

**TRANSACTIONS OF SOCIETY OF ACTUARIES
1981 VOL. 33**

**1980 CSO AND 1980 CET MORTALITY TABLES ON AN
AGE LAST BIRTHDAY BASIS**

This report presents the 1980 CSO and 1980 CET Tables on an Age Last Birthday (ALB) basis. These tables were derived from the 1980 CSO Age Nearest Birthday (ANB) Tables, with the cooperation of the Committee to Recommend New Mortality Tables for Valuation. The 1980 CSO and 1980 CET ANB Tables are also published in these *Transactions*.

By the use of the formula below, the 1980 CSO ALB Tables were derived from the 1980 CSO ANB Tables, for all ages, including age 0. In this formula, the symbol (x) denotes age at nearest birthday, and \underline{x} denotes age at last birthday.

$$q_{\underline{x}} = [q_{(x)} + (1 - q_{(x)})q_{(x+1)}]/(2 - q_{(x)}) .$$

This formula, like the formula employed in constructing the 1958 CSO ALB Tables, assumes a uniform distribution of deaths and can be derived from the following equations:

$$l_{\underline{x}} = 1/2(l_{(x)} + l_{(x+1)}) ;$$

$$d_{\underline{x}} = l_{\underline{x}} - l_{\underline{x+1}} ;$$

$$q_{\underline{x}} = d_{\underline{x}}/l_{\underline{x}} .$$

Because of the uneven distribution of exposure for age (0) and the non-uniformity of deaths within the first six months of life, alternative formulas for q_0 were considered. However, since these formulas give larger values than the alternative formulas, hence larger reserves and cash values for policies issued at age 0, no adjustment was made. This is consistent with the approach taken in 1958.

The 1980 CET ANB Tables were derived by adding to the 1980 CSO ANB Tables a loading equal to the greater of 0.75 deaths per thousand or 30 percent of the 1980 CSO mortality. The 1980 CET ALB Tables were derived from the 1980 CSO ALB Tables plus this same loading. This is a departure from the method used in 1958, when the CET ALB Table was derived from the CET ANB Table, by using the uniform distribution assumption.

The earlier method has the advantage of maintaining the relationship between ANB and ALB tables. Nonetheless, the committee considered the following points to carry greater weight:

1. The loading applied to extended term mortality (i.e., for the CET ANB tables) has been recognized as necessary and adequate. Use of a different loading, as would indirectly result from the earlier method, weakens the validity of the original loading.
2. The difference between the two methods is trivial (no more than 0.01 deaths per thousand) between ages 1 and 70. Above age 70, the method used produces higher reserves, making it more conservative.

Appendix A contains the 1980 CSO ALB Tables, and Appendix B contains the 1980 CET ALB Tables.

APPENDIX A

1980 CSO—AGE LAST BIRTHDAY

Age	Male 1,000q _z]	Female 1,000q _z]	Age	Male 1,000q _z]	Female 1,000q _z]
0	2.63	1.88	50	7.00	5.13
1	1.03	0.84	51	7.63	5.50
2	0.99	0.80	52	8.33	5.92
3	0.97	0.78	53	9.13	6.38
4	0.93	0.77	54	10.01	6.85
5	0.88	0.75	55	10.96	7.33
6	0.83	0.73	56	11.97	7.80
7	0.78	0.71	57	13.04	8.25
8	0.75	0.70	58	14.18	8.70
9	0.74	0.69	59	15.42	9.20
10	0.75	0.68	60	16.80	9.80
11	0.81	0.70	61	18.36	10.54
12	0.92	0.73	62	20.12	11.49
13	1.07	0.77	63	22.09	12.63
14	1.24	0.82	64	24.27	13.92
15	1.42	0.87	65	26.62	15.29
16	1.59	0.92	66	29.13	16.71
17	1.72	0.96	67	31.79	18.13
18	1.82	1.00	68	34.65	19.59
19	1.88	1.03	69	37.81	21.23
20	1.90	1.06	70	41.37	23.16
21	1.90	1.08	71	45.43	25.53
22	1.88	1.10	72	50.08	28.47
23	1.84	1.12	73	55.34	31.99
24	1.80	1.15	74	61.10	36.05
25	1.75	1.17	75	67.25	40.56
26	1.72	1.20	76	73.70	45.45
27	1.71	1.24	77	80.37	50.68
28	1.70	1.28	78	87.32	56.32
29	1.72	1.32	79	94.76	62.57
30	1.75	1.37	80	102.94	69.67
31	1.80	1.42	81	112.09	77.83
32	1.87	1.47	82	122.41	87.25
33	1.95	1.54	83	133.84	97.90
34	2.05	1.61	84	146.12	109.62
35	2.17	1.70	85	158.98	122.29
36	2.32	1.82	86	172.21	135.82
37	2.49	1.96	87	185.73	150.18
38	2.68	2.13	88	199.53	165.38
39	2.90	2.32	89	213.69	181.54
40	3.15	2.53	90	228.43	198.85
41	3.42	2.75	91	244.11	217.68
42	3.71	2.98	92	261.43	238.69
43	4.03	3.20	93	282.13	263.41
44	4.37	3.44	94	309.97	295.23
45	4.73	3.68	95	351.86	341.02
46	5.12	3.92	96	420.99	413.88
47	5.53	4.19	97	541.00	537.24
48	5.97	4.48	98	745.15	743.96
49	6.46	4.79	99	1,000.00	1,000.00

APPENDIX B

1980 CET—AGE LAST BIRTHDAY

Age	Male 1,000q _z	Female 1,000q _z	Age	Male 1,000q _z	Female 1,000q _z
0	3.42	2.63	50	9.10	6.67
1	1.78	1.59	51	9.92	7.15
2	1.74	1.55	52	10.83	7.70
3	1.72	1.53	53	11.87	8.29
4	1.68	1.52	54	13.01	8.91
5	1.63	1.50	55	14.25	9.53
6	1.58	1.48	56	15.56	10.14
7	1.53	1.46	57	16.95	10.73
8	1.50	1.45	58	18.43	11.31
9	1.49	1.44	59	20.05	11.96
10	1.50	1.43	60	21.84	12.74
11	1.56	1.45	61	23.87	13.70
12	1.67	1.48	62	26.16	14.94
13	1.82	1.52	63	28.72	16.42
14	1.99	1.57	64	31.55	18.10
15	2.17	1.62	65	34.61	19.88
16	2.34	1.67	66	37.87	21.72
17	2.47	1.71	67	41.33	23.57
18	2.57	1.75	68	45.05	25.47
19	2.63	1.78	69	49.15	27.60
20	2.65	1.81	70	53.78	30.11
21	2.65	1.83	71	59.06	33.19
22	2.63	1.85	72	65.10	37.01
23	2.59	1.87	73	71.94	41.59
24	2.55	1.90	74	79.43	46.87
25	2.50	1.92	75	87.43	52.73
26	2.47	1.95	76	95.81	59.09
27	2.46	1.99	77	104.48	65.88
28	2.45	2.03	78	113.52	73.22
29	2.47	2.07	79	123.19	81.34
30	2.50	2.12	80	133.82	90.57
31	2.55	2.17	81	145.72	101.18
32	2.62	2.22	82	159.13	113.43
33	2.70	2.29	83	173.99	127.27
34	2.80	2.36	84	189.96	142.51
35	2.92	2.45	85	206.67	158.98
36	3.07	2.57	86	223.87	176.57
37	3.24	2.71	87	241.45	195.23
38	3.48	2.88	88	259.39	214.99
39	3.77	3.07	89	277.80	236.00
40	4.10	3.29	90	296.96	258.51
41	4.45	3.58	91	317.34	282.98
42	4.82	3.87	92	339.86	310.30
43	5.24	4.16	93	366.77	342.43
44	5.68	4.47	94	402.96	383.80
45	6.15	4.78	95	457.42	443.33
46	6.66	5.10	96	547.29	538.04
47	7.19	5.45	97	703.30	698.41
48	7.76	5.82	98	968.70	967.15
49	8.40	6.23	99	1,000.00	1,000.00