2003 SOA Pension Plan Turnover Study
Summary and Practical Guidance

This summary is intended to provide the pension actuary with guidance in interpreting and using the termination and retirement information in the 2003 SOA Pension Plan Termination and Retirement Study[1]. The tables in the study were developed based on 1.7 million life years of data from 112 plans collected primarily from actuarial consulting firms for the period 1995 – 2000. The guidance provided here is produced by the Non-Mortality Decrement Task Force of the Society of Actuaries and is intended to help the pension actuary use these tables to best advantage. However, the actuary should always exercise judgment in applying the tables and using the methods described here, rather than apply any guidance given here without consideration.

The full 2003 SOA turnover study has more detailed information on termination and other turnover decrements and how they vary based on various characteristics of the individual, the pension plan or the employer. It will be useful to consult the full report (available on the SOA web site) to better understand how to use the tables presented here.

Key Observations

- The five core tables in this summary will be useful primarily for providing termination rates. They are based on a large, diverse amount of experience.
- Retirement rates are also shown for the Basic Age Table, but may be more difficult to directly apply.
- The shape of the termination curve is convex (rates drop more rapidly at younger ages or fewer years of service). Note that the shape of the standard T-tables is concave, which is not consistent with this study or other recent studies of turnover experience. The T-tables were based on practical experience and intuition, rather than experience data.
- Termination rates are highly correlated with both age and service, but vary more by service in the early years.
- Termination rates are slightly higher for females than males at ages 25-55, but this study showed a much smaller difference than in prior studies.

The Termination Tables

Five core tables were pulled from the 2003 SOA study for this summary document: a basic age table; a basic service table; a small (1000 lives or less) plan age table; a small (1000 lives or less) plan service table; and a select and ultimate table. They should be useful to actuaries looking for rates to use in actuarial valuations of pension plans. The tables are described below. Suggestions for how to use the tables follow the descriptions.

The Basic Age Table – This table is based on all the data that were not rejected for the study. It includes information for different types of pay (hourly, salaried), employment (union, non-union), plan (final average, career average, flat benefit, hybrid), industry, etc. It shows both termination and retirement rates. Rates are determined by age. The

termination rates were smoothed by the Whittaker-Henderson Type B graduation method. Retirement rates are not smoothed because sharp increases and decreases in the rates at certain ages are expected. Retirement rates in the table reflect experience from plans with different early retirement eligibility and benefit provisions. There was a relatively small amount of data available at the lowest ages (under 22) and actuaries may want to further smooth rates at those ages based on their own judgment.

The Basic Service Table – This table is based on all the data that were not rejected for the study. It includes information for different types of pay (hourly, salaried), employment (union, non-union), plan (final average, career average, flat benefit, hybrid), industry, etc. Termination rates are determined by year of service. The rates were smoothed by the Whittaker-Henderson Type B graduation method. The "new hire" rate is for participants entering the population during the year. The "0" rate is for participants in the population at the beginning of the year but with less than a full year of service.

The Select & Ultimate Table – This table is based on all the data that were not rejected for the study. It includes information for different types of pay (hourly, salaried), employment (union, non-union), plan (final average, career average, flat benefit, hybrid), industry, etc. This table shows rates of termination for four service categories by age. The rates were smoothed by the Whittaker-Henderson Type B graduation method. The rates at the lowest ages in each category are based on a small amount of data and actuaries may want to further smooth rates based on their own judgment.

Small (1000 lives or less) Plan Age Table – This table is based on the data for plans with less than 1,000 active participants (68 plans and 82,000 life years). Termination rates are somewhat higher than in the Basic Age Table, and more so at the younger ages. Rates are determined by age. The rates were smoothed by developing a multinomial logit formula* to predict the probability of termination based on age, from the data.

Small (1000 lives or less) Plan Service Table – This table is based on the data for plans with less than 1,000 active participants (68 plans and 82,000 life years). Termination rates are somewhat higher than in the basic service table, until about 20 years of service. Rates are determined by year of service. The rates were smoothed by developing a multinomial logit formula* from the data to predict the probability of termination based on years of service.

* This statistical technique allows the rates for the small plan tables to incorporate information from the non-small plan data into the development of the rates. The rates in these tables can be expressed succinctly as formulae. The formulae are shown just before the small plan tables at the end of this document.

Suggestions for Using the Core 2003 SOA Tables:

The suggestions presented below should help you understand some of the typical ways that the Non-Mortality Decrement Task Force expects that actuaries can use these tables.

- If you have enough experience data to develop rates for each age and/or service level you may not need the tables from this study, except for comparison purposes. The 2003 SOA tables may help you to develop more appropriate select and ultimate rates if you don't have enough data for each of the age/service cells that you want to have.
- In many cases (e.g. for populations from a few hundred up to several thousand participants), you will have enough data to adjust the standard rates. You can use the expected rates in one of the core 2003 SOA tables and adjust the rates in the table up or down based on your plan's actual experience. For example, start with your plan's actual experience. Calculate the aggregate (sum of) termination rates for ages less than 30, for ages 30-40 and for age 40 and over and compare each of these to the corresponding sum of termination rates in the 2003 SOA Basic Age Table. Multiply all the 2003 SOA rates in each of the age ranges by the ratio of your plan's experience to the sum of the termination rates for that age range in the 2003 SOA table. Use your judgment with regard to the right age ranges for this technique and smoothing and rounding.
- If you are working with a small plan with little credible experience, you could use the 2003 SOA small plan table, with no adjustment.
- If you have a population with little experience data and you are using a Frees 2003 SOA table, you may want to consider adjustments for any of the following: career average pay plan (lower rates: 90%-99% adjustment factor); hybrid plan (higher rates: 101% - 110% adjustment factor); union hourly (lower rates: 70% - 99% adjustment factor); non-union hourly (higher rates: 101% - 130% adjustment factor); existence of postretirement medical or large plan or large employer (lower rates: 80% - 99% adjustment factor). The postretirement medical, large plan and large employer factors are presumed to be interrelated, so that one would not need to adjust separately for each factor.   Of course, other factors may also be interrelated. These factors are only provided as rough guides. See the full 2003 SOA turnover study for more information on these factors.

Retirement Rates

The 2003 SOA Study includes calculation of retirement rates from the data and retirement rates are shown in the Basic Age Table which follows. The formulas and tables of retirement information may be of interest and useful to many actuaries. The problem with applying the rates determined in the study is that there is no differentiation by early retirement eligibility and benefit adjustment provisions. For example, the rates in the study are based on all plans – those that provide unreduced benefits after 30 years of service, regardless of age, are not differentiated from those that provide unreduced benefits at age 60, or those that reduce all benefits before age 65. Further differentiation of retirement provisions in future data may help provide more directly useful retirement rate information. The information now provided may help actuaries judge the significance of reaching certain milestone ages or may provide other useful information.

Other Considerations in Using the 2003 SOA Tables

Of course, it is not certain that any of the conclusions of the study will apply to the plan population that you are valuing. A particular table or adjustment from this study may be a good estimate of termination for a certain type of plan population, but not work well for your plan population, even though it is the same type of population as in the study.

For the most part, no cause and effect relationships have been identified in the study, so the user must presume that the same correlation identified in the study will exist for the population being valued. Apply judgment and other available information when deciding how to use the tables and adjustments presented here.

Select Rates and Use of Service vs. Use of Age

The study showed that termination rates vary as much or more with service than with age, especially in the early service years. Consequently, in many situations, use of tables based only on service can be just as appropriate as use of tables based only on age. Actuaries should always consider the use of a select and ultimate table since both service and age affect termination rates. The data in the study indicate that a 10-year select period will capture the years when rates vary most for each year of service. Any select period up to 10 years should improve the 'accuracy' of the table. Whether or not this has a material effect on the actuarial liability measurement is for the actuary to judge.

Rates versus Probabilities

Actuaries will be familiar with the concept of a probability (the probability of terminating in the next year) in contrast to a rate (the rate of termination at any age; the central rate of termination for the next year). The term "rate" in this paper is used for what are technically probabilities - the term "rate" is used informally. To convert the probabilities in the tables to central rates use the following approximation:

$$R(termination) = P(termination)/(1 – 0.5*P(termination+retirement))$$

Other

The 2003 SOA study showed various other interesting results. For example, one of the most potentially interesting trends identified was that termination rates for union hourly workers are significantly lower than those for salaried workers which are significantly lower than those for non-union hourly workers. However, in general, this and other trends were judged to be supported by too little data (too few life years or too few plans). Hopefully additional data collected in the future will make it possible to produce more specialized tables. Readers of this document are encouraged to read the full 2003 SOA report for more information.

Another potential addition to the study in the future will be a select and ultimate table showing termination rates for every year of service up to 10 years.

[1]Pension Plan Termination and Retirement Study by Edward W. Frees in cooperation with the Society of Actuaries Non-Mortality Decrement Task Force, Published 2003; available at www.soa.org.

2003 SOA Pension Plan Turnover Study
The Basic Age Table

Age Nearest Birthday	Turnover per 100 lives	
	Termination	**Retired***
18	35.72	0.00
19	19.71	0.00
20	17.46	0.00
21	21.23	0.00
22	22.25	0.00
23	21.82	0.00
24	20.19	0.00
25	18.51	0.00
26	16.99	0.00
27	15.53	0.00
28	14.15	0.00
29	13.02	0.00
30	12.19	0.00
31	11.44	0.00
32	10.70	0.00
33	9.91	0.00
34	9.25	0.00
35	8.78	0.00
36	8.37	0.00
37	8.00	0.00
38	7.58	0.00
39	7.23	0.00
40	7.00	0.00
41	6.72	0.00
42	6.54	0.00
43	6.43	0.00
44	6.33	0.00
45	6.21	0.00
46	6.10	0.00
47	5.98	0.00
48	5.92	0.00
49	5.85	0.09
50	5.63	0.68
51	5.48	0.61
52	5.35	0.72
53	5.10	0.89
54	4.32	2.75
55	2.92	6.50
56	2.25	5.81
57	2.06	6.38
58	2.12	6.61
59	2.27	8.71
60	2.20	11.20
61	2.33	14.89
62	2.56	20.72
63	2.50	15.98
64	2.62	23.25
65	2.82	35.20
66	2.94	21.38
67	2.85	16.84
68	2.94	19.68
69	3.50	23.19
70	4.03	21.13
Aggregate	8.76	1.08

* Retirement rates are not recommended for direct application in any one plan as they reflect rates of retirement in plans with many different early retirement eligibility and benefit provisions.

2003 SOA Pension Plan Turnover Study
The Basic Service Table

Completed Years of Service	Turnover per 100 lives
	Termination
new hires	16.42
0	17.13
1	16.02
2	15.63
3	11.98
4	9.87
5	8.34
6	7.36
7	6.46
8	5.88
9	5.13
10	4.91
11	4.55
12	4.16
13	3.92
14	3.92
15	3.66
16	3.45
17	3.23
18	2.96
19	2.96
20	2.81
21	2.66
22	2.49
23	2.31
24	2.31
25	2.12
26	2.11
27	1.91
28	1.75
29	1.66
30	1.52
31	1.34
32	1.31
33	1.02
34	0.71
35	0.40
36	0.20
37	0.00
38	0.00
39	0.00
40	0.00
41	0.00
42	0.00
43	0.00
44	0.00
45	0.00
46	0.00
47	0.00
48	0.00
49	0.00
50	0.00
51	0.00
Aggregate	8.67

2003 SOA Pension Plan Turnover Study
The Select & Ultimate Table

Age Nearest Birthday	Turnover per 100 lives				
	Service < 2	Service = 2, 3, 4	Service = 5-9	Service ≥ 10	Overall
18	39.64				35.72
19	20.23				19.71
20	17.99	14.19			17.46
21	22.38	18.19			21.23
22	24.07	19.60	15.00		22.25
23	23.85	19.58	15.09		21.82
24	22.70	18.32	14.25		20.19
25	21.74	17.14	12.96		18.51
26	20.95	16.27	11.29		16.99
27	20.41	15.29	9.97		15.53
28	19.42	14.52	9.15	8.75	14.15
29	18.73	13.93	8.69	5.21	13.02
30	18.61	13.58	8.39	4.84	12.19
31	18.83	13.09	8.02	5.39	11.44
32	18.32	12.60	7.76	5.47	10.70
33	17.39	11.97	7.56	5.30	9.91
34	16.94	11.33	7.37	5.15	9.25
35	16.78	11.02	7.15	5.02	8.78
36	16.69	10.98	6.85	4.87	8.37
37	16.29	10.99	6.68	4.68	8.00
38	16.00	10.77	6.44	4.43	7.58
39	15.36	10.59	6.27	4.32	7.23
40	15.91	10.35	6.01	4.15	7.00
41	15.94	10.01	5.89	3.93	6.72
42	16.05	9.72	5.84	3.86	6.54
43	15.98	9.71	5.75	3.81	6.43
44	15.88	9.62	5.77	3.79	6.33
45	15.48	9.47	5.82	3.73	6.21
46	15.61	9.54	5.81	3.64	6.10
47	15.30	9.47	5.61	3.66	5.98
48	15.15	9.37	5.52	3.70	5.92
49	15.53	9.02	5.60	3.65	5.85
50	15.60	8.90	5.32	3.49	5.63
51	15.35	9.32	5.13	3.38	5.48
52	14.35	9.52	4.99	3.35	5.35
53	14.34	9.24	4.70	3.22	5.10
54	14.17	8.80	4.12	2.37	4.32
55	13.52	7.82	2.59	0.88	2.92
56	12.84	7.49	1.84	0.23	2.25
57	12.66	7.67	1.54	0.11	2.06
58	12.74	7.68	1.58	0.22	2.12
59	13.50	7.94	1.92	0.31	2.27
60	13.63	7.84	2.12	0.20	2.20
Aggregate	18.52	12.60	6.78	3.59	8.76

Multinomial Logit Model Formulas Used to Derive the Small Plan Age and Small Plan Service Table

The following are formulas for calculating the Termination rates in the Small Plan Age Table and Small Plan Service Table. For more details on the application of multinomial logit models, see Section 3 and Appendix B of the 2003 SOA turnover study.

Small Plan Age Table

$V_{i,\text{Retirement}} =$ **-19.081 + 0.276 x Age**

$V_{i,\text{Termination}} =$ **-0.010 - 0.056 x Age**

$$\text{Termination Rate} = \frac{\exp(V_{i,\text{Termination}})}{1 + \exp(V_{i,\text{Retirement}}) + \exp(V_{i,\text{Termination}})}$$

Small Plan Service Table

$V_{i,\text{Retirement}} =$ **-5.821 + 0.103 x Completed Years of Service**

$V_{i,\text{Termination}} =$ **-1.397 - 0.112 x Completed Years of Service**

$$\text{Termination Rate} = \frac{\exp(V_{i,\text{Termination}})}{1 + \exp(V_{i,\text{Retirement}}) + \exp(V_{i,\text{Termination}})}$$

2003 SOA Pension Plan Turnover Study
Small (1000 lives or less) Plan Age Table

Age Nearest Birthday	Turnover per 100 lives Termination
18	26.4
19	25.4
20	24.3
21	23.3
22	22.3
23	21.3
24	20.4
25	19.5
26	18.6
27	17.8
28	17.0
29	16.2
30	15.5
31	14.7
32	14.0
33	13.4
34	12.7
35	12.1
36	11.5
37	11.0
38	10.4
39	9.9
40	9.4
41	9.0
42	8.5
43	8.1
44	7.7
45	7.3
46	6.9
47	6.6
48	6.2
49	5.9
50	5.6
51	5.3
52	5.0
53	4.7
54	4.5
55	4.2
56	4.0
57	3.7
58	3.5
59	3.3
60	3.0
61	2.8
62	2.6
63	2.3
64	2.1
65	1.9
66	1.7
67	1.4
68	1.2
69	1.0
70	0.8
Aggregate	9.9

2003 SOA Pension Plan Turnover Study
Small (1000 lives or less) Plan Service Table

Completed Years of Service	Turnover per 100 lives Termination
new hires	21.6
0	19.8
1	18.1
2	16.5
3	15.0
4	13.6
5	12.3
6	11.2
7	10.1
8	9.1
9	8.2
10	7.4
11	6.7
12	6.0
13	5.4
14	4.9
15	4.4
16	3.9
17	3.5
18	3.2
19	2.8
20	2.5
21	2.3
22	2.0
23	1.8
24	1.6
25	1.4
26	1.3
27	1.1
28	1.0
29	0.9
30	0.8
31	0.7
32	0.6
33	0.6
34	0.5
35	0.4
36	0.4
37	0.3
38	0.3
39	0.3
40	0.2
41	0.2
42	0.2
43	0.2
44	0.1
45	0.1
46	0.1
47	0.1
48	0.1
49	0.1
50	0.1
51	0.1
Aggregate	**9.9**