and Dimensions



Shipping Configurations:

A truckload stack consists of five CrashGard Barrels and five lids, both nested.

The amount of CrashGard barrels per truckload depends upon the amount of inserts required. Call us with your array requirements, and we will calculate shipping configurations for you.



CrashGard® Sand Barrel System Limitations:

CrashGard Sand Barrel System meets MASH criteria, Test Level 3, for non-redirective, gating crash cushions. It should not be used for any other function.

Impacts that exceed design capabilities may not result in acceptable crash performances as described in MASH criteria, Test Level 3.

CrashGard® Sand Barrel System Warranty:

PSS warrants each CrashGard Sand Barrel System is free from manufacturing defects for one (1) year from date of purchase. (Subject to additional terms and conditions. Please contact PSS for complete warranty.)

PSS warrants each CrashGard Sand Barrel System against UV degradation for six (6) years from date of purchase on a pro-rated, "repair or replace" basis.

CrashGard® Sand Barrel System

Recommended Installation Procedure

Proper installation ensures successful performance.

Review all engineering plans prior to installation for proper design array. Contact PSS at 800-662-6338 for questions about CrashGard® Sand Barrel System.

PSS recommends the following installation procedure, with dimensions as noted. State specifications may differ from our recommended dimensions. State specifications always supersede our recommendations.

For example, we recommend a minimum 12" space between the fixed object and the first row of barrels. However, some states specify a minimum of 18". In that case, installers should follow the state specification and place the barrels at least 18" from the fixed object.

In all installations, installers should adhere to state specifications or drawings.

A) Prepare the Site:

- 1) Implement proper traffic control procedures to protect workers and the driving public.
- 2) Clear the site of any debris or snow.
- 3) Measure the grade of the installation site. The grade should not exceed 5% in either direction. The site requires grading if over 5%.

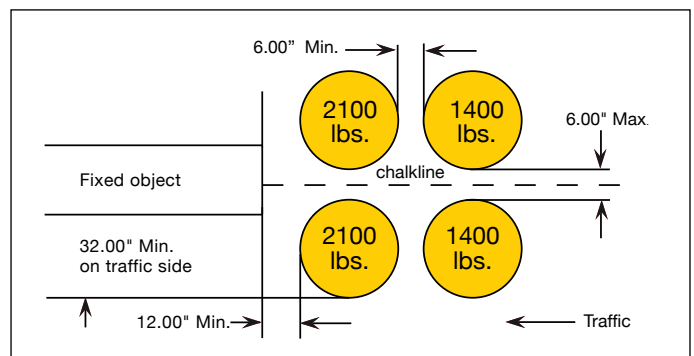
B) Set the First Row:

The row of sand barrels closest to the fixed object and perpendicular to traffic is considered the first row. Start the installation at the first row, as the rows should follow a straight line.

- 1) Laterally offset the first row on the side of traffic a minimum of 32".
- 2) Allow for a minimum 12" of space between the first row and the fixed object.

C) Set the Rest of the Array:

- 1) Mark the centerline of the array with a chalk line or other marking device. (This works especially well for new installations.)
- 2) Adhering to the centerline, set each barrel in place:
 - a) Allow a minimum of 6" between barrels parallel to traffic. Measure from the top of the barrel.
 - b) Allow a maximum of 6" between barrels perpendicular to traffic. Measure from the top of the barrel.



D) Fill the Barrels:

To meet MASH requirements, please see new sand-fill measurements for 1,400 lb. barrels on Pages 3 and 8.

- 1) Filling the barrels offsite: follow the directions below, but also make sure to mark the barrels with their respective weights to avoid misplacement in the array.
- 2) Filling the barrels on site:
 - a) Review the array plans or drawings to determine the appropriate weight for each barrel.
 - b) Install CrashGard Insert for weights of 200, 400, 700 and 1,400 lbs.
 - c) Weights of 2,100 lbs. do not require Inserts.
- 3) Compact the sand to achieve proper fill.

CrashGard® Sand Barrel System

Recommended Installation Procedure

D) Fill the Barrels continued:

- 4) Fill the barrels with the appropriate weight of sand, using the fill level marks on the side of the barrel.

See Page 8 of this manual to measure sand-fill levels from inside the barrel if retroreflective sheeting obscures the fill level marks.

- 5) Use only sand that meets ASTM C-33, washed concrete sand or equivalent. Use only sand that contains less than 3% moisture. In freezing conditions, add a minimum of 5% rock salt. In all cases, sand must meet state specifications.

Caution: If the sand has been heated recently, make sure it is cool before filling any barrels. Hot sand could distort the barrel or insert and cause leaks.

- 6) Press a lid on each barrel. Check that each has completely snapped into the lid groove on the barrel. Compare the array to the specifications for a final check. Clean up area.

Insert Instructions

- 1) Determine which barrels in the array require Inserts. Only those barrels with weights of 200, 400, 700 and 1,400 lbs. require Inserts. Barrels of 2,100 lbs. do not require Inserts.
- 2) Always install CrashGard® Insert with the cone-shaped side face up.
- 3) Figure A: Lean the barrel inward for convenience. Hold the Insert, cone-shaped side face up, with both hands.



Figure A

- 4) Figure B: CrashGard Insert is a square-sided unit. Make sure the configuration of the Insert matches the configuration of the barrel shelf upon which it rests. Slowly drop the Insert into position.



Figure B

Once properly aligned, press-fit the Insert into the barrel. There should be no rocking or sliding; the Insert should fit snugly. The barrel is now ready to fill with sand.

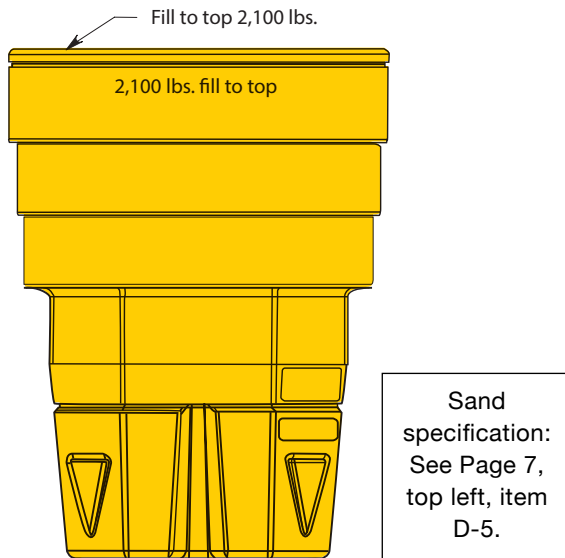
DOT Approved Installations



CrashGard® Sand Barrel System

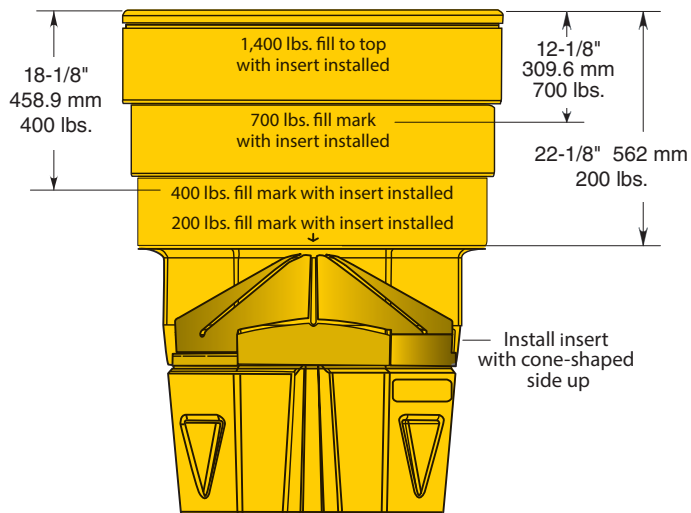
Sand-Fill Measurements

To determine sand-fill levels from the inside of the barrel, use the measurements listed below. Measure from the TOP of the barrel to determine the appropriate fill level.



For 2,100 lbs. without Insert

To meet MASH requirements, please see new sand-fill measurements for 1,400 lb. barrels on Pages 3 and 8.



For 200, 400, 700 and 1,400 lbs. with Insert

Lifting Options: CrashGard Hoist® and Forklift

We designed CrashGard® Sand Barrel System for both safe and easy transport with CrashGard Hoist or a forklift.

CrashGard® Hoist:

- Transport of barrels can be a one-person operation.
- Operates with a simple scissor action.
- Made of welded steel. Weighs 140 lbs.
- Powder-coated paint helps deter corrosion.



Forklift Instructions:

To accommodate forklift trucks, we designed four flat sides, located just below the bottom round tier, at the 200 lb. fill level. We also designed that bottom tier to act as a "shelf" for the forklift blades.

- 1) Caution: Never stand or walk under a sand barrel during transport.
- 2) Measure the distance between forklift blades from inside to inside. That distance should not exceed 28".
- 3) Figure A: Align the blade with the flat sides of the barrel. If the barrel contains any significant weight, use the center of the blades for balance.
- 4) Figure B: Many forklift blades become loose after years of use. To ensure the blades maintain consistent distance, we suggest using a chain binder or similar-type binding equipment.



Figure A



Figure B

CrashGard® Sand Barrel System

CrashGard® Hoist Transport Instructions

We designed and manufactured CrashGard® Hoist for the safe, easy and efficient transport of CrashGard Sand Barrels. With CrashGard Hoist, loading or unloading a truck is at most a two-person operation and often a one-person operation.

CrashGard Hoist operates in a scissor-like mode to engage and disengage as necessary and uses the CrashGard barrel itself to do so.

CrashGard® Hoist Instructions:

- 1) **Caution:** Never stand or walk under a sand barrel during transport.
- 2) **Figure A:** Using a boom, simply hook the Hoist's lifting ring. Raise the Hoist.
- 3) **Figures B and C:** Align the Hoist over a CrashGard barrel and slowly lower it. The lid of the barrel will open the Hoist.
- 4) **Figures D and E:** Continue to lower the Hoist until it is fully open and rests upon the barrel top.
- 5) **Figure F:** Raise the Hoist. The tension on the steel cables will cause the Hoist to clamp tightly, directly underneath the middle-round tier.
- 6) **Figure G:** Once engaged, continue to raise the Hoist and carry it to its destination. Place the barrel where appropriate.

To Disengage CrashGard® Hoist:

- 1) Lower the Hoist to full rest on the lid of the barrel. The Hoist will open.
- 2) While the Hoist is in the open position, simply slide it off either side of the barrel.
- 3) Once off, raise the Hoist clear of the barrel to pick up another.

Note: Some lifting devices made by other barrel manufacturers are adjustable by size. If using a device with settings to transport CrashGard, we recommend setting the device to "large."



Figure A



Figure B



Figure C



Figure D



Figure E



Figure F



Figure G

	Design velocity 70 mph 19 barrels/array		Design velocity 45 mph 9 barrels/array
	Design velocity 65 mph 17 barrels/array		Design velocity 40 mph 8 barrels/array
	Design velocity 60 mph 14 barrels/array		Design velocity 35 mph 7 barrels/array
	Design velocity 55 mph 12 barrels/array		Design velocity 30 mph 7 barrels/array
	Design velocity 50 mph 10 barrels/array		Design velocity 25 mph 6 barrels/array

Recommended Array Configurations:
PSS recommends the above arrays for the designated speeds, as noted.
To meet MASH requirements, please see new sand-fill measurements for 1,400 lb. barrels on pages 3 and 8.

Speed		Weight	
MPH	Kilometers	Lbs.	Kilograms
25	40.2	200	90.7
30	48.3	400	181.4
35	56.3	700	317.5
40	64.4	1,400	635.0
45	72.4	2,100	952.5
50	80.5		
55	88.5		
60	96.6		
65	104.6		
70	112.6		

CrashGuard® Sand Barrel System Mixed Array Recommendations

FHWA issued Acceptance Letter CC-97-A, an amendment to the original letter, CC-97. In CC-97-A, FHWA accepts the use of our CrashGuard® Sand Barrel in “mixed arrays”.

A mixed array is defined as an array that contains barrels from different manufacturers. A mixed array usually evolves, as portions of the original array are destroyed in crashes over time. Installers may replace the destroyed barrels with new ones from another manufacturer, thus creating the mixed array.

PSS advises and recommends:

- Installers should ALWAYS place CrashGuard BEHIND shorter barrels.
- Installers should NEVER place CrashGuard IN FRONT OF shorter barrels.

PSS recommends installers follow the manufacturers' recommendation, design or plan that utilizes the highest number of barrels.

If placed incorrectly within an array, CrashGuard may not perform as designed or intended.

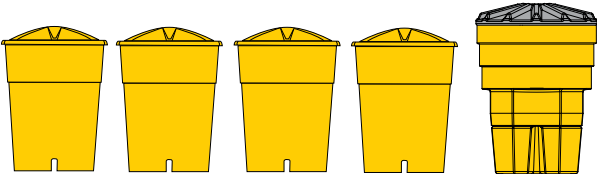
Installers may place CrashGuard in front of, next to or behind other manufacturers' barrels when those barrels are the same height as CrashGuard.

CrashGuard is completely interchangeable with other manufacturers' barrels of the same height.

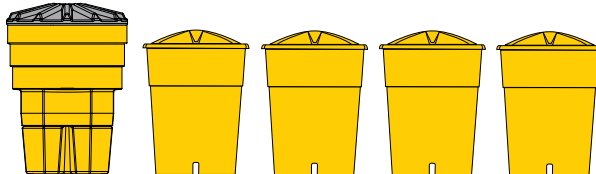
Please call our technical support staff for more information: 800-662-6338.

Placement of CrashGuard® Sand Barrels in Mixed Arrays

Place CrashGuard® behind shorter barrels.

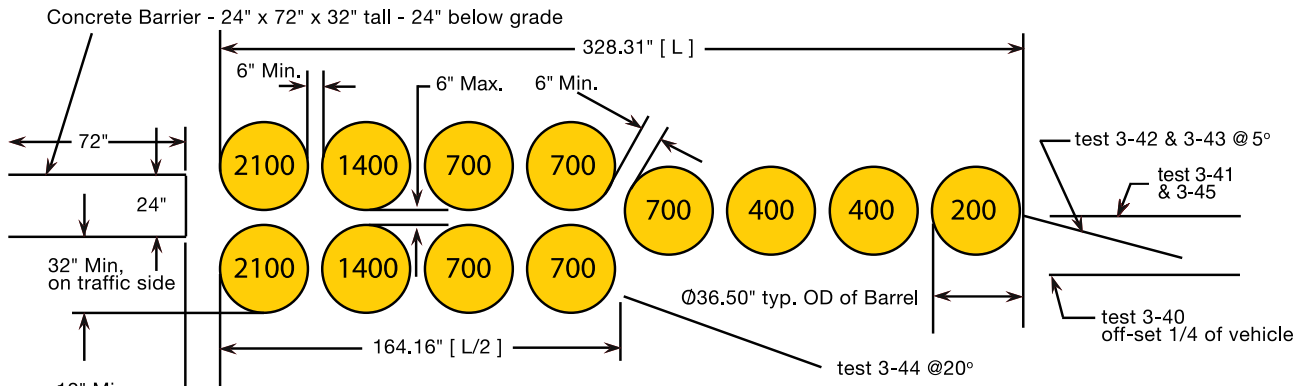


Do not place shorter barrels behind CrashGuard®.



CrashGard® Sand Barrel System Crash Testing

MASH (Manual for Assessing Safety Hardware) Crash Test Guidelines supersede NCHRP-350 Test Guidelines. PSS crash-tested CrashGard® Sand Barrel System to Mash Test Level 3 Guidelines in Spring 2018. CrashGard passed all MASH Tests. To meet MASH requirements, please see new sand-fill measurements for 1,400 lb. barrels on Pages 3 and 8.



MASH Test 3-40 - 3-45

All lengths in inches. All weights in pounds.

1. MASH Test 3-40:

Vehicle: Passenger Car
 Weight: 1,100 kg / 2,425 lbs.
 Impact Speed: 100 kph / 62 mph
 Impact Angle: 0° (Head-On)
 Offset 1/4 width of vehicle

2. MASH Test 3-41:

Vehicle: Pickup Truck
 Weight: 2,270 kg / 5,004 lbs.
 Impact Speed: 100 kph / 62 mph
 Impact Angle: 0° (Head-On)

3. MASH Test 3-42:

Vehicle: Passenger Car
 Weight: 1,100 kg / 2,425 lbs.
 Impact Speed: 100 kph / 62 mph
 Impact Angle: 5°

4. MASH Test 3-43:

Vehicle: Pickup Truck
 Weight: 2,270 kg / 5,004 lbs.
 Impact Speed: 100 kph / 62 mph
 Impact Angle: 5°

5. MASH Test 3-44:

Vehicle: Pickup Truck
 Weight: 2,270 kg / 5,004 lbs.
 Impact Speed: 100 kph / 62 mph
 Impact Angle: 20°

6. MASH Test 3-45:

Vehicle: Intermediate Vehicle
 Weight: 1,500 kg / 3,307 lbs.
 Impact Speed: 100 kph / 62 mph
 Impact Angle: 0°



Custom Training Improves Safety



From Classroom to Field...

START Group and PSS, innovators in their respective fields, have united to provide custom training designed specifically to improve the safety of your employees.

Beginning with a training audit or needs assessment, we create practical training programs that support and enhance your safety and training requirements.

Results of our custom training will exceed your expectations. Our trainers, experts in their life's work, will teach your employees how to perform their jobs more safely and efficiently.

To discuss your training needs further, contact:

Glenda Bleau
PSS Roadway Safety Consultant
216-409-6842
Glenda.Bleau@PSS-Innovations.com

Specialized Safety Training:

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