which provides a small measure of additional longitudinal stability and a visually pleasing outline.

The width of the squared-off tail block on the hot dog or general purpose board is usually from three to six inches. Most surfers seem to prefer about five inches. If this dimension is too small, it requires too bulgy a tail section (with poor effect on stability in turns) or too long and narrow a tail (with loss of lift).

PLANING SURFACE AND TRANSVERSE BOTTOM CURVATURE

The flatter the bottom, transversely, on a general purpose board, the more sensitive it will be to turning pressure, particularly in combination with dropped rails. This is due to the fact that the flat or relatively flat bottom surface causes the board to ride higher up on the water where it can move from side to side with less side-wall pressure to contend with. As mentioned above, a completely flat bottom causes the board to lose stability, especially in riding at high speed over thick foam left by the preceding wave. To minimize side slippage in the soup, a small skeg about 1½ inches high and 4 inches long depending from the center of the board approximately 3½ feet from the bow, has been found successful, although its use requires turning from the rear position to keep the belly-skeg airborne during the turn.

Most surfboards, of any class, have some degree of transverse curvature which blends in with rounded rails. A transverse curvature of approximately 9/16 of an inch for 18 inches of width at the forward end of the planing surface produces a satisfactory combination of turning sensitivity and stability when properly combined with other elements of design as discussed elsewhere. This curvature

may steepen in the bow section (a crown) for parting chops. For *maximum-speed capability,* whatever degree of curvature is used at the forward end of the planing surface, that amount must not change all the way aft. In other words, a template, cut to the given curvature and held at right angles to the bottom surface, could be moved aft along the planing surface and remain in contact with the bottom surface to the very end. Such a high speed planing surface is a section of an oblique cylinder. Any variation in the degree of curvature will produce drag just as longitudinal curvature or rounded breakaway edges will do.

WEIGHT

Heretofore, weight has been a factor usually considered alone. Those who wanted a more stable board preferred greater weight; those wanting a board easier to maneuver usually chose the lighter weight. At present however, the understanding is spreading that weight and maneuverability are bound in with other elements of design. A board with a quick turning bottom surface and tail features can weigh 35 or even as much as 40 pounds and still feel fairly light in riding position. On the other hand, a board weighing only 25 pounds, while vulnerable to wind and cross chop, can feel heavy and sluggish on the wave due to the shape of its bottom, tail and rails. Accordingly, as elements of design and their function become more clearly understood, there is a trend toward slightly heavier boards among surfers who prefer moderate and large waves. In combination with a faster and more maneuverable bottom design, the average weight may be effectively raised with some advantage from, say, 29 pounds for a 10 foot board to around 33 or 34 pounds or more.

COMPROMISES

The harmonizing of all the elements of design of a surfboard involves necessary compromises. This occurs, for example, in merging the planing surface of the big gun with forward elements. The planing surface has to be longitudinally flat if high speed is desired. How far forward should it extend? For straight-off riding position or a moderate slide, only the after half or one-third of the board is wetted. But on a critically sharp slide, nearly the entire inboard rail of the board is in the water, the outboard section being air-borne. This would make it desirable to extend the longitudinally flat planing surface clear up to the bow, thus eliminating the bow scoop. Such a board would be very fast, but, lacking in bow scoop, it would be highly susceptible to digging in choppy water and to pearl diving. So a compromise is necessary. The planing surface, therefore, is usually limited to approximately three to four feet maximum length measuring from the stern forward to the commencement of the scoop. The bow scoop is usually kept to approximately five to seven inches measuring the vertical distance from the planing surface to the uppermost point of the bow as shown on page 146.

The big-wave rider takes his stance for a hard-driving wall ride over the longitudinally flat planing surface, thus enabling the most efficient planing. On windy or bumpy days there is a tendency for the board to pitch which encourages the rider to take a more forward position to keep the bow down. This brings the scoop into play as additional wetted surface and slows the board due to its fore-and-aft curvature. The solution to this problem is to add weight to the board, especially to the middle and forward sections bringing the board to, say, thirty-eight or forty

pounds or even more. While this solves to some extent the problem of pitching and stability on the big fast rides, it tends to make the gun board excessively stable and even harder to turn, another of those difficult compromises.

The bottom contour of the planing surface and tail of big guns has a bearing on the board's maximum speed. The trend in the late 1950's and early 1960's was for longer thin tails. This was to insure that the skeg and tail remain water-borne during the most critical peak take-offs, peak turns and fast slides on large steep waves. Also, the pin tail is considered easier to dig in for stable bottom turns. However, opinion is now divided as to the relative speed capabilities of the narrow tail as compared to those with wider tails, other elements being the same. Some hold that the rider's weight forcing the narrow tail down into a groove in the wave wall, done to assure stability, slows the descent. Support for this view was given when the fast skim boards of John Waidelich and Jim Growney began passing guns in Hawaii's big north shore surf in 1961-62. New light was thrown on the relation between speed and the lateral shape of planing surfaces. Many surfers had previously associated high speed with the long, thin, planing surfaces of big guns. The skim boards proved that approximately the same total area, made shorter and wider, produced greater speed, breakaway edges and longitudinal flatness being the same. This view was further strengthened with the performance of the hydroplane surfboards whose planing surface is somewhat wider and shorter than that of the conventional gun. Accordingly, there is greater lift directly beneath the rider. Thus the hydros ride higher on the water and commence planing over its surface sooner, rather than grooving through the water as with the conventional pin-tail gun. This also contributes to the hydro's easier turning. No effective surfboard can be built, to the