INSTALLATION RECOMMENDATIONS FOR FLOATING DOCKS, RAFTS AND BOAT WELLS

CREATE BUILD-IT-YOURSELF FLOATING STRUCTURES WITH STYROFOAM™ BRAND BUOYANCY BILLETS

These instructions describe the materials needed and guidelines for building floating docks, rafts and boat wells/docks with STYROFOAM™ Brand Buoyancy Billets.

Extremely buoyant and durable, the billet material is composed of millions of tiny non-interconnecting air cells – each serving as an independent buoyancy chamber. These billets won't lose their buoyancy, even if punctured. It takes only 1 cubic foot (0.03 cubic meter) of STYROFOAM™ Brand Buoyancy Billets to float 55 pounds (25 kilograms).

Lightweight, the billets are easy to install. And they stay on the job year after year under normal conditions. They resist the attack of destructive marine growths, are unaffected by salt or fresh water, won't become waterlogged and won't corrode.

MATERIALS CHECKLIST

- Handsaw
- Framing square
- Handheld drill
- Hammer
- Wrench
- Carriage bolts/washers/nuts (see Table 1)
- Treated wood* (see Table 1)
- Nails (see Table 1)
- Scrap of 1/2" (13 mm) plywood

PLANS FOR A FLOATING DOCK

These instructions describe the materials needed and guidelines for building a 6' x 10' (1.8 m x 3 m) floating dock. Additional sections can be made to increase the length of the dock. The materials needed for one section are shown in Table 1. The plans for the floating dock are shown in Figure 1.

FIGURE 1: FLOATING DOCK PLAN

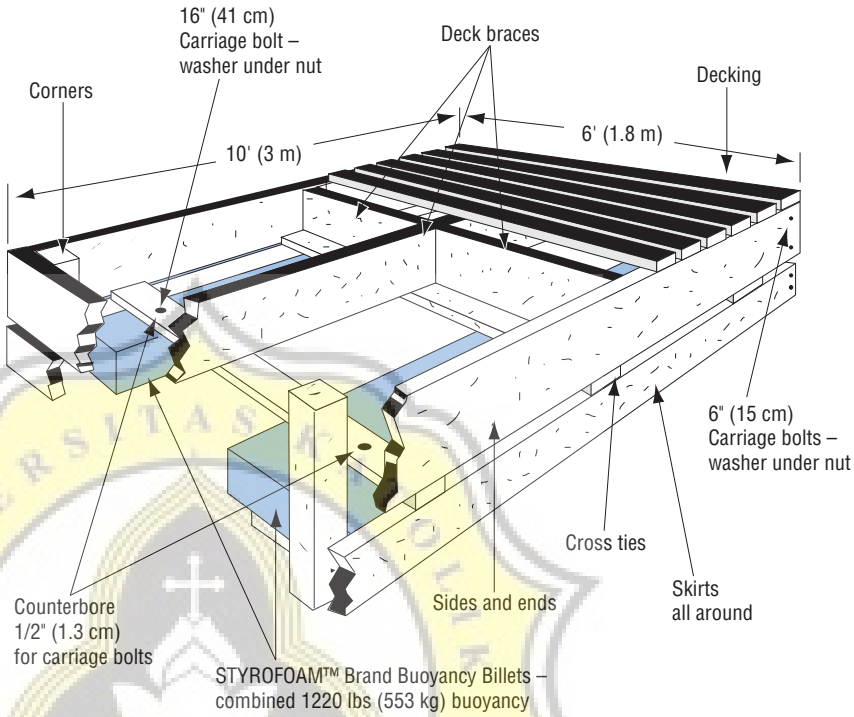

TABLE 1: MATERIALS FOR DOCK

Part Name	Size, inch (cm)	Quantity Needed
Deck Braces	2 x 10 x 117 (5 x 25 x 297)	1
Deck Braces	2 x 10 x 33-3/4 (5 x 25 x 85.7)	2
Deck Sides	2 x 10 x 120 (5 x 25 x 305)	2
Deck Ends	2 x 10 x 72 (5 x 25 x 183)	2
Skirts	2 x 6 x 120 (5 x 15 x 305)	2
Skirts	2 x 6 x 72 (5 x 15 x 183)	2
Cross Ties	2 x 6 x 72 (5 x 15 x 183)	3
Decking	2 x 6 x 72 (5 x 15 x 183)	20
Skids	2 x 6 x 108 (5 x 15 x 274)	2
Corners	4 x 4 x 16-1/4 (10 x 10 x 41)	4
Galvanized Carriage Bolts with Nuts (or threaded rod cut to required length)	Diameter: 3/8 (0.95) Length: 16 (41)	6
Galvanized Carriage Bolts with Nuts (or threaded rod cut to required length)	Diameter: 3/8 (0.95) Length: 6 (15)	16
Galvanized Nails	Length: 3-1/2 (9)	6 lbs (2.7 kg)
Galvanized Washers	Diameter: 3/8 (0.95)	22
STYROFOAM™ Brand Buoyancy Billets	10 x 20 x 96 (25 x 51 x 244)	2

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*Use treated wood (or wood naturally resistant to decay/insect attack). Wood should be clean, dry and free from oil residue.

CONSTRUCTION STEPS

1. Following the illustrations, create the framework shown in Figure 2. With the frame structure upside down, nail on the three cross ties and the four skirt boards.
2. Consulting Figure 3, lay the STYROFOAM™ Brand Buoyancy Billets across the cross ties. Place skids on the foam as shown. To connect the foam, drill six holes through the skids, foam, and the cross ties. Insert the long bolts and reach under the cross ties to apply washers and nuts.
3. Turn the structure over and tighten the nuts to a snug fit.
4. Install lengthwise brace. Then install cross bracing.
5. Nail on deck boards using a piece of 1/2" (13 mm) plywood to space boards 1/2" apart (Figure 4).

FIGURE 2: BOTTOM VIEW OF DOCK

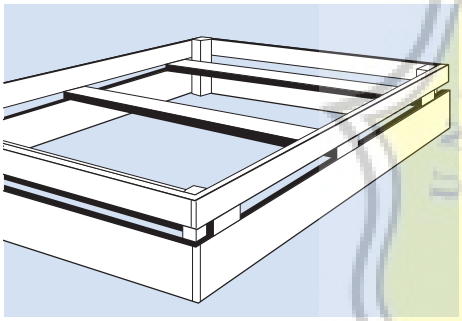


FIGURE 3: ATTACHING BILLETS TO BOTTOM OF DOCK

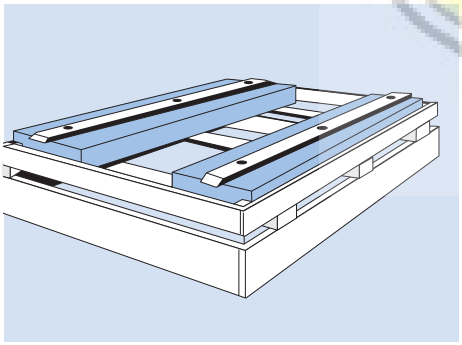
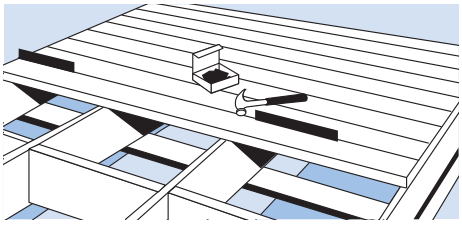


FIGURE 4: ATTACHING DECKING TO TOP OF RAFT OR DOCK



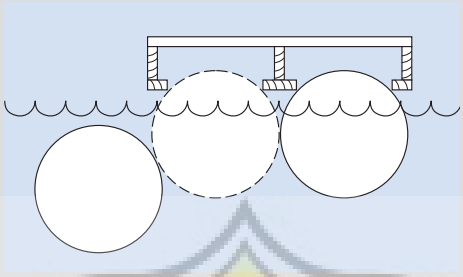
REPLACING EXISTING DRUMS

Easily replace drums on a boat well/wharf with buoyancy billets while the floating structure is still in the water. The rocking that is usually experienced in drum-floated structures is greatly reduced by using STYROFOAM™ Brand Buoyancy Billets.

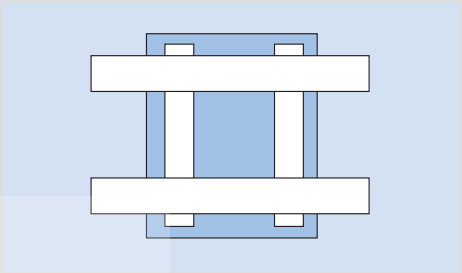
Plus, there are no hollow drumming noises to listen to at night.

One 10" x 20" x 96" (25 x 51 x 244 cm) STYROFOAM™ Brand Buoyancy Billet has an average buoyancy that is approximately 150 percent greater than a 55-gallon (208-liter) drum (Table 2).

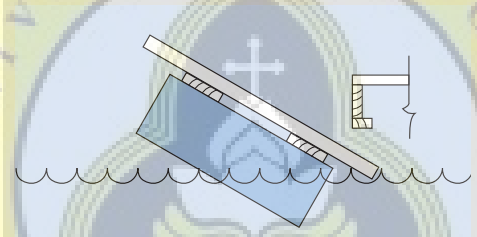
DRUM REPLACEMENT STEPS



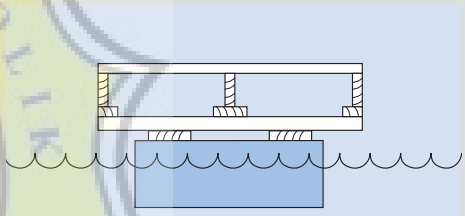
1. Replace small sections one at a time. Sink and remove only two side-by-side drums at a time.



2. Build a crib from lumber – 2" x 8" (5 x 20 cm) boards are suggested. Fasten the crib to the STYROFOAM™ Brand Buoyancy Billet. Cross members should be longer than the wharf is wide.



3. Tilt crib and push under wharf using the 2" x 8" boards as handles.



4. Center under the wharf. Secure with 16 pennyweight (16d) nails. Saw off protruding 2" x 8" handles.

TABLE 2: COMPARATIVE SIZE AND BUOYANCY DATA

Product	Cubic Feet (Cubic Meters)	Approximate Weight, lbs (kg)	Approximate Buoyancy, lbs (kg)
Billet Size, inch (cm)			
7 x 20 x 96 (18 x 51 x 244)	7.7 (0.22)	14 (6.4)	425 (192.8)
10 x 20 x 96 (25 x 51 x 244)	11.1 (0.31)	20 (9.1)	610 (276.7)
7 x 20 x 108[1]	8.6 (0.24)	16 (7.3)	480 (217.7)
10 x 20 x 108[1]	12.5 (0.35)	23 (10.4)	690 (313.0)
10 x 24 x 96[1]	13.3 (0.38)	24 (10.9)	730 (331.1)
Drum Size			
55-gallon (208-liter), 18-gauge	7.8 (0.22)	48.5 (22.0)	440 (199.6)

(1) Available in the U.S. only

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PLANS FOR A SWIMMING RAFT

These instructions describe the materials needed and guidelines for building an 8' x 12' (2.4 m x 3.7 m) swimming raft. The materials needed are shown in Table 3. The plans for the raft are shown in Figure 5.

CONSTRUCTION STEPS

1. Following the illustrations, create the framework shown in Figure 6. With the frame structure upside down, nail on the four cross ties and the four skirt boards.
2. Cut the three STYROFOAM™ Brand Buoyancy Billets in half for the six shorter pieces shown in Figure 7.
3. Consulting Figure 7, lay the sections of the STYROFOAM™ Brand Buoyancy Billets across the cross ties. Place skids on the foam as shown. To connect the foam, drill six holes through the skids, foam and the cross ties. Insert the long bolts and reach under the cross ties to apply washers and nuts.
4. Turn the structure over and tighten the nuts to a snug fit.
5. Install lengthwise bracing first, then install cross bracing.
6. Consulting Figure 4, nail on deck boards using a piece of 1/2" (13 mm) plywood to space boards 1/2" apart.

FIGURE 5: SWIMMING RAFT PLAN

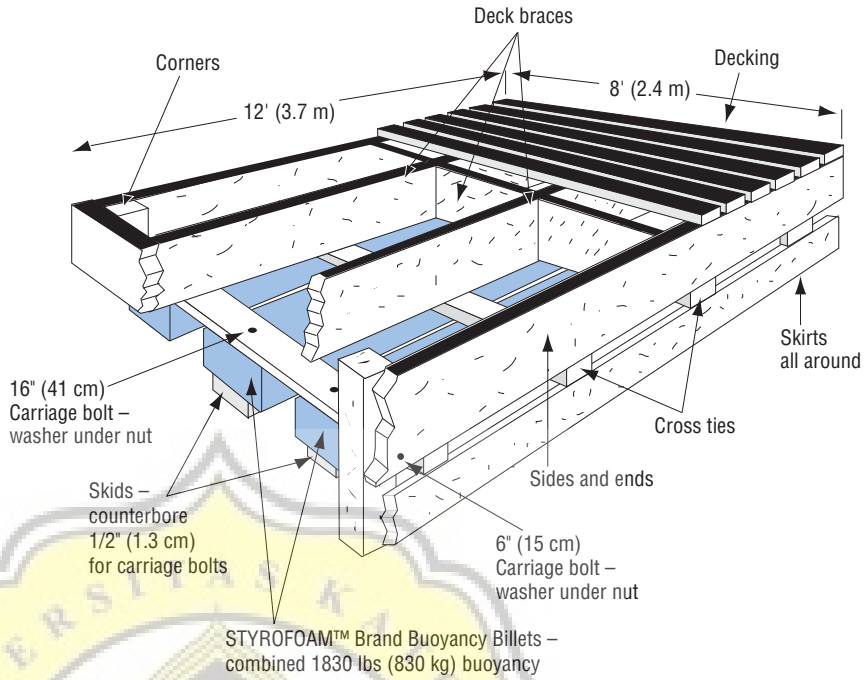

FIGURE 6: BOTTOM VIEW OF RAFT

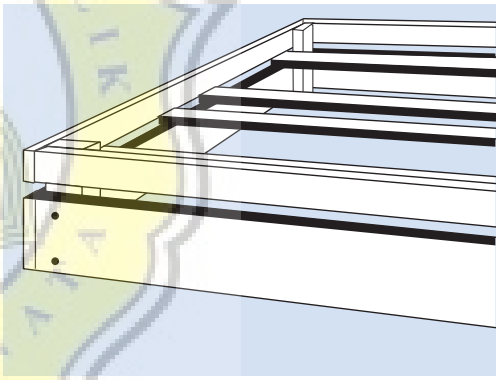

FIGURE 7: ATTACHING BILLETS TO BOTTOM OF RAFT

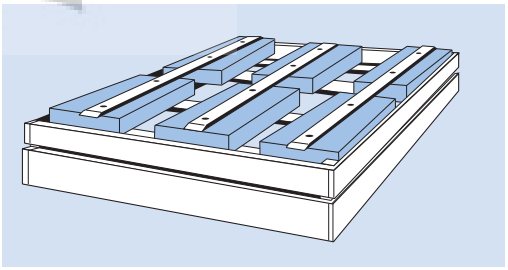

TABLE 3: MATERIALS FOR SWIMMING RAFT

Part Name	Size, inch (cm)	Quantity Needed
Sides	2 x 10 x 144 (5 x 25 x 366)	2
Ends	2 x 10 x 93 (5 x 25 x 236)	2
Deck Braces	2 x 10 x 141 (5 x 25 x 358)	2
Deck Braces	2 x 10 x 330 (5 x 25 x 76)	3
Skirts	2 x 6 x 144 (5 x 15 x 366)	2
Skirts	2 x 6 x 93 (5 x 15 x 236)	2
Cross Ties	2 x 6 x 96 (5 x 15 x 244)	4
Decking	2 x 6 x 96 (5 x 15 x 244)	24
Skids	2 x 6 x 134 (5 x 15 x 340)	3
Corners	4 x 4 x 16-1/4 (10 x 10 x 41)	4
Galvanized Carriage Bolts with Nuts (or threaded rod cut to required length)	Diameter: 3/8 (0.95) Length: 16 (41)	12
Galvanized Carriage Bolts with Nuts (or threaded rod cut to required length)	Diameter: 3/8 (0.95) Length: 6 (15)	16
Galvanized Nails	Length: 3-1/2 (9)	6 lbs (2.7 kg)
Galvanized Washers	Diameter: 3/8 (0.95)	28
STYROFOAM™ Brand Buoyancy Billets	10 x 20 x 96 (25 x 51 x 244)	3

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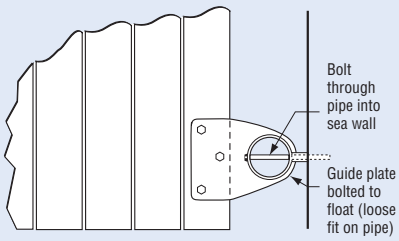
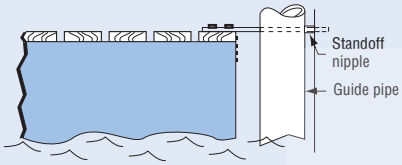
HOW TO SECURE FLOATING DOCKS AND RAFTS

DOCK TO SEAWALL FOR TIDAL VARIATION

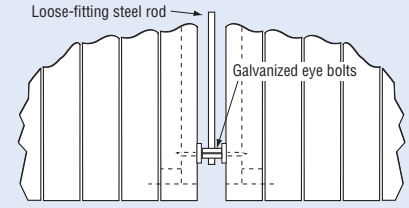


TOP VIEW

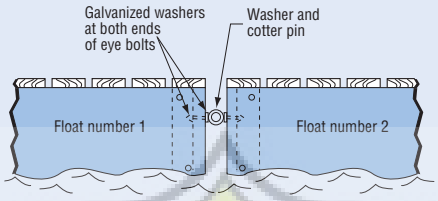


SIDE VIEW

DOCK TO DOCK

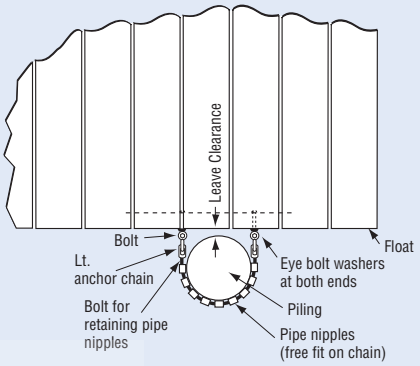


TOP VIEW



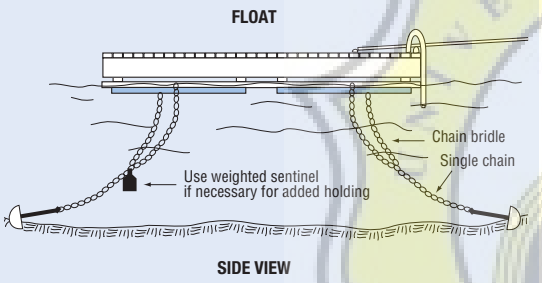
SIDE VIEW

DOCK TO PILING FOR TIDAL VARIATION



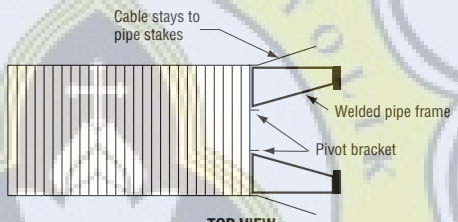
TOP VIEW

RAFT TO BOTTOM

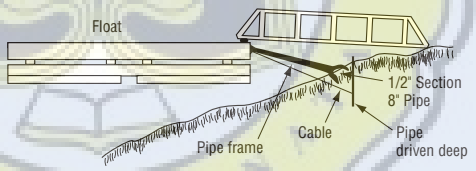


SIDE VIEW

DOCK TO SHORELINE



TOP VIEW



SIDE VIEW

PRECAUTIONS

STYROFOAM™ Brand Buoyancy Billets are sold for use in marine applications only. Billets are combustible. Protect from high heat sources. Care should be taken not to expose material to open flame or other ignition sources. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400 in the U.S. or 1-519-339-3711 in Canada.

The foam is subject to attack by some chemicals, including concentrated quantities of gasoline and oil. If this, or pollution by industrial waste is suspected, reaction of the foam should be checked prior to construction. In case of extreme pollution, additional protection – such as solvent-free epoxy coatings – may be required. Compatibility of the coating to the billet should be checked prior to applying the coating.

Skirt boards will protect foam from mechanical damage and degradation from ultraviolet light.

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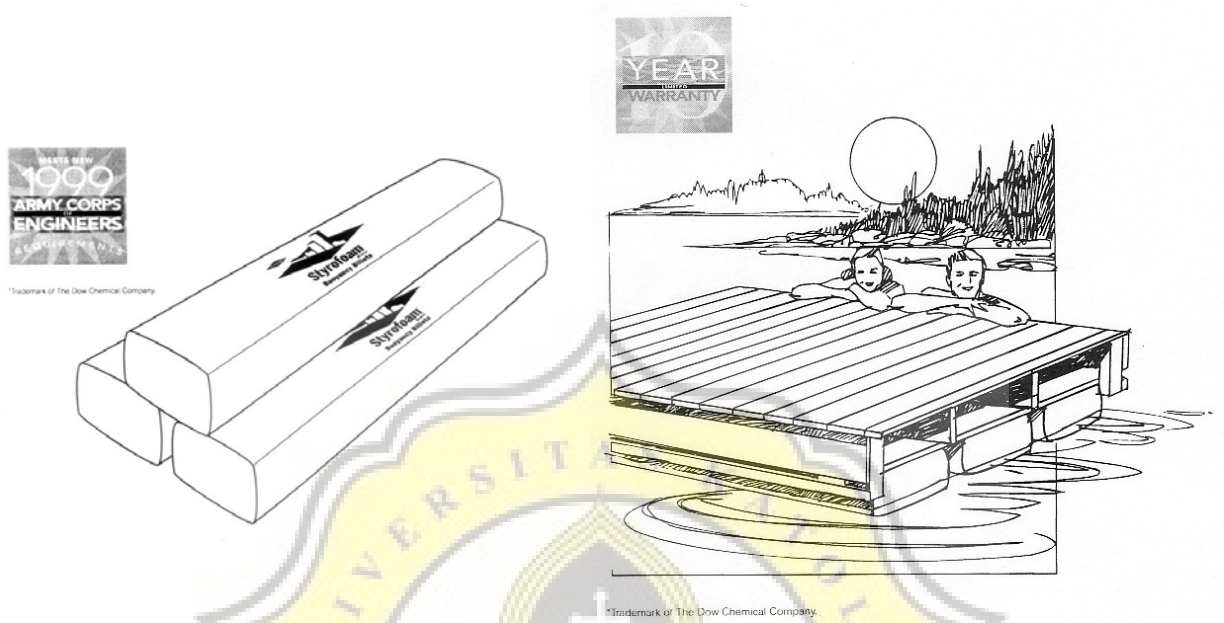
STYROFOAM™ Buoyancy Billets



STYROFOAM™ BUOYANCY BILLETS

STYROFOAM* brand Buoyancy Billets are manufactured from polystyrene foam by means of a continuous extrusion process. The process produces a foam of continuous closed cell construction with excellent long-term resistance to water absorption. Testing performed by both Dow and independent researchers has established the low water absorption and superior long-term buoyancy retention of STYROFOAM brand Buoyancy Billets. STYROFOAM brand Buoyancy Billets have been produced for over 40 years. And, in fact, many billets have been in service for over 3 years in the same structures. They are colored blue for unmistakable identification.

Because of the proven performance, STYROFOAM brand Buoyancy Billets have been approved by the U.S. Army Corps of Engineers. STYROFOAM brand Buoyancy Billets meet military specification, MIL-P-40619B (MI) Plastic material, Cellular, Polystyrene, Class 1, Grade A, (For Buoyancy Application), dated October 18, 1991.

Sizes Available:

ITEM NO.	DIMENSIONS
1-01	7” x 20” x 96”
1-02	10” x 20” x 96”
1-03	10” x 24” x 96”

See following pages for Design Guidelines and Considerations.

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STYROFOAM™ Buoyancy Billets

Calculating Your Flotation Requirements: The key in designing for long-term flotation are (1) to determine correctly the wave action you floating structure will be exposed to and (2) to bear the weight of the structure on an adequate load-bearing area of the billets. These steps will be accomplished automatically as you follow these recommendations.

Determining Your Live and Dead Loads: Your first step is to determine the live and dead loads of your floating structure.

The dead load is the weight of all framing, decking, connections, flotation units, and all permanently attached equipment, such as pipes, pumps, utilities, fire fighting equipment, gangways, etc. The weight of lumber and hardware can be estimated between 12 and 15 lbs/sq.ft. of structure.

The live load is essentially the weight of the people who will be on the floating structure adding their weight to the dead load. It is recommended that the structure be designed for approximately 40% submergence, so that the remaining 60% can be used to support the design live load, which may add between 15 and 30 lbs/sq ft more weight to the structure.

Determining Billets Needed: Your next step is to figure out how many billets you will need to float the live and dead loads you've just calculated. Start by consulting Table 1. This table shows how much weight each size billet will support at four different depths of submergence. Decide which billet size you wish to use and how deeply you want to submerge it. Then from Table 1 the accompanying buoyant force for that billet at that submergence. And divide your calculated dead load by that buoyant force.

For example, assume a swim raft with calculated dead load of 1200 pounds. Table 1 shows that a 10" x 24" billet will support 290 pounds when 40% of it is submerged. So four of these billets will support the raft (1200/290 equals 4), with a 60% of each billet floating above the waterline, a freeboard of six inches. The available live load which can now be supported on this swim raft is 1720 pounds. Here is the supporting calculation. Table 1 shows that it takes 2920 pounds to submerge these four billets 100% (4 x 730 equals 2920). So then 2920 pounds of buoyant force minus the 1200 pound dead load of the raft leaves 1720 pounds of available live load.

Determining Bearing Area Needed: Your final step is to determine how many square inches of the structure's cross-members you should place in contact with the billets to transfer the structure's weight to the billets. To determine the size of this billet contact area in square inches, multiply the dead load of the structure by the appropriate Design Factor from Table 2 (based on expected wave action). Since this is the contact area for the entire structure, and since you want to determine the contact area for each cross – member which will be bearing on the billets, divide your answer by twice the number of billets you will be using (assuming two cross-members per billet).

For example, if the aforementioned swim raft is located in sheltered waters, multiply its dead weight (1200) by the Design Factor for sheltered waters, found in Table 2 (0.24). Thus, 1200 x 0.24 equals 288. So the dead load of the raft must be spread across 288 square inches of billet surface. This comes to 72 square inches of contact area for each of the four supporting billets (288/4 equals 72). And since each billet must have contact with at least two cross-members of the structure, each cross-member should have at least 36 square inches in contact with the billet (72/2 equals 36).

Table 1. Buoyant Force of One Buoyancy Billet At Four Depths of Submergence

STYROFOAM BRAND BUOYANCY BILLETS		40% SUBMERGENCE		50% SUBMERGENCE		60% SUBMERGENCE		100% SUBMERGENCE	
		Free-board (in)	Buoyant Force (lb)	Free-board (in)	Buoyant Force (lb)	Free-board (in)	Buoyant Force (lb)	Free-board (in)	Buoyant Force (lb)
7"x20"x96"	7.78 cu.ft.	4.2	170	3.5	215	2.8	255	0	430
10"x20"x96"	11.11 cu.ft.	6	245	5	305	4	365	0	610
10"x24"x96"	13.33 cu.ft.	6	290	5	365	4	440	0	730

Table 2. Design Factors

LOCATION OF FLOATING STRUCTURE	DESIGN FACTOR
Sheltered Waters	0.24
Average Inland Lakes	0.32
Large Waters	0.40

Engineering Table 1 and 2 are based upon several factors:

1. **The minimum compressive strength of STYROFOAM brand Buoyancy Billets is 19 lbs./in.**
2. **A buoyancy safety factor has been applied to account for the weight of the foam and to account for long-term moisture absorption and incidental damage to the billets. Table 1 is based on a conservative buoyant force of 55 lbs./sq.ft of foam, rather than on 62.4 lbs/sq.ft. which is the total weight of displaced water.**
3. **Appropriate design factors have been incorporated into Table 2 to take into account (A) the slight curvature on the surface of the billets and (B) the variability in wave action between sheltered waters, inland lakes, and large waters.**

STYROFOAM™ Buoyancy Billets

DESIGN CONSIDERATIONS

Preventing Solvent Attack: Gasoline and oil can attack the billets. If the billets are to be used at fueling docks, they should be protected from accidental fuel spills by coating with a two-component polyurethane marine coating. In addition, a fiberglass mesh can be embedded in the polyurethane coating for improved coating impact resistance. As an alternate, sheet metal can be used to deflect gasoline spills. The sheet metal can be laid below the decking and should extend beyond the skirt boards.

Preventing Animal, Insect, and Plant Damage: The hard skin surface and continuous closed-cell construction of STYROFOAM brand Buoyancy Billets discourages insects, rooting plants and pecking birds. Although STYROFOAM brand Buoyancy Billets offer no food value to insects, plants or animals, the billets are occasionally damaged by saltwater crabs and muskrats. This can be prevented by running galvanized wire mesh continuously under the structure.

Preventing Ice Flow Damage: Although STYROFOAM brand Buoyancy Billets are resistant to freeze/thaw cycling, they can be damaged by the mechanical action of flowing ice, if the structure is left in the water during the winter under certain conditions. This can be prevented by removing the structure from the water during the winter.

Blueprints for Pre-engineered Flotation Structures: Blueprints are available for the construction of the following floating structures: 8'x12' swim raft (Form No. 179-4278), 20' x 20' "T" Dock (Form No. 179-4277), and 18' x 24' "U" Dock (Form No. 179-4276). These prints include a complete parts list and assembly suggestions and are ideal for the do-it-yourself builder.

NOTICE: STYROFOAM brand Buoyancy Billets are combustible. They contain no fire-retardant additives and must be protected from flame and other high heat sources. They should not be installed in virtually air-tight spaces. For more information, call Dow (1-800-441-4369.

NOTICE: Dow believes that the information and recommendations described herein are accurate and reliable as of the date printed. However, since the installer uses his or her own skill and expertise to determine the construction of each particular 8'x12' Swim Raft, 20'x20' "T" Dock, and 18'x24' "U" Dock outside the control of Dow. Dow assumes no liability or obligation in providing such information. Dow does not guarantee results from use of such products, specifications or other information. No warranty of merchantability or fitness for a particular purpose, or any other express or implied warranties are given. Since laws and use conditions may change, it is the Buyers responsibility to determine the appropriateness of Dow's products for the Buyer's specific end uses.