verse bending stresses equal to Poisson's ratio times the longitudinal bending stresses are present. For rectangular beams of moderate width, Ashwell (Ref. 10) shows that the stiffness depends not only upon the ratio of depth to width of the beam but also upon the radius of curvature to which the beam is bent. For a rectangular beam of width b and depth h bent to a radius of curvature ρ by a bending moment M, these variables are related by the expression $1/\rho = M/KEI$, where $I = bh^3/12$, and the following table of values for K is given for several values of Poisson's ratio and for the quantity $b^2/\rho h$.

	$b^2/\rho h$						
Value of ν	0.25	1.00	4.00	16.0	50.0	200.	800.
0.1000	1.0000	1.0003	1.0033	1.0073	1.0085	1.0093	1.0097
0.2000	1.0001	1.0013	1.0135	1.0300	1.0349	1.0383	1.0400
0.3000	1.0002	1.0029	1.0311	1.0710	1.0826	1.0907	1.0948
0.3333	1.0002	1.0036	1.0387	1.0895	1.1042	1.1146	1.1198
0.4000	1.0003	1.0052	1.0569	1.1357	1.1584	1.1744	1.1825
0.5000	1.0005	1.0081	1.0923	1.2351	1.2755	1.3045	1.3189

In very short wide beams, such as the concrete slabs used as highway-bridge flooring, the deflection and fiber-stress distribution cannot be regarded as uniform across the width. In calculating the strength of such a slab, it is convenient to make use of the concept of *effective width*, i.e., the width of a spanwise strip which, acting as a beam with uniform extreme fiber stress equal to the maximum stress in the slab, develops the same resisting moment as does the slab. The effective width depends on the manner of support, manner of loading, and ratio of breadth to span b/a. It has been determined by Holl (Ref. 22) for a number of assumed conditions, and the results are given in the following table for a slab that is freely supported at each of two opposite edges (Fig. 8.17). Two kinds of loading are considered, viz. uniform load over the entire slab and load uniformly distributed over a central circular area of radius c. The ratio of the effective width e to the span a is given for each of a number of ratios of c to slab thickness h and each of a number of b/a values.

	Values of e/a for				
Loading	$b/a = 1$	$b/a = 1.2$	$b/a = 1.6$	$b/a = 2$	$b/a = \infty$
Uniform	0.960	1.145	1.519	1.900	
Central, $c = 0$	0.568	0.599	0.633	0.648	0.656
Central, $c = 0.125h$	0.581	0.614	0.649	0.665	0.673
Central, $c = 0.250h$	0.599	0.634	0.672	0.689	0.697
Central, $c = 0.500h$	0.652	0.694	0.740	0.761	0.770

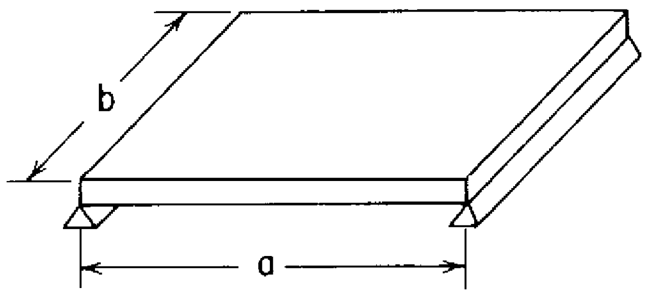

Figure 8.17

For the same case (a slab that is supported at opposite edges and loaded on a central circular area) Westergaard (Ref. 23) gives $e = 0.58a + 4c$ as an approximate expression for effective width. Morris (Ref. 24) gives $e = \frac{1}{2}e_c + d$ as an approximate expression for the effective width for midspan *off-center* loading, where e_c is the effective width for central loading and d is the distance from the load to the nearer unsupported edge.

For a slab that is *fixed* at two opposite edges and uniformly loaded, the stresses and deflections may be calculated with sufficient accuracy by the ordinary beam formulas, replacing E by $E/(1 - \nu^2)$. For a slab thus supported and loaded at the center, the maximum stresses occur under the load, except for relatively large values of c, where they occur at the midpoints of the fixed edges. The effective widths are approximately as given in the following table (values from the curves of Ref. 22). Here b/a and c have the same meaning as in the preceding table, but it should be noted that values of e/b are given instead of e/a.

Values of c	Values of e/b for				Max stress at
	$b/a = 1$	$b/a = 1.2$	$b/a = 1.6$	$b/a = 2.0$	
0	0.51	0.52	0.53	0.53	Load
$0.01a$	0.52	0.54	0.55	0.55	Load
$0.03a$	0.58	0.59	0.60	0.60	Load
$0.10a$	0.69	0.73	0.81	0.86	Fixed edges

Holl (Ref. 22) discusses the deflections of a wide beam with two edges supported and the distribution of pressure under the supported edges. The problem of determining the effective width in concrete slabs and tests made for that purpose are discussed by Kelley (Ref. 25), who also gives a brief bibliography on the subject.

The case of a very wide *cantilever* slab under a concentrated load is discussed by MacGregor (Ref. 26), Holl (Ref. 27), Jaramillo (Ref. 47), Wellauer and Seireg (Ref. 48), Little (Ref. 49), Small (Ref. 50), and others. For the conditions represented in Fig. 8.18, a cantilever plate of infinite length with a concentrated load, the bending stress σ at any point can be expressed by $\sigma = K_m(6P/t^2)$, and the deflection y at any point by $y = K_y(Pa^2/\pi D)$, where K_m and K_y are dimensionless coeffi-