



 Segal Consulting

North Dakota Teachers' Fund for Retirement

Experience Review

July 2009 – June 2014

April 30, 2015

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Agenda

- Overview
- Economic Assumptions
 - Inflation
 - Salary Increase
 - Payroll Growth
 - Investment Return
- Demographic Assumptions
 - Termination
 - Disability
 - Retirement
 - Mortality
 - Spouse Information
- Cost Impact
- Appendix

Overview: Purpose of an Experience Study

- An experience study provides the basis for developing recommended assumptions to be used in the annual actuarial valuation
 - Performed on a periodic basis, typically every five years
 - Last TFFR experience study was conducted in 2009 for the 5-year period ending June 30, 2009
 - Current study is based on the period July 1, 2009 through June 30, 2014
- Actuarial Standards of Practice #27 and #35 provide guidance on best practices for performing assumption-setting analysis
 - Each assumption should be the actuaries best estimate
- Segal's role is to make appropriate "best estimate" recommendations to the Board for each assumption
 - The assumptions are the Board's assumptions and the Board can adopt all, none, or some of the recommendations of the actuary

Overview: How Assumptions Are Set

- Review past experience
- Compare past experience (“actual”) with assumptions (“expected”)
- Determine trends – make judgments about future
- Develop component parts of each assumption
 - Maintain linkage with investments
 - Maintain internal consistency
- Keep in mind
 - No “right” answer – best estimate
 - Assumptions are long-term

Overview: Actuarial Assumptions

Demographic

- Termination
- Disability
- Retirement
- Death after retirement
- Death in active service

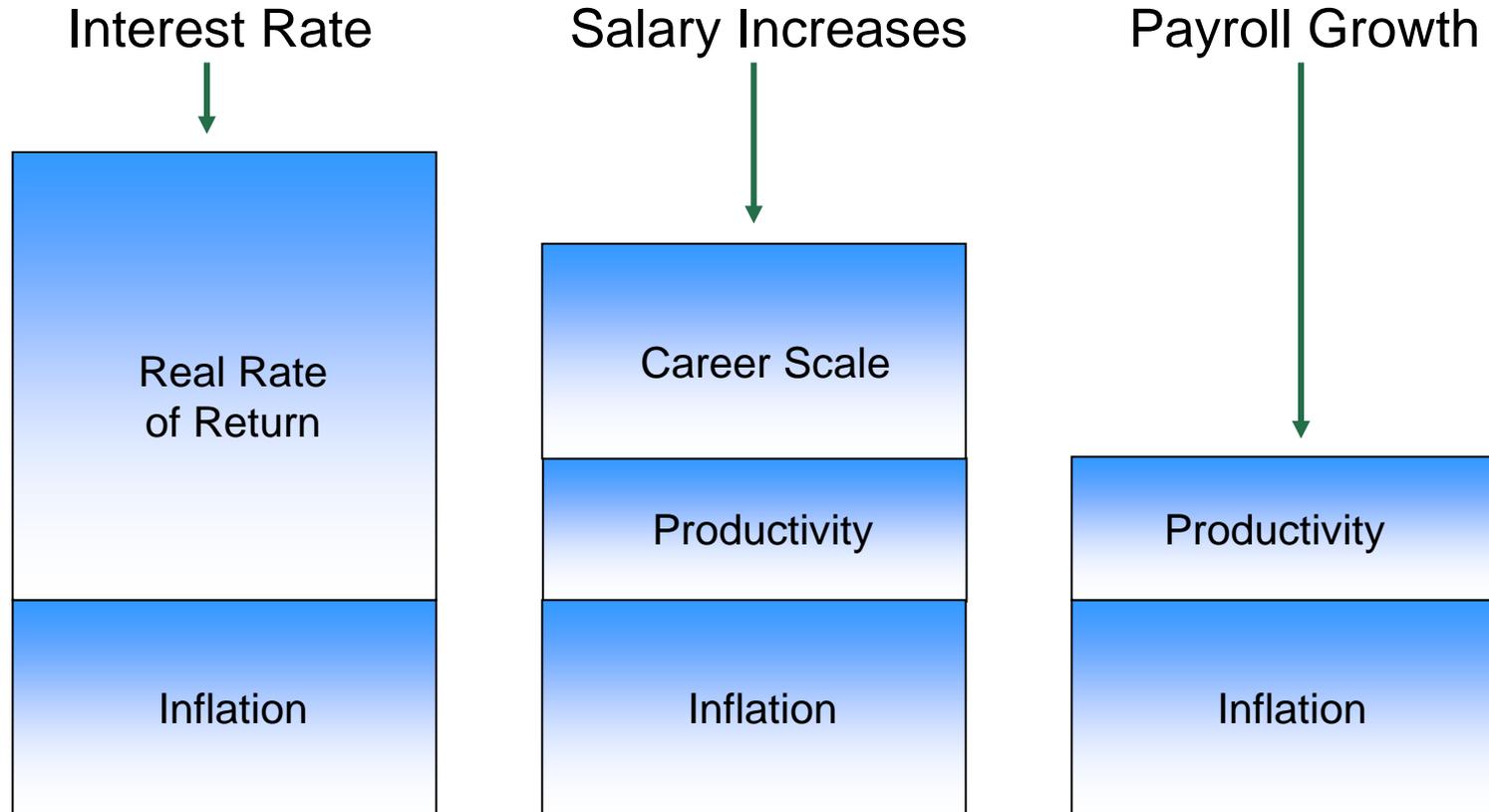
Economic

- Inflation
- Salary increase
- Payroll growth
- Investment return

Actuaries make assumptions as to when and why a member will leave active service and estimate the amount and duration of the pension benefits paid.

Building Block Method – Basis for Setting Economic Assumptions

Each economic assumption has 2 or 3 components (or building blocks)



**Building blocks should be consistent across all economic assumptions,
but may be adjusted for conservatism.**

Assumed Rate of Inflation

- Inflation represents the annual increase in the cost of living.
- The inflation assumption, currently 3.00%, indirectly affects the valuation.
 - Inflation is a component of the following economic assumptions:
 - Investment return
 - Payroll growth
 - Individual salary increases
- Segal's recommendation is to lower the assumption from 3.00% to 2.75%. This recommendation is based on:
 - Current market expectations indicate that low inflation is expected to continue; and
 - Both Callan and Segal Rogerscasey expect inflation to be less than 2.50% over the next 10-20 years.

Assumed Rate of Inflation *(continued)*

- As of June 30, 2014, the historical national inflation (CPI-U) averages are:
 - 5-year average is 2.02%.
 - 10-year average is 2.31%.
 - 20-year average is 2.41%.
 - 30-year average is 2.81%.
 - 50-year average is 4.16%.
- In addition to historical inflation, other metrics to consider are current market expectations and inflation assumptions used for similar pension plans.

Assumed Rate of Inflation *(continued)*

- By observing the difference between the yields on US Treasury bonds with and without inflation indexing, we can calculate the rate of inflation that investors expect.
- As of June 2014, the yields on 30-year Treasury bonds were as follows:
 - Inflation indexed: 1.03%
 - Non-inflation indexed: 3.39%
 - The difference between these figures is 2.36%.
 - This difference of 2.36% represents the financial market's current expectations of inflation over the next 30 years.
- Social Security uses three inflation assumptions to project its future financial status:
 - Low inflation of 2.0%;
 - Moderate inflation of 2.7%; and
 - High inflation of 3.4%.

Assumed Rate of Inflation *(continued)*

- The National Association of State Retirement Administrators (NASRA) Public Fund Survey collects general information on 126 public pension systems.
- The median inflation assumption of these 126 systems is 3.00%.
- We recommend that the Board adopt an assumption that falls between:
 - The rate indicated by financial market data; and
 - The median rate used by peer retirement systems.

We recommend that the Board lower the inflation assumption from 3.00% to 2.75%.

Assumed Rate of Payroll Growth

- The amortization of the unfunded actuarial accrued liability (UAAL) is calculated as a level percentage of payroll over a closed period of time.
 - The amortization amount is expected to increase each year as payroll increases (i.e., amortization payments are back loaded.)
 - The payroll growth assumption is used to estimate the annual increase in total payroll.
- A lower payroll growth assumption is more conservative.
 - A lower payroll growth assumption results in larger amortization payments.
 - For example, a 0% payroll growth assumption uses level amortization payments, similar to a mortgage.
- The current payroll growth assumption of 3.25% consists of the following components:
 - Inflation: 3.00%
 - Productivity: 1.50%
 - Adjustment for conservatism: -1.25%

Assumed Rate of Payroll Growth *(continued)*

- As the recommended inflation component is 2.75%, we need to examine the productivity component.
- Productivity can be measured as the excess of the increase in the National Average Wage over inflation.
 - The 20-year average of the National Average Wage is 3.4%.
 - The 20-year average inflation is 2.4%.
 - Therefore, productivity has averaged about 1.0% over the last 20 years.
 - We expect productivity in North Dakota to be greater than the national average due to its overall strong economy.
- We recommend no change in the 1.50% productivity component of the payroll growth assumption.

Assumed Rate of Payroll Growth *(continued)*

- The following table summarizes the Fund's historical payroll and active population growth:

Year Ended June 30	Covered Payroll (\$ in Millions)	Active Members
1994	\$262.4	9,653
1999	314.6	10,046
2004	376.5	9,826
2009	440.0	9,707
2014	557.2	10,305

- 5-year average: 4.8% 1.2%
- 10-year average: 4.0% 0.5%
- 15-year average: 3.9% 0.2%
- 20-year average: 3.8% 0.3%

- Based on the 30-year open group projection (level active population) used in connection with the July 1, 2014, actuarial valuation, projected total payroll increased by 3.23% per year, on average.

Assumed Rate of Payroll Growth *(continued)*

- The following table summarizes the components of the current and recommended payroll growth assumption:

Component	Current	Recommended
Inflation	3.00%	2.75%
Productivity	1.50%	1.50%
Adjustment for Conservatism	<u>-1.25%</u>	<u>-1.00%</u>
Total	3.25%	3.25%

- We recommend no change to the 3.25% payroll growth assumption and to maintain the conservative approach.

Assumed Rate of Individual Salary Increases

- Individual member salary increases components:
 - Inflation
 - Productivity
 - Merit and seniority increases
- Since merit and seniority increases are unique to each retirement system, it is appropriate to base this assumption on recent experience.
 - We study the merit and seniority increases (plus productivity) separately from inflation.
 - Between 2009 and 2014, inflation averaged 2.0%.

Assumed Rate of Individual Salary Increases

(continued)

- The following table compares the actual and expected individual salary increases over the past 5 years, adjusted to remove actual annual inflation of about 2%.

Service Range	Actual Increase	Expected Increase
0 – 4	7.84%	7.25%
5 – 9	4.30%	4.57%
10 – 14	3.62%	3.76%
15 – 19	3.07%	3.25%
20 – 24	2.69%	2.89%
25 – 29	2.39%	2.50%
30+	2.06%	2.50%
Total	4.01%	4.10%

- Based on this experience, we recommend no change to the merit and seniority (and productivity) portion of individual salary increases.

Assumed Rate of Individual Salary Increases

(continued)

- The following tables show the total current and proposed individual salary increase assumption by years of service.
- The only change is a 0.25% reduction due to lower recommended inflation.

Years of Service	Current Total Salary Increase Rate	Proposed Total Salary Increase Rate
0 – 0.99	14.75%	14.50%
1 – 1.99	8.00%	7.75%
2 – 2.99	7.75%	7.50%
3 – 3.99	7.50%	7.25%
4 – 4.99	7.25%	7.00%
5 – 5.99	7.00%	6.75%
6 – 6.99	6.75%	6.50%
7 – 7.99	6.50%	6.25%

Years of Service	Current Total Salary Increase Rate	Proposed Total Salary Increase Rate
8 – 9.99	6.25%	6.00%
10 – 11.99	6.00%	5.75%
12 – 13.99	5.75%	5.50%
14 – 15.99	5.50%	5.25%
16 – 18.99	5.25%	5.00%
19 – 22.99	5.00%	4.75%
23 – 24.99	4.75%	4.50%
25+	4.50%	4.25%

Salary Spiking Prior to Retirement

- We studied salary increases during the last 5 years of employment before retirement for members who have retired since 2009.
 - We found that there are some members whose salary dramatically increased (“spiked”) in the years leading up to retirement.
 - However, there were also members who received smaller salary increases than expected.
 - Therefore, in aggregate, the salary increases near retirement are consistent with the current assumption.
- While this salary spiking is built into the assumption and requires no additional change, if salary spiking is not desired, the Board may want to consider taking action. For example:
 - School districts must pay for actuarial cost of salary increases above x%
 - Within 5 years of retirement, increases above y% are not pensionable
- The table on the following slide shows the average salary increase by year for recent retirees as well as for all active members.

Salary Spiking Prior to Retirement *(continued)*

Average Salary Increase

Year Ending June 30,	2011 Retirements	2012 Retirements	2013 Retirements	2014 Retirements	Average Salary Increase for Actives Age 50 and Older Who Did Not Retire in 2011-2014.
2008	5.09%	5.42%			5.16%
2009	5.04%	4.90%	4.58%		5.08%
2010	4.47%	5.04%	4.96%	4.87%	5.58%
2011		4.77%	4.47%	4.78%	4.94%
2012			3.80%	4.29%	4.00%
2013				3.12%	4.23%

Assumed Rate of Investment Return

- The current investment return assumption of 8.00% consists of two components:
 - Inflation: 3.00%
 - Real rate of return: 5.00%, net of 0.65% for investment and administrative expenses
 - Real return represents the excess of what the assets earn over inflation
 - Our approach is to analyze inflation and real return separately
- Currently, the assumed real rate of return is 5.00%, net of 0.65% for expected investment and administrative expenses.
 - We recommend removing the administrative expense from the investment return assumption and adding an explicit load to the normal cost.
 - This approach is required by the Governmental Accounting Standards Board (GASB) for GASB 68 purposes.

Assumed Rate of Investment Return *(continued)*

- The following table shows that **investment expenses** over the last 5 years have been about 0.79% of the market value of assets (MVA):

Year Ended June 30	Market Value of Assets (\$ in Thousands)	Investment Expense (\$ in Thousands)	Investment Expense (% of MVA)
2010	\$ 1,437,950	\$ 14,961	1.04%
2011	1,726,179	14,019	0.81%
2012	1,654,150	12,044	0.73%
2013	1,839,584	14,206	0.77%
2014	<u>2,090,977</u>	<u>13,771</u>	<u>0.66%</u>
Total	\$ 8,748,840	\$69,001	0.79%

Assumed Rate of Investment Return *(continued)*

- While average investment expenses as a % of MVA over the last 5 years have been about 0.79%, investment expenses declined by an average of 9.5 basis points per year.
 - 11 basis point drop in the most recent fiscal year end.
- RIO notes that SIB client assets under management increased by 56% in the past two fiscal years
 - From \$6.0 billion at 6/30/2012 to \$9.4 billion at 6/30/2014
- This robust asset growth has allowed RIO to increase its negotiating leverage with investment managers, which has been instrumental in reducing investment fees (in bps).
 - RIO expects this trend to continue in future years.
- Considering actual recent experience and expected future trends, we recommend lowering the expected real rate of return by 0.50% to account for investment expenses.

Assumed Rate of Investment Return *(continued)*

- The following table shows that **administrative expenses** over the last 5 years have been about 0.34% of payroll:

Year Ended June 30	Covered Payroll (\$ in Thousands)	Administrative Expense (\$ in Thousands)	Administrative Expense (% of Payroll)
2010	\$ 465,000	\$ 1,903	0.41%
2011	488,800	2,004	0.41%
2012	505,300	1,597	0.32%
2013	526,700	1,624	0.31%
2014	<u>557,200</u>	<u>1,586</u>	<u>0.28%</u>
Total	\$2,543,000	\$ 8,714	0.34%

- We recommend removing the administrative expense from the investment return assumption and increasing the normal cost by the prior year's administrative expenses plus inflation, which will be converted to a percentage of payroll in the actuarially determined contribution rate.

Assumed Rate of Investment Return *(continued)*

- We have based our analysis of the expected real rate of return on the Horizon Survey of Capital Market Assumptions (2014 Edition).
 - This survey compiles and averages the capital market assumptions of 23 investment consultants (including Callan and Segal Rogerscasey).
 - We also analyzed the expected real rate of return using Segal Rogerscasey's 2015 capital market assumptions.
- We believe the Horizon survey is the better alternative because it aggregates the capital market assumptions of most major investment consultants.
- The calculation of the expected real rate of return based on the Horizon survey and Segal Rogerscasey's assumptions are shown on the following slides.
- Note that expected arithmetic returns are used to determine the expected returns by asset class. The portfolio's expected geometric return (which is the appropriate basis for this assumption) is estimated by reducing the arithmetic return by half of the portfolio's expected variance.

Assumed Rate of Investment Return – Segal Rogerscasey

Asset Class	20-Year Horizon Annual Arithmetic Real Return	Target Allocation	Weighted Real Return
US Equities Large Cap	6.70%	24%	1.61%
US Equities Small/Mid Cap	6.70%	7%	0.47%
Intl Equities Developed	7.40%	17%	1.26%
Emerging Markets Equities	9.70%	4%	0.39%
US Bonds Core	1.60%	12%	0.19%
US Bonds High Yield	4.45%	5%	0.22%
Intl Debt Developed	1.60%	5%	0.08%
Cash Equivalents	1.00%	1%	0.01%
Real Estate	4.50%	15%	0.68%
Infrastructure	4.50%	5%	0.23%
Private Equities	11.80%	5%	0.59%
Total		100%	5.73%
Adjustment to Geometric			(0.62%)
Geometric Real Rate of Return			5.11%

Assumed Rate of Investment Return – Horizon Survey

Asset Class	20-Year Horizon Annual Arithmetic Real Return	Target Allocation	Weighted Real Return
US Equities Large Cap	7.05%	24%	1.69%
US Equities Small/Mid Cap	8.10%	7%	0.57%
Intl Equities Developed	7.71%	17%	1.31%
Emerging Markets Equities	10.24%	4%	0.41%
US Bonds Core	2.48%	12%	0.30%
US Bonds High Yield	4.71%	5%	0.24%
Intl Debt Developed	2.05%	5%	0.10%
Cash Equivalents	1.11%	1%	0.01%
Real Estate	4.95%	15%	0.74%
Infrastructure	6.16%	5%	0.31%
Private Equities	10.97%	5%	0.55%
Total		100%	6.23%
Adjustment to Geometric			(0.62%)
Geometric Real Rate of Return			5.61%

Assumed Rate of Investment Return

- Using the Fund's target asset allocation and the capital market assumptions from the Horizon survey, the expected real rate of return is 5.61%.
 - The expected real rate of return is reduced by 0.50% to account for investment expenses.
 - As described earlier, instead of reducing the real rate of return to account for administrative expenses, we recommend adding an explicit administrative expense load to the normal cost.
- The expected real rate of return is 5.11%, net of expected investment expenses of 0.50%.

Gross Real Rate of Return	5.61%
Less Investment Expenses	<u>(0.50%)</u>
Net Real Rate of Return	5.11%

Assumed Rate of Investment Return *(continued)*

- Over a 20-year period, the Fund is expected to earn an annual real rate of return of at least 5.11% half of the time.
- Lowering the expected real rate of return to 5.00% will increase the likelihood of meeting the expectation over a 20-year period to 52%.
- The following table shows the components of the current and recommended investment return assumption.

Component	Current	Recommended	50/50	8.00%	7.50%
Inflation	3.00%	2.75%	2.75%	2.75%	2.75%
Real Rate of Return	5.65%	5.61%	5.61%	5.61%	5.61%
Investment Expense	(0.65%)	(0.50%)	(0.50%)	(0.50%)	(0.50%)
Risk Adjustment	<u>(0.00%)</u>	<u>(0.11%)</u>	<u>(0.00%)</u>	<u>0.14%</u>	<u>(0.36%)</u>
Total	8.00%	7.75%	7.86%	8.00%	7.50%
Confidence Level	N/A	52%	50%	48%	55%

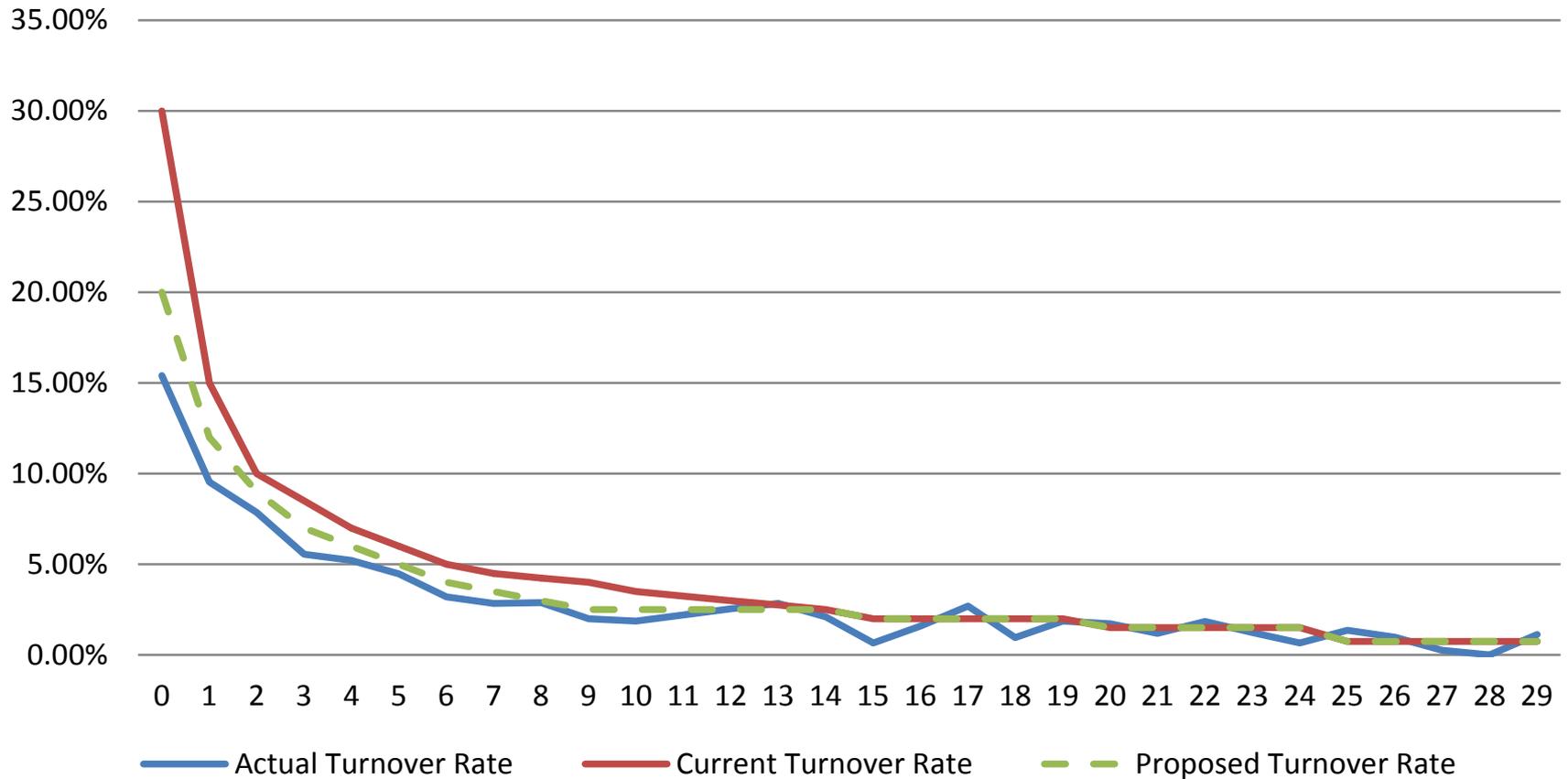
Demographic Assumptions

- Termination
- Disability
- Retirement
- Death after retirement
- Death in active service
- Spouse information

Termination

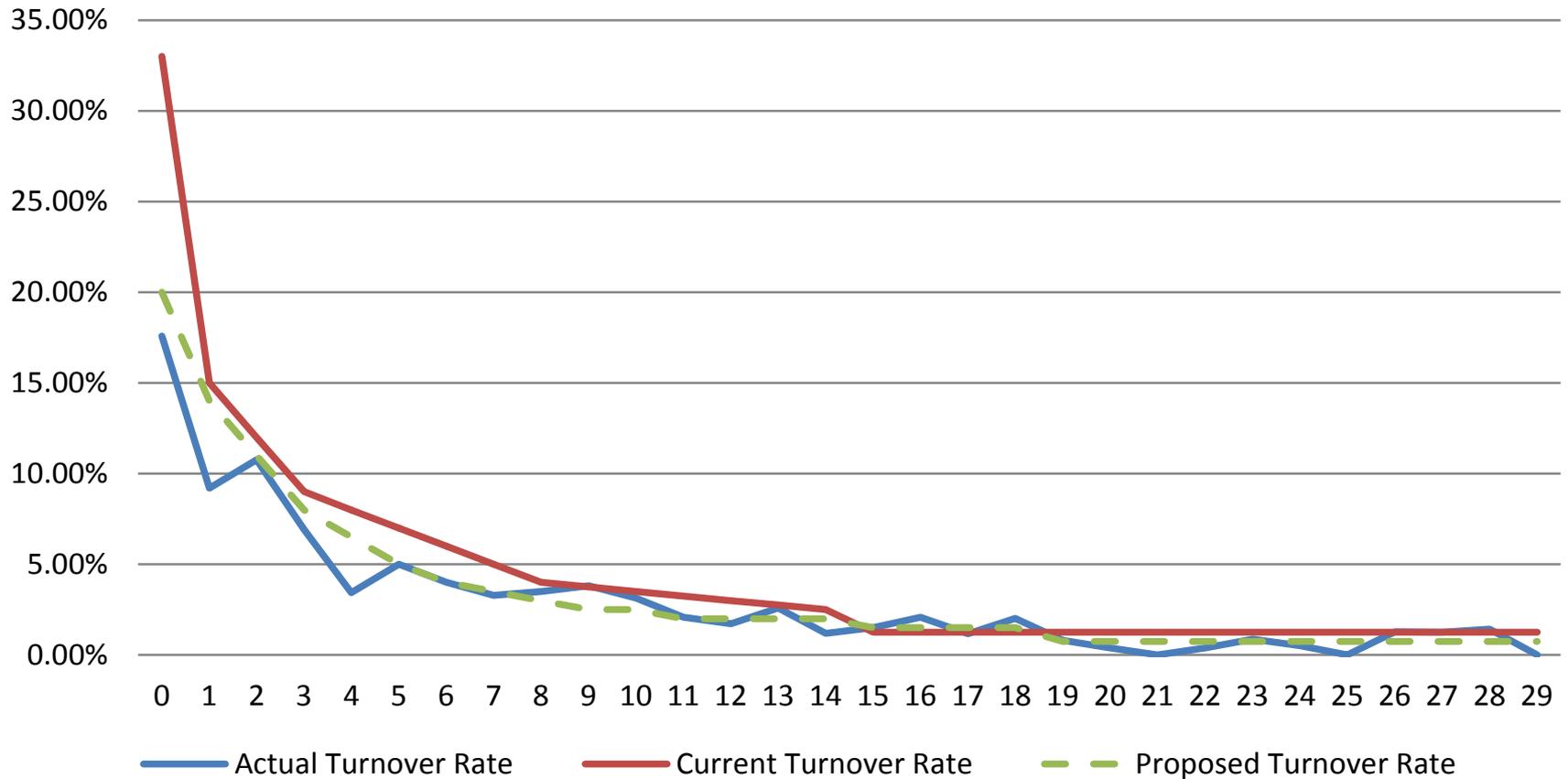
- Current rates are gender distinct and based on years of service.
- Experience shows that fewer members than expected are leaving the Fund with less than 15 years of service.
- The experience is closer to expected for longer service members.
- We recommend lowering turnover rates for shorter service members.
- The graphs on the following pages show the actual, expected, and proposed termination rates based on years of service.

Termination – Females



Exposures	Actual Terminations	Expected Terminations	Actual to Expected	Proposed Terminations	Actual to Proposed
28,414	1,175	1,742	67%	1,409	83%

Termination – Males



Exposures	Actual Terminations	Expected Terminations	Actual to Expected	Proposed Terminations	Actual to Proposed
10,152	408	588	69%	474	86%

Disability Retirement

- Rates vary based on member's age.
- From 2009 to 2014:
 - 41 members were expected to start receiving a disability pension; and
 - 46 members actually started receiving a disability pension.
- The experience is reasonably close to expected.
- From 2004 to 2009, there were 40 new disability pensions awarded.
- We recommend no change to the disability rates.

Retirement Eligibilities

➤ Tiers

- Tier 1: Hired before July 1, 2008

- Grandfathered: As of June 30, 2013, either at least age 55 and at least 3 years of service or age plus service is at least 65.
- Non-grandfathered: As of June 30, 2013, does not meet the requirements to be grandfathered.

- Tier 2: Hired after June 30, 2008

➤ Eligibility for reduced benefits

- For all Tier 1 members, age 55 and 3 years of service
- For Tier 2 members, age 55 and 5 years of service

Retirement Eligibilities *(continued)*

- Eligibility for unreduced benefits
 - For Tier 1 members, the earlier of:
 - Age 65 and 3 years of service.
 - If grandfathered, age plus service is at least 85.
 - If non-grandfathered, age plus service is at least 90 with a minimum age of 60.
 - For Tier 2 members, the earlier of:
 - Age 65 and 5 years of service.
 - Age plus service is at least 90 with a minimum age of 60.

Active Member Retirements

- Current rates:
 - Vary based on member's age and gender.
 - Vary depending on whether the member is eligible for a reduced or unreduced benefit.
 - In the first year that the member becomes eligible for an unreduced benefit, the unreduced retirement rate is increased by 10%.
- We have analyzed Tier 1 retirement experience for the following groups:
 - Eligible for a reduced benefit.
 - Eligible for an unreduced benefit in the 1st year only.
 - Eligible for an unreduced benefit in all other years.
- There is no Tier 2 retirement experience and little grandfathered versus non-grandfathered experience to analyze at this point.
- However, the retirement rates take into account each individual's eligibility requirements.

Active Member Retirements – Summary of Experience

➤ Reduced retirements:

- There were more retirements than expected, so we recommend higher rates at most ages.
- There were insufficient actual retirements to justify gender distinct rates, so we recommend unisex rates of retirement.

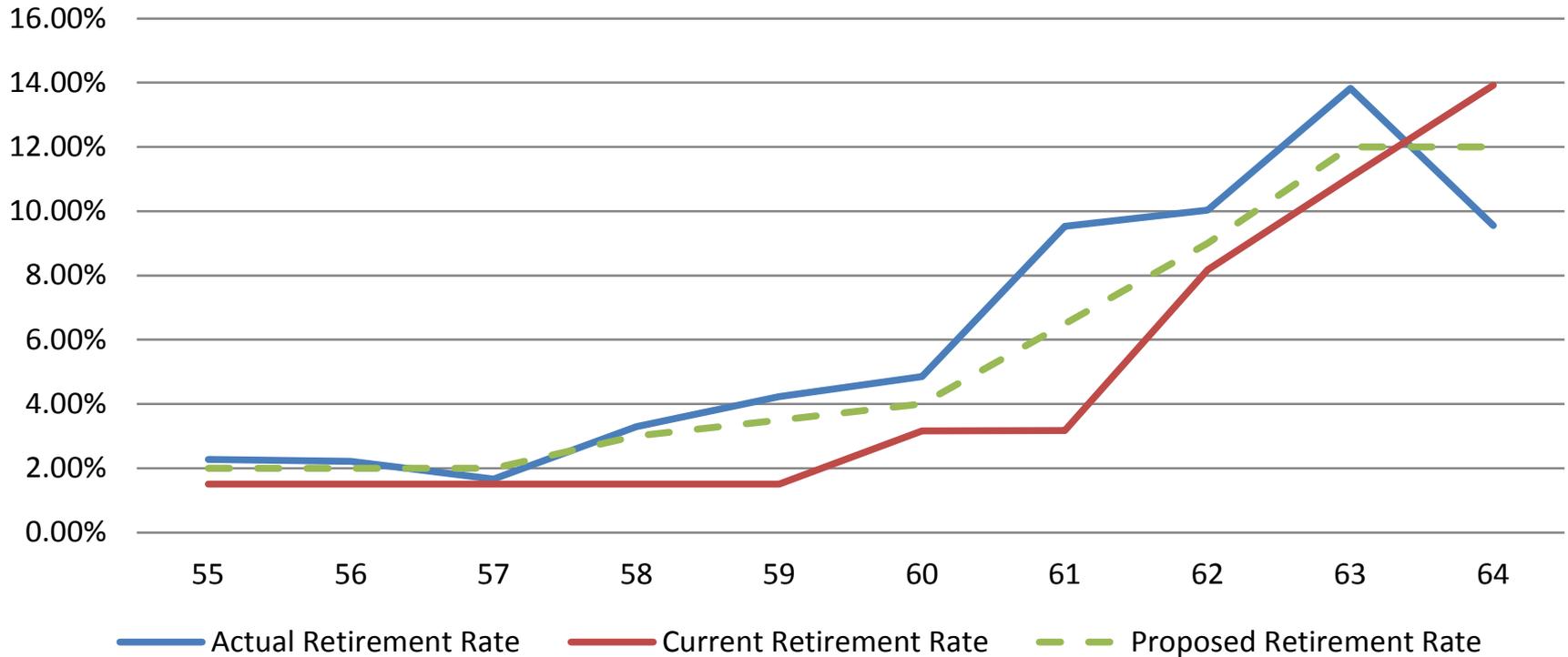
➤ First year of eligibility for unreduced benefits:

- In the first year of being eligible for unreduced benefits, members retired at an average rate of 30% per year.
- After the first year of being eligible for unreduced benefits, members retired at an average rate of 20% per year.
- Therefore, we recommend continuing to use the 10% increase in retirement rates for the first year of eligibility for unreduced benefits.

➤ After the first year of eligibility for unreduced benefits:

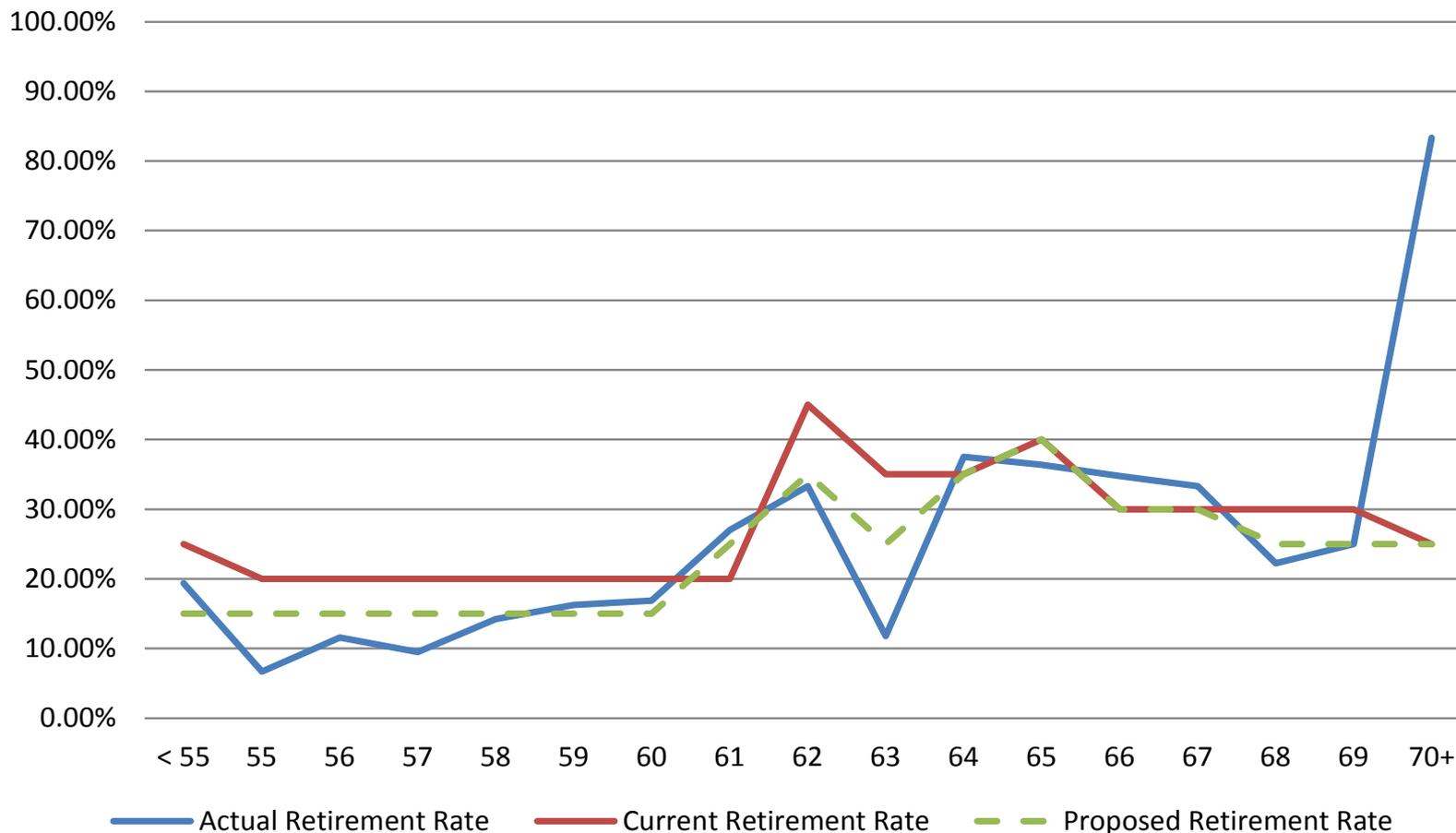
- There were fewer retirements than expected, so we recommend lowering rates, primarily at younger ages.
- However, we recommend increased rates for females ages 64 to 66.

Active Member Retirements – Reduced Benefits



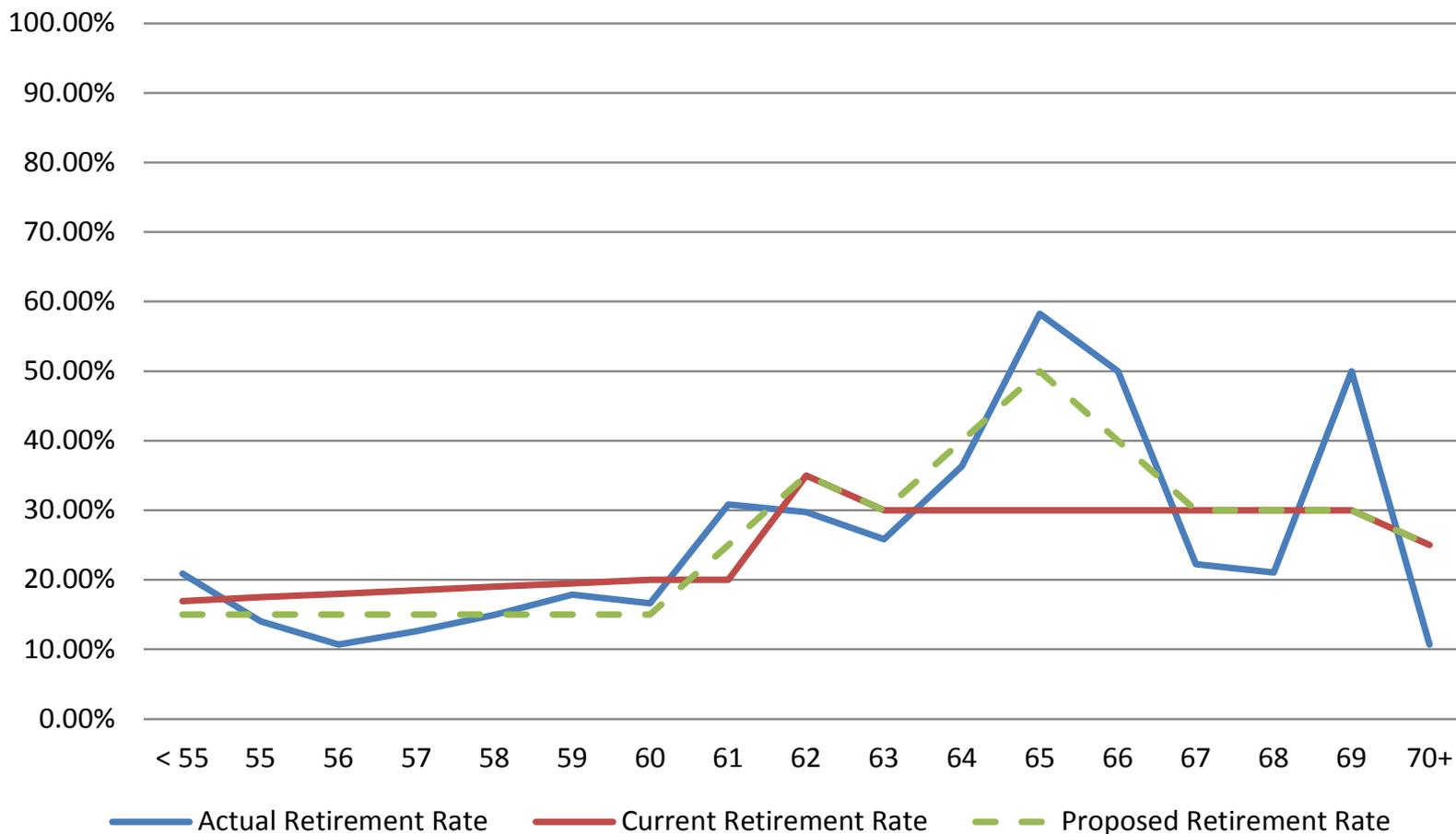
Exposures	Actual Retirements	Expected Retirements	Actual to Expected	Proposed Retirements	Actual to Proposed
5,972	268	174	154%	236	114%

Active Member Retirements – Unreduced Benefits (Male)



Exposures	Actual Retirements	Expected Retirements	Actual to Expected	Proposed Retirements	Actual to Proposed
1,347	259	334	78%	277	94%

Active Member Retirements – Unreduced Benefits (Female)



Exposures	Actual Retirements	Expected Retirements	Actual to Expected	Proposed Retirements	Actual to Proposed
3,415	702	742	95%	705	100%

Inactive Vested Retirements

- The current assumption is that all inactive vested members will retire at normal retirement age.
- From 2009 to 2014, of the 2,321 inactive vested members eligible to commence benefits early with reduced benefits, 104 elected to retire.
- Therefore, we recommend adding retirement rates of 5% at each early retirement age prior to normal retirement age and continuing to assume that 100% of remaining inactive vested members retire at normal retirement age.
- There is a small subsidy in the early retirement benefit, so this approach is more conservative.

Exposures	Actual Retirements	Expected Retirements	Actual to Expected	Proposed Retirements	Actual to Proposed
2,321	104	0	N/A	116	90%

Death After Retirement (Non-Disabled)

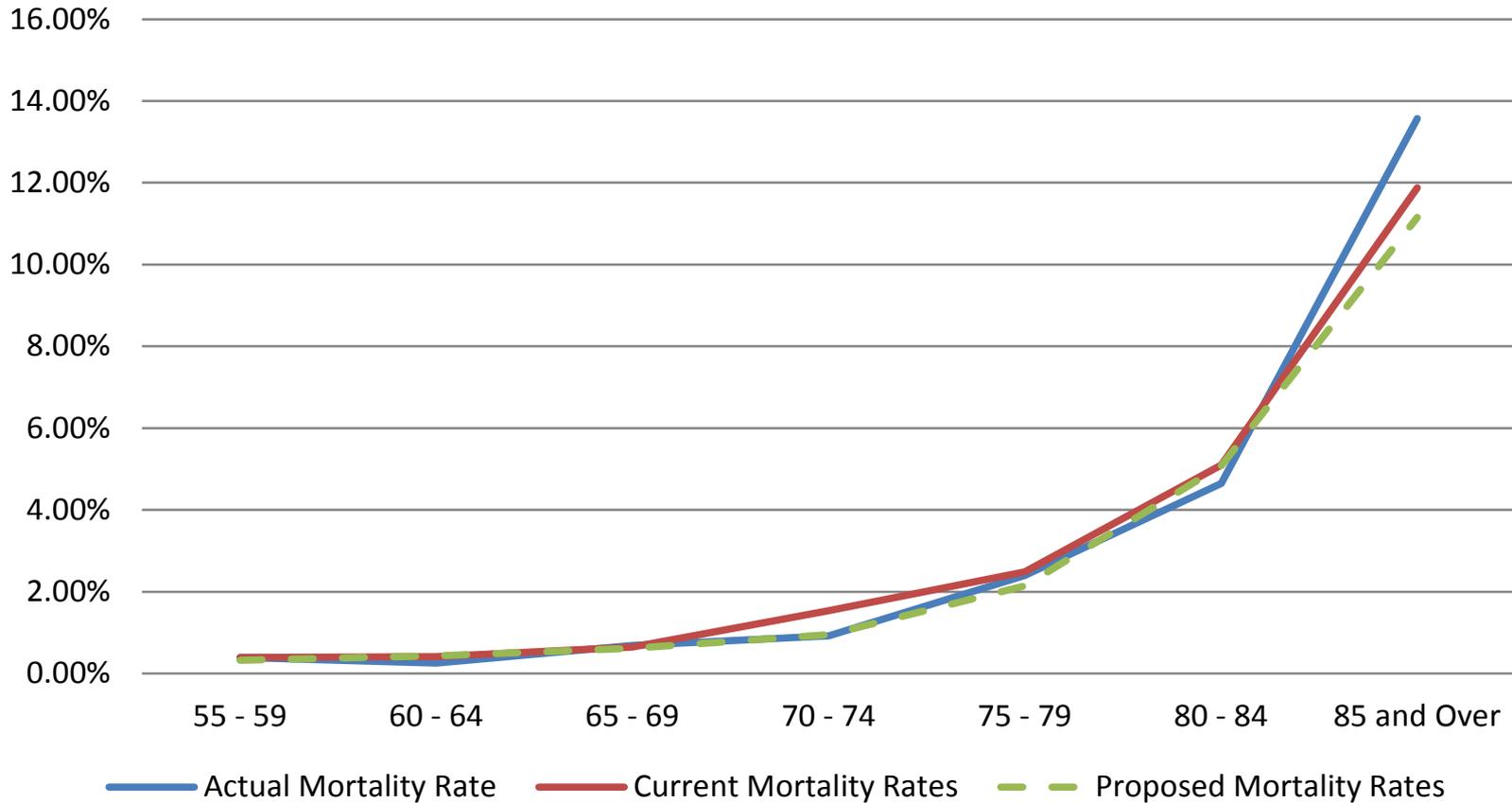
- Rates vary based on gender and age of the annuitant.
- Our analysis uses a benefit-weighted approach, which weights the probability of death with each annuitant's pension benefit. This methodology takes into consideration any correlation between the health of the annuitant and the size of the benefit.
- Experience for non-disabled annuitants has been consistent with the current assumption.
- However, the current assumption no longer has a sufficient margin for future mortality improvement.
- Therefore, we recommend revising the non-disabled mortality assumption to use a variation of the new mortality tables ("RP-2014") recently released by the Society of Actuaries.
- We have adjusted the RP-2014 annuitant table to match the Fund's experience.
- To account for future mortality improvement, we recommend applying the new generational mortality improvement scale ("MP-2014") that is intended to be used with the new RP-2014 tables.

Life Expectancy Based on Recommended Table

- The following table shows the future life expectancy (and expected age at death) at various ages using the recommended mortality table.

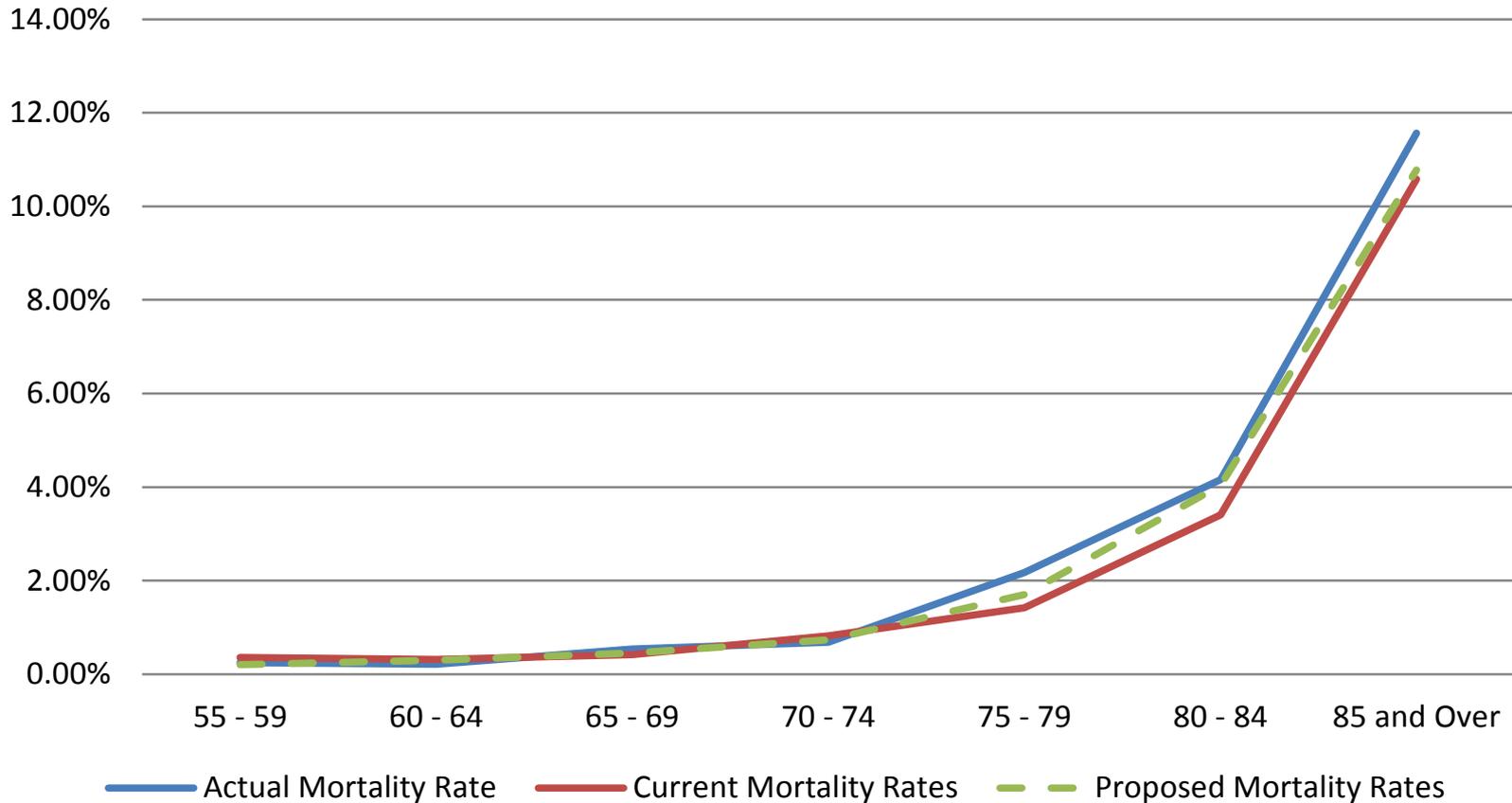
Age	Male	Female
55	34.1 (89.1)	36.3 (91.3)
60	29.1 (89.1)	31.2 (91.2)
65	24.3 (89.3)	26.2 (91.2)
70	19.6 (89.6)	21.4 (91.4)
75	15.0 (90.0)	16.7 (91.7)

Death After Retirement (Non-Disabled) – Male



Exposures	Actual Deaths	Expected Deaths	Actual to Expected	Proposed Deaths	Actual to Proposed
269,702	4,049	4,330	94%	3,841	105%

Death After Retirement (Non-Disabled) – Female

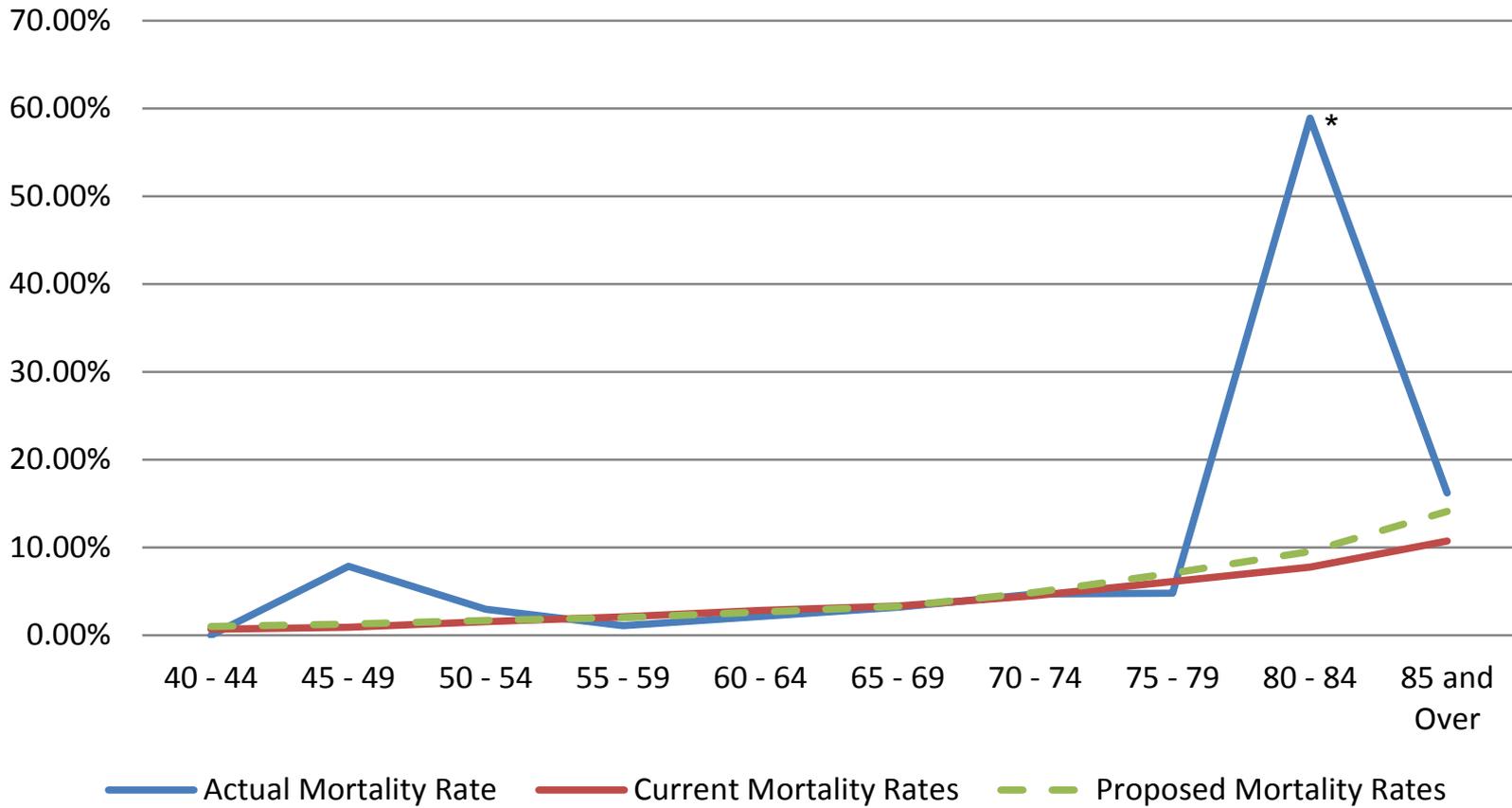


Exposures	Actual Deaths	Expected Deaths	Actual to Expected	Proposed Deaths	Actual to Proposed
388,250	6,385	5,809	110%	5,992	107%

Death After Retirement (Disabled)

- Rates vary based on gender and age of the annuitant.
- Experience for disabled annuitants has been consistent with the current assumption. The ratio of actual to expected deaths is 122%, so there is still sufficient margin for future mortality improvements.
- However, we recommend updating the assumption to use a variation of the most recent RP-2014 Disabled Mortality Table.
- We have adjusted the RP-2014 disabled mortality table to match the Fund's experience and built in sufficient margin for future mortality improvements.

Death After Retirement (Disabled) – Male & Female



Exposures	Actual Deaths	Expected Deaths	Actual to Expected	Proposed Deaths	Actual to Proposed
7,602	248	204	122%	209	119%

* 59% is an outlier due to the small sample size. There were 3 deaths and 6 exposures, not weighted for benefit size.

Death In Active Service

- Mortality rates applied to active members
 - Very few members die in active service.
 - Liability associated with active death is a small percentage of the total liability.
 - Plan experience is insufficient to set assumption.
- The current assumptions include separate mortality tables for active and retired members.
 - Since we are using the new RP-2014 annuitant table for retired lives, we recommend using the RP-2014 employee table for active members.
 - This table includes adjustment at earlier ages to reflect the fact that many younger members are actively employed.

Spouse Information

- Current assumptions:
 - 75% of members are married.
 - Male spouses are three years older than female spouses.
 - 100% of spouses are opposite gender.
- We have limited data on spouse information.
- However, these assumptions are reasonable and consistent with similar plans.
- In addition, all optional forms of payment are actuarially equivalent, so these assumptions are not materially relevant.
- Therefore, we recommend no change to these assumptions.

Summary of Economic Assumptions

Assumption	Current	Proposed
Inflation	3.00%	2.75%
Productivity	1.50%	1.50%
Payroll Growth	3.25%	3.25%
Salary Scale	Merit rates based on years of service plus inflation and productivity.	No change to merit rates. Total rates decreased by 0.25% due to lower recommended inflation.
Investment Return	8.00%	7.75%
Administrative Expense	Implicitly included in the investment return assumption.	Explicit load to normal cost equal to prior year administrative expenses plus inflation.

Summary of Demographic Assumptions

Assumption	Current	Proposed
Turnover	Gender distinct rates based on years of service.	Lower rates for members with less than 15 years of service and for males with 20 or more years of service.
Disability	Age based rates	No change
Active Retirement	Gender distinct rates based on age that range from 1.5% to 100% at age 75. Higher rates are assumed when a member is eligible to retire with unreduced benefits. In the first year that members become eligible for unreduced benefits, the unreduced retirement rate is increased 10%.	Unisex, increased rates for members retiring early with reduced benefits. Lower rates at younger ages for members retiring with unreduced benefits. Increased rates for females around age 65. No change to the 10% rate increase in the first year that members become eligible for unreduced benefits.
Inactive Retirements	100% at normal retirement age	5% at early retirement ages and 100% at normal retirement age

Summary of Demographic Assumptions *(continued)*

Assumption	Current	Proposed
Healthy Mortality	GRS specific mortality tables.	RP-2014 Healthy Annuitant Table set back one year, multiplied by 50% for ages under 75 and grading up to 100% by age 80. The MP-2014 improvement scale is applied.
Disabled Mortality	RP-2000 Disabled Mortality Table for males and females multiplied by 80% and 95%, respectively.	RP-2014 Disabled Mortality Table set forward four years.
Active Mortality	Healthy Post-Retirement Mortality multiplied by 60% for males and 40% for females.	RP-2014 Employee Mortality Table with generational mortality improvement using scale MP-2014.
Spouse Information	75% married, male spouses are three years older than female spouses, and 100% of spouses are opposite gender.	No changes.

Cost Impact (Based on the July 1, 2014, Actuarial Valuation)

Description	Current Assumptions	Proposed Mortality Assumptions	Proposed Mortality and Turnover Assumptions	Proposed Mortality, Turnover, and Retirement Assumptions
Actuarial Accrued Liability	\$3,138.8M	\$3,235.3M	\$3,232.4M	\$3,222.6M
Actuarial Value of Assets	\$1,940.5M	\$1,940.5M	\$1,940.5M	\$1,940.5M
Unfunded Actuarial Accrued Liability	\$1,198.3M	\$1,294.8M +96.5M	\$1,291.9M -2.9M	\$1,282.1M -9.8M
Funded Percentage	61.8%	60.0%	60.0%	60.2%
Normal Cost	\$63.0M	\$65.0M +2.0M	\$65.6M +0.6M	\$65.2M -0.4M
Actuarially Determined Contribution Rate	11.57%	12.93% +1.36%	13.01% +0.08%	12.83% -0.18%
Margin / (Deficit)	1.18%	(0.18%)	(0.26%)	(0.08%)
Effective Amortization Period	24 years	30 years	30 years	29 years

Cost Impact (Based on the July 1, 2014, Actuarial Valuation)

Description	Proposed Demographic and Current Economic Assumptions	Proposed Demographic Assumptions and 7.75% Interest Rate	Proposed Demographic Assumptions, 7.75% Interest Rate, Salary Scale, and Inflation
Actuarial Accrued Liability	\$3,222.6M	\$3,313.3M	\$3,294.5M
Actuarial Value of Assets	\$1,940.5M	\$1,940.5M	\$1,940.5M
Unfunded Actuarial Accrued Liability	\$1,282.1M	\$1,372.8M +90.7M	\$1,354.0M -18.8M
Funded Percentage	60.2%	58.6%	58.9%
Normal Cost	\$65.2M	\$70.6M +5.4M	\$68.0M -2.6M
Actuarially Determined Contribution Rate	12.83%	14.33% +1.50%	13.75% -0.58%
Margin / (Deficit)	(0.08%)	(1.58%)	(1.00%)
Effective Amortization Period	29 years	38 years	34 years

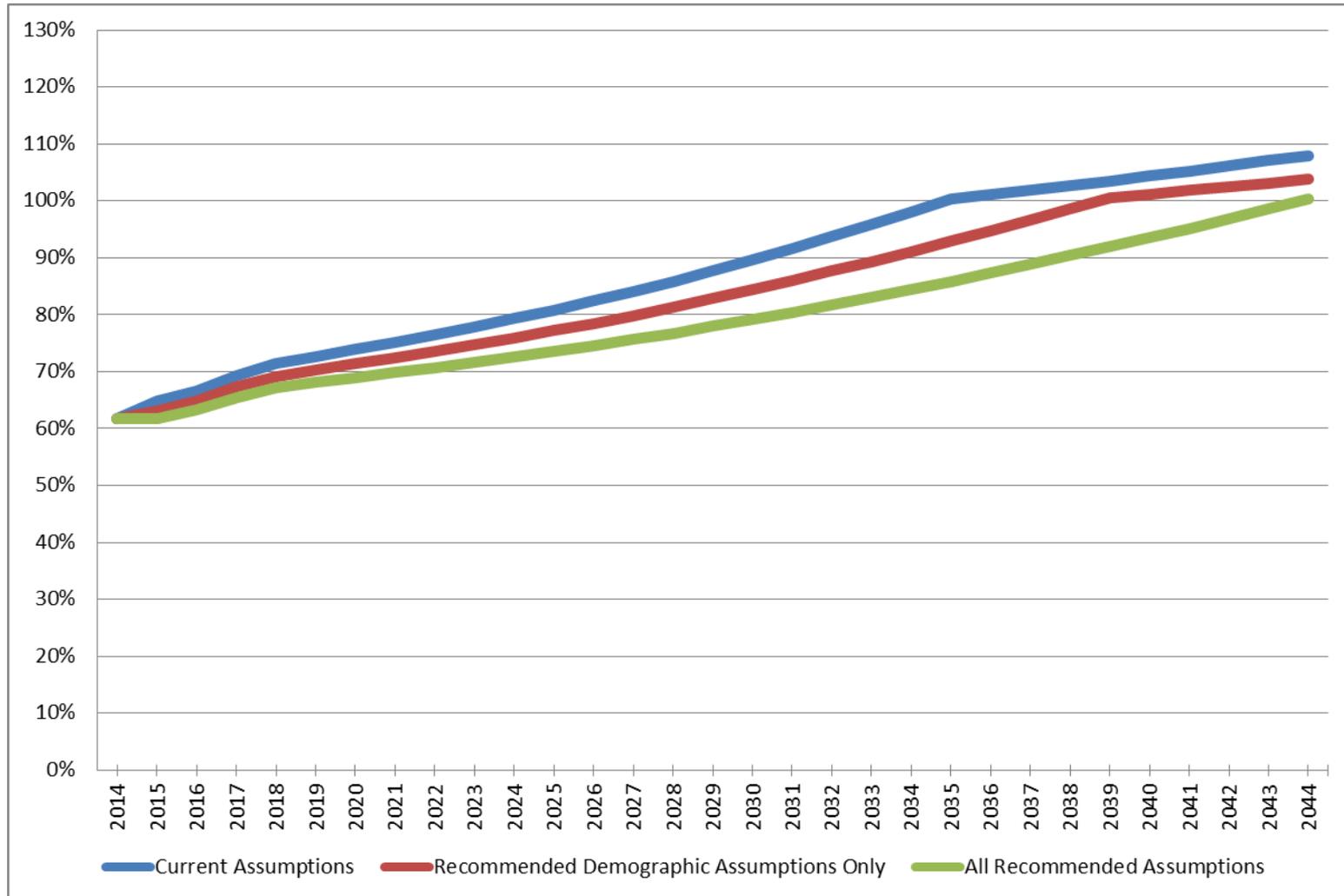
Cost Impact (Based on the July 1, 2014, Actuarial Valuation)

Description	Current Assumptions	Proposed Assumptions	Change
Actuarial Accrued Liability	\$3,138.8M	\$3,294.5M	\$155.7M
Actuarial Value of Assets	\$1,940.5M	\$1,940.5M	\$0.0M
Unfunded Actuarial Accrued Liability	\$1,198.3M	\$1,354.0M	\$155.7M
Funded Percentage	61.8%	58.9%	(2.9%)
Normal Cost	\$63.0M	\$68.0M	\$5.0M
Actuarially Determined Contribution Rate	11.57%	13.75%	2.18%
Margin / (Deficit)	1.18%	(1.00%)	(2.18%)
Effective Amortization Period	24 years	34 years	10 years

Cost Impact – Projections

- Projections of estimated funded ratios and margin for 30 years
 - Baseline based on July 1, 2014, actuarial valuation using current assumptions
- Includes contribution rates from HB 1134
 - Member rate is 11.75% for FY15 and thereafter
 - Employer rate is 12.75% for FY15 and thereafter
 - Increases “sunset” back to 7.75% once the funded ratio reaches 100% (based on actuarial assets)

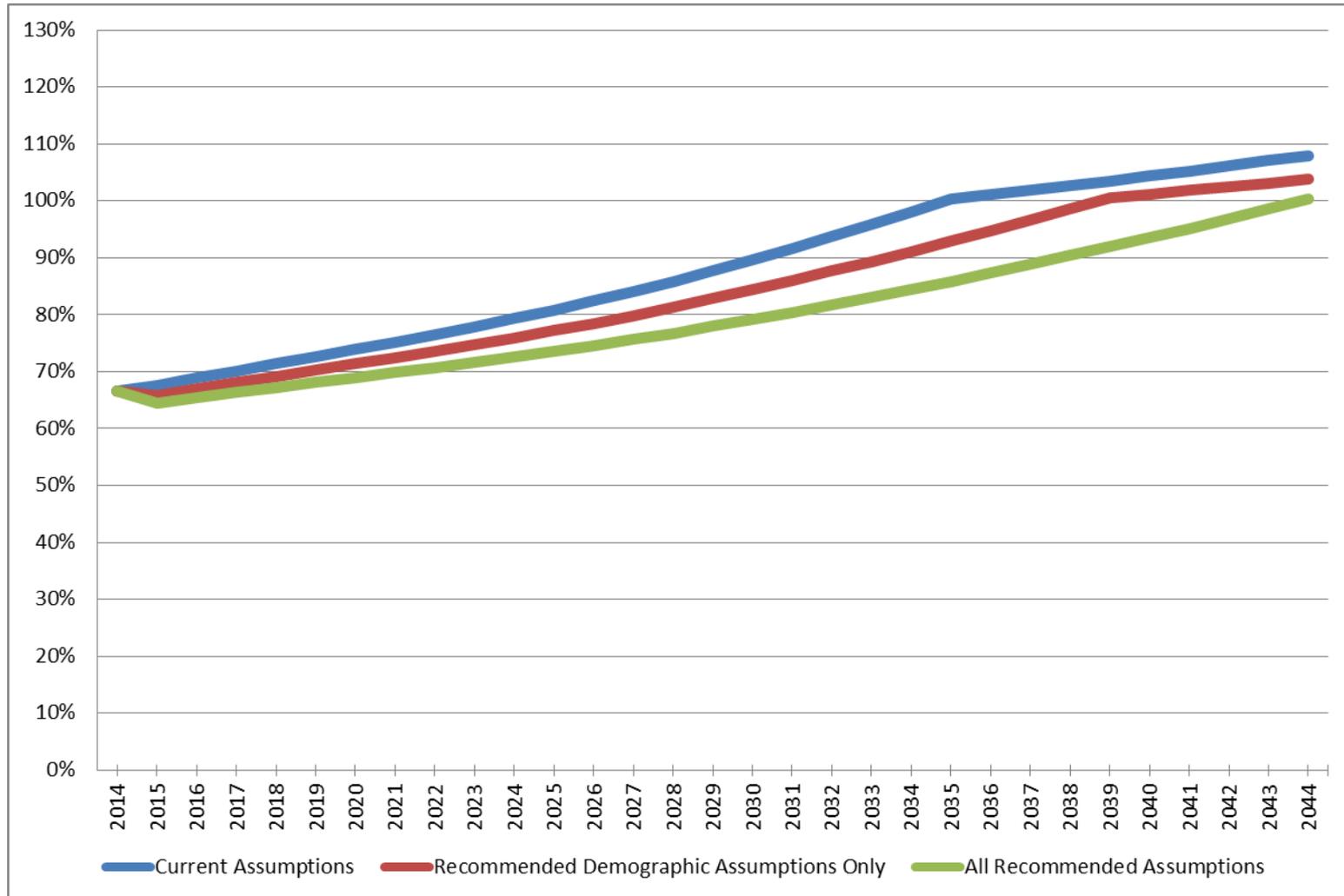
Projected Funded Ratios (AVA Basis)



Projected Funded Ratios (AVA Basis)

Valuation Year	Current Assumptions	Recommended Demographic Assumptions Only	All Recommended Assumptions
2014	62%	62%	62%
2015	65%	63%	62%
2016	67%	65%	63%
2017	69%	67%	66%
2018	71%	69%	67%
2019	73%	70%	68%
2024	79%	76%	73%
2029	88%	83%	78%
2034	98%	91%	84%
2039	104%	101%	92%
2044	108%	104%	100%

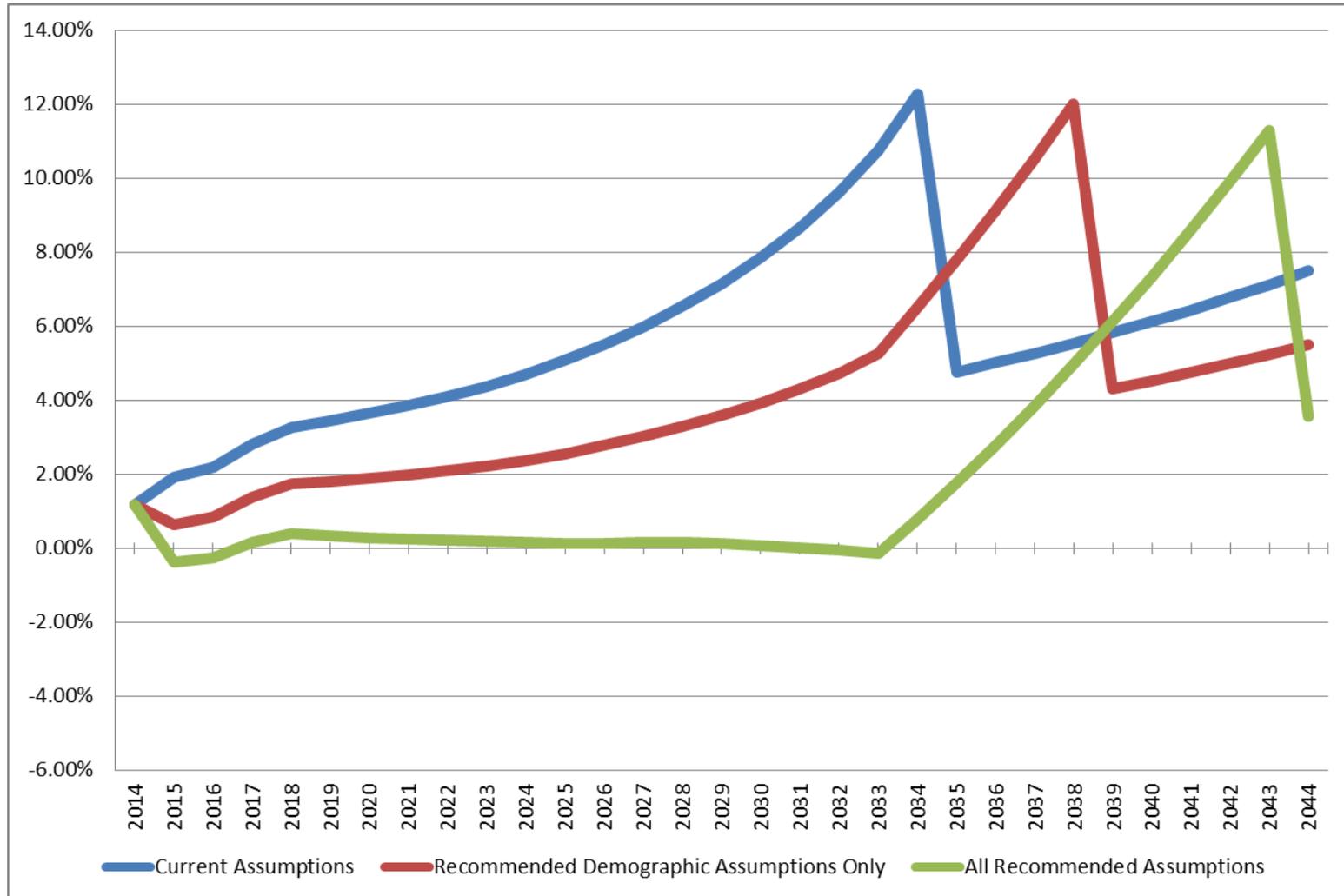
Projected Funded Ratios (MVA Basis)



Projected Funded Ratios (MVA Basis)

Valuation Year	Current Assumptions	Recommended Demographic Assumptions Only	All Recommended Assumptions
2014	67%	67%	67%
2015	68%	66%	64%
2016	69%	67%	65%
2017	70%	68%	66%
2018	71%	69%	67%
2019	73%	70%	68%
2024	79%	76%	73%
2029	88%	83%	78%
2034	98%	91%	84%
2039	104%	101%	92%
2044	108%	104%	100%

Projected Margin (AVA Basis)



Projected Margin (AVA Basis)

Valuation Year	Current Assumptions	Recommended Demographic Assumptions Only	All Recommended Assumptions
2014	1.18%	1.18%	1.18%
2015	1.91%	0.63%	-0.37%
2016	2.20%	0.84%	-0.26%
2017	2.81%	1.37%	0.16%
2018	3.27%	1.73%	0.40%
2019	3.45%	1.79%	0.34%
2024	4.69%	2.36%	0.14%
2029	7.15%	3.59%	0.12%
2034	12.28%	6.50%	0.79%
2039	5.82%	4.30%	6.12%
2044	7.49%	5.50%	3.57%

Questions?



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Actuarial Certification

We are pleased to submit this presentation on the actuarial experience of the North Dakota Teachers' Fund for Retirement for the period July 1, 2009, through June 30, 2014. This investigation is the basis for our recommendation of the assumptions and methods to be used for the July 1, 2015, actuarial valuation.

All current actuarial assumptions and methods were reviewed as part of this study. Some of our recommendations reflect changes to the assumptions and methods used in the July 1, 2014, actuarial valuation while other current assumptions and methods remain appropriate.

Our analysis was conducted in accordance with generally accepted actuarial principles as prescribed by the Actuarial Standards Board (ASB) and the American Academy of Actuaries. Additionally, the development of all assumptions contained herein is in accordance with ASB Actuarial Standard of Practice (ASOP) No. 27 (*Selection of Economic Assumptions for Measuring Pension Obligations*) and ASOP No. 35 (*Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations*).

The undersigned actuaries are experienced with performing experience studies for large public-sector pension plans and are qualified to render the opinions contained in this report.

Sincerely,



Kim Nicholl, FSA, MAAA, EA, FCA
Senior Vice President and Actuary



Matthew A. Strom, FSA, MAAA, EA
Vice President and Actuary

Appendix

- Full schedule of proposed assumption tables
 - Salary Increase
 - Turnover
 - Unreduced retirement
 - Reduced retirement
 - Healthy post-retirement mortality
 - Disabled post-retirement mortality
 - Active/pre-retirement mortality

APPENDIX

Proposed Salary Increase (Service-Based Rates)

Years of Service	Current Total Salary Increase Rate	Proposed Total Salary Increase Rate	Years of Service	Current Total Salary Increase Rate	Proposed Total Salary Increase Rate
0	14.75%	14.50%	8 – 9	6.25%	6.00%
1	8.00%	7.75%	10 – 11	6.00%	5.75%
2	7.75%	7.50%	12 – 13	5.75%	5.50%
3	7.50%	7.25%	14 – 15	5.50%	5.25%
4	7.25%	7.00%	16 – 18	5.25%	5.00%
5	7.00%	6.75%	19 – 22	5.00%	4.75%
6	6.75%	6.50%	23 – 24	4.75%	4.50%
7	6.50%	6.25%	25+	4.50%	4.25%

APPENDIX

Proposed Turnover Rates (Males)

Years of Service	Current Turnover Rate	Proposed Turnover Rate	Years of Service	Current Turnover Rate	Proposed Turnover Rate
0	33.00%	20.00%	15	1.25%	1.50%
1	15.00%	14.00%	16	1.25%	1.50%
2	12.00%	11.00%	17	1.25%	1.50%
3	9.00%	8.00%	18	1.25%	1.50%
4	8.00%	6.50%	19	1.25%	0.75%
5	7.00%	5.00%	20	1.25%	0.75%
6	6.00%	4.00%	21	1.25%	0.75%
7	5.00%	3.50%	22	1.25%	0.75%
8	4.00%	3.00%	23	1.25%	0.75%
9	3.75%	2.50%	24	1.25%	0.75%
10	3.50%	2.50%	25	1.25%	0.75%
11	3.25%	2.00%	26	1.25%	0.75%
12	3.00%	2.00%	27	1.25%	0.75%
13	2.75%	2.00%	28	1.25%	0.75%
14	2.50%	2.00%	29+	0.00%	0.75%

Termination rates end at first retirement eligibility.

APPENDIX

Proposed Turnover Rates (Females)

Years of Service	Current Turnover Rate	Proposed Turnover Rate	Years of Service	Current Turnover Rate	Proposed Turnover Rate
0	30.00%	20.00%	15	2.00%	2.00%
1	15.00%	12.00%	16	2.00%	2.00%
2	10.00%	9.00%	17	2.00%	2.00%
3	8.50%	7.00%	18	2.00%	2.00%
4	7.00%	6.00%	19	2.00%	2.00%
5	6.00%	5.00%	20	1.50%	1.50%
6	5.00%	4.00%	21	1.50%	1.50%
7	4.50%	3.50%	22	1.50%	1.50%
8	4.25%	3.00%	23	1.50%	1.50%
9	4.00%	2.50%	24	1.50%	1.50%
10	3.50%	2.50%	25	0.75%	0.75%
11	3.25%	2.50%	26	0.75%	0.75%
12	3.00%	2.50%	27	0.75%	0.75%
13	2.75%	2.50%	28	0.75%	0.75%
14	2.50%	2.50%	29+	0.00%	0.75%

Termination rates end at first retirement eligibility.

APPENDIX

Proposed Unreduced Retirement (Males)

Age	Current Retirement Rate	Proposed Retirement Rate	Age	Current Retirement Rate	Proposed Retirement Rate
50	25.00%	15.00%	63	35.00%	25.00%
51	25.00%	15.00%	64	35.00%	35.00%
52	25.00%	15.00%	65	40.00%	40.00%
53	25.00%	15.00%	66	30.00%	30.00%
54	25.00%	15.00%	67	30.00%	30.00%
55	20.00%	15.00%	68	30.00%	25.00%
56	20.00%	15.00%	69	30.00%	25.00%
57	20.00%	15.00%	70	25.00%	25.00%
58	20.00%	15.00%	71	25.00%	25.00%
59	20.00%	15.00%	72	25.00%	25.00%
60	20.00%	15.00%	73	25.00%	25.00%
61	20.00%	25.00%	74	25.00%	25.00%
62	45.00%	35.00%	75	100.00%	100.00%

Additional 10% rate increase in the first year that members become eligible for unreduced benefits.

APPENDIX

Proposed Unreduced Retirement (Females)

Age	Current Retirement Rate	Proposed Retirement Rate	Age	Current Retirement Rate	Proposed Retirement Rate
50	15.00%	15.00%	63	30.00%	30.00%
51	15.50%	15.00%	64	30.00%	40.00%
52	16.00%	15.00%	65	30.00%	50.00%
53	16.50%	15.00%	66	30.00%	40.00%
54	17.00%	15.00%	67	30.00%	30.00%
55	17.50%	15.00%	68	30.00%	30.00%
56	18.00%	15.00%	69	30.00%	30.00%
57	18.50%	15.00%	70	25.00%	25.00%
58	19.00%	15.00%	71	25.00%	25.00%
59	19.50%	15.00%	72	25.00%	25.00%
60	20.00%	15.00%	73	25.00%	25.00%
61	20.00%	25.00%	74	25.00%	25.00%
62	35.00%	35.00%	75	100.00%	100.00%

Additional 10% rate increase in the first year that members become eligible for unreduced benefits.

APPENDIX

Proposed Reduced Retirement (Unisex)

Age	Current Retirement Rate		Proposed Retirement Rate
	Male	Female	
55	1.50%	1.50%	2.00%
56	1.50%	1.50%	2.00%
57	1.50%	1.50%	2.00%
58	1.50%	1.50%	3.00%
59	1.50%	1.50%	3.50%
60	4.00%	3.00%	4.00%
61	4.00%	3.00%	6.50%
62	9.00%	8.00%	9.00%
63	7.00%	12.00%	12.00%
64	10.00%	15.00%	12.00%

APPENDIX

Proposed Healthy Mortality

Males

Age	Current Mortality Rate	Proposed Mortality Rate
50	0.22%	0.20%
55	0.38%	0.27%
60	0.36%	0.37%
65	0.46%	0.51%
70	1.20%	0.77%
75	1.99%	1.22%
80	3.95%	3.62%
85	7.83%	6.93%
90	13.70%	12.15%
95	20.78%	20.11%
100	27.29%	29.38%

Females

Age	Current Mortality Rate	Proposed Mortality Rate
50	0.12%	0.14%
55	0.28%	0.17%
60	0.35%	0.24%
65	0.33%	0.37%
70	0.67%	0.58%
75	1.07%	0.95%
80	2.38%	2.82%
85	5.55%	5.40%
90	10.39%	9.56%
95	15.90%	16.30%
100	22.29%	25.11%

Proposed mortality rates above are sample rates for 2014. For actuarial valuation purposes, mortality rates will be projected from 2014 on a generational basis using the MP-2014 improvement scale.

APPENDIX

Proposed Disabled Mortality

Males

Age	Current Mortality Rate	Proposed Mortality Rate
40	1.81%	1.53%
45	1.81%	1.98%
50	2.32%	2.28%
55	2.84%	2.59%
60	3.36%	3.04%
65	4.01%	3.83%
70	5.01%	5.10%
75	6.57%	7.12%
80	8.75%	10.44%
85	11.33%	15.87%
90	14.67%	23.19%
95	21.40%	31.03%
100	27.56%	39.51%

Females

Age	Current Mortality Rate	Proposed Mortality Rate
40	0.71%	0.81%
45	0.71%	1.14%
50	1.10%	1.40%
55	1.57%	1.64%
60	2.07%	1.99%
65	2.66%	2.63%
70	3.58%	3.80%
75	4.96%	5.64%
80	6.87%	8.37%
85	9.52%	12.29%
90	13.30%	18.15%
95	18.48%	26.06%
100	22.56%	35.29%

APPENDIX

Proposed Active Mortality

Males

Age	Current Mortality Rate	Proposed Mortality Rate
20	0.03%	0.04%
25	0.03%	0.05%
30	0.04%	0.05%
35	0.04%	0.05%
40	0.06%	0.06%
45	0.08%	0.10%
50	0.13%	0.17%
55	0.23%	0.28%
60	0.21%	0.47%
65	0.27%	0.83%
70	0.72%	1.39%
75	1.20%	2.32%
80	2.37%	3.88%

Females

Age	Current Mortality Rate	Proposed Mortality Rate
20	0.01%	0.02%
25	0.01%	0.02%
30	0.01%	0.02%
35	0.02%	0.03%
40	0.02%	0.04%
45	0.03%	0.07%
50	0.05%	0.11%
55	0.11%	0.17%
60	0.14%	0.24%
65	0.13%	0.37%
70	0.27%	0.63%
75	0.43%	1.08%
80	0.95%	1.84%

Proposed mortality rates above are sample rates for 2014. For actuarial valuation purposes, mortality rates will be projected from 2014 on a generational basis using the MP-2014 improvement scale.