

Appendix J-2

2001 CSO Building ALB & Gender Blended Tables

1. Naming Convention. The following method is used to identify the 84 specific tables within this memo.

- a. Template. 2001 CSO (Sex) Smoking Type Basis.
- b. Sex.
 - i. M. Male.
 - ii. F. Female.
 - iii. 80. 80 percent male, 20 percent female.
 - iv. 60. 60 percent male, 40 percent female.
 - v. 50. 50 percent male, 50 percent female.
 - vi. 40. 40 percent male, 60 percent female.
 - vii. 20. 20 percent male, 80 percent female.
- c. Smoking.
 - i. Composite. Not smoker distinct.
 - ii. Non-smoker.
 - iii. Smoker.
- d. Type.
 - i. S&U. Select & ultimate.
 - ii. U. Ultimate.
- e. Basis.
 - i. ANB. Age near birthday.
 - ii. ALB. Age last birthday.
- f. Example. 2001 CSO (80) Composite U ALB is the gender blended table based on 80 percent males, 20 percent females. This table is just the ultimate portion of the table and is age last birthday.
- g. Groups of tables. When an item is not identified, all versions of that item are included. For example, 2001 CSO (M) S&U would include all of the select & ultimate tables for males, including composite, non-smoker, smoker, age near birthday, and age last birthday.

2. Provided tables.

- a. 2001 CSO (M) Composite S&U ANB.
- b. 2001 CSO (M) Non-Smoker S&U ANB.
- c. 2001 CSO (M) Smoker S&U ANB.
- d. 2001 CSO (F) Composite S&U ANB.
- e. 2001 CSO (F) Non-Smoker S&U ANB.
- f. 2001 CSO (F) Smoker S&U ANB.

3. **2001 CSO (M or F) U ANB.** Ultimate versions of the provided tables are taken directly from the ultimate column of these tables. For attained ages less than age 25 the values from issue age 0 are used. This determines these tables.
- 2001 CSO (M) Composite U ANB.
 - 2001 CSO (M) Non-Smoker U ANB.
 - 2001 CSO (M) Smoker U ANB.
 - 2001 CSO (F) Composite U ANB.
 - 2001 CSO (F) Non-Smoker U ANB.
 - 2001 CSO (F) Smoker U ANB.

4. **2001 CSO (X) U ANB.** Gender blended versions of the ultimate tables are developed using the methodology that was used for the 1980 CSO gender blended tables. The following are the steps used to do these calculations.

{Comment: Using theoretical values based on the actual issue age was considered. This was rejected due to the complexity of the resulting tables. Using a simple blend of mortality rates was also considered. This approach was rejected since it did not reasonably reproduce values for selected theoretical issue ages. Values were also calculated using a pivot age of 55. There was only marginal difference in values from using a pivot age of 45. Thus the pivot age approach was selected using a pivot age of 45 to be consistent with the development of the 1980 CSO gender blended tables.}

- Develop l'_x 's. Male and female l'_x 's are developed using the values from 2001 CSO (M or F) U ANB, based on $l_{120} = 200$ lives. These values are rounded to the near life.
- Develop adjustment factor. The following ratio is calculated for the male table: $f^M = \frac{(l_{45}^M + l_{45}^F) \times r}{l_{45}^M}$, where r is the percentage of males. The

following ratio is calculated for the female table: $f^F = \frac{(l_{45}^M + l_{45}^F) \times (1-r)}{l_{45}^F}$.

These ratios are not rounded.

- Develop adjusted l'_x 's. Male and female l'_x 's are calculated by multiplying the appropriate ratios times the l'_x 's from a. These are rounded to the near life.
- Develop gender blended \bar{l}'_x 's. Male and female adjusted l'_x 's from c. are added together to create the gender blended \bar{l}'_x 's.
- Calculate q'_x 's. The mortality rates per 1,000 lives are calculated using the \bar{l}'_x 's from d. These mortality rates are rounded near to 2 places. The non-smoker rates were adjusted to be not greater than the comparable values from the composite tables. The smoker rates were adjusted to be not less than the comparable values from the composite tables.

- f. Tables. This step calculates the following tables.
- i. 2001 CSO (80) Composite U ANB.
 - ii. 2001 CSO (80) Non-Smoker U ANB.
 - iii. 2001 CSO (80) Smoker U ANB.
 - iv. 2001 CSO (60) Composite U ANB.
 - v. 2001 CSO (60) Non-Smoker U ANB.
 - vi. 2001 CSO (60) Smoker U ANB.
 - vii. 2001 CSO (50) Composite U ANB.
 - viii. 2001 CSO (50) Non-Smoker U ANB.
 - ix. 2001 CSO (50) Smoker U ANB.
 - x. 2001 CSO (40) Composite U ANB.
 - xi. 2001 CSO (40) Non-Smoker U ANB.
 - xii. 2001 CSO (40) Smoker U ANB.
 - xiii. 2001 CSO (20) Composite U ANB.
 - xiv. 2001 CSO (20) Non-Smoker U ANB.
 - xv. 2001 CSO (20) Smoker U ANB.

5. **2001 CSO (X) S&U ANB.** Values for the ultimate portion of these tables are taken from 2001 CSO (X) U ANB calculated in 4. This also determines all the values for issue age 0. Values for the select portion of these tables are calculated by weighting the effective selection factor from the male and female

tables using the following formula
$$q_{[x]+t}^r = q_{x+t}^r \times \frac{\left\{ \left[\frac{q_{[x]+t}^M}{q_{x+t}^M} \times s \right] + \left[\frac{q_{[x]+t}^F}{q_{x+t}^F} \times (1-s) \times \frac{q_{x+t}^F}{q_{x+t}^M} \right] \right\}}{s + \left[\frac{q_{x+t}^F}{q_{x+t}^M} \times (1-s) \right]}.$$

In this formula, s is the percentage of males for the attained age, based on the calculations in 4 $\left(s = \frac{l_{x+t}^M}{l_{x+t}^T} \right)$. These rates are rounded near to 2 places. This step calculates the following tables.

{Comment: This uses the methodology proposed by Robert J. Johansen for developing the select factors for the 1980 CSO blended tables. It can be found in the NAIC Proceedings – 1984 Volume I, page 457. The ratio s is used rather than the fixed pivot percentage described in the Johansen memorandum. Also, the actual ratio of female to male mortality is used rather than an assumed 60 percent ratio.}

- a. 2001 CSO (80) Composite S&U ANB.
- b. 2001 CSO (80) Non-Smoker S&U ANB.
- c. 2001 CSO (80) Smoker S&U ANB.
- d. 2001 CSO (60) Composite S&U ANB.
- e. 2001 CSO (60) Non-Smoker S&U ANB.

- f. 2001 CSO (60) Smoker S&U ANB.
- g. 2001 CSO (50) Composite S&U ANB.
- h. 2001 CSO (50) Non-Smoker S&U ANB.
- i. 2001 CSO (50) Smoker S&U ANB.
- j. 2001 CSO (40) Composite S&U ANB.
- k. 2001 CSO (40) Non-Smoker S&U ANB.
- l. 2001 CSO (40) Smoker S&U ANB.
- m. 2001 CSO (20) Composite S&U ANB.
- n. 2001 CSO (20) Non-Smoker S&U ANB.
- o. 2001 CSO (20) Smoker S&U ANB.

6. 2001 CSO S&U ALB. Values for these tables are calculated according to the following formulas. Values for these mortality rates per 1,000 lives are rounded near to 2 places. Except for issue age 99, values are developed from age near birthday rates that are in the same duration. For issue age 99, values are developed from different durations.

{Comment: Values were calculated using two approaches. The first is as described here. The second approach developed gender blended ALB U values first, then S&U values from these U values. There was not a material difference in values, so it was decided to use the easier approach described here.}

a. Issue age 99.
$$q_{[99]+t}^{ALB} = \left\{ \frac{q_{[99]+t}^{ANB} + [(1 - q_{[99]+t}^{ANB}) \times q_{[99]+t+1}^{ANB}]}{2 - q_{[99]+t}^{ANB}} \right\}.$$

b. Other issue ages and ultimate rates.
$$q_{[x]+t}^{ALB} = \left\{ \frac{q_{[x]+t}^{ANB} + [(1 - q_{[x]+t}^{ANB}) \times q_{[x]+t+1}^{ANB}]}{2 - q_{[x]+t}^{ANB}} \right\}.$$

c. The following tables are developed from this step.

- i. 2001 CSO (M) Composite S&U ALB.
- ii. 2001 CSO (M) Non-Smoker S&U ALB.
- iii. 2001 CSO (M) Smoker S&U ALB.
- iv. 2001 CSO (F) Composite S&U ALB.
- v. 2001 CSO (F) Non-Smoker S&U ALB.
- vi. 2001 CSO (F) Smoker S&U ALB.
- vii. 2001 CSO (80) Composite S&U ALB.
- viii. 2001 CSO (80) Non-Smoker S&U ALB.
- ix. 2001 CSO (80) Smoker S&U ALB.
- x. 2001 CSO (60) Composite S&U ALB.
- xi. 2001 CSO (60) Non-Smoker S&U ALB.
- xii. 2001 CSO (60) Smoker S&U ALB.
- xiii. 2001 CSO (50) Composite S&U ALB.
- xiv. 2001 CSO (50) Non-Smoker S&U ALB.
- xv. 2001 CSO (50) Smoker S&U ALB.
- xvi. 2001 CSO (40) Composite S&U ALB.

- xvii. 2001 CSO (40) Non-Smoker S&U ALB.
- xviii. 2001 CSO (40) Smoker S&U ALB.
- xix. 2001 CSO (20) Composite S&U ALB.
- xx. 2001 CSO (20) Non-Smoker S&U ALB.
- xxi. 2001 CSO (20) Smoker S&U ALB.

7. 2001 CSO (X) U ALB. Ultimate versions of the age last birthday tables are taken directly from the ultimate column of these tables. For attained ages less than age 25 the values from issue age 0 are used. This determines these tables.

- a. 2001 CSO (M) Composite U ALB.
- b. 2001 CSO (M) Non-Smoker U ALB.
- c. 2001 CSO (M) Smoker U ALB.
- d. 2001 CSO (F) Composite U ALB.
- e. 2001 CSO (F) Non-Smoker U ALB.
- f. 2001 CSO (F) Smoker U ALB.
- g. 2001 CSO (80) Composite U ALB.
- h. 2001 CSO (80) Non-Smoker U ALB.
- i. 2001 CSO (80) Smoker U ALB.
- j. 2001 CSO (60) Composite U ALB.
- k. 2001 CSO (60) Non-Smoker U ALB.
- l. 2001 CSO (60) Smoker U ALB.
- m. 2001 CSO (50) Composite U ALB.
- n. 2001 CSO (50) Non-Smoker U ALB.
- o. 2001 CSO (50) Smoker U ALB.
- p. 2001 CSO (40) Composite U ALB.
- q. 2001 CSO (40) Non-Smoker U ALB.
- r. 2001 CSO (40) Smoker U ALB.
- s. 2001 CSO (20) Composite U ALB.
- t. 2001 CSO (20) Non-Smoker U ALB.
- u. 2001 CSO (20) Smoker U ALB.