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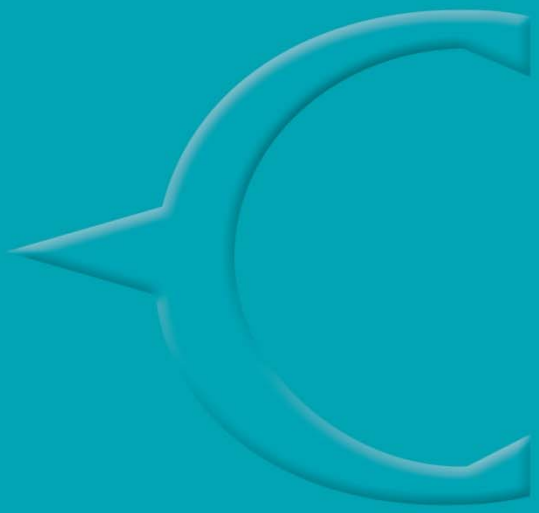

Maine Public Employees Retirement System

Experience Study as of June 30, 2020

Produced by Cheiron

June 2021

www.cheiron.us 1.877.CHEIRON (243.4766)

TABLE OF CONTENTS

Section *Page*

Transmittal Letter i

Section I Executive Summary 1

Section II Economic Assumptions 4

A. Discount Rate 4
B. Inflation Rate 15
C. COLA Assumed Rate 20

Section III Demographic Assumptions 21

A. Merit Salary Increases 21
B. Retirement Rates 24
C. Termination Rates 44
D. Disability Rates 50
E. Mortality Rates 58

Appendices

Appendix A Summary of Assumptions 67

A. State Employees and Teachers Plan 68
B. Participating Local Districts 76
C. Judicial Program 83
D. Legislative Program 89

Appendix B Disclosure of Models Used 95

June 8, 2021

Board of Trustees
Maine Public Employees Retirement System
PO Box 349
Augusta, Maine 04332-0349

Dear Members of the Board:

The purpose of this report is to provide the results of the experience study of the Maine Public Employees Retirement System (MainePERS) covering the demographic experience from June 30, 2015 through June 30, 2020 as well as recommendations for the economic assumptions. The report includes analyses and recommendations of economic and demographic assumptions to be used beginning with the June 30, 2021 actuarial valuation and the ratemaking process for fiscal years ending 2024 and 2025.

In preparing our report, we relied on information, some oral and some written, supplied by MainePERS. This information includes, but is not limited to, the plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23.

This report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices and our understanding of the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board as well as applicable laws and regulations. Furthermore, as credentialed actuaries, we meet the Qualification Standards of the American Academy of Actuaries to render the opinions contained in this report. This report does not address any contractual or legal issues. We are not attorneys, and our firm does not provide any legal services or advice.

This report was prepared for MainePERS for the purposes described herein. This report is not intended to benefit any third party, and Cheiron assumes no duty or liability to any such party.

If you have any questions about the report or would like additional information, please let us know.

Sincerely,
Cheiron

Gene Kalwarski, FSA, EA
Principal Consulting Actuary

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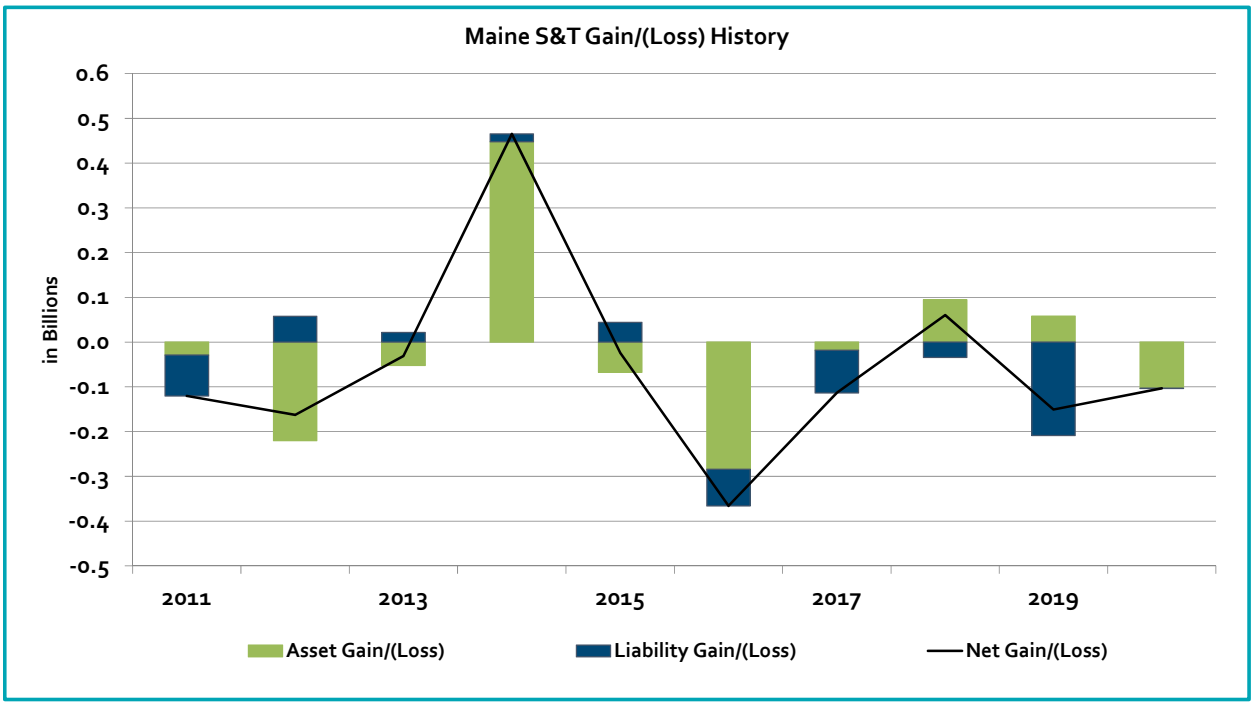
Principal Consulting Actuary

Elizabeth Wiley, FSA, EA
Consulting Actuary

SECTION I - EXECUTIVE SUMMARY

Actuarial assumptions, both economic and demographic, are intended to be long-term in nature and should be both individually reasonable and consistent and reasonable in the aggregate. The purpose of this experience study is to evaluate whether or not the current assumptions adequately reflect the current long-term expectations for MainePERS, and if not, to recommend any adjustments to the assumptions that might be needed. It is important to note that frequent and significant changes in the actuarial assumptions are not typically desirable, unless there are known fundamental changes in expectations of the economy or with respect to MainePERS's membership or assets that would warrant such frequent or significant changes.

The chart below shows MainePERS's historical actuarial gains and losses for the State Employees and Teachers Plan, broken into the asset and liability components. This chart does not include any changes in MainePERS's assets and liabilities attributable to changes in benefits, methods, procedures, or assumptions. The total liability loss over the 20-year period shown has been approximately $108 million. The total investment loss over the same period has been approximately $2,457 million. The investment losses for this period are measured based on the smoothed actuarial value of assets and are primarily due to the market downturns in the 2001-2003 and 2008-2010 periods. Taken together, the total experience has been a net loss of $2,565 million over the 20-year period.



SECTION I - EXECUTIVE SUMMARY

The following table provides the gain/(loss) history for each of the four Programs in the System for both a 10-year period and a five-year period for assets and liabilities. As in the prior chart, no changes attributable to changes in benefits, methods, procedures, or assumptions are included. Note that the five-year period corresponds with the period since the last experience study was completed.

Gain/(Loss) History (in millions)					
		State Employee & Teacher Program	Consolidated Plan for PLDs	Judicial Program	Legislative Program
2011-2020	Asset G/(L)	(174)	(20)	(0.9)	(0.1)
	Liability G/(L)	(370)	(5)	0.3	1.1
	Total G/(L)	(544)	(24)	(0.6)	1.0
2016-2020	Asset G/(L)	(253)	(46)	(1.2)	(0.2)
	Liability G/(L)	(420)	29	2.3	(0.5)
	Total G/(L)	(673)	(17)	1.1	(0.7)

Summary of Economic Assumption Analysis

The economic assumptions reviewed in this study include the following:

- **Rate of investment return (or discount rate)**
- **Inflation rate (both wage and price)**
- **Cost-of-living adjustment (COLA) assumed rate**

The last time that economic assumptions were changed was in 2018, when the rate of investment return was lowered from 6.875% to 6.75% while the inflation assumption remained at 2.75%. The MainePERS Board and staff follow a process whereby the economic assumptions are reviewed annually on an ongoing basis, as opposed to being reviewed only when a formal experience study, such as this one, is conducted.

Over the last 10 years, the Board has gradually made significant changes to these economic assumptions. The discount rate was reduced from 7.75% to 7.25% in 2011, to 7.125% in 2014, to 6.875% in 2016, and as mentioned above, to 6.75% in 2018. The inflation assumption was reduced from 4.5% to 3.5% in 2011, and then to the current 2.75% in 2016. The COLAs are limited to a maximum 3% increase for all Programs except those for PLDs; so with the current underlying 2.75% inflation assumption, we assume, based on our stochastic modelling, that the average or expected COLA is 2.20% currently, an assumption that has declined in parallel with the decline in the inflation assumption. For the Consolidated PLD Plan, the COLA is limited to a maximum 2.50% increase, resulting in a current COLA assumption of 1.91%.

We recommend no changes to the discount rate, inflation, or COLA assumptions at this time as the Board reviews the appropriateness of these assumptions each year and the current assumptions remain reasonable at this time.

SECTION I - EXECUTIVE SUMMARY

Summary of Demographic Assumption Analysis

This experience study specifically analyzed and offered recommendations for changes to the following demographic assumptions (we have noted the most significant changes within each assumption below as well).

- **Merit salary increases** – slight changes for teachers, increases for state employees, and slight increases for PLD members
- **Retirement rates** – adjustments to rates for all Tiers for State and Teachers as well as movement to separate tables for State and Teachers and minor adjustments for PLD and Judicial members
- **Termination rates** – slight changes in termination rates for teachers, state employees, and Legislators as well as PLD members
- **Disability rates** – decreases for teachers, state regular employees, and PLD members; no disability is assumed for Judicial or Legislative members
- **Mortality rates** – change to the Public Sector 2010 Mortality tables and an adjusted MP-2020 mortality improvement scale for all Programs
- **Family composition** – no changes at this time
- **Employee contribution interest** – change to use the actual rates paid for past years and the inflation assumption for future years from the current 5% assumed for all years

The details of the full recommendations for each plan are provided in Appendix A to this report.

The most significant demographic assumption change recommended is to the mortality rates. Recently completed Public Sector mortality studies by the Society of Actuaries were developed based on the experience of public employees. The prior tables used by this system were based on the experience of private sector employees and retirees only. Significantly, these new tables are developed on the basis of employee type, so tables based on teacher experience are used for the teacher members while tables based on general public employees are used for the other members. The tables produced by the Society are designed to provide a template against which large plans are able to measure their own mortality experience and make adjustments as indicated in developing their mortality assumptions.

The recommended changes to mortality rates for MainePERS reflect both the improvement in mortality since the last experience study and the application of fully generational improvements in future years.

The body of this report provides additional detail and support for our conclusions and recommendations.

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

The economic assumptions used in actuarial valuations are intended to be long-term in nature and should be both individually reasonable and consistent with each other. The specific assumptions analyzed in this report are as follows:

- **Discount rate** – used both to project long-term asset growth and to discount future cash flows in calculating the liabilities and costs of MainePERS
- **Inflation rate** – as it may impact "across-the-board" wage growth used to project benefits and as used to amortize the unfunded liability as a level percentage of expected payroll
- **COLA assumed rate** – used to project future increases in annual pension for retirees and beneficiaries

In order to develop recommendations for each of these assumptions, the following factors are considered:

1. Historical experience,
2. Future expectations,
3. Industry trends such as assumptions used by other large public sector pension plans,
4. Regulatory/professional standards,
5. Plan dynamics, and
6. The MainePERS Board's risk tolerance/preference.

The most important factors are future expectations, plan dynamics, and the Board's risk tolerance/preference. The least important factors for setting this forward-looking assumption are the historical experience and industry trends.

Finally, one set of economic assumptions are developed and recommended in this section to apply to all of the MainePERS Programs.

Discount Rate

The discount rate assumption is typically the most significant of all the assumptions employed in actuarial valuations of pensions. The discount rate is normally based on the long-term expected return on plan investments, but it is also impacted by the dynamics of the particular plan along with the risk tolerance and preferences of the particular Board. In the short-term, a higher discount rate results in lower expected contributions. However, over the long-term, actual contributions will depend on actual investment returns and not the assumed discount rate (or expected investment returns). If actual investment returns are lower than expected, future contribution rates will increase. It is important to set a realistic discount rate so that projections of future contributions for budgeting purposes will not be biased, particularly not to be too low.

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

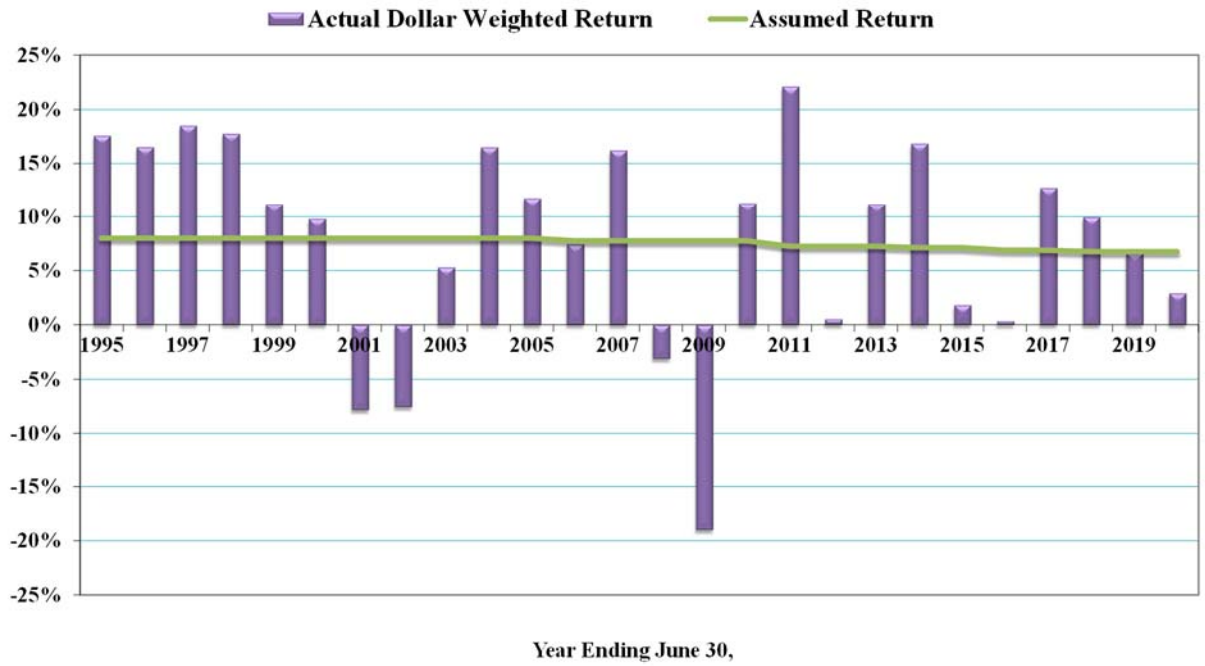
The factors the Board considered with respect to the discount rate were as follows:

1. Historical Data

Historical returns are just one factor to be considered when setting investment return assumptions. One must temper this "historical" look with future expectations, which are more relevant in assumption setting, particularly when the asset allocation has changed from historical periods.

Chart II-D1 shows the historical investment returns achieved by MainePERS compared to the assumed discount rate over the past 26 years. Over this period, the dollar weighted geometric return over the period was approximately 7.50%. In the last 10 years, the dollar weighted geometric return over the period was just under 8.25%, which is more than the currently assumed discount rate of 6.75%.

Chart II-D1
MainePERS Historical Returns



However, a historical investment performance is a poor barometer for what to expect in the future. Past performance is highly impacted by past inflation rates and interest rate environments.

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

2. Future Expectations

The target asset allocation of MainePERS's investment portfolio has a significant impact on the investment returns expected to be experienced by MainePERS. We were provided information about the target allocation based on the Board's current target allocation policy along with the capital market assumptions by the System's investment consultant, Cambridge Associates. Based on these assumptions and using their 2.50% inflation assumption, they calculated expected geometric returns of 6.1% 10-year midrange and 7.3% 25-year long range for the portfolio assuming a lognormal distribution of investment returns.

We also examined the target allocation policy versus capital market assumptions from the 2020 Survey published by Horizon Actuarial Services based on the assumptions of 39 different investment firms for both a 10-year timeframe and a 20-year timeframe as shown in Tables II-D2 and II-D3.

Table II-D2

Portfolio Assumptions based on Horizon Survey - 10-Year Timeframe			
Asset Category	**Target Allocation**	**Geometric Return**	**Standard Deviation**
US Equity - Large Cap	26.00%	6.20%	16.22%
US Equity - Small/Mid Cap	4.00%	6.93%	20.22%
US Corp Bonds - Core	7.50%	2.60%	5.47%
US Corp Bonds - High Yield	3.50%	4.91%	9.75%
TIPS	7.50%	1.98%	6.05%
Real Estate	10.00%	5.85%	16.84%
Hedge Funds	7.50%	4.78%	8.00%
Commodities	5.00%	3.25%	17.60%
Infrastructure	10.00%	7.00%	14.58%
Private Equity	15.00%	9.31%	21.99%
Private Debt	4.00%	7.84%	12.06%
Total	100.00%	6.44%	11.12%

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Table II-D3

Portfolio Assumptions based on Horizon Survey - 20-Year Timeframe			
Asset Category	Target Allocation	Geometric Return	Standard Deviation
US Equity - Large Cap	26.00%	7.17%	16.22%
US Equity - Small/Mid Cap	4.00%	7.72%	20.22%
US Corp Bonds - Core	7.50%	3.60%	5.47%
US Corp Bonds - High Yield	3.50%	5.69%	9.75%
TIPS	7.50%	2.76%	6.05%
Real Estate	10.00%	6.62%	16.84%
Hedge Funds	7.50%	5.80%	8.00%
Commodities	5.00%	4.16%	17.60%
Infrastructure	10.00%	7.48%	14.58%
Private Equity	15.00%	10.45%	21.99%
Private Debt	4.00%	7.97%	12.06%
Total	100.00%	7.30%	11.12%

Based on these capital market assumptions from the survey, we also calculated the potential distribution of returns over 10 and 20-year periods as shown in Table II-D4. This distribution indicates that there is approximately a 50% chance of achieving a return of 6.75% or greater over a 10-year period. The probability grows slightly to 55% over a 20-year period.

Table II-D4

Expected Distribution of Average Annual Investment Returns		
	Time Horizon	
Percentile	10 Years	20 Years
95th	13.20%	11.44%
75th	11.87%	10.51%
60th	9.68%	8.98%
55th	7.30%	7.30%
50th	6.78%	6.93%
45th	6.51%	6.74%
40th	6.15%	6.49%
25th	4.98%	5.65%
5th	1.72%	3.32%

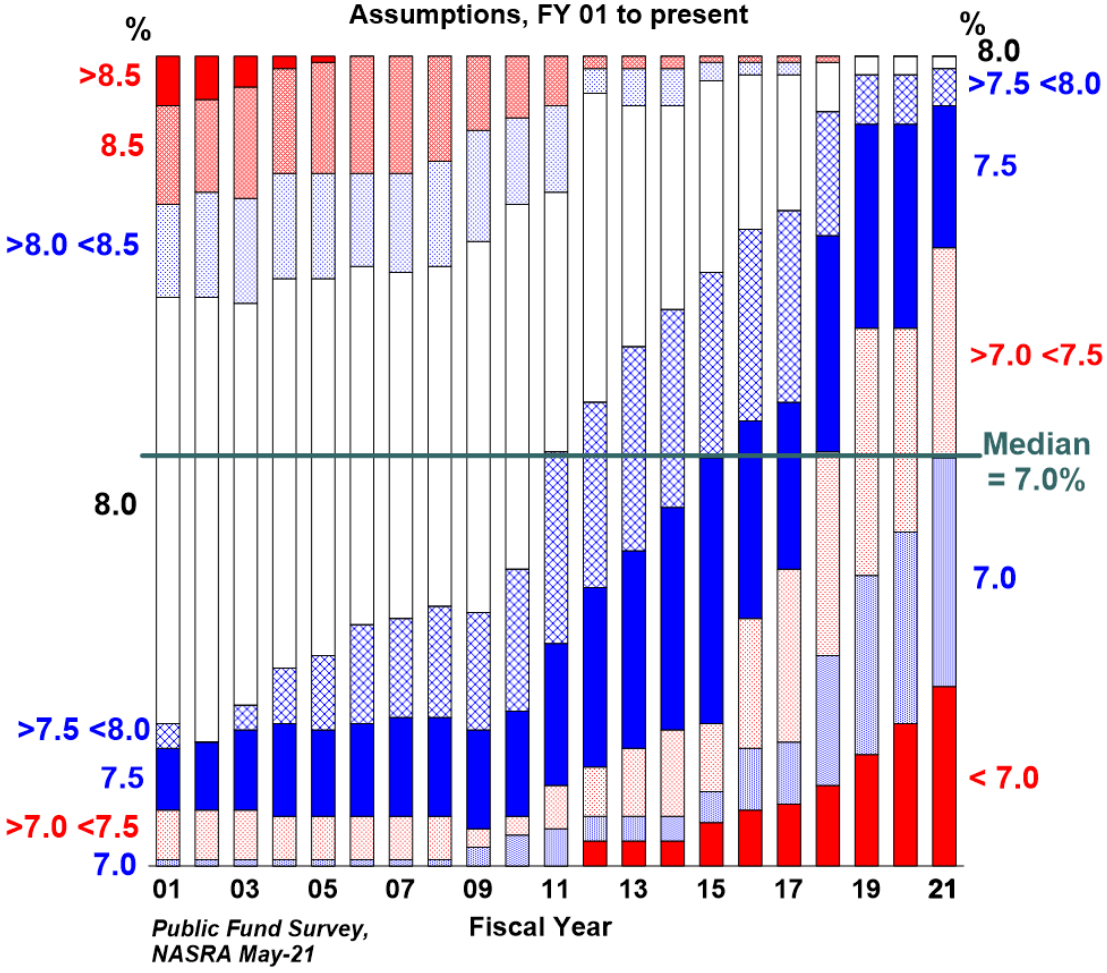
SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

3. Industry Trends

Based on the Public Fund Survey, developed by the National Association of State Retirement Administrators (NASRA) covering 131 of the largest public retirement systems in the country, there has been a general movement over at least the last two decades to reduce the discount rate used in the actuarial valuations of public pensions. Chart II-D5 that follows shows the change in the distribution of discount rate assumptions amongst these plans since 2001. The median assumption is now 7.00%, with the largest grouping now being at this value. MainePERS's current 6.75% assumption falls beneath that range. Of the 131 plans, only 11 had a discount rate assumption lower than MainePERS's current 6.75%. However, it is important to keep in mind that NASRA adjusts their data whenever new rates are announced, so some of these rates may not yet be in effect.

Chart II-D5

Distribution of Nominal Investment Return Assumptions, FY 01 to present



SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

4. Regulatory/Professional Standards

There currently are no regulatory standards, either federal or State of Maine, that apply to the selection of the MainePERS discount rate. However, there is a professional standard required by Actuarial Standard of Practice (ASOP) No. 27 that is applicable. This standard requires that the discount rate assumption has no significant bias except for the case where a provision for adverse deviation is included, in which case this must be disclosed to comply with the standard.

We believe that an assumption in the range from 6.25% to 6.75% would comply with all regulatory and professional standards, including ASOP No. 27. Further, we believe that this assumption range does not have a significant bias and thus does not require additional disclosure of such.

5. Plan Dynamics

The Plan's dynamics refers to the asset liability structure of the Plan, including its current and projected funded status, the Plan's net cash flows (contributions less benefits and expenses), and other dynamics such as the size of the Plan's costs relative to the State's revenues and the size of Plan assets compared to the active member payroll.

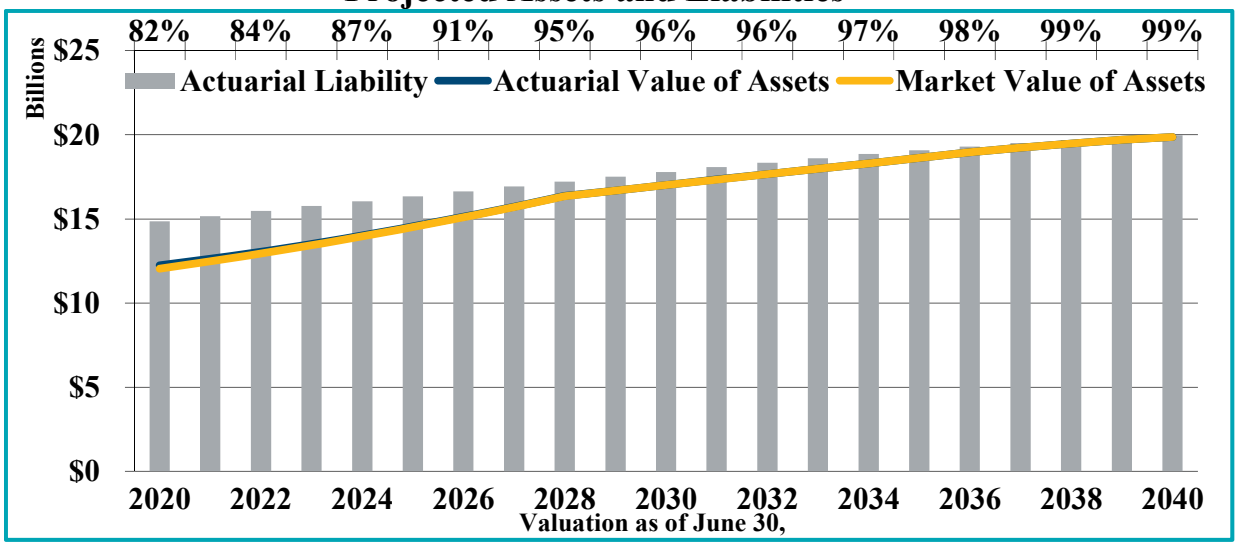
Pension plans have historically compared their investment performance to their peers. While we find some merit in assessing this for information purposes, this is not an appropriate basis for setting this assumption in our opinion as different plans have different plan dynamics and thus should consider their asset allocations and thus assumed rate of return reflective of their own situations. For MainePERS, those dynamics are as described in the following sections.

Plan's Asset Liability Structure

As shown in the two charts that follow, Chart II-D6 and Chart II-D7, the largest MainePERS plan is over 80% funded currently, approaching full funding in 2029 with the State's contributions dramatically declining after 2028, which will lead to significantly increased negative cash flows measured by contributions less benefits and expenses.

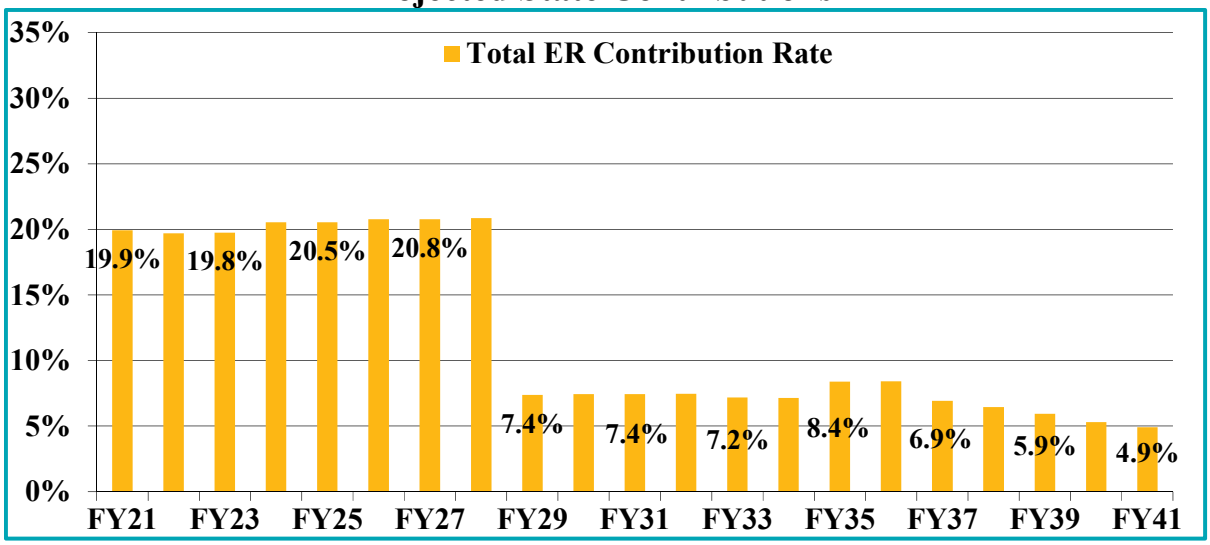
SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Chart II-D6
Projected Assets and Liabilities*



* Projections are from the 2020 valuation of the State and Teacher Plan. Please refer to that report for the assumptions used.

Chart II-D7
Projected State Contributions*



* Projections are from the 2020 valuation of the State and Teacher Plan. Please refer to that report for the assumptions used.

Plans with increasing negative cash flows will experience increased sensitivity to investment volatility. In the two charts that follow, Chart II-D8 and Chart II-D9, we demonstrate the impact of negative cash flows on a hypothetical plan's dollar weighted investment return, Chart II-D8 demonstrating a plan with no negative cash flows and Chart II-D9 demonstrating a plan with negative cash flows. Within each chart, we show the accumulation of plan assets

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

over a 10-year period assuming a flat 6.75% earnings each and every year, (represented by the grey bars) and then assuming down returns followed by up returns (represented by the red bars) which just happens to average out to 6.75% per year for the full 10-year period on a time-weighted basis.

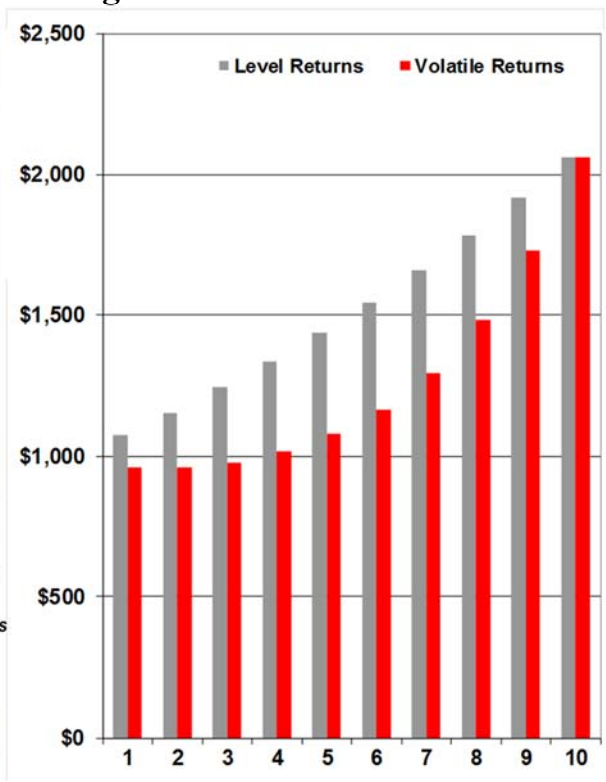
Chart II-D8
Pension Plan with No Negative Cash Flows

Starting Assets	$1,000	Net Cash Flow Growth	0.0%
Net Cash Flow	$ -	Market Cycle	downup

Year	New Cash Flow	Level Returns	Volatile Returns	ASSETS level	ASSETS volatile
1	$ -	7.5%	-4.0%	$1,075	$960
2	$ -	7.5%	0.0%	$1,156	$960
3	$ -	7.5%	2.0%	$1,242	$979
4	$ -	7.5%	4.0%	$1,335	$1,018
5	$ -	7.5%	6.0%	$1,436	$1,079
6	$ -	7.5%	8.0%	$1,543	$1,166
7	$ -	7.5%	10.9%	$1,659	$1,293
8	$ -	7.5%	14.5%	$1,783	$1,480
9	$ -	7.5%	17.0%	$1,917	$1,732
10	$ -	7.5%	19.0%	$2,061	$2,061

reported return=	7.5%	7.5%	time weighted returns
actual return =	7.5%	7.5%	dollar weighted returns

Asset Loss/(Gain) $0 or 0%



As is shown at the right side of Chart II-D8, for both the level grey experience and the down and then up red experience, the ending assets after 10 years are the same, as are the actual and reported returns shown at the bottom left in this case where there are net zero cash flows (meaning the contributions received and the benefit payments and expenses paid are exactly equal).

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Chart II-D9
Pension Plan with Negative Cash Flows

Starting Assets	$ 1,000	Net Cash Flow Growth	0.0%
Net Cash Flow	$ (80)	Market Cycle	downup

Year	New Cash Flow	Level Returns	Volatile Returns	ASSETS level	ASSETS volatile
1	$ (80.0)	7.5%	-4.0%	$992	$882
2	$ (80.0)	7.5%	0.0%	$984	$802
3	$ (80.0)	7.5%	2.0%	$974	$737
4	$ (80.0)	7.5%	4.0%	$964	$685
5	$ (80.0)	7.5%	6.0%	$954	$643
6	$ (80.0)	7.5%	8.0%	$942	$612
7	$ (80.0)	7.5%	10.9%	$930	$594
8	$ (80.0)	7.5%	14.5%	$917	$595
9	$ (80.0)	7.5%	17.0%	$903	$609
10	$ (80.0)	7.5%	19.0%	$888	$638
reported return=		7.5%	7.5%	time weighted returns	
actual return =		7.5%	5.4%	dollar weighted returns	

Asset Loss/(Gain) $250 or -28%

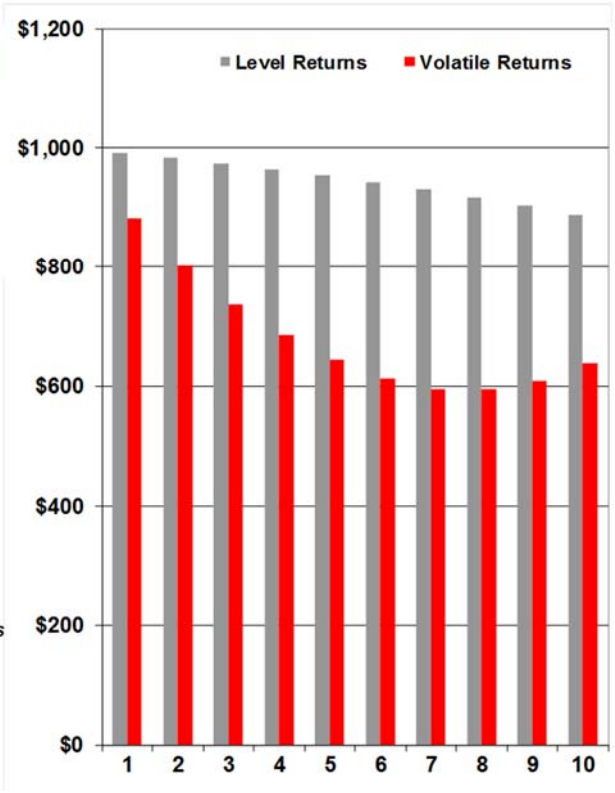


Chart II-D9 now shows that with negative cash flows, the ending assets and actual returns are significantly less for the down and then up market cycle red experience compared to the level returns grey experience despite both the red and the grey experiences averaging the same 7.5% for the 10-year period on a time-weighted basis. The point being, if you have negative cash flows and lose money, there are less assets to be reinvested and earn the higher returns that typically follow.

While any negative cash flow will produce these results, it is typically a negative cash flow rate of 5% or greater that causes significant concerns (the hypothetical plan shown in Chart II-D8 has an 8% negative cash flow rate). For the MainePERS State Employees and Teacher Plan, the negative cash flow is between around 2.5-3% between 2020 and 2028 but is expected to approach 5% after 2028 and increases thereafter, so continued awareness of this dynamic is important.

Other Plan Dynamics

Other plan dynamics should also impact the Board's consideration of actuarial assumptions to use, including the discount rate. Such dynamics include the size of Program costs relative to state revenues and the recent and expected trends of state revenues.

6. The Board's Risk Tolerance/Preference

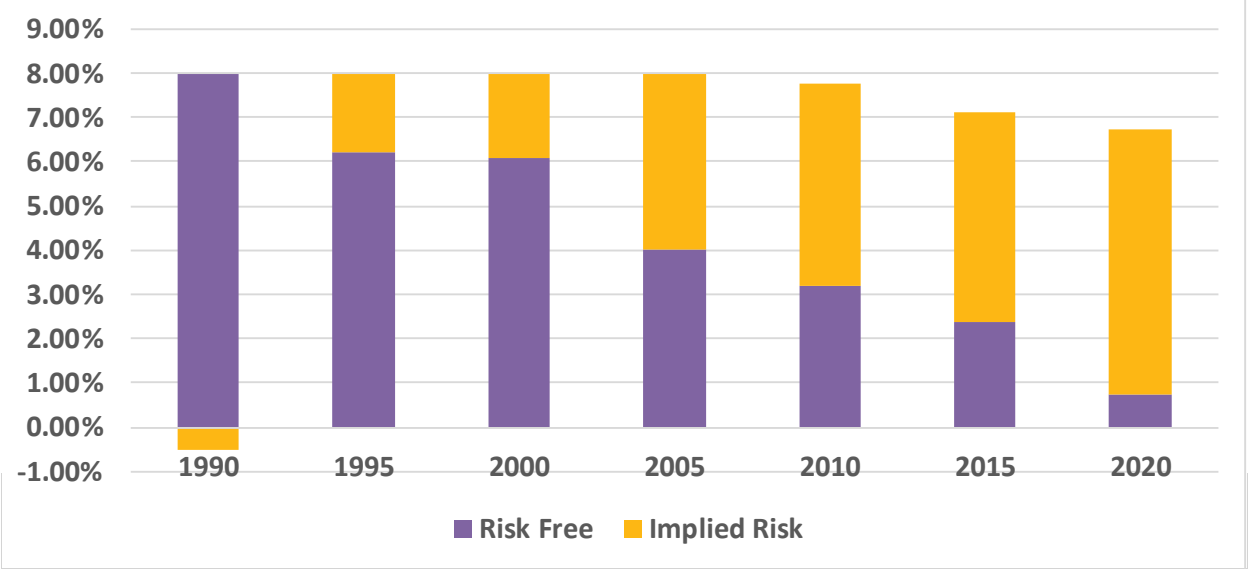
A Board's risk preference generally refers to where the Board's preferences lie within a range of reasonable assumptions, from the more conservative end to the most liberal end, or somewhere in between. Another view of the Board's risk preference would be an assessment of whether the Board would prefer a somewhat lower discount rate, meaning expecting higher contributions concomitant with lower volatility in contributions versus a higher discount rate.

An additional metric to assess risk and thus evaluate the Board risk's preference is shown in Table II-D10 regarding changes in market environments. The decline in interest rates since the 1980s has made achieving a given assumed rate of return increasingly difficult, requiring taking additional risk. In 1990, the yield on the 10-year Treasury was 8.5%, making it relatively easy to achieve, for example, an 8.0% return. In 2014, however, the yield on the 10-year Treasury was only 2.6%, so in order to achieve MainePERS's assumed investment return of 7.125% at that time, the Plan would need to earn 4.525% in addition to what a 10-year Treasury would yield. Based on the 0.73% yield as of June 2020, this risk premium now must be 6.02% to maintain the 6.75% return. Note that while the monthly rate as of June 30, 2020 was extremely low at 0.74%, based on the most recent monthly rate as of April 2021, the implied risk premium is still 5.11%.

SECTION II - ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Table II-D10

	1990	1995	2000	2005	2010	2015	2020
Assumed Return	8.00%	8.00%	8.00%	8.00%	7.75%	7.125%	6.75%
10- Year Treasuries	8.50%	6.20%	6.10%	4.00%	3.20%	2.36%	0.73%
Implied Risk Premium	-0.50%	1.80%	1.90%	4.00%	4.55%	4.77%	6.02%



In response to this decline in interest rates, public pension plans have generally increased the amount of investment risk they are taking in their portfolio allocations while also reducing their discount rate assumptions to increase their likelihood of achieving their assumed return.

Conclusions on the Discount Rate

Based on all the above considerations, we believe a reasonable range for the discount rate assumption is from 6.25% to 6.75%. The Board has adopted a discount rate of 6.75%, which is within this range.

Inflation

Long-term price inflation rates are the foundation of other economic assumptions, including the discount rate as previously discussed. In a growing economy, wages and investments are expected to grow at the underlying inflation rate plus some additional real growth rate, whether it reflects productivity in terms of wages or risk premiums in terms of investments. In recent years and for the foreseeable future, real wage growth in terms of productivity has typically been zero, if not negative, and governmental budgets have been strained by the two market downturns in the 2000's as well as growing uncertainties looking forward. As a result, we recommend equating our price inflation assumption to the across-the-board annual wage inflation and offering no additional margin for real wage growth.

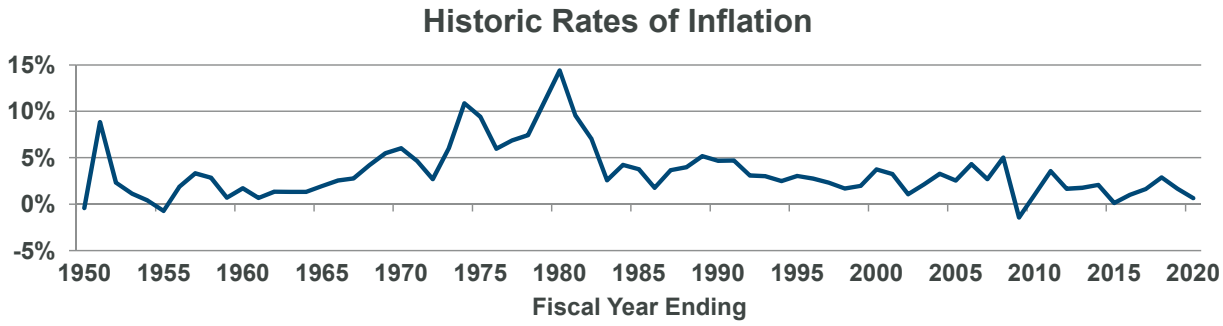
In considering changes to this assumption, the Board reviewed the following factors:

1. Historical Data

In considering the historical experience related to inflation, we considered both price and wage inflation experience as well as historical experience relating to the nation as a whole and to MainePERS in particular. Since wage inflation must eventually equal price inflation, we use the same assumption for wage and price inflation. Any short-term differences between wage and price inflation are reflected in the merit components of the assumptions.

Chart II-I1 below shows the historic rates of inflation for the United States, as given by the Consumer Price Index – All Urban Consumers, by individual year since 1950.

Chart II-I1



Over the period of 50 years ending June 2020, the average geometric inflation rate for the nation has been about 3.9%, but this average is heavily influenced by the high inflation rates of the 1970s and early 1980s. Over the last 30 years, the average geometric inflation rate falls significantly to 2.3%. This rate declines further when we look only at the last 10 years ending June 2020, with an average rate of 1.7%.

2. Future Expectations

Similar to our discussion on discount rates, while it is important to consider historical experience, future expectations are more significant in setting the inflation assumptions. One measure of the market consensus of expected future inflation rates is the difference in yields between conventional Treasury securities and Treasury Inflation-Protected Securities (TIPS) of the same maturity. Table II-I2 below shows the yields for both of these types of bonds of various maturities as well as the difference in their yields, known as the break-even inflation rate, as of December 2020. This break-even inflation is the level of inflation needed for an investment in TIPS to "break-even" with an investment in conventional Treasury bonds of the same maturity. This table shows that even over the longest maturity available, 30 years, this break-even rate barely exceeds 2.0%.

Table II-I2

Break-Even Inflation Based on Treasury Bond Yields

Time to Maturity	Conventional Yield	TIPS Yield	Break Even Inflation
5 Years	0.45	-1.66	2.11
10 Years	1.08	-1.00	2.08
20 Years	1.63	-0.53	2.16
30 Years	1.82	-0.28	2.10

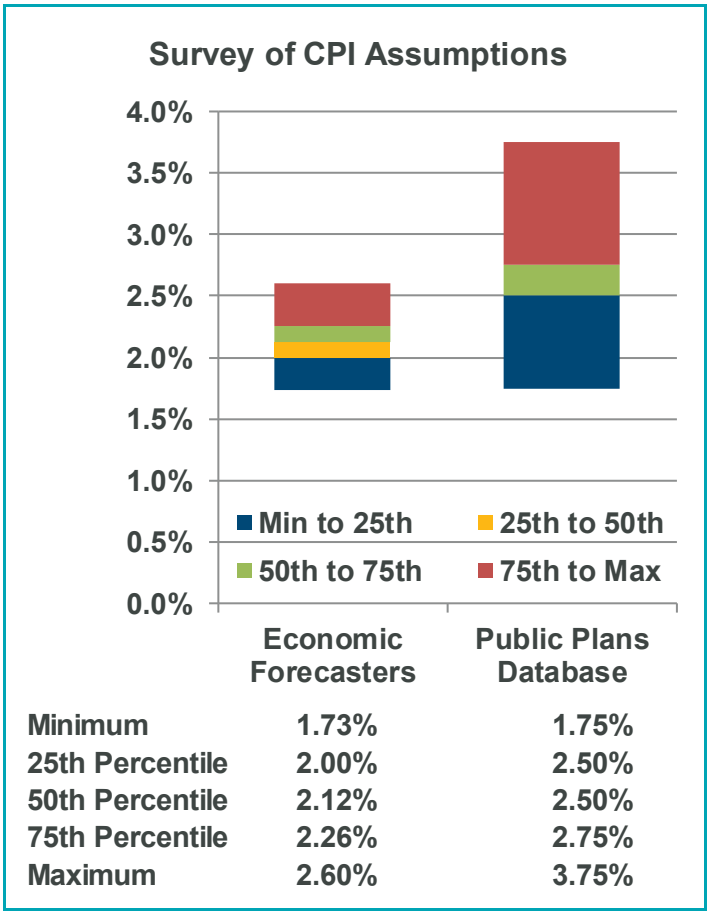
Data Source: Federal Reserve, Constant Maturity Yields
Monthly Series as of December 2020

Another measure of expected future inflation is the quarterly survey of professional economic forecasters' predictions for inflation over the next 10 years published by The Federal Reserve Bank of Philadelphia. For the third quarter of 2020, this survey shows a median inflation forecast of 1.90% with a minimum forecast of 1.61% and a maximum forecast of 2.30%. This is further supported by the policies of the Federal Reserve, which has a long-term target of approximately 2.0%.

Chart II-I3 on the next page shows the distribution of the current 10-year forecasts for CPI-U from this professional survey published by the Federal Reserve Bank of Philadelphia compared to the most recent assumptions for the 139 large public pension plans in the Center for Retirement Research's Public Plans Database who had assumptions reported in either fiscal year 2019 or 2020 as of December 31, 2020.

SECTION II - ECONOMIC ASSUMPTIONS
INFLATION RATE

Chart II-I3



	Economic Forecasters	Public Plans Database
Minimum	1.73%	1.75%
25th Percentile	2.00%	2.50%
50th Percentile	2.12%	2.50%
75th Percentile	2.26%	2.75%
Maximum	2.60%	3.75%

A final source of information regarding expectations for inflation is the Social Security Trustee Reports. The most recent 2020 report reduced the inflation scenarios from those used in 2019 by 0.2% with an intermediate assumption of 2.4% along with a low assumption of 1.8% and a high assumption of 3.0%.

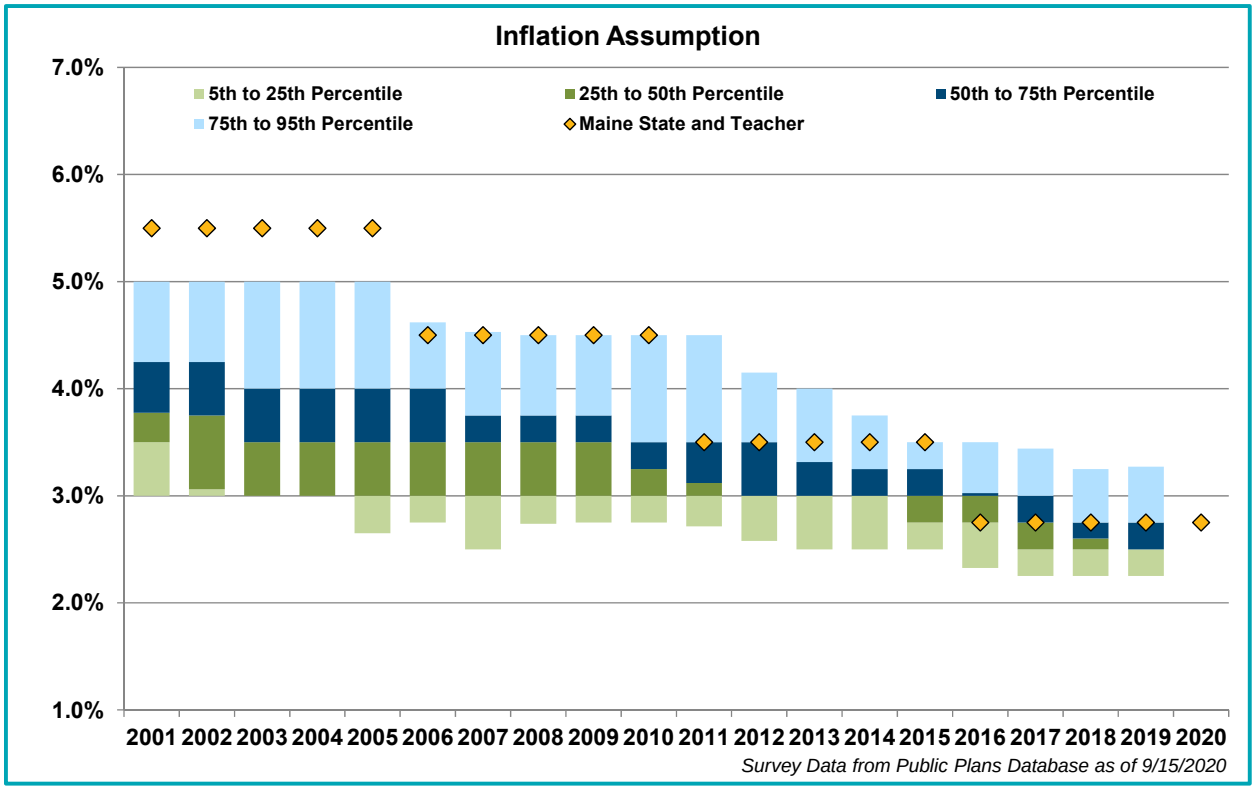
Based on these future expectations and the long-time horizon for the MainePERS inflation assumption, we find that an inflation assumption in the range from 2.50% to 2.75% is reasonable.

3. Industry Trends

The Center for Retirement Research publishes a database of information on state and municipal public pension plans. Chart II-I4 below shows the inflation assumptions for the central 90% of the plans in this database since 2001 as well as the MainePERS assumption assumed for each of these years.

SECTION II - ECONOMIC ASSUMPTIONS
INFLATION RATE

Chart II-I4



The chart shows that the current average inflation assumption as of September 2020 was approximately 2.25%, which is less than MainePERS's current assumption of 2.75%.

4. Regulatory/Professional Standards

There currently are no regulatory standards, either federal or State of Maine-specific, which would apply to the setting of MainePERS's inflation assumption. There is however, as mentioned in the section on the discount rate, an actuarial professional standard, provided by Actuarial Standard of Practice (ASOP) No. 27, which requires that any actuarial economic assumption used in valuing pension have no significant bias (i.e., be neither significantly optimistic nor pessimistic), except when provisions for adverse deviation are included and disclosed. The word "significant" is not quantitatively defined within this standard, but there is general agreement that the permissible range has been significantly tightened from prior ASOP standards.

Therefore, conservative assumptions are permitted under current regulatory and professional standards if desired, as long as they are disclosed as such. However, in MainePERS's case, we believe that an inflation assumption between 2.5 and 2.75% would satisfy all applicable professional standards, including being neither significantly optimistic nor pessimistic.

5. Plan Dynamics

The primary plan dynamics to consider in MainePERS's case is that both the initial annuities, which are calculated reflecting pay history, and the cost-of-living adjustments are impacted by inflation as well as the amounts of the amortization payments to be paid on the unfunded liabilities of the Programs. Therefore, when reductions are made to the assumed inflation rate, the decrease in liability due to lower assumed benefit and COLA increase amounts are partially offset by a lower assumed rate of growth in the amortization payments.

6. The Board's Risk Tolerance/Preference

The Board's risk tolerance/preference is a consideration for each of the economic and demographic assumptions and results in determining whether the recommended assumption should be on the more conservative or aggressive end of the recommended range for each assumption. This consideration was discussed in detail in the previous section on the discount rate, which is the most significant of the economic assumptions to the development of the liabilities of the Plans. The concepts in that discussion also apply to the inflation assumption, as well as all other assumptions under consideration.

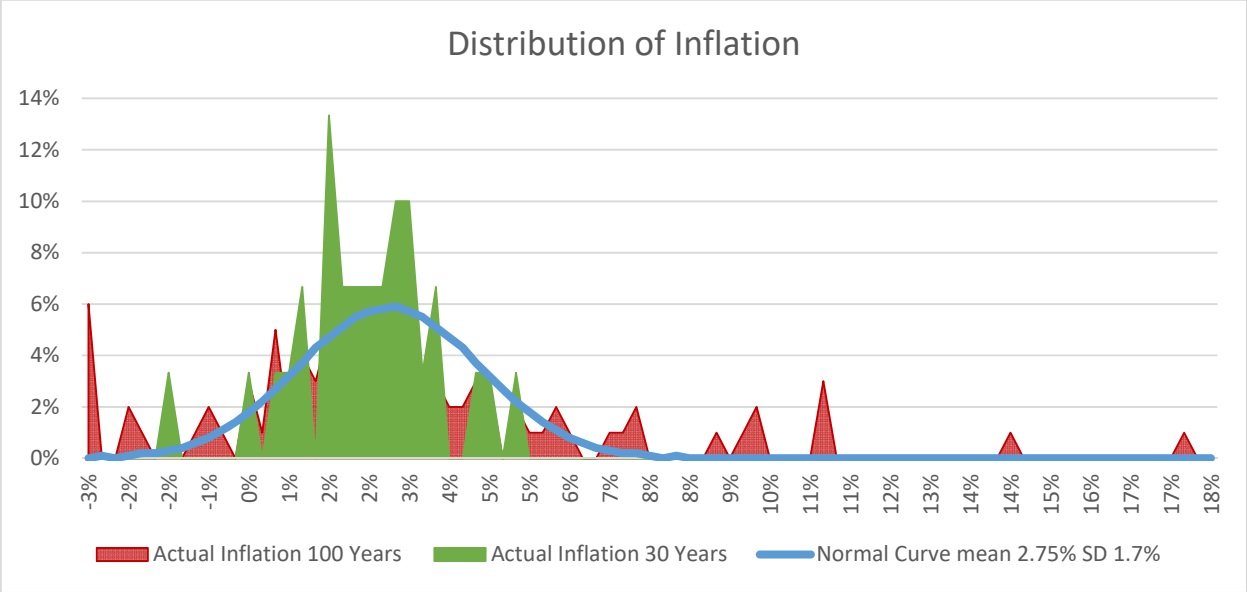
Conclusions on the Inflation Assumption

Based on all the above considerations, we believe a reasonable range for the inflation rate assumption is from 2.5% to 2.75%. The Board has adopted no change in the inflation rate of 2.75%, which is within this range.

COLA Assumption

The COLA assumption is directly linked to the inflation assumption. The only difference is that the actual COLA assumption for all Programs except the Consolidated PLD Plan reflects the inflation assumption with a 3.0% COLA cap and should, therefore, be lower than the 2.75% inflation assumption being recommended in this report. The 2.75% inflation assumption is the expected average of future inflation, and there will be years that inflation exceeds 2.75% and years that it will be less than 2.75%, but the COLA will not exceed 3.0% in any year. As a result, the average future COLA based on an inflation assumption of 2.75% and a COLA cap of 3.0% must be less than 2.75%. Chart II-C1 below may help in explaining this issue.

Chart II-C1



The chart shows that the actual inflation experience, either over the last 30 years or 100 years, bears a reasonable resemblance to a normal distribution with a mean of 2.75% and standard deviation of 1.7%, shown by the blue line in the chart. When capping inflation at 3%, using a lognormal stochastic projection methodology, we conclude that an annual COLA increase assumption of 2.20% would result from and be consistent with the Board's adopted inflation increase assumption of 2.75%. Similarly, for the Consolidated PLD Plan with a cap on the COLA of 2.5%, the annual COLA increase assumption produced by this methodology is 1.91%.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MERIT SALARY INCREASES

The demographic assumptions used in actuarial valuations of pension plans are intended to be long-term in nature and should be both individually reasonable and consistent with each other. The specific assumptions analyzed in this report are as follows:

- **Merit salary increases**
- **Retirement rates**
- **Termination rates**
- **Disability rates**
- **Mortality rates**

In contrast to the economic assumptions, the factors considered in developing recommendations for these assumptions are primarily based on MainePERS's own experience rather than national trends. In addition to considering the actual experience during the study period, we also considered regulatory and professional standards, expectations for the future, and the preferences and risk tolerance of the MainePERS Board. Finally, while industry trends are not a primary consideration in recommending these assumptions, we did consider them for informational purposes prior to finalizing our recommendations on these demographic assumptions.

Also, in contrast to the economic assumptions, these demographic assumptions are generally developed for each individual MainePERS Program rather than for all the Programs as one. The full details of the current and recommended demographic assumptions by each MainePERS Program are provided in Appendix A to this report.

We first discuss the merit salary increase assumptions with the remainder of this section comprised of analysis relating to the demographic rate assumptions.

Merit Salary Increases

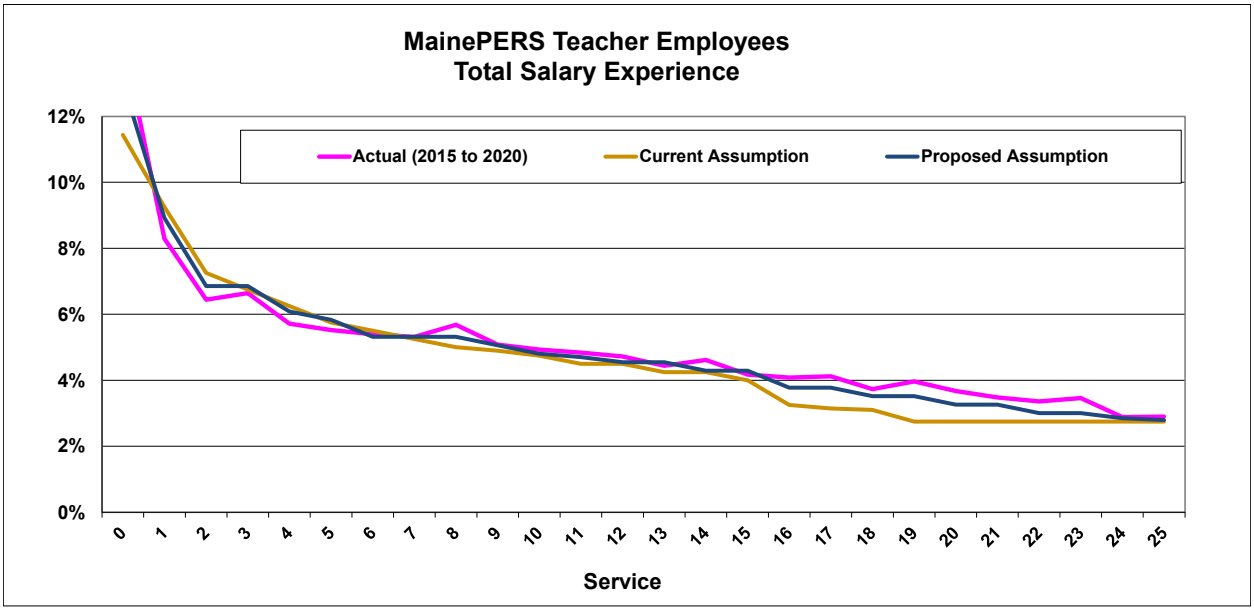
Inflation is one of two components of total individual salary increases. In this section, the analysis develops the second of these individual salary increases components, the merit increase. Generally, newly hired employees are more likely to earn a step increase or receive a promotion, so their salary increases tend to be greater than those for longer-service employees. In some plans, the merit increase is best predicted by service, while in other plans it is best predicted by age. As part of our analysis, we examined both approaches and found service to be a better fit than age for these Programs.

The merit salary increase assumption is added to the inflation assumption to calculate the total salary increase expected for an individual. To analyze the merit component, the increase in the average salary paid to members of the Plan for a given year is reduced by the component assumed to relate to growth due to wage inflation. Assumed merit salary increases for members of each Program net of assumed inflation rate are then developed for each year of service.
Charts III-S1, III-S2, and III-S3 show the current total salary increase assumption (gold line) compared to the actual experience (pink line) and the proposed assumption (dark blue line) for

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MERIT SALARY INCREASES

each year of service from 0 to 25 for teachers, state employees, and PLD employees, respectively. The analysis of salary increases was performed using data from the 2015-2020 valuations. Compared to the current assumption for teachers, the proposed assumption reflects mostly greater salary increases for all employees. Compared to the current assumption for state employees, the proposed assumption reflects larger total salary increases for nearly all employees. The PLD proposed assumption also recommends greater salary increases than the current assumption. Details of these recommendations are included in Appendix A of this report, including the rates recommended for the Judicial and Legislative Programs as well.

Chart III-S1 - Teachers



SECTION III - DEMOGRAPHIC ASSUMPTIONS
MERIT SALARY INCREASES

Chart III-S2 - State Employees

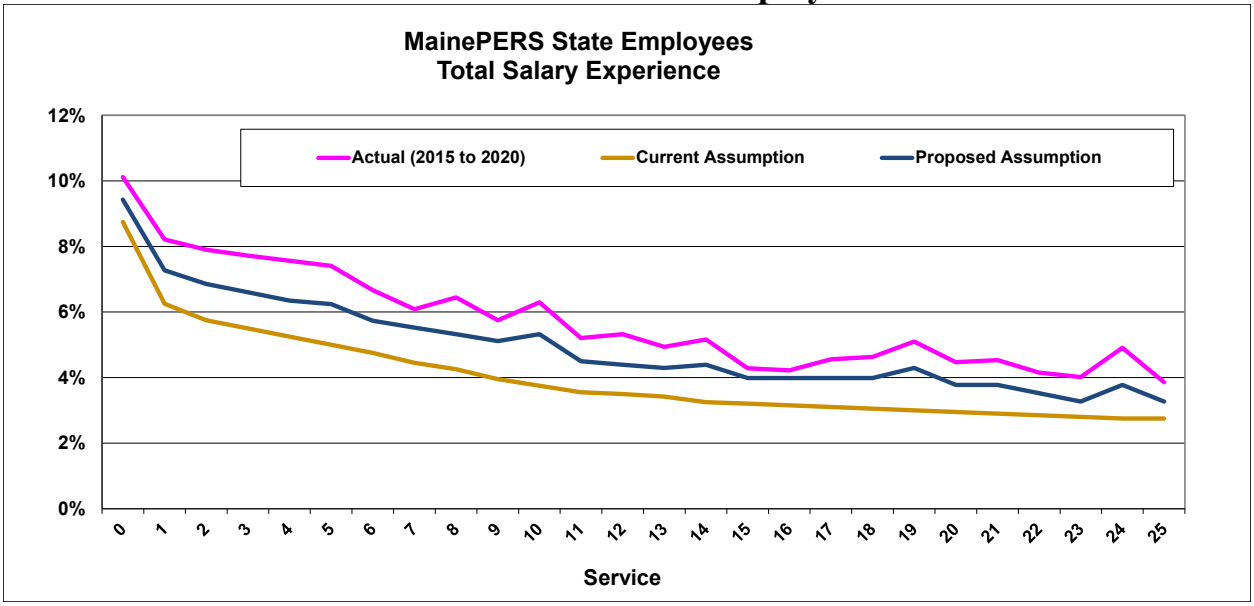
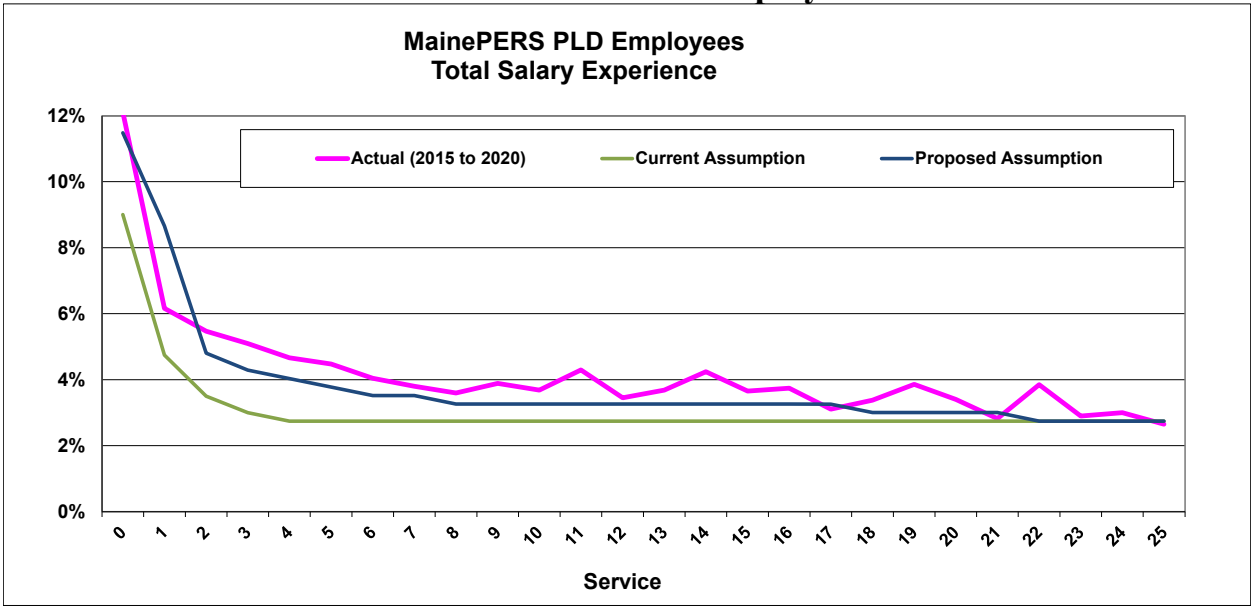


Chart III-S3 - PLD Employees



SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Introduction to Analysis of Demographic Rate Assumptions

For the remainder of the demographic assumptions, we determined the ratio of the actual number of decrements for each membership group compared to the expected number of decrements (A/E ratio or actual-to-expected ratio). If an assumption were perfect, this ratio would be 100%, and any recommended assumption change should move from the current A/E ratio towards an A/E ratio closer to 100%, unless future experience is expected to be different from the experience during the period of study.

We considered both headcount-weighted assumptions, where each individual is counted once, and benefits-weighted assumptions for each of the assumptions, and determined that it was more appropriate to use headcount-weighted assumptions in all cases but mortality.

We also calculated an r-squared statistic for each assumption. R-squared values measure how well an assumption fits the actual data and can be thought of as the percentage of the variation in the actual data that is explained by the assumption. Ideally, r-squared values would equal 100%, but this is never the case in reality. A recommended assumption will generally increase the r-squared value compared to the r-squared value of the current assumption, moving it closer to 100%, unless the pattern of future decrements is expected to be different from the pattern experienced during the period of study. Note, however, that the proposed assumptions will typically only move the r-squared value closer to 100% rather than all the way, reflecting the desire to adjust assumptions gradually.

In addition, we also calculated 90% confidence intervals for each demographic rate assumption, which represent the range within which the true decrement rate during the experience study period fell within 90% confidence. (If there is insufficient data to calculate a confidence interval for a given group and assumption, the confidence interval is shown as the entire range of the graph.) We generally propose assumption changes when the current assumption is outside the 90% confidence interval of the observed experience. However, adjustments are made to account for differences between future expectations and historical experience, to account for the past experience represented by the current assumption, and to maintain a neutral to slightly conservative bias in the selection of the assumption.

Retirement Rates

The current retirement rates vary by age and are different for Teachers and State Regular Employees, State Special Employees, PLD Regular Employees, PLD Special Plan Employees, Judicial, and Legislative. For all groups except the State Special Employees and PLD Employees, the current assumptions are further developed based on the following subgroups:

- NRA 60 – members with at least 10 years of creditable service on July 1, 1993 (Normal Retirement Age = 60),

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

- NRA 62 – members with less than 10 years of creditable service on July 1, 1993, but five or more years of creditable service on July 1, 2011 (Normal Retirement Age = 62), and
- NRA 65 – members with less than five years of creditable service on July 1, 2011 (Normal Retirement Age = 65).

For the PLD Employees, the current assumptions are further developed based on the following subgroups:

- NRA 60 – employees hired prior to July 1, 2014, and
- NRA 65 – employees hired on or after July 1, 2014 (Normal Retirement Age = 65).

For the State Special Plan, we developed separate retirement assumptions, with specific distinct assumptions for the 25 & Out Plan and the 98 Special Plan (including Fire Marshals) as well as a third distinct retirement assumption for the remaining special plans.

We discuss significant changes in the retirement rates for the various Programs in the following sections, but Appendix A of this report should be referred to for complete details of the proposed retirement rates for all of the Programs.

State & Teacher Retirement Program Retirement

We analyzed the State Regular and Teacher's retirement experience as two separate groups and on a combined basis, both excluding the State Special experience. The separate experience proved to be a better fit for the data, so we propose keeping separate sets of retirement assumption tables for the three tiers forState Regular Employees and Teachers.

Table III-R1 shows the calculation of actual-to-expected ratios and the r-squared statistic for Teachers in the NRA 60 group, and Chart III-R1 shows this information graphically along with the 90% confidence intervals.

The data shows higher actual retirement rates than expected at most ages under the current assumption and that members are retiring later than age 70. The proposed assumption, shown as the green line in Chart III-R1, increases the assumed rate of retirement and decreases the aggregate A/E ratio from 113% to 103%. The r-squared also increases from 0.9595 to 0.9922. For the proposed assumption, assumed 100% retirement is extended from age 75 to age 80.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R1

Teachers Retirement Rates - NRA 60						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
57	306	14	12	12	114%	114%
58	422	32	32	32	101%	101%
59	535	115	80	107	143%	107%
60	557	160	139	153	115%	104%
61	480	106	96	101	110%	105%
62	461	113	92	106	123%	107%
63	417	98	83	92	118%	107%
64	355	107	89	99	121%	108%
65	284	94	99	97	95%	97%
66	198	55	50	53	111%	103%
67	148	50	59	52	84%	97%
68	100	27	30	28	90%	96%
69	65	19	13	18	146%	108%
70	40	13	8	12	163%	108%
71	25	9	5	8	180%	120%
72	17	5	3	5	147%	98%
73	12	5	2	4	208%	139%
74	10	6	2	4	300%	150%
75+	22	7	22	22	32%	32%
Total	**4,454**	**1,035**	**918**	**1,004**	**113%**	**103%**
R-squared			**0.9595**	**0.9922**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R1

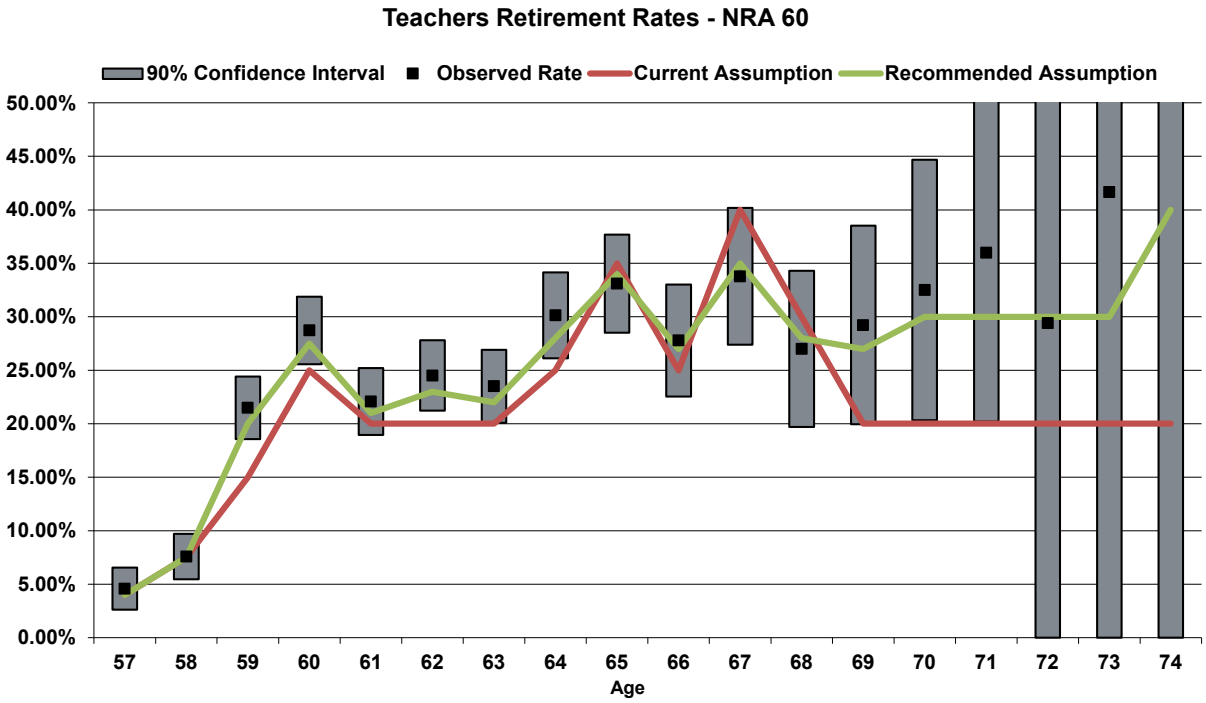


Table III-R2 shows the calculation of actual-to-expected ratios and the r-squared statistic for Teachers in the NRA 62 group, and Chart III-R2 shows this information graphically along with the 90% confidence intervals.

The data shows higher actual retirement rates than expected under the current assumption. The proposed assumption, shown as the green line in Chart III-R2, generally increases the assumed rate of retirement and decreases the aggregate A/E ratio from 110% to 99%. The r-squared also increases from 0.8708 to 0.9425. For the proposed assumption, assumed 100% retirement is extended from age 75 to age 80.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R2

Teachers Retirement Rates - NRA 62						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
57	1,077	35	43	38	81%	93%
58	1,005	36	40	40	90%	90%
59	979	55	39	44	140%	125%
60	914	83	69	73	121%	114%
61	873	232	153	210	152%	111%
62	1,905	407	476	419	85%	97%
63	1,558	273	234	280	117%	97%
64	1,353	313	271	298	116%	105%
65	1,045	322	261	314	123%	103%
66	755	222	170	211	131%	105%
67	547	157	109	153	144%	103%
68	403	94	81	89	117%	106%
69	316	83	63	79	131%	105%
70	243	79	49	49	163%	163%
71	149	27	30	30	91%	91%
72	105	19	21	21	90%	90%
73	75	16	15	15	107%	107%
74	53	18	11	11	170%	170%
75+	138	21	138	138	15%	15%
Total	**13,493**	**2,492**	**2,272**	**2,511**	**110%**	**99%**
R-squared			**0.8708**	**0.9425**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R2

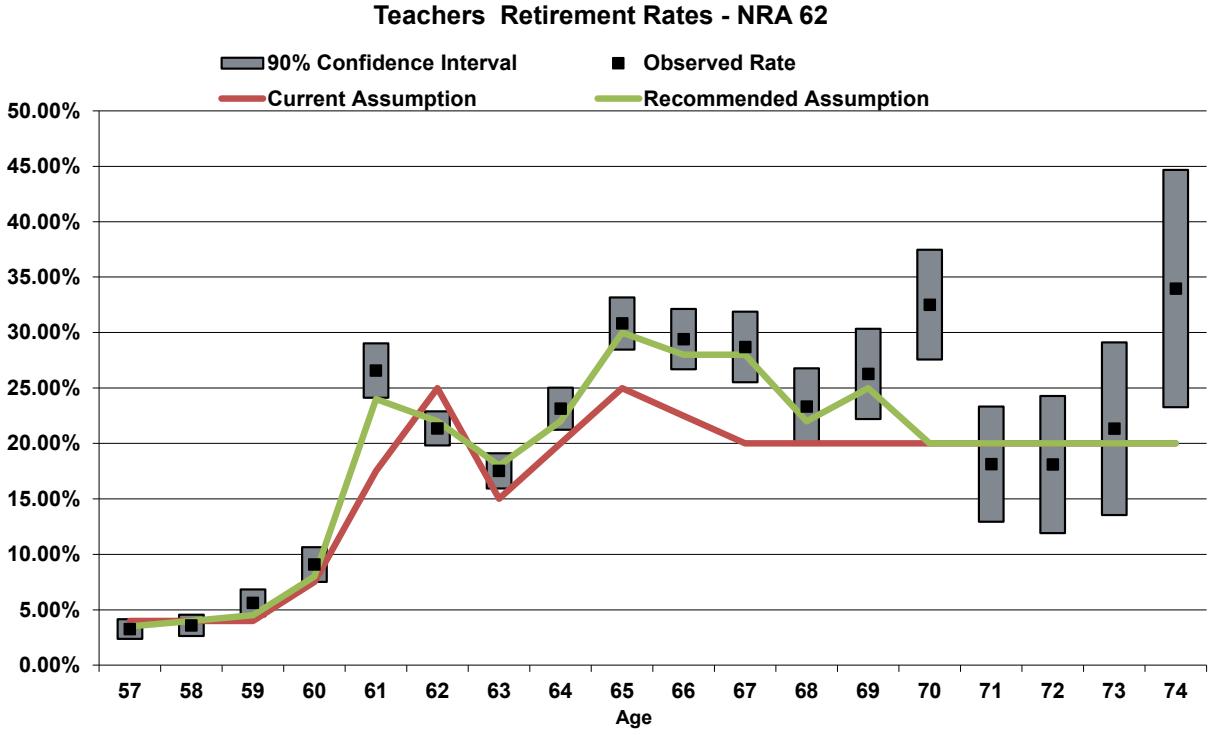


Table III-R3 shows the calculation of actual-to-expected ratios and the r-squared statistic for Teachers in the NRA 65 group, and Chart III-R3 shows this information graphically along with the 90% confidence intervals.

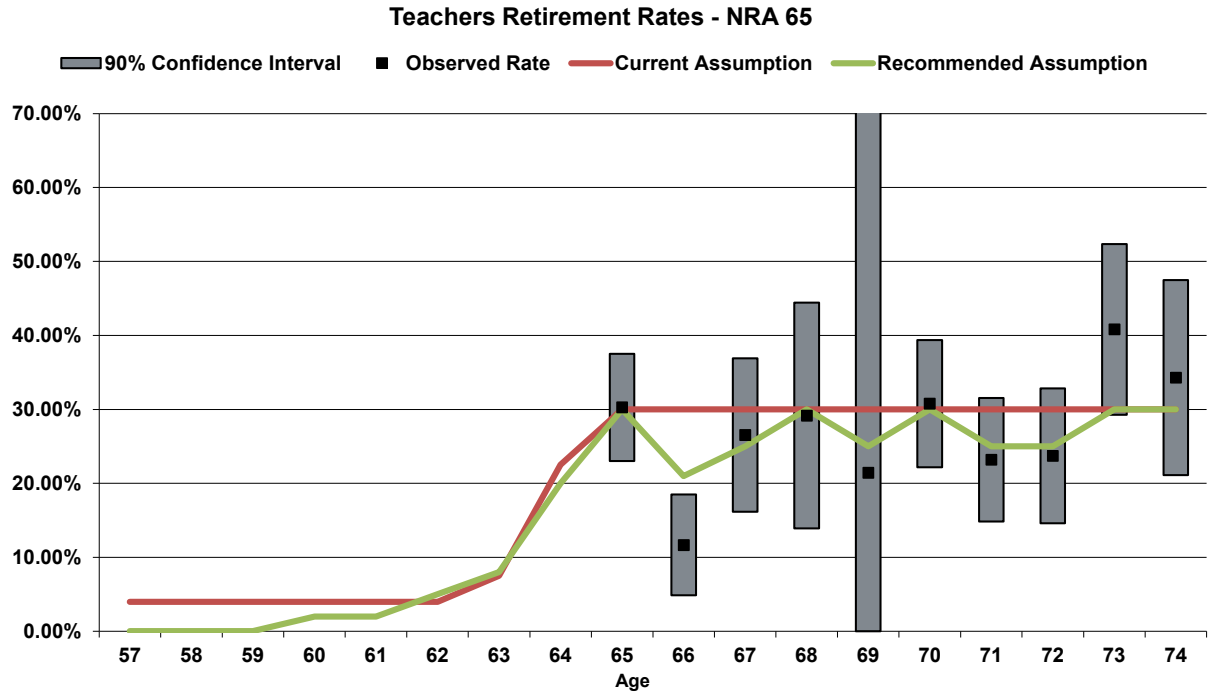
The data is fairly inconclusive since the only members eligible to retire from this group would be those already age 65 and older. Given the lack of credible experience to fully move towards a results-based table, we recommend a general lowering of the retirement assumption. Our recommended assumption is shown as the green line in Chart III-R3. The lack of credible experience is reflected in the low value of the A/E ratios, with the current assumption being 66% and the proposed only increasing this to 69%, and the low r-squared values. We will revisit this assumption as actual experience emerges. For the proposed assumption, assumed 100% retirement is extended from age 75 to age 80.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R3

Teachers Retirement Rates - NRA 65						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
65	109	33	33	33	101%	101%
66	60	7	18	13	39%	56%
67	49	13	15	12	88%	106%
68	24	7	7	7	97%	97%
69	14	3	4	4	71%	86%
70	78	24	23	23	103%	103%
71	69	16	21	17	77%	93%
72	59	14	18	15	79%	95%
73	49	20	15	15	136%	136%
74	35	12	11	11	114%	114%
75+	119	37	119	119	31%	31%
Total	**665**	**186**	**283**	**268**	**66%**	**69%**
R-squared			**0.5899**	**0.6111**		

Chart III-R3



SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R4 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Regular Employees in the NRA 60 group, and Chart III-R4 shows this information graphically along with the 90% confidence intervals.

The data shows lower actual retirement rates than expected at some ages under the current assumption and that members are retiring later than age 70. The proposed assumption, shown as the green line in Chart III-R4, decreases the assumed rate of retirement and increases the aggregate A/E ratio from 91% to 96%. The r-squared also increases from 0.6238 to 0.9573. For the proposed assumption, assumed 100% retirement is extended from age 75 to age 80.

Table III-R4

State Regular Retirement Rates - NRA 60						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
57	170	7	7	7	103%	103%
58	212	4	16	8	25%	47%
59	239	68	36	62	190%	109%
60	190	38	48	40	80%	95%
61	183	38	37	38	104%	99%
62	168	36	34	35	107%	102%
63	138	36	28	35	130%	104%
64	122	21	31	23	69%	91%
65	115	25	40	24	62%	104%
66	102	21	26	21	82%	98%
67	81	15	32	16	46%	93%
68	64	20	19	19	104%	104%
69	41	8	8	8	98%	98%
70	29	5	6	6	86%	86%
71	20	4	4	4	100%	100%
72	16	2	3	3	63%	63%
73	12	6	2	4	250%	143%
74	2	0	0	1	0%	0%
75+	21	7	21	21	33%	33%
Total	**1,925**	**361**	**397**	**377**	**91%**	**96%**
R-squared			**0.6238**	**0.9573**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R4

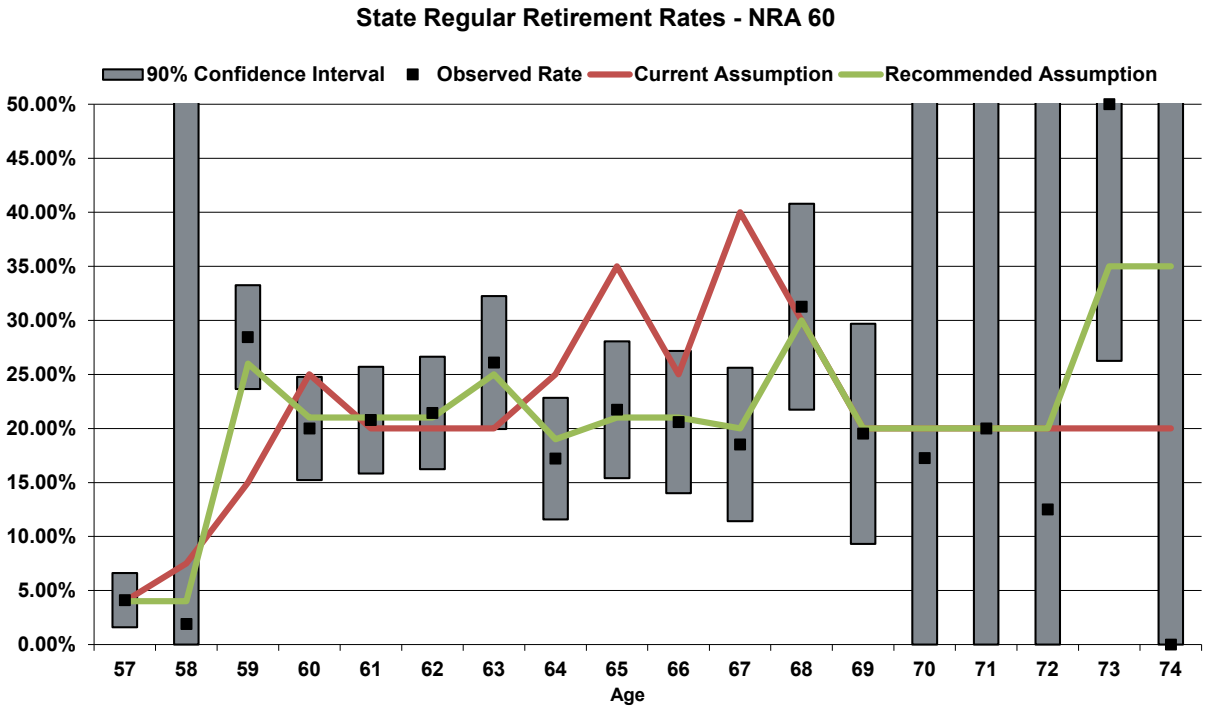


Table III-R5 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Regular employees in the NRA 62 group, and Chart III-R5 shows this information graphically along with the 90% confidence intervals.

The data shows higher actual retirement rates than expected under the current assumption. The proposed assumption, shown as the green line in Chart III-R5, generally increases the assumed rate of retirement and decreases the aggregate A/E ratio from 108% to 98%. The r-squared also increases from 0.8240 to 0.9582. For the proposed assumption, assumed 100% retirement is extended from age 75 to age 80.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R5

State Regular Retirement Rates - NRA 62						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
57	543	16	22	19	74%	84%
58	541	12	22	19	55%	63%
59	525	22	21	21	105%	105%
60	502	23	38	25	61%	92%
61	479	178	84	168	212%	106%
62	863	235	216	233	109%	101%
63	636	123	95	114	129%	107%
64	524	106	105	105	101%	101%
65	411	89	103	90	87%	98%
66	333	90	75	83	120%	108%
67	251	56	50	55	112%	101%
68	189	47	38	38	124%	124%
69	143	31	29	29	108%	108%
70	143	31	29	29	108%	108%
71	115	21	23	23	91%	91%
72	83	14	17	17	84%	84%
73	63	18	13	16	143%	114%
74	43	10	9	11	116%	93%
75+	75	24	75	75	32%	32%
Total	**6,462**	**1,146**	**1,060**	**1,169**	**108%**	**98%**
R-squared			**0.8240**	**0.9582**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R5

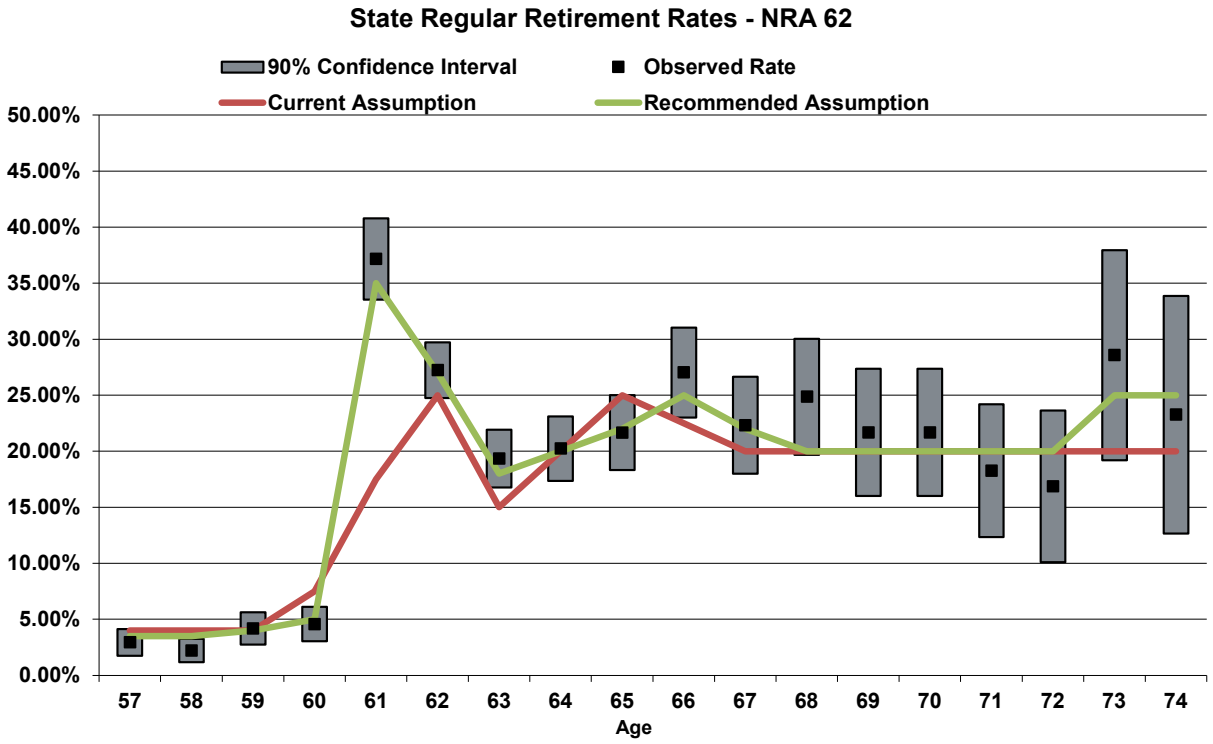


Table III-R6 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Regular Employees in the NRA 65 group, and Chart III-R6 shows this information graphically along with the 90% confidence intervals.

The data is fairly inconclusive, since the only members eligible to retire from this group would be those already age 65 and older. Given the lack of credible experience to fully move towards a results-based table, we recommend generally lowering the retirement assumption. Our recommended assumption is shown as the green line in Chart III-R3. The lack of credible experience is reflected in the low value of the A/E ratios, with the current assumption being 69% and the proposed only increasing this to 84%, and the low r-squared values. We will revisit this assumption as actual experience emerges. For the proposed assumption, assumed 100% retirement is extended from age 75 to age 80.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R6

State Regular Retirement Rates - NRA 65						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
65	83	25	25	21	100%	120%
66	60	18	18	16	100%	111%
67	53	7	16	11	44%	66%
68	26	7	8	7	90%	100%
69	17	2	5	3	39%	59%
70	33	7	10	7	71%	106%
71	21	5	6	4	79%	119%
72	16	3	5	3	63%	94%
73	15	3	5	4	67%	80%
74	8	1	2	2	42%	50%
75+	26	9	26	26	35%	35%
Total	**358**	**87**	**126**	**104**	**69%**	**84%**
R-squared			**0.6389**	**0.5622**		

Chart III-R6

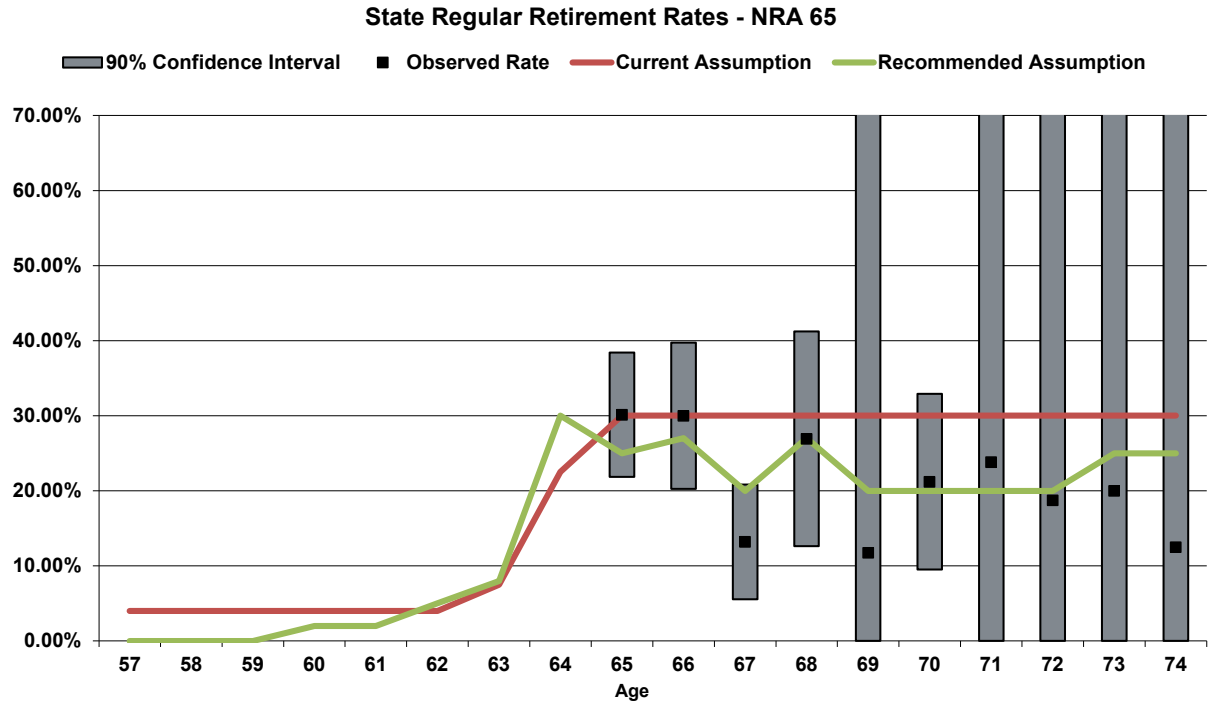


Table III-R7 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Special Employees in the 25 & Out Plan, and Chart III-R7 shows this information graphically along with the 90% confidence intervals. However, given the limited experience of this group due to its limited size, the confidence intervals generally stretch the full graph.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

This shows that actual retirement rates were less than expected under the current assumption across all service amounts. The proposed assumption, shown as the green line in Chart III-R7, therefore generally decreases the assumed rates of retirement, thus increasing the aggregate A/E ratio from 57% to 69%. The r-squared value actually decreases slightly from 0.1626 to 0.1147, but this is not significant given the limited data available.

Table III-R7

State Special - 25 & Out Retirement Rates						
		Terminations			Actual to Expected Ratios	
Service	Exposures	Actual	Current	Recommended	Current	Recommended
25	56	7	14	14	50%	50%
26	40	6	10	10	60%	60%
27	36	7	9	9	78%	78%
28	30	7	8	8	93%	93%
29	28	5	8	7	63%	71%
30	21	5	11	6	48%	87%
31	16	1	8	4	13%	24%
32	13	4	7	5	62%	77%
33	10	4	5	4	80%	100%
34	5	2	3	2	80%	100%
35	4	1	4	2	25%	63%
36	4	2	4	2	50%	125%
37	2	1	2	1	50%	125%
38+	4	1	2	4	50%	25%
Total	**269**	**53**	**93**	**77**	**57%**	**69%**
R-squared			**0.1626**	**0.1147**		

Chart III-R7

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

The 1998 Special Plan assumptions are based on age with experience divided into those with less than 25 years of service and those with 25 or more years of service. Table III-R8 shows the calculation of the actual-to-expected ratios and the r-squared statistic for State Special members in the 1998 Special Plan, and Chart III-R8 shows this information graphically along with the 90% confidence intervals. Note that we have combined the pre and post-25 years of service assumptions to show all of the retirement experience together.

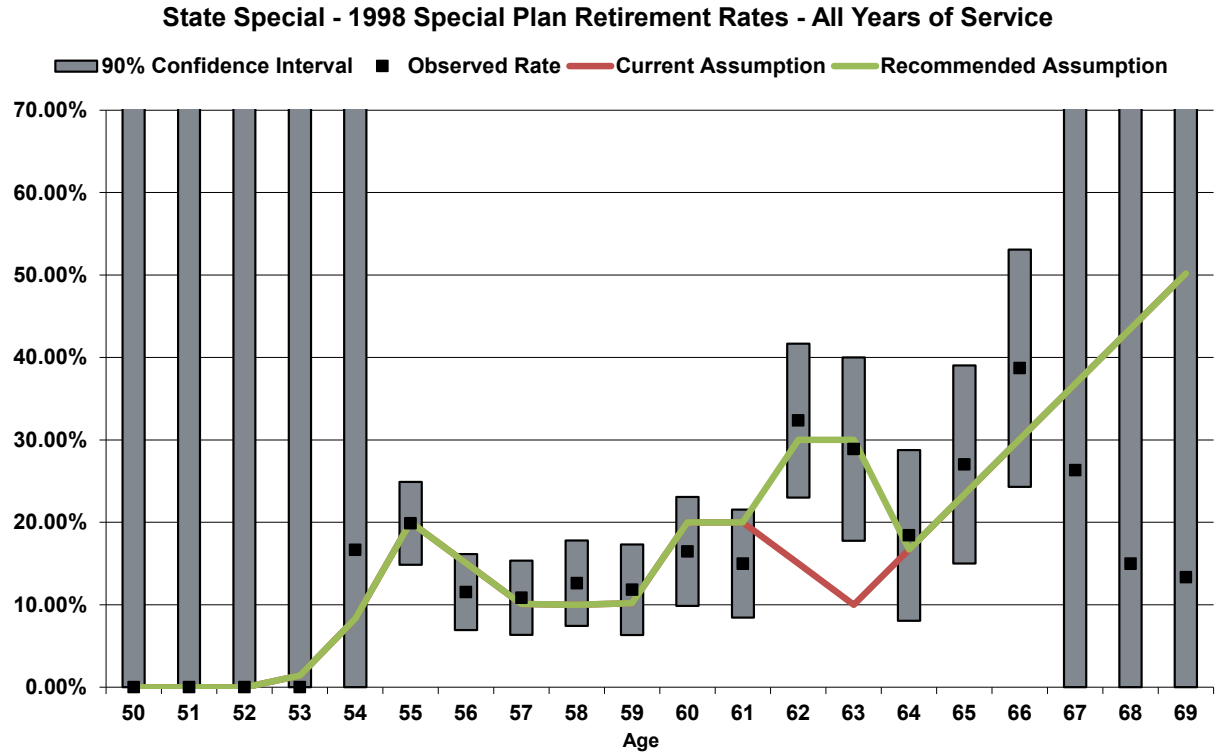
This shows that actual retirement rates were slightly more than expected under the current assumption from ages 62 to 63. The proposed assumption, shown as the green line in Chart III-R8 increases the assumed retirement rates at those ages along with adjustments to fit the structure of the actual experience better. While this results in a moderate decrease in the aggregate A/E ratio from 92% to 84%, it increases the r-shared value from 0.7664 to 0.9122 reflecting the improved alignment of this assumption with actual experience..

Table III-R8

State Special - 1998 Special Plan Retirement Rates - All Years of Service						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
50	3	0	-	-	0%	0%
51	5	0	-	-	0%	0%
52	5	0	-	-	0%	0%
53	7	0	0	0	0%	0%
54	6	1	1	1	200%	200%
55	171	34	34	34	99%	99%
56	130	15	20	20	77%	77%
57	129	14	13	13	107%	107%
58	111	14	11	11	126%	126%
59	93	11	10	10	116%	116%
60	85	14	17	17	82%	82%
61	80	12	16	16	75%	75%
62	68	22	10	20	216%	108%
63	45	13	5	14	289%	96%
64	38	7	6	6	110%	110%
65	37	10	9	9	116%	116%
66	31	12	9	9	129%	129%
67	19	5	7	7	72%	72%
68	20	3	9	9	34%	34%
69	15	2	8	8	27%	27%
70	33	10	33	33	30%	30%
Total	**1,131**	**199**	**216**	**236**	**92%**	**84%**
R-squared			**0.7664**	**0.9122**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R8



The remaining Special Plans membership is small enough and the experience reasonably supports the current assumptions, so the recommended assumptions for the remaining Special Plans is to maintain the assumption of 50% retirement annually beginning when eligibility for unreduced benefits is met, with a 100% rate assumed at age 70.

PLD Consolidated Program Retirement

Our analysis of retirement rates for the PLDs split apart the Regular Tier 1, Regular Tier 2, and Special members. Table III-R9 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Regular NRA 60 members, and Chart III-R9 shows this information graphically along with the 90% confidence intervals.

The data shows lower actual retirement rates than expected under the current assumption. The proposed assumption decreases the assumed rate of retirement and increases the aggregate A/E ratio from 85% to 105%. The r-squared also increases from 0.8392 to 0.9796.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R9

PLD Regular Retirement Rates Age 60 - All Years of Service						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
50	34	4	2	-	235%	0%
51	43	6	2	-	279%	0%
52	57	4	3	-	140%	0%
53	73	0	4	-	0%	0%
54	94	6	5	-	128%	0%
55	114	11	6	-	193%	0%
56	132	7	7	-	106%	0%
57	153	11	8	9	144%	120%
58	161	12	8	10	149%	124%
59	681	67	136	68	49%	98%
60	1,184	160	237	142	68%	113%
61	1,096	133	219	132	61%	101%
62	1,005	171	201	161	85%	106%
63	836	109	167	134	65%	81%
64	732	151	146	146	103%	103%
65	568	182	142	170	128%	107%
66	392	133	98	118	136%	113%
67	288	61	72	72	85%	85%
68	241	53	60	60	88%	88%
69	188	51	47	47	109%	109%
Total	**8,072**	**1,332**	**1,569**	**1,269**	**85%**	**105%**
R-squared			**0.8392**	**0.9796**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R9

PLD Regular Retirement Rates Age 60 - All Years of Service

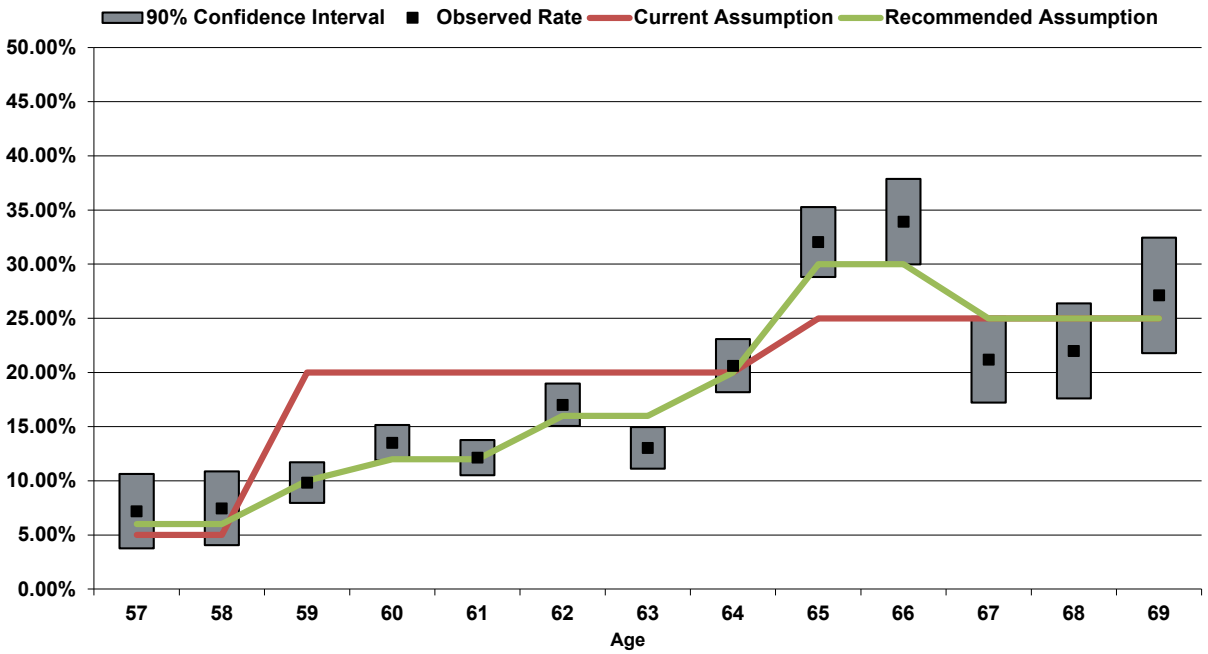


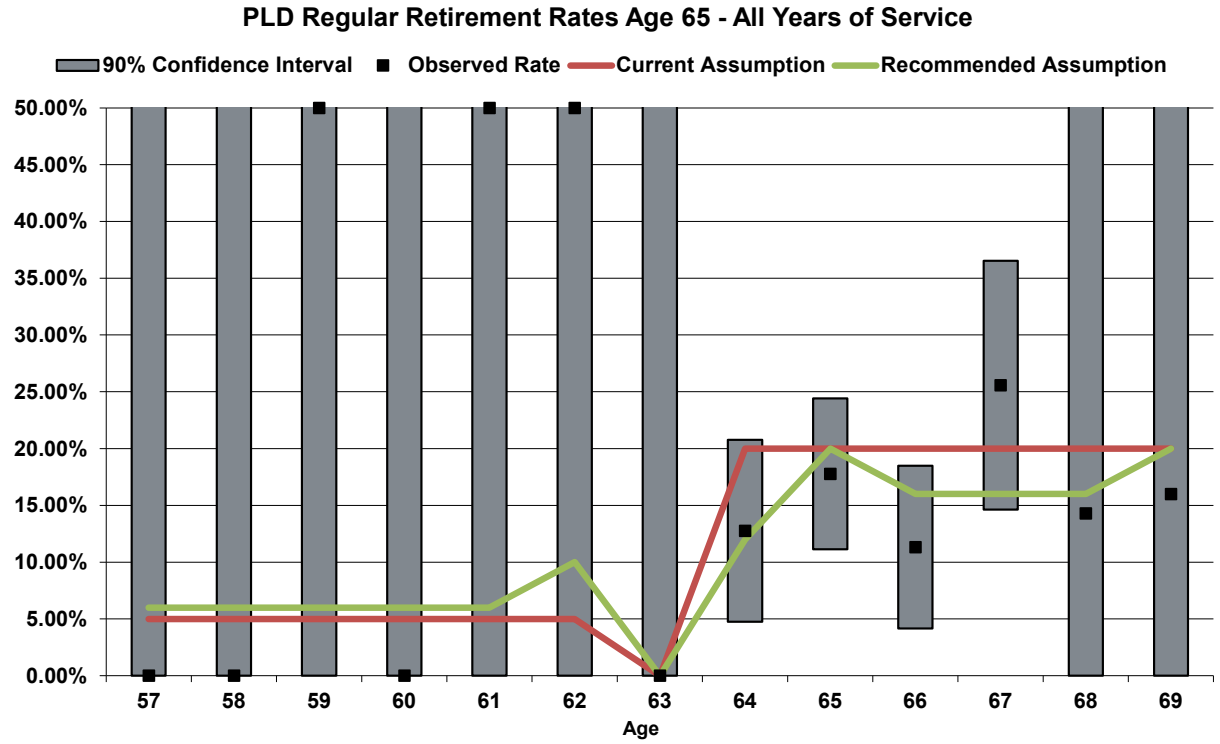
Table III-R10 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Regular NRA 65 members, and Chart III-R10 shows this information graphically along with the 90% confidence intervals. The data shows lower actual retirement rates than expected under the current assumption. The proposed assumption decreases the assumed rate of retirement and increases the aggregate A/E ratio from 52% to 99%. The r-squared also increases from 0.9092 to 0.9172.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R10

PLD Regular Retirement Rates Age 65 - All Years of Service						
		Retirements			Actual to Expected Ratios	
Age	Exposures	Actual	Current	Recommended	Current	Recommended
54	1	0	0	-	0%	0%
55	-	0	-	-	0%	0%
56	-	0	-	-	0%	0%
57	1	0	0	0	0%	0%
58	2	0	0	0	0%	0%
59	2	1	0	0	1000%	833%
60	1	0	0	0	0%	0%
61	2	1	0	0	1000%	833%
62	2	1	0	0	1000%	500%
63	-	0	-	-	0%	0%
64	47	6	9	6	64%	106%
65	90	16	18	18	89%	89%
66	53	6	11	8	57%	71%
67	43	11	9	7	128%	160%
68	28	4	6	4	71%	89%
69	25	4	5	5	80%	80%
70+	70	16	70	18	23%	91%
Total	**367**	**66**	**128**	**67**	**52%**	**99%**
R-squared			**0.9092**	**0.9172**		

Chart III-R10



SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R11 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Special members, and Chart III-R11 shows this information graphically along with the 90% confidence intervals.

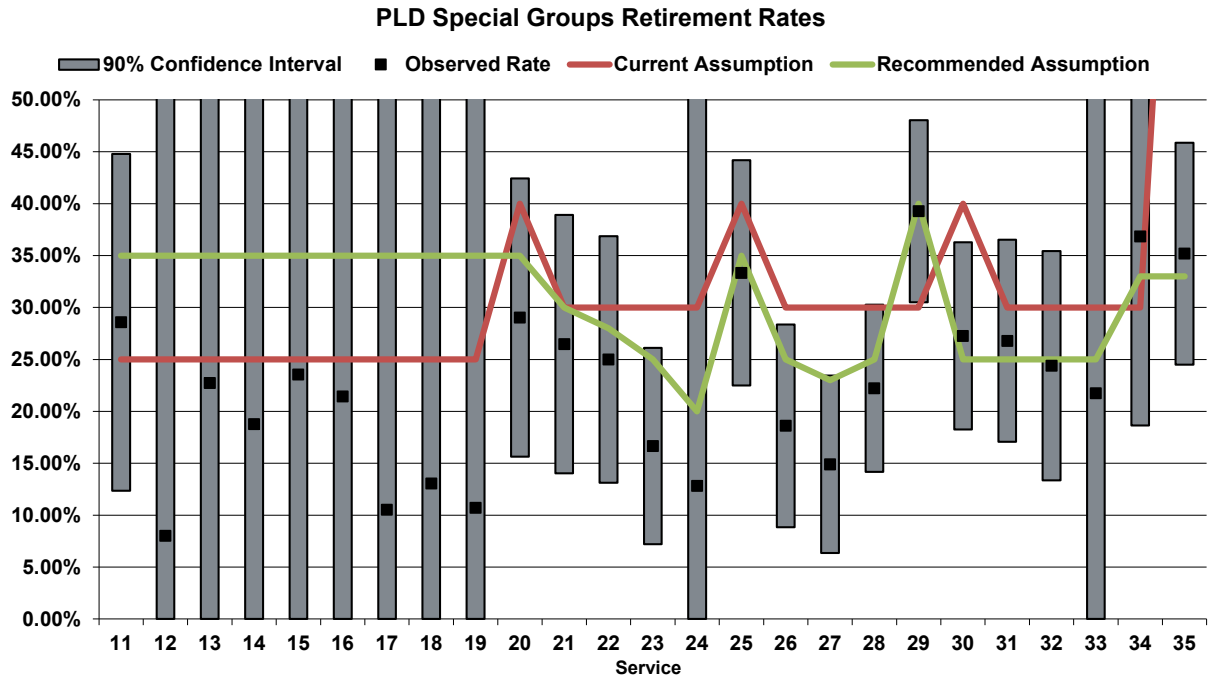
The data generally shows lower actual retirement rates than expected under the current assumption. The proposed assumption adjusts the assumed rates of retirement and increases the aggregate A/E ratio from 71% to 82%. The r-squared also increases from 0.5573 to 0.9138.

Table III-R11

PLD Special Groups Retirement Rates						
		Terminations			Actual to Expected Ratios	
Service	Exposures	Actual	Current	Recommended	Current	Recommended
10	22	7	6	8	127%	91%
11	21	6	5	7	114%	82%
12	25	2	6	9	32%	23%
13	22	5	6	8	91%	65%
14	16	3	4	6	75%	54%
15	17	4	4	6	94%	67%
16	14	3	4	5	86%	61%
17	19	2	5	7	42%	30%
18	23	3	6	8	52%	37%
19	28	3	7	10	43%	31%
20	31	9	12	11	73%	83%
21	34	9	10	10	88%	88%
22	36	9	11	10	83%	89%
23	42	7	13	11	56%	67%
24	39	5	12	8	43%	64%
25	51	17	20	18	83%	95%
26	43	8	13	11	62%	74%
27	47	7	14	11	50%	65%
28	72	16	22	18	74%	89%
29	84	33	25	34	131%	98%
30	66	18	26	17	68%	109%
31	56	15	17	14	89%	107%
32	41	10	12	10	81%	98%
33	23	5	7	6	72%	87%
34	19	7	6	6	123%	112%
35	54	19	54	18	35%	107%
Total	**945**	**232**	**326**	**283**	**71%**	**82%**
R-squared			**0.5573**	**0.9138**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Chart III-R11



Judicial Retirement Program Retirement

As of the 2020 valuation, there was only one active judge with an age 60 normal retirement age. The average age of this group was 72. We are recommending that the probability of retirement be lowered to 50% with 100% retirement assumption at age 75 for this group.

For other active judges, with a normal retirement age of either 62 or 65, the current assumption is that 50% will retire each year once they reach retirement eligibility. Over the experience study period, only 13 judges with these normal retirement rates retired between the ages of 62 and 75 out of a total of 122 possible exposure years, resulting in a percentage well below the current 50% assumption. Based on this, we recommend a reduction in the 50% retirement assumption to 25% and extending the assumption of 100% retirement for judges with an age 65 normal retirement rate to age 80 from the current age 75.

Legislative Retirement Program Retirement

Legislative retirement assumptions are set differently than the groups above. The House and Senate are up for reelection every two years, and there is a four consecutive terms term limit. The current assumption is 25% probability of retirement upon reaching eligibility for all tiers and only applies this assumption in years following a biennial term (with 0% rates in the other years) until assumption of 100% retirement at age 70. We recommend no changes to this assumption.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Rates of termination from active employment have a significant impact on the cost of MainePERS. The current assumption is based on service for State, Teacher, Legislative, and PLD plans, and on age for the Judicial Program.

For each service group, we determined the ratio of the actual number of terminations at each age compared to the expected number of terminations (A/E ratio), similar to what we developed for retirements. If the assumption were perfect, this ratio would be 100%. In addition, we calculated the 90% confidence intervals, which represent the range within which the true termination rate during the experience study period fell with 90% confidence. (If there is insufficient data to calculate a confidence interval, the confidence interval is shown as the entire range of the graph.) We generally propose assumption changes when the current assumption is outside the 90% confidence interval of the observed experience. However, adjustments are made to account for differences between future expectations and historical experience, to account for the past experience represented by the current assumption, and to maintain a neutral to slight conservative bias in the selection of the assumption.

State & Teacher Retirement Program Termination

We analyzed the State and Teacher termination experience separately and on a combined basis, looking at age-based rates, service-based rates, and rates based on gender. The separate service-based experience proved to be a better fit for the data, and gender was not a significant predictor, so we propose using separate tables for Teachers and State Employees.

Table III-T1 shows the calculation of actual-to-expected ratios and the r-squared statistic for Teacher employees, and Chart III-T1 shows this information graphically along with the 90% confidence intervals.

The data shows lower actual termination rates than expected under the current assumptions for teachers. The proposed assumption decreases the assumed rates of termination and increases the aggregate A/E ratio from 71% to 84%. The r-squared also increases from 0.9794 to 0.9906.

Table III-T1

Teacher Termination Rates						
		Terminations			Actual to Expected Ratios	
Service	Exposures	Actual	Current	Recommended	Current	Recommended
<1	5,370	998	1,799	1,396	55%	71%
1 - 5	32,266	3,874	5,414	4,664	72%	83%
5 - 9	22,714	1,499	1,879	1,683	80%	89%
10 - 14	20,435	782	1,027	923	76%	85%
15 - 19	17,203	540	724	587	75%	92%
20 - 24	10,997	298	440	330	68%	90%
25+	8,641	316	346	259	91%	122%
Total	**117,626**	**8,307**	**11,629**	**9,843**	**71%**	**84%**
R-squared			**0.9794**	**0.9906**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Chart III-T1

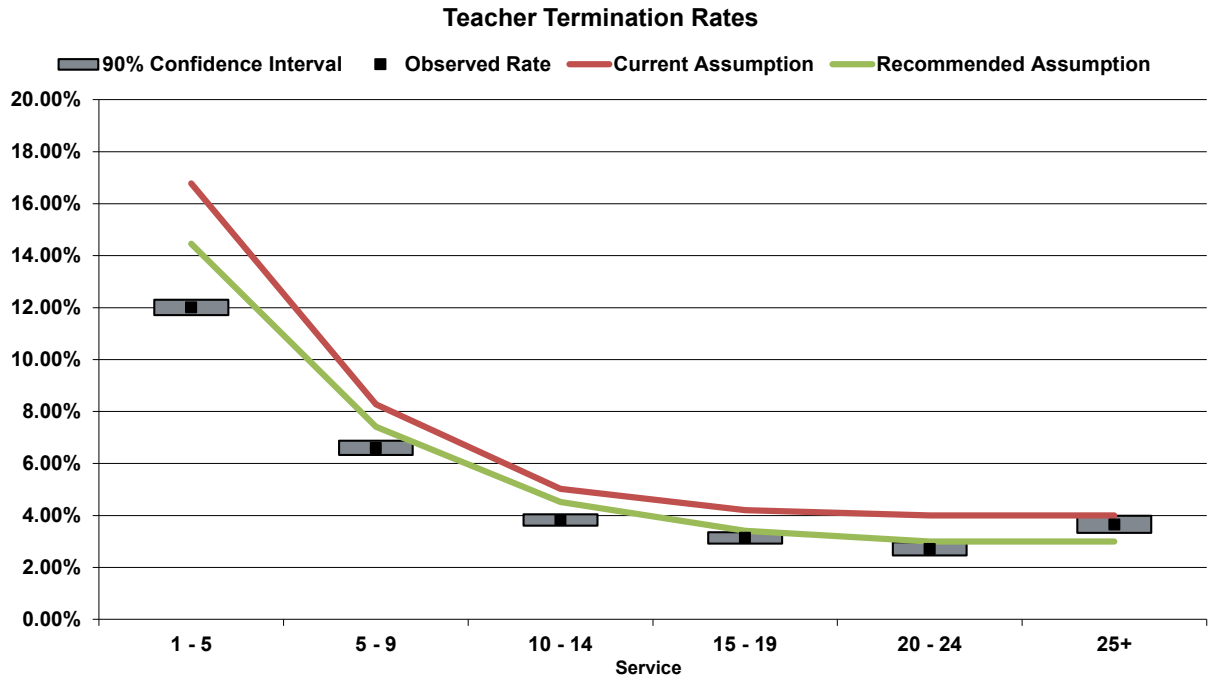


Table III-T2 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Regular Employees, and Chart III-T2 shows this information graphically along with the 90% confidence intervals.

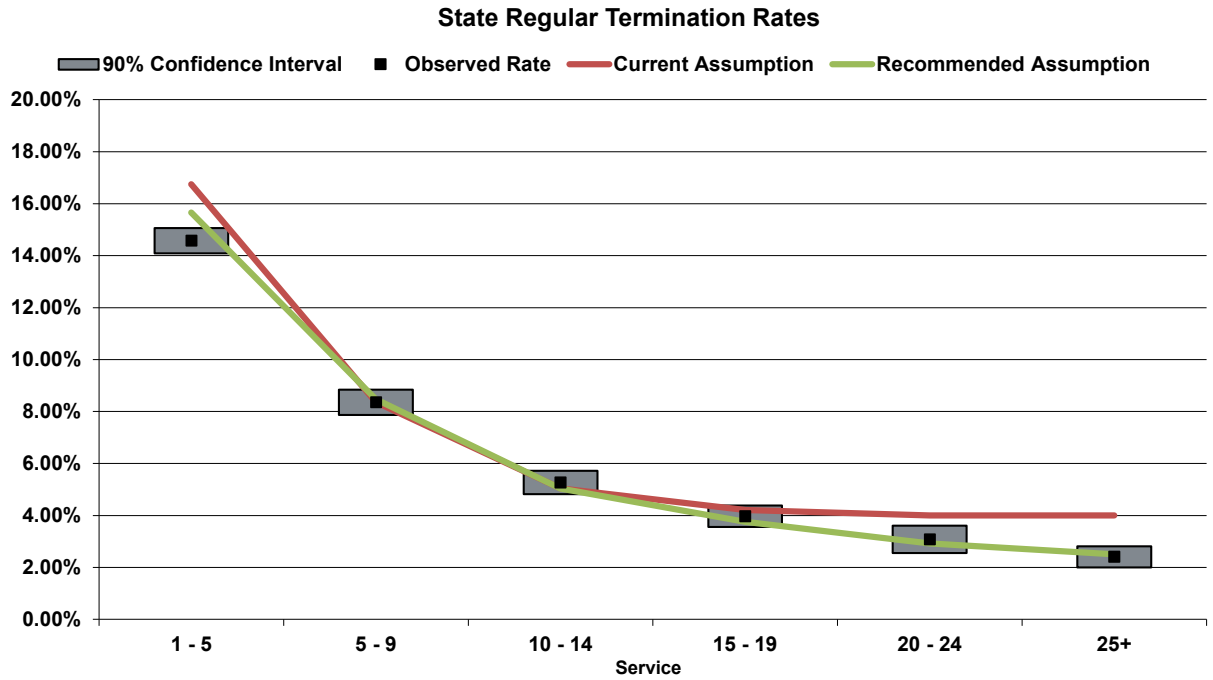
The data shows lower actual termination rates than expected under the current assumptions for state employees. The proposed assumption decreases the assumed rates of termination and increases the aggregate A/E ratio from 91% to 97%. The r-squared also increases slightly from 0.9951 to 0.9987.

Table III-T2

State Regular Termination Rates						
		Terminations			Actual to Expected Ratios	
Service	Exposures	Actual	Current	Recommended	Current	Recommended
<1	3,300	1,047	1,106	1,073	95%	98%
1 - 5	14,058	2,049	2,354	2,202	87%	93%
5 - 9	8,845	739	739	749	100%	99%
10 - 14	6,647	350	335	334	104%	105%
15 - 19	6,024	239	254	226	94%	106%
20 - 24	2,924	90	117	85	77%	105%
25+	3,904	94	156	98	60%	96%
Total	**45,702**	**4,608**	**5,061**	**4,767**	**91%**	**97%**
R-squared			**0.9951**	**0.9987**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Chart III-T2



PLD Consolidated Retirement Program Termination

Table III-T3 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Regular Employees, and Chart III-T3 shows this information graphically along with the 90% confidence intervals.

The data shows higher actual termination rates than expected under the current assumption. The proposed assumption increases the assumed rates of termination and decreases the aggregate A/E ratio from 108% to 105%. The r-squared increases very slightly from 0.9919 to 0.9955.

Table III-T3

PLD Regular Termination Rates - All Ages						
		Terminations			Actual to Expected Ratios	
Service	Exposures	Actual	Current	Recommended	Current	Recommended
<1	3,197	957	799	895	120%	107%
1 - 4	13,137	2,143	2,017	2,064	106%	104%
5 - 9	8,210	602	590	577	102%	104%
10 - 14	4,368	216	233	196	93%	110%
15 - 19	2,625	93	105	92	89%	101%
20 - 24	1,335	45	33	45	135%	101%
25+	578	33	14	17	228%	190%
Total	**33,450**	**4,089**	**3,792**	**3,886**	**108%**	**105%**
R-squared			**0.9919**	**0.9955**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Chart III-T3

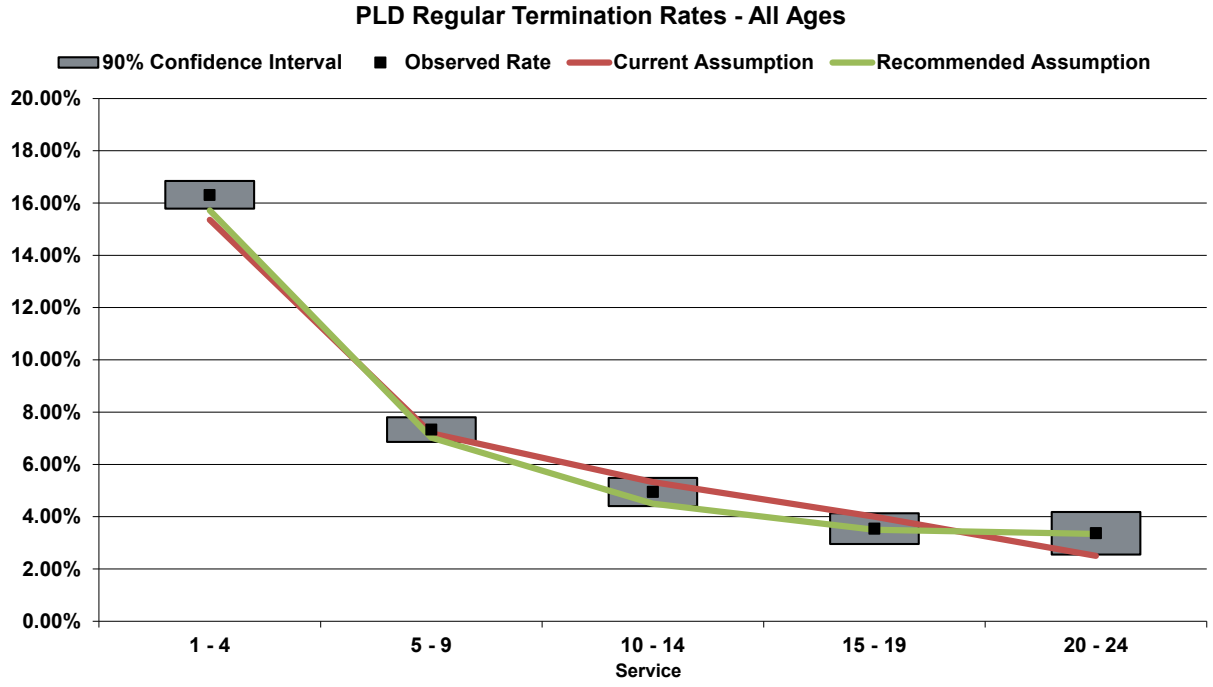


Table III-T4 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Special Employees, and Chart III-T4 shows this information graphically along with the 90% confidence intervals.

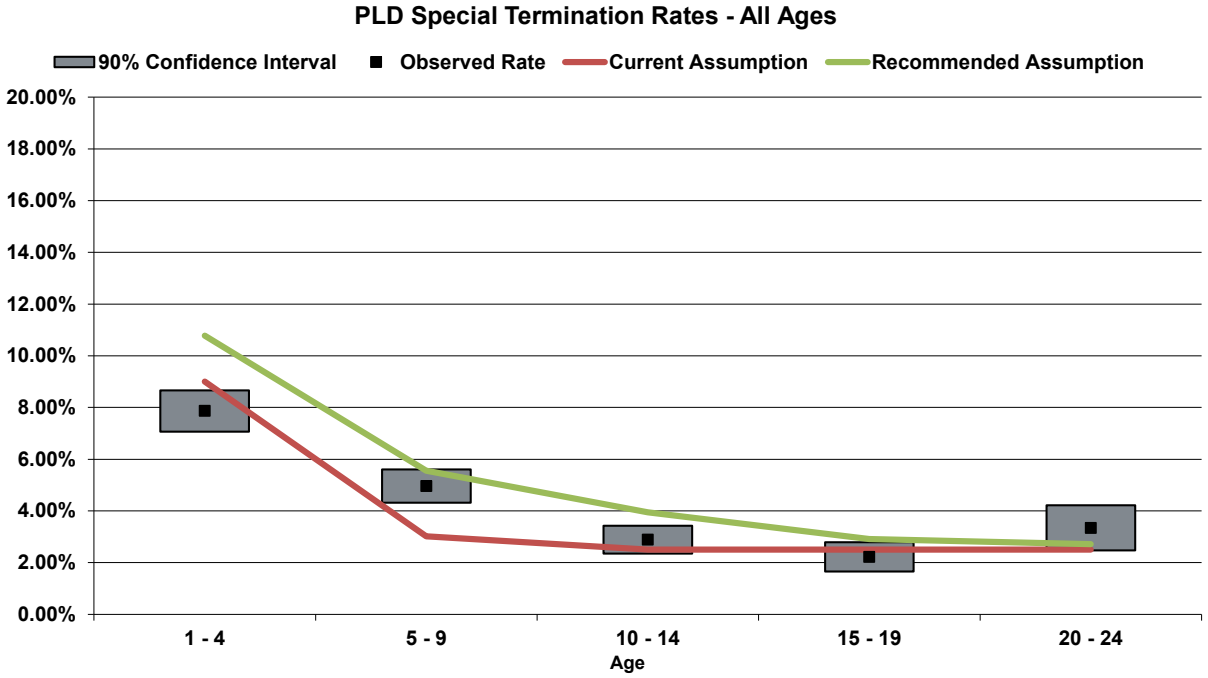
The data shows higher actual termination rates than expected under the current assumption. The proposed assumption increases the assumed rates of termination and decreases the aggregate A/E ratio from 95% to 78%. The r-squared increases from 0.7870 to 0.9599.

Table III-T4

PLD Special Termination Rates - All Ages						
		Terminations			Actual to Expected Ratios	
Service	Exposures	Actual	Current	Recommended	Current	Recommended
<1	554	69	139	99	50%	70%
1 - 4	3,077	242	277	332	87%	73%
5 - 9	3,063	152	93	170	164%	89%
10 - 14	2,596	75	65	102	116%	73%
15 - 19	1,847	41	46	54	89%	76%
20 - 24	1,137	38	28	31	134%	123%
25+	-	-	-	-	0%	0%
Total	**12,274**	**617**	**648**	**788**	**95%**	**78%**
R-squared			**0.7870**	**0.9599**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Chart III-T4



Judicial Retirement Program Termination

Over the study period, there were only two terminations from the Judicial program out of 149 possible exposure years. The termination rates are already very low (7% at age 25 dropping to 1% at age 55) already, so we do not recommend making any changes at this time.

Legislative Retirement Program Termination

Due to the election cycle and term limits of the House and Senate, the current assumption is a service-based table for the Legislative that is only applied in even years with zero percent assumed in the odd years. We recommend keeping this format, but adjusting the termination rates at certain service amounts to better align with actual experience.

Table III-T5 shows the termination experience for Legislative members in the even years. The proposed assumption closes the majority of this gap, predicting 108.9 terminations for the even years studied in which 120 actually occurred.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Table III-T5

Years of Service	Exposures	Terminations	Proposed Assumption*
0	0	0	0%
1	0	0	5%
2	124	0	10%
3	88	0	15%
4	108	12	20%
5	108	0	25%
6	85	18	30%
7	65	6	40%
8	45	9	50%
9	18	24	50%
10	7	4	50%
11	12	0	50%
12	8	1	50%
13	9	4	50%
14	5	0	50%
15	4	0	50%
16	4	0	50%
TOTAL	690	78	79.3

*Applies only in years following a biennial term, with 0% in the other years.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

This section analyzes the incidence of disability by the age of the employee for each of the MainePERS Programs. These assumptions are developed as one unisex assumption for males and females at each age as no significant difference in disability incidence related to gender was seen in the actual experience for these Programs. Similar information and graphs are developed as in the retirement and termination sections.

Teacher Program Disability

We examined the disability experience for the State Employees and Teachers members and concluded that the best fit was produced by developing assumptions separately for each of Teachers, State Regular, and State Special. Table III-D1 shows the calculation of actual-to-expected ratios and the r-squared statistic for Teachers, and Chart III-D1 shows this information graphically along with the 90% confidence intervals.

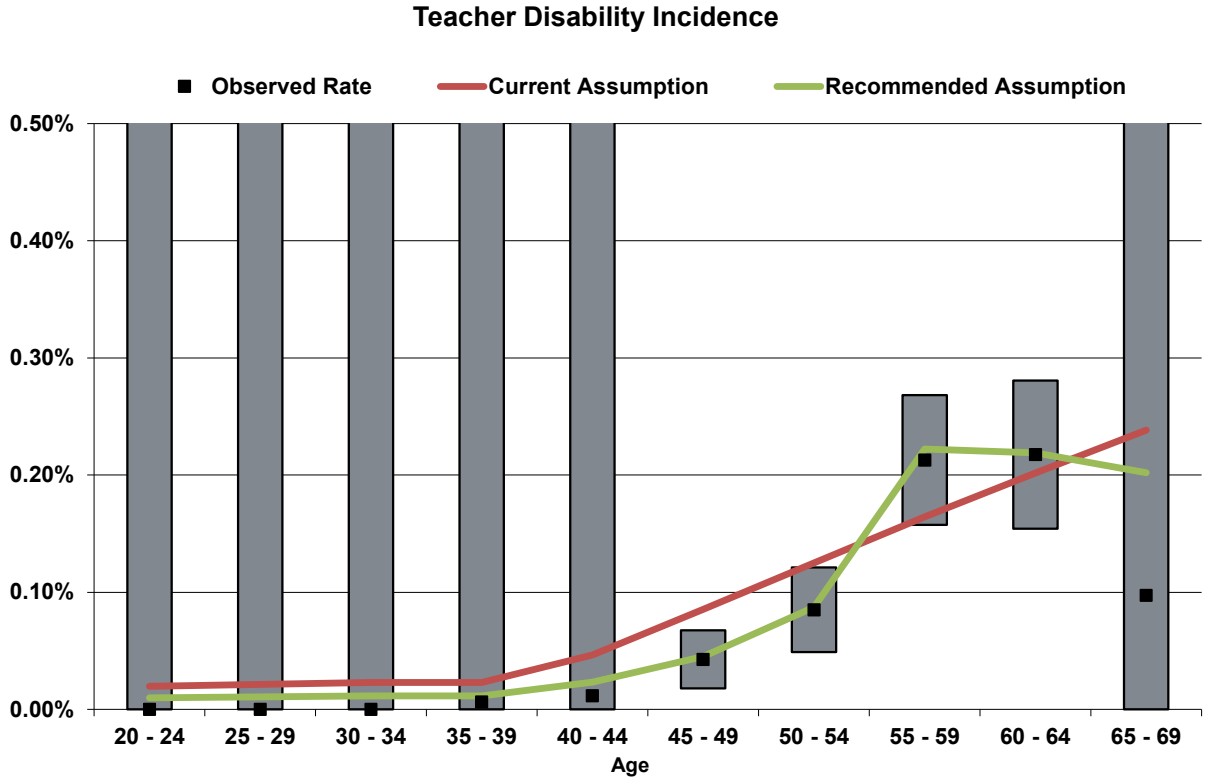
The data shows lower actual disability rates than expected under the current assumption. The proposed assumption decreases the assumed rates of disability and increases the aggregate A/E ratio from 79% to 87%. The r-squared also increases from 0.7435 to 0.8397.

Table III-D1

Teacher Disability Incidence Rates						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Recommended	Current	Recommended
19 - 24	3,609	0	1	0	0%	0%
25 - 29	10,582	0	2	1	0%	0%
30 - 34	12,954	0	3	1	0%	0%
35 - 39	15,784	1	4	2	28%	55%
40 - 44	17,013	2	8	4	25%	51%
45 - 49	18,702	8	16	8	50%	95%
50 - 54	17,636	15	22	15	68%	97%
55 - 59	18,790	40	31	42	130%	96%
60 - 64	14,714	32	30	32	108%	99%
65 - 69	5,132	5	12	10	41%	48%
70 +	924	1	4	2	28%	45%
Total	**135,840**	**104**	**132**	**119**	**79%**	**87%**
R-squared			**0.7435**	**0.8397**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Chart III-D1



State Regular Program Disability

Table III-D2 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Regular Employees, and Chart III-D2 shows this information graphically along with the 90% confidence intervals.

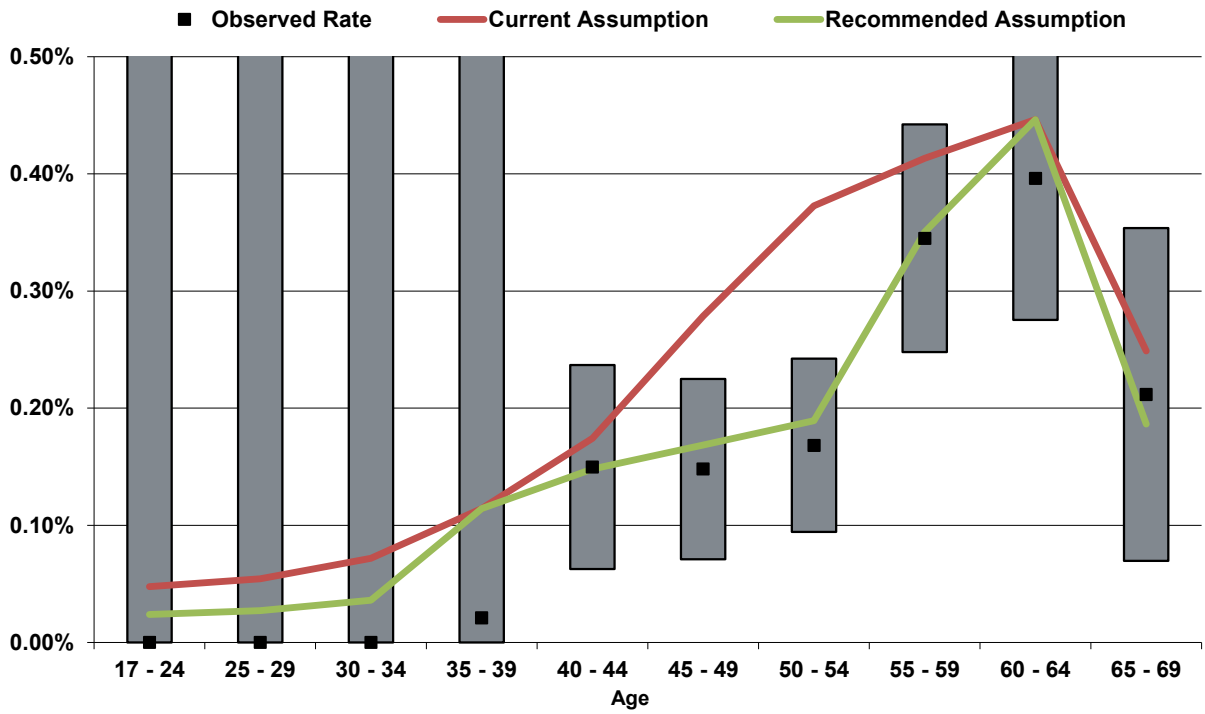
The data shows lower actual disability rates than expected under the current assumption. The proposed assumption decreases the assumed rates of disability and increases the aggregate A/E ratio from 68% to 89%. The r-squared also increases from 0.7355 to 0.8321.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Table III-D2

State Regular Disability Incidence Rates						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Recommended	Current	Recommended
17 - 24	1,566	0	1	0	0%	0%
25 - 29	3,079	0	2	1	0%	0%
30 - 34	4,049	0	3	1	0%	0%
35 - 39	4,754	1	5	5	18%	18%
40 - 44	5,340	8	9	8	86%	101%
45 - 49	6,753	10	19	11	53%	88%
50 - 54	8,321	14	31	16	45%	89%
55 - 59	9,855	34	41	35	83%	98%
60 - 64	7,321	29	33	33	89%	89%
65 - 69	2,833	6	7	5	85%	114%
70 +	999	3	3	2	87%	161%
Total	**54,870**	**105**	**154**	**117**	**68%**	**89%**
R-squared			**0.7355**	**0.8321**		

Chart III-D2



SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

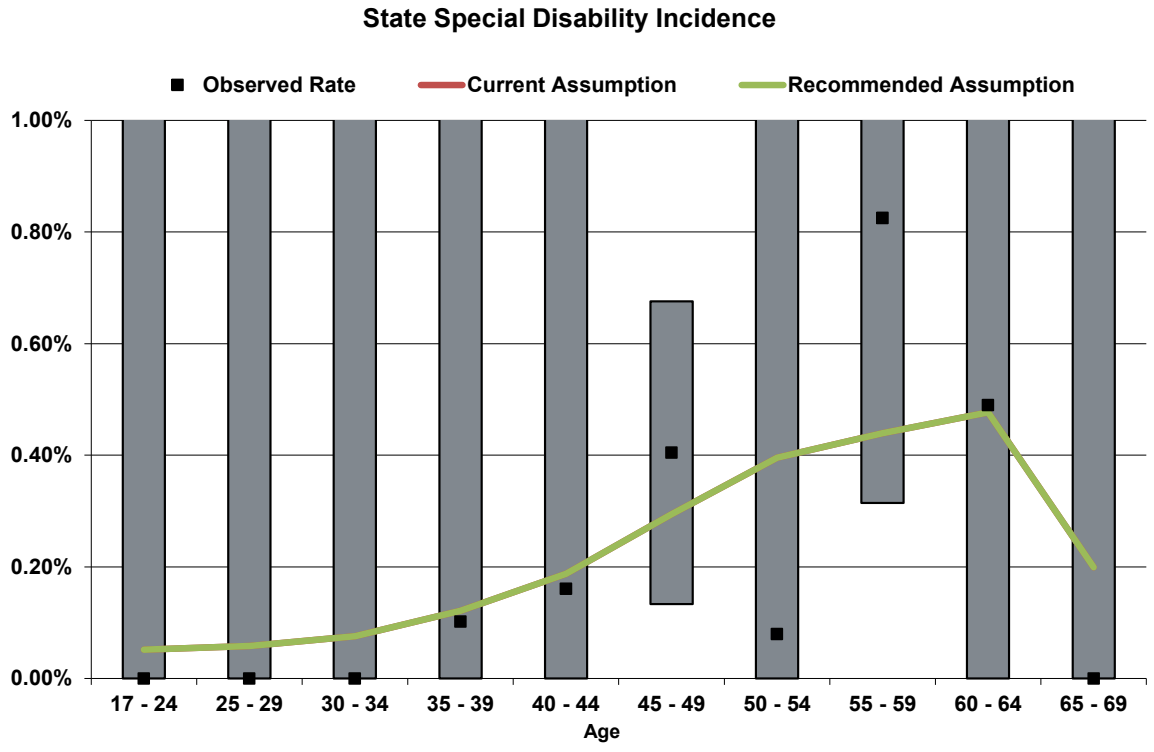
State Special Program Disability

Table III-D3 shows the calculation of actual-to-expected ratios and the r-squared statistic for State Special Employees, and Chart III-D3 shows this information graphically along with the 90% confidence intervals. We do not recommend a change to this assumption at this time.

Table III-D3

State Special Disability Incidence Rates						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Recommended	Current	Recommended
20 - 24	477	0	0	0	0%	0%
25 - 29	960	0	1	1	0%	0%
30 - 34	983	0	1	1	0%	0%
35 - 39	980	1	1	1	84%	84%
40 - 44	1,244	2	2	2	86%	86%
45 - 49	1,483	6	4	4	137%	137%
50 - 54	1,257	1	5	5	20%	20%
55 - 59	848	7	4	4	188%	188%
60 - 64	408	2	2	2	103%	103%
65 - 69	148	0	0	0	0%	0%
70 +	33	0	0	0	0%	0%
Total	**8,821**	**19**	**20**	**20**	**93%**	**93%**
R-squared			**0.2377**	**0.2377**		

Chart III-D3



SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

PLD Consolidated Program Disability

Table III-D4 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Regular employees, and Chart III-D4 shows this information graphically along with the 90% confidence intervals.

The data shows lower actual disability rates than expected under the current assumption. The proposed assumption decreases the assumed rates of disability and increases the aggregate A/E ratio from 35% to 65%. The r-squared also increases from 0.4419 to 0.6348.

Table III-D4

PLD Disability Incidence Rates						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Recommended	Current	Recommended
20 - 24	1,905	0	0	0	0%	0%
25 - 29	2,592	0	0	0	0%	0%
30 - 34	3,085	0	1	0	0%	0%
35 - 39	3,581	1	1	1	89%	110%
40 - 44	4,018	0	2	2	0%	0%
45 - 49	5,228	5	7	6	74%	83%
50 - 54	6,497	11	17	13	65%	82%
55 - 59	7,124	15	33	21	46%	71%
60 - 64	5,556	11	44	17	25%	66%
65 - 69	1,921	1	19	6	5%	17%
70 +	161	0	2	0	0%	0%
Total	**41,668**	**44**	**126**	**68**	**35%**	**65%**
R-squared			**0.4419**	**0.6348**		

SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Chart III-D4

PLD Regular Disability Incidence

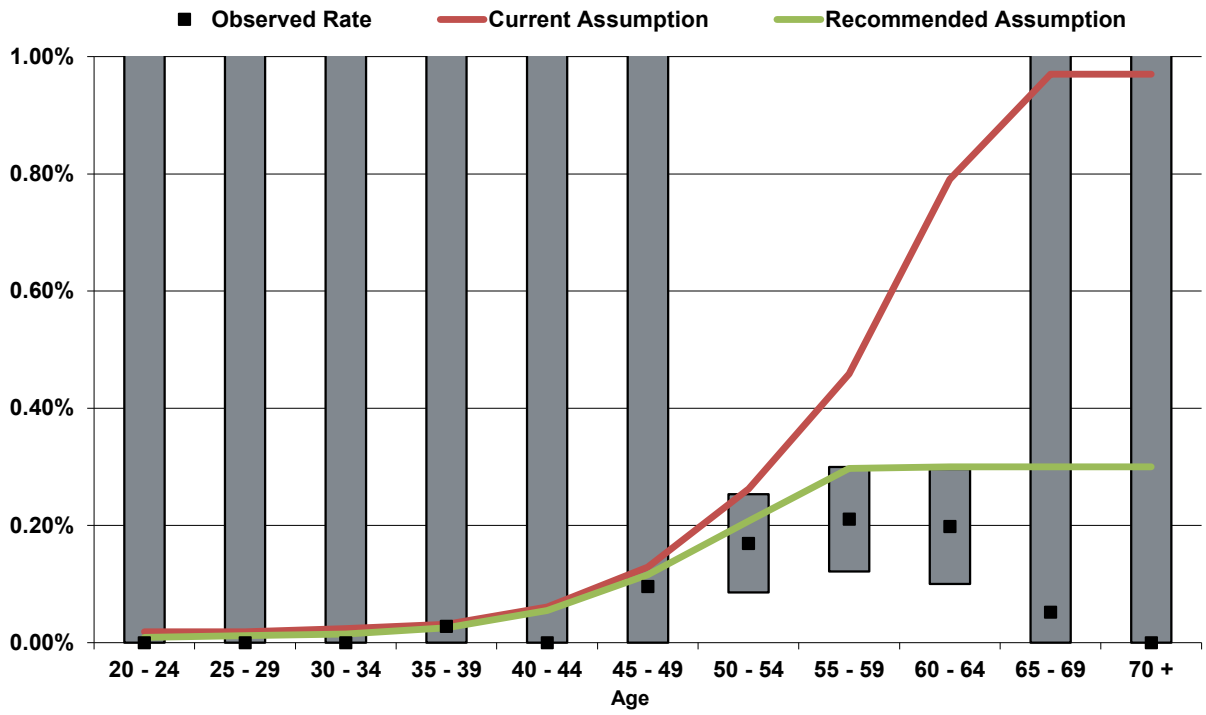


Table III-D5 shows the calculation of actual-to-expected ratios and the r-squared statistic for PLD Special employees, and Chart III-D5 shows this information graphically along with the 90% confidence intervals.

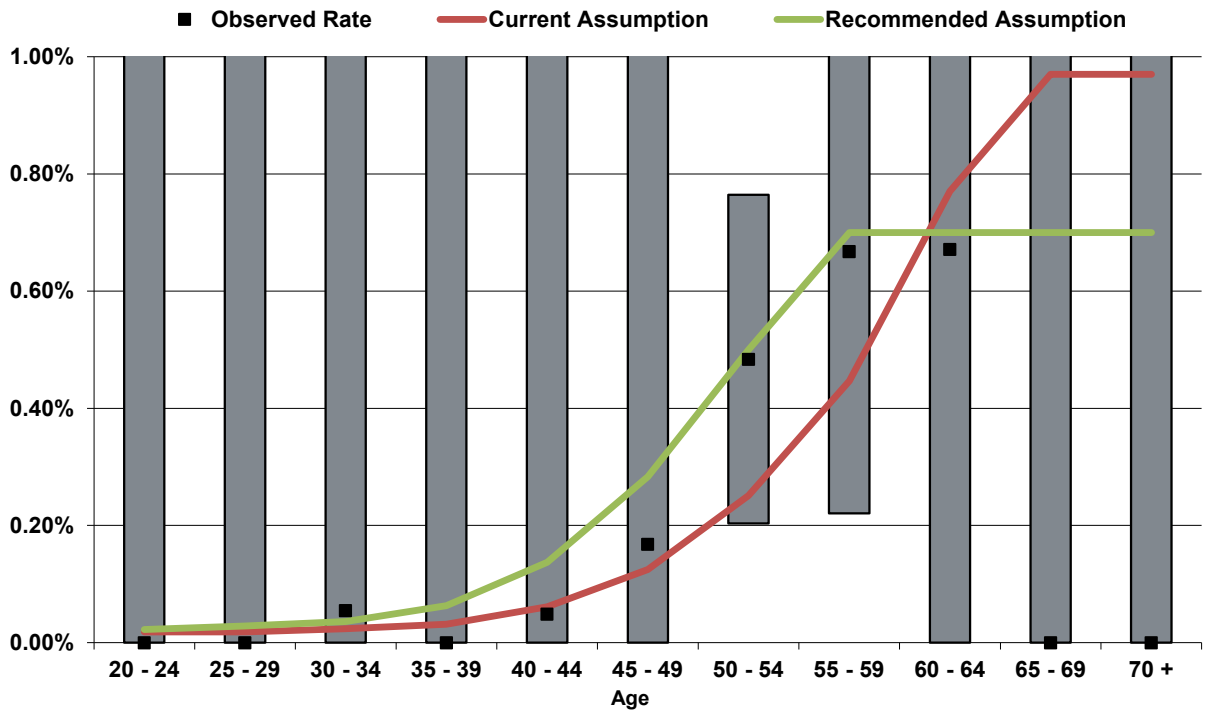
The data shows lower actual disability rates than expected under the current assumption. The proposed assumption decreases the assumed rates of disability and decreases the aggregate A/E ratio from 126% to 76%. The r-squared also decreases from 0.5978 to 0.4206.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Table III-D5

PLD Special Disability Incidence Rates						
Age Band	Exposures	Disabilities			Actual to Expected Ratios	
		Actual	Current	Recommended	Current	Recommended
20 - 24	685	0	0	0	0%	0%
25 - 29	1,723	0	0	0	0%	0%
30 - 34	1,830	1	0	1	0%	0%
35 - 39	1,898	0	1	1	169%	84%
40 - 44	2,055	1	1	3	0%	0%
45 - 49	2,381	4	3	7	168%	74%
50 - 54	1,654	8	4	8	265%	133%
55 - 59	899	6	4	6	374%	238%
60 - 64	447	3	3	3	320%	352%
65 - 69	85	0	1	1	121%	168%
70 +	6	0	0	0	0%	0%
Total	**13,663**	**23**	**18**	**30**	**126%**	**76%**
R-squared			**0.5978**	**0.4206**		

Chart III-D5



SECTION III - DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Judicial and Legislative Program Regular Disability

Over the experience period, there were no disabilities in the Judicial and Legislative Programs. We recommend continuing to assume no disability decrement for these Programs as disabilities for these groups are very rare.

SECTION III - DEMOGRAPHIC ASSUMPTIONS

MORTALITY RATES

Post-retirement mortality assumptions are typically developed separately by gender for both healthy annuitants and disabled annuitants. Pre-retirement mortality assumptions are developed separately for males and females. Unlike most of the other demographic assumptions that rely exclusively on the experience of the Program, for mortality, standard mortality tables and projection scales serve as the primary basis for the assumption, which is then adjusted to reflect the experience of the Program.

The Society of Actuaries recently completed extensive studies of mortality and mortality improvement and issued a set of mortality tables bases on Public Sector experience named the PUB-2010 mortality tables and a mortality improvement projection scale named the MP-2020 scale. We used these studies and tables as the basis for our analysis.

The steps in our analysis are as follows:

1. Select a standard mortality table that is based on experience most closely matching the anticipated experience of MainePERS group being studied.
2. Compare actual MainePERS experience to what would have been predicted by the selected standard table for the period of the experience study.
3. Adjust the standard table either fully or partially depending on the level of credibility for the group for MainePERS experience. This adjusted table is called the base table.
4. Select an appropriate standard mortality improvement projection scale and apply it to the developed base table.

The published PUB-2010 mortality tables are based on experience from public sector defined benefit plans across the US.

Similar to the methodology used to develop the PUB-2010 tables, when actual MainePERS experience is compared to that of the standard table, the experience is weighted based on the amount of benefit being paid (or salary for active members). Mortality studies in the U.S. have consistently shown that higher income individuals have longer life expectancies than lower income individuals. Because higher income individuals also typically have higher pension benefit amounts, it is important for a pension plan to use assumptions that are weighted to reflect this impact on liabilities.

The fourth step described above develops a generational mortality improvement assumption. In the past, the mortality improvement assumption used for MainePERS was not generational, so each time an experience study was performed in the past, this assumption was updated to anticipate additional future improvements in mortality. With a generational assumption, anticipated improvements are built into the assumption, so in future experience studies the mortality assumption should be closer to actual experience and the magnitude of future adjustments may be reduced compared to when they were always being adjusted to account for more improvements. However, while the proposed mortality improvement assumption does include future mortality improvement, we will continue to study this item with each experience study to reflect possible updated scales reflecting more recent experience, similar to what we

have done with the current study where we recommend moving to the most recent published scale.

The sections below develop the base tables (that were identified in step three above) for each of the separate mortality assumptions.

Healthy Annuitant Mortality: Teachers

Table III-M1 below summarizes our analysis and development of the base mortality table for teacher healthy male annuitants. We adjusted the PUB-2010 Benefits-Weighted Teacher Healthy Annuitants table to the midpoint of the study period (2017) using scale MP-2020 before making the comparisons. The exposure and retirement counts in the tables in this section are benefits-weighted, so an individual with a larger benefit impacts the developed ratios more than an individual with a lower benefit. This benefit-weighted approach is the one recommended for use with the PUB-2010 tables as previously discussed. Further, for this group and the others analyzed in this mortality section, we restricted the ages used in the analysis to those providing the best fit with the tables being adjusted. Based on this analysis, we recommend rates for healthy male teacher annuitants based on 98.1% of the Pub-2010 Teacher Healthy Annuitant Mortality Table for males under age 85 and 106.4% of the Pub-2010 Teacher Healthy Annuitant Mortality Table for males age 85+. These rates are projected generationally using the RPEC_2020 model, with an ultimate rate of 1.00% for ages 80 and under, grading down to 0.05% at age 95, and further grading down to 0.00% at age 115, along with convergence to the ultimate rates in the year 2027. All other parameters used in the RPEC_2020 model are those included in the published MP-2020 scale.

Table III-M1

Healthy Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	128	2	713,001	12,681	3,222	-	394%	0%
55 - 59	352	2	6,709,547	30,096	44,461	20,328	68%	148%
60 - 64	2,860	13	81,182,925	324,651	726,683	386,516	45%	84%
65 - 69	8,251	69	219,665,240	1,660,558	2,818,035	1,622,924	59%	102%
70 - 74	8,459	120	221,792,000	2,726,441	4,368,183	2,784,083	62%	98%
75 - 79	5,288	129	134,680,140	3,165,484	4,324,488	3,153,439	73%	100%
80 - 84	3,188	154	76,498,403	3,394,824	4,244,859	3,464,050	80%	98%
85 - 89	1,783	164	38,002,302	3,417,930	3,608,012	3,426,097	95%	100%
90 - 94	597	106	11,164,042	2,007,167	1,799,788	1,785,563	112%	112%
95 +	111	33	1,658,632	518,158	406,780	426,942	127%	121%
Total	**31,017**	**792**	**792,066,231**	**17,257,991**	**22,344,510**	**17,069,941**	**77%**	**101%**

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Similarly for female teachers, we recommend rates for healthy female teacher annuitants based on 87.5% of the Pub-2010 Teacher Healthy Annuitant Mortality Table for females under age 80 and 122.3% of the Pub-2010 Teacher Healthy Annuitant Mortality Table for females age 80+. These rates are projected with the female version of the same projection rates mentioned with the male teacher assumptions.

Table III-M2

Healthy Annuitant Mortality - Base Table for Females								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	155	2	1,313,481	8,069	3,998	0	202%	0%
55 - 59	689	3	14,628,616	10,669	63,937	33,052	17%	32%
60 - 64	7,248	24	196,975,002	459,637	1,283,639	631,118	36%	73%
65 - 69	19,600	67	490,084,999	1,560,918	4,717,637	2,235,816	33%	70%
70 - 74	15,510	121	354,508,515	2,621,426	5,361,911	2,766,776	49%	95%
75 - 79	9,329	149	197,421,392	3,145,063	4,952,231	3,036,308	64%	104%
80 - 84	5,865	247	114,201,381	4,703,119	4,958,290	4,848,568	95%	97%
85 - 89	3,763	314	69,149,672	5,710,029	5,351,403	5,590,202	107%	102%
90 - 94	1,759	278	28,569,875	4,488,127	3,816,782	4,203,476	118%	107%
95 +	601	145	9,292,490	2,230,780	1,975,065	2,337,764	113%	95%
Total	**64,519**	**1,350**	**1,476,145,423**	**24,937,837**	**32,484,894**	**25,683,080**	**77%**	**97%**

Healthy Annuitant Mortality: Non-Teachers

With the exception of the teacher members discussed above, we combined the mortality experience of the remaining MainePERS members and developed "non-teachers" mortality assumptions. We recommend these non-teacher mortality assumptions be applied to the remaining members: State Regular, State Special, PLD Regular, PLD Special, Judicial, and Legislative.

For male non-teachers, we recommend rates based on 112.1% of the Pub-2010 General Healthy Annuitant Mortality Tables for males projected with the same generational projection rates described for the Teachers. This is illustrated in Table III-M3 below.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M3

Healthy Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	1,147	9	30,499,685	77,573	148,489	117,119	52%	66%
55 - 59	2,518	14	68,663,129	312,592	456,020	400,082	69%	78%
60 - 64	7,220	58	178,183,821	1,227,671	1,639,792	1,529,847	75%	80%
65 - 69	12,843	155	295,024,522	3,484,559	3,936,968	3,658,127	89%	95%
70 - 74	11,427	216	259,243,375	4,201,683	5,346,474	5,108,244	79%	82%
75 - 79	7,516	308	155,426,759	5,991,915	5,280,623	5,372,147	113%	112%
80 - 84	5,570	353	107,067,144	6,701,808	6,258,054	6,782,680	107%	99%
85 - 89	3,402	394	61,946,423	7,145,299	6,295,498	6,947,905	113%	103%
90 - 94	1,306	287	20,917,079	4,411,313	3,517,346	3,772,515	125%	117%
95 +	283	86	4,310,099	1,329,845	1,114,582	1,189,748	119%	112%
Total	**53,232**	**1,880**	**1,181,282,037**	**34,884,256**	**33,993,846**	**34,878,414**	**103%**	**100%**

For female non-teachers, we recommend rates based on 118.6% of the Pub-2010 General Healthy Annuitant Mortality Tables for females projected with the same generational projection rates described for the Teachers. This is illustrated in Table III-M4 below.

Table III-M4

Healthy Annuitant Mortality - Base Table for Females								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	876	4	8,596,598	42,247	31,258	25,601	135%	165%
55 - 59	2,208	15	30,311,887	139,905	156,112	125,065	90%	112%
60 - 64	7,537	37	118,898,039	475,557	913,668	681,208	52%	70%
65 - 69	13,358	111	199,660,415	1,529,659	2,321,733	1,708,680	66%	90%
70 - 74	11,385	157	161,711,086	2,220,830	2,992,461	2,332,410	74%	95%
75 - 79	8,651	222	116,165,110	3,125,898	3,580,328	3,064,101	87%	102%
80 - 84	6,758	362	87,195,786	4,736,720	4,619,890	4,236,631	103%	112%
85 - 89	5,264	508	63,092,840	5,920,212	6,018,034	5,787,542	98%	102%
90 - 94	3,044	501	35,248,734	5,501,821	5,716,235	5,575,364	96%	99%
95 +	1,031	249	11,342,523	2,648,184	2,908,944	2,814,367	91%	94%
Total	**60,112**	**2,166**	**832,223,020**	**26,341,034**	**29,258,664**	**26,350,968**	**90%**	**100%**

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Employee Mortality

The number of active deaths were not sufficient to perform credible mortality analysis for the actives, so we used the ratios applied to the appropriate published PUB-2010 tables for healthy annuitants for each group. Therefore, the base tables used for teachers are 91.9% and 93.1% of the Pub-2010 Teacher Employees Mortality Tables for females and males, respectively. The base tables for non-teachers are 88.6% and 83.5% of the Pub-2010 General Employees Mortality Tables for females and males, respectively. Note that in both the case of the healthy annuitant mortality assumptions and the employee mortality assumptions, if mortality rates are needed at ages not defined in the published table, we use the rates from the other table for those ages.

The mortality improvement assumption for the employee mortality is also the same as the healthy annuitants (also used for the disabled annuitants discussed in the next section) as described previously.

Disabled Annuitant Mortality

The current assumptions for disabled annuitant mortality are based on the RP-2014 Total Dataset Disabled Annuitant Mortality Table for males and females. While MainePERS is not large enough to have very credible experience for disabled annuitant mortality, there is a large body of evidence that disabled annuitant mortality is higher than healthy annuitant mortality. The degree to which disabled mortality is higher depends on a number of factors, particularly the definition of disability used in practice to award disability benefits. While it is difficult to assess the varying definitions and the resulting impact on mortality, we found that the PUB-2010 disabled mortality assumption fits MainePERS's experience reasonably well. Based on the analysis below, we recommend that the Board adopt mortality assumptions for disabled annuitants separate from those adopted for healthy annuitants.

For male teacher disabled members, we recommend rates based on 94.2% of the Pub-2010 Non-Public Safety Disabled Annuitant Mortality Tables for males projected with the same generational mortality improvements described for Healthy Annuitants. This is illustrated in Table III-M5 below.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M5

Disabled Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	22	1	697,945	38,801	16,055	11,961	242%	324%
55 - 59	45	3	1,397,617	65,929	35,958	30,606	183%	215%
60 - 64	137	3	4,229,344	98,812	126,819	112,379	78%	88%
65 - 69	251	5	7,555,661	94,300	279,106	235,353	34%	40%
70 - 74	196	7	6,220,690	172,701	295,731	233,543	58%	74%
75 - 79	87	6	2,624,959	163,892	173,572	133,213	94%	123%
80 - 84	53	-	1,510,296	-	150,123	116,109	0%	0%
85 - 89	42	1	1,113,300	22,934	162,175	123,869	14%	19%
90 - 94	12	2	282,170	52,271	58,307	44,713	90%	117%
95 +	-	-	-	-	-	-	0%	0%
Total	**845**	**28**	**25,631,982**	**709,640**	**1,297,844**	**1,041,745**	**55%**	**68%**

For female teacher disabled members, we recommend rates based on 123.8% of the Pub-2010 Non-Public Safety Disabled Annuitant Mortality Tables for males projected with the same generational mortality improvements described for Healthy Annuitants. This is illustrated in Table III-M6 below.

Table III-M6

Disabled Annuitant Mortality - Base Table for Females								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	112	6	2,856,716	151,465	37,819	48,680	401%	311%
55 - 59	299	12	8,363,358	318,917	136,097	174,449	234%	183%
60 - 64	598	21	16,836,806	549,007	324,312	377,614	169%	145%
65 - 69	634	15	18,094,632	378,886	438,987	445,916	86%	85%
70 - 74	448	9	13,117,130	275,507	437,096	409,775	63%	67%
75 - 79	208	7	5,610,462	199,263	279,099	258,935	71%	77%
80 - 84	119	10	3,127,363	253,896	240,342	230,281	106%	110%
85 - 89	61	10	1,473,372	231,021	163,781	160,996	141%	143%
90 - 94	15	3	259,993	54,085	43,605	41,543	124%	130%
95 +	3	1	46,426	15,854	10,681	10,039	148%	158%
Total	**2,497**	**94**	**69,786,257**	**2,427,901**	**2,111,819**	**2,158,226**	**115%**	**112%**

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

For male non-teacher disabled members, we recommend rates based on 107.3% of the Pub-2010 Non-Public Safety Disabled Annuitant Mortality Tables for males projected with the same generational mortality improvements described for Healthy Annuitants. This is illustrated in Table III-M7 below.

Table III-M7

Disabled Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	260	5	6,976,557	113,501	158,402	131,939	72%	86%
55 - 59	560	14	14,358,051	380,816	370,756	360,640	103%	106%
60 - 64	784	21	19,691,484	535,734	583,503	589,384	92%	91%
65 - 69	777	26	20,390,172	687,522	745,945	718,593	92%	96%
70 - 74	529	28	12,874,018	643,725	614,840	552,604	105%	116%
75 - 79	271	18	5,487,205	434,913	362,563	316,943	120%	137%
80 - 84	169	18	2,878,296	271,376	278,865	245,558	97%	111%
85 - 89	99	22	1,858,278	350,536	268,330	233,547	131%	150%
90 - 94	6	4	107,270	63,816	21,126	18,385	302%	347%
95 +	-	-	-	-	-	-	0%	0%
Total	**3,455**	**156**	**84,621,332**	**3,481,941**	**3,404,329**	**3,167,592**	**102%**	**110%**

For female teacher disabled members, we recommend rates based on 103.2% of the Pub-2010 Non-Public Safety Disabled Annuitant Mortality Tables for males projected with the same generational mortality improvements described for Healthy Annuitants. This is illustrated in Table III-M8 below.

SECTION III - DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M8

Disabled Annuitant Mortality - Base Table for Females								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	249	1	5,399,639	13,019	72,167	89,542	18%	15%
55 - 59	531	18	11,852,305	394,276	191,874	237,276	205%	166%
60 - 64	608	21	13,673,418	466,394	262,466	295,243	178%	158%
65 - 69	599	9	14,019,317	173,370	340,285	332,940	51%	52%
70 - 74	510	17	10,756,951	356,870	364,279	328,529	98%	109%
75 - 79	241	10	4,409,343	186,321	214,424	191,517	87%	97%
80 - 84	132	9	2,287,484	140,682	175,242	161,746	80%	87%
85 - 89	72	6	1,100,145	84,228	124,002	117,437	68%	72%
90 - 94	42	10	533,181	118,456	88,889	81,686	133%	145%
95 +	2	1	41,598	20,964	9,220	8,322	227%	252%
Total	**2,986**	**102**	**64,073,381**	**1,954,580**	**1,842,848**	**1,844,236**	**106%**	**106%**

Mortality Projection Scale

There has been a long history of mortality improvement among pensioners in the U.S., and there is an expectation that mortality rates will continue to improve in the future. Since 2014, the Society of Actuaries has been publishing projection scales designed to predict future increases in mortality. These are developed based on three key concepts:

- Recently observed experience is the best predictor of future near-term mortality improvement rates.
- Long-term rates of mortality improvement should be based on "expert opinion" and analysis of longer-term mortality patterns.
- Near-term rates should transition smoothly into the assumed long-term mortality improvement rates over appropriately selected convergence periods.

The Society of Actuaries publishes an updated table every year, with the most recent being MP-2020. While Scale MP-2020 represents the Society's Retirement Plans Experience Committee's best estimate of future mortality improvement, they note that given the uncertainty of the underlying assumptions, that other appropriate parameters for their model would also provide a reasonable basis for projecting mortality. As such, the Society provided a model called RPEC_2014_v2020 allowing actuaries to adjust assumptions underlying the development of the mortality improvement scale to produce their own custom mortality improvement scale based on, but differing from, MP-2020.

SECTION III - DEMOGRAPHIC ASSUMPTIONS

MORTALITY RATES

We recommend adopting a revised version of the MP-2020 using this RPEC_2014_v2020 model, with an ultimate rate of 1.00% for ages 20-80, grading down to an ultimate rate of 0.05% for ages 80-95, and finally grading down to an ultimate rate of 0.00% for ages 95-115%, and convergence to the ultimate rate in the year 2027. These adjusted parameters recognize the debate over whether too much mortality improvement is being assumed by reducing the ultimate rates slightly and speeding up the convergence slightly.

APPENDIX A - SUMMARY OF ASSUMPTIONS
INTRODUCTION

This Appendix A includes summaries of the assumptions for each MainePERS plan. This information is provided organized by Program. The assumptions shown with no shading are the current assumptions that were in place for the 2020 valuations while the assumptions shown with grey shading are those recommended in this report and adopted by the MainePERS board for the 2021 valuations.

The order of the plans shown in this Appendix A is: State Employees and Teachers Program, Consolidated PLD Plan, Judicial Program, and Legislative Program.

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

A. Actuarial Assumptions

1. Discount Rate:

	Current
State Employees	6.75%
Teachers	6.75

Rate is net of both administrative and investment expense.

2. Cost-of-Living Adjustment (COLA) Assumed Rate:

	Current
State Employees	2.20%
Teachers	2.20

3. Sample Rates of Individual Salary Increases (% at Selected Years of Service):

	Current Assumption		Proposed Assumption	
Service	State Employees	Teachers	State Employees	Teachers
0	8.75%	14.50%	9.43%	13.03%
5	5.00	5.75	6.24	5.83
10	3.75	4.75	5.32	4.81
15	3.20	4.00	3.98	4.29
20	2.95	2.75	3.78	3.26
25 and over	2.75	2.75	3.26	2.80

The current rates currently include a 2.75% across-the-board increase at each year of service. The proposed rates include a 2.75% across-the-board increase at each year of service.

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

4. Sample Rates of Termination (% at Selected Years of Service):

Service	Current Assumption State Employees & Teachers	Proposed Assumption State Employees	Proposed Assumption Teachers
0	33.5%	32.5%	26.0%
5	10.50	10.0	9.0
10	5.95	6.0	5.5
15	4.25	4.0	3.5
20	4.00	3.0	3.0
25	4.00	2.5	3.0

Non-vested members are assumed to take a refund of contributions with interest. Once vested, the member is assumed to elect the greater of the deferred vested benefit or a refund of member contributions with interest-based on present value at the time of termination.

5. Sample Rates of Mortality for Healthy Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)				Proposed Assumption (showing values in 2021)			
	State Employees		Teachers		State Employees		Teachers	
Age	Male	Female	Male	Female	Male	Female	Male	Female
50	40	31	38	25	31	25	10	6
55	56	42	53	34	47	35	21	17
60	76	61	72	50	72	48	36	27
65	108	93	103	77	104	70	59	37
70	167	149	159	123	160	113	98	60
75	273	245	259	202	271	202	180	115
80	459	413	437	341	489	373	345	323
85	801	734	763	606	899	706	719	632
90	1,434	1,333	1,365	1,100	1,560	1,317	1,338	1,193
95	2,297	2,226	2,187	1,837	2,432	2,148	2,251	2,122

State Employees are based on 104% and 120% of the RP-2014 Total Dataset Healthy Annuitant Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Employee Mortality Table for ages prior to the start of the Healthy Annuitant Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020. Current rates for Teachers are based on 99% of the RP-2014 Total Dataset Healthy Annuitant Mortality Table for both males and females, using the RP-2014 Total Dataset Employee Mortality

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

Table for ages prior to the start of the Healthy Annuitant Mortality Table, respectively, both projected using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates for State Employees are based on 112.1% and 118.5% of the 2010 Public Plan General Benefits-Weighted Healthy Retiree Mortality Table, respectively, for males and females.

Proposed rates for Teachers are based on the 2010 Public Plan Teacher Benefits-Weighted Healthy Retiree Mortality Table adjusted as follows:

- 98.1% and 87.5% respectively of the rates for males before age 85 and females before age 80
- 106.4% and 122.3% respectively of the rates for males on and after age 85 and females on and after age 80

The proposed rates are projected generationally using the RPEC_2020 model, with an ultimate rate of 1.00% for ages 80 and under, grading down to 0.05% at age 95, and further grading down to 0.00% at age 115, along with convergence to the ultimate rates in the year 2027. All other parameters used in the RPEC_2020 model are those included in the published MP-2020 scale.

6. Sample Rates of Mortality for Active Lives at Selected Ages (number of deaths per 10,000 members)*:

	Current Assumption (showing values in 2021)				Proposed Assumption (showing values in 2021)			
	State Employees		Teachers		State Employees		Teachers	
Age	Male	Female	Male	Female	Male	Female	Male	Female
20	4	2	3	1	3	1	3	1
25	4	2	4	2	3	1	2	1
30	4	2	4	2	4	2	3	2
35	5	3	5	3	6	3	4	3
40	6	5	6	4	7	4	5	3
45	9	7	9	6	8	5	6	4
50	16	12	16	10	12	7	10	6
55	27	19	26	16	18	11	16	10
60	46	28	44	23	28	17	26	16
65	81	43	77	35	40	25	41	24

* For State Regular and Teachers, 5% of deaths assumed to arise out of and in the course of employment; for State Special, 20% of deaths are assumed to arise out of and in the course of employment.

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

Current rates for State Employees are based on 104% and 120% of the RP-2014 Total Dataset Employee Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Healthy Annuitant Mortality Table rates after the end of the Total Employee Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020. Current rates for Teachers are based on 99% of the RP-2014 Total Dataset Healthy Annuitant Mortality Table for both males and females, using the RP-2014 Total Dataset Healthy Annuitant Mortality Table rates after the end of the Total Employee Mortality Table, respectively, both projected using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates for State Employees are based on 83.5% and 88.6% of the 2010 Public Plan General Benefits-Weighted Employee Mortality Table, respectively, for males and females. Proposed rates for Teachers are based on 93.1% and 91.9% of the 2010 Public Plan Teacher Benefits-Weighted Employee Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model as described in the healthy annuitant mortality.

7. Sample Rates of Mortality for Disabled Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)				Proposed Assumption (showing values in 2021)			
	State Employees		Teachers		State Employees		Teachers	
Age	Male	Female	Male	Female	Male	Female	Male	Female
25	80	23	80	23	36	21	31	25
30	77	29	77	29	53	37	47	44
35	90	41	90	41	72	57	63	68
40	108	56	108	56	89	76	78	91
45	168	88	168	88	112	99	98	119
50	206	116	206	116	161	144	142	173
55	238	146	238	146	220	185	194	222
60	270	173	270	173	280	213	246	256
65	323	211	323	211	331	223	290	268
70	418	286	418	286	390	264	343	316

Current rates are based on 108% and 105% of the RP-2014 Total Dataset Disabled Annuitant Mortality Table, respectively, for males and females, projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

Proposed rates for State Employees are based on 107.3% and 103.2% of the 2010 Public Plan Non-Safety Benefits-Weighted Disabled Retiree Mortality Table, respectively, for males and females. Proposed rates for Teachers are based on 94.2% and 123.8% of the 2010 Public Plan Non-Safety Benefits-Weighted Disabled Retiree Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model described in the healthy annuitant mortality.

8. Sample Rates of Retirement at Selected Ages (number retiring per 1,000 members):

	Current Assumptions State Regular Employees and Teachers		
Age	NRA 60	NRA 62	NRA 65
45	13	NA	NA
50	29	NA	NA
55	40	40	40
59	150	40	40
60	250	75	40
61	200	175	40
62	200	250	40
63	200	150	75
64	250	200	225
65	350	250	300
70	200	200	300
75	1,000	1,000	1,000

	Proposed Assumptions State Regular Employees			Proposed Assumptions Teachers		
Age	NRA 60	NRA 62	NRA 65	NRA 60	NRA 62	NRA 65
57	40	35	N/A	40	35	N/A
59	260	40	N/A	200	45	N/A
60	210	50	20	275	80	20
61	210	350	20	210	240	20
62	210	270	50	230	220	50
63	250	180	80	220	180	80
64	190	200	300	280	220	200
65	210	220	250	340	300	300
70	200	200	200	300	200	300
75	350	350	250	400	200	300
80	1,000	1,000	1,000	1,000	1,000	1,000

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

In the case of State Regular and Teacher employees, NRA 60 refers to those who had accrued at least 10 years of service by July 1, 1993. NRA 62 refers to those who had not accrued at least 10 years of service by July 1, 1993 or were hired after that date but had five years of service by July 1, 2011. NRA 65 refers to those who did not have five years of service by July 1, 2011. Rates are only applied for early retirement when the member is at least age 57. Earlier rates are applicable for normal retirement.

State Special Plans

Members of the 1998 Special Plan are assumed to retire at rates that vary by age and whether service is less than 25 years or not. Sample rates are as follows:

1998 Special Plan Retirement				
	Current Assumption		Proposed Assumption	
Age	Service < 25	Service >= 25	Service < 25	Service >= 25
55	20.0%	25.0%	20.0%	25.0%
57	10.0	25.0	10.0	25.0
60	20.0	30.0	20.0	30.0
62	15.0	30.0	30.0	30.0
65	23.4	30.0	23.4	30.0
67	36.8	50.0	36.8	50.0
70	100.0	100.0	100.0	100.0

Members of the 25 & Out Plan are assumed to retire at rates that vary by service. Sample rates are as follows:

Service	25 & Out Plan Current Assumption	Proposed Assumption
<24	0.0%	0.0%
25-29	25.0%	25.0
30-31	50.0%	25.0
32-34	50.0%	40.0
35-37	100.0%	40.0
38+	100.0%	100.0

Members of State Special Plans other than the 25 & Out Plan and the 1998 Special Plan are all currently assumed to retire at a rate of 50% per year, beginning when they reach eligibility for unreduced benefits, with a 100% assumed rate at age 70. Rates are only applied when the member is at least age 50.

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

9. Sample Rates of Disability at Selected Ages (number becoming disabled per 10,000 members)*:

	Current Assumptions			Proposed Assumptions		
	State Employees			State Employees		
	Regular	Special	Teachers	Regular	Special	Teachers
25	5.0	5.4	2.1	2.5	5.4	1.1
30	6.1	6.5	2.3	3.1	6.5	1.2
35	9.3	9.9	2.3	9.3	9.9	1.2
40	14.8	15.8	3.1	14.0	15.8	1.6
45	22.8	24.4	7.0	16.0	24.4	3.1
50	34.0	36.4	10.9	18.0	36.4	6.6
55	39.9	42.6	14.9	25.0	42.6	22.1
60	43.4	46.4	18.8	43.4	46.4	22.2

* 10% assumed to receive Workers Compensation benefits offsetting disability benefit; also, current rates for State Special groups are higher by 7 per 10,000 at all ages.

10. Family Composition Assumptions:

80% of active members are assumed to be married and have two children born when the member is 24 and 28; children are assumed dependent until age 18; a female spouse is assumed to be three years younger than a male spouse; member is assumed to have no dependent parents; unmarried members are assumed to have beneficiaries entitled to benefits worth 80% as much as those of married members' beneficiaries.

No changes were proposed to these assumptions.

11. Vacation/Sick Leave Credits:

For members who had 10 years of service on July 1, 1993, credits for unused vacation and sick leave may be used to increase final average compensation and/or creditable service. In order to reflect this, projected retirement benefits are increased by 0.48% for state (regular) employees and 0.75% for teachers for impacted members.

No change was proposed to this assumption.

12. Technical and Miscellaneous Assumptions:

Decrement Timing: Middle of the valuation year

APPENDIX A - SUMMARY OF ASSUMPTIONS
STATE EMPLOYEES AND TEACHERS PROGRAM

Pay Increase Timing: Salary provided is treated as the rate of pay as of the valuation date. Annual increases are applied as of the beginning of each subsequent valuation.

Member Contribution Interest Rate: 5% assumed for all future years. Proposed assumption: Reflect actual historical member contribution rates from 1970 through the valuation; future contribution interest to equal the inflation assumption of 2.75%.

COLA Timing: September 1

Special Plan Member Contribution Rates: For members of Special Plans where the contribution rate drops from 8.65% to 7.65% after a given number of years, 8.65% is used for all years for valuation purposes as a simplifying assumption reflecting data limitations.

13. Rationale for Assumptions:

The assumptions were adopted by the Board of Trustees at their July 14, 2016 meeting. The demographic assumptions adopted are based on an experience study covering the period from June 30, 2012 through June 30, 2015, and the economic assumptions are based on this experience study along with the advice of the MainePERS investment consultants.

The proposed assumptions were adopted by the Board of Trustees at their March 11, 2021 meeting for all Programs except the Consolidated PLD Plan, for which the recommended assumptions were adopted by the Board of Trustees at their May 13, 2021 meeting. The demographic assumptions adopted are based on an experience study covering the period from July 1, 2015 through June 30, 2020, and the economic assumptions are based on this experience study along with advice of the MainePERS investment consultants.

APPENDIX A - SUMMARY OF ASSUMPTIONS
PARTICIPATING LOCAL DISTRICTS

A. Actuarial Assumptions

1. Discount Rate:

	Current
PLDs	6.75%

Rate is net of both administrative and investment expense.

2. Cost-of-Living Adjustment (COLA) Assumed Rate:

	Current
PLDs	1.91%

3. Sample Rates of Individual Salary Increases (% at Selected Years of Service):

Years of Service	Current	Proposed
0	9.0%	11.48%
1	4.8	8.66
2	3.6	4.81
3	3.1	4.29
4	2.75	4.03
5	2.75	3.78
10	2.75	3.26
15	2.75	3.26
20	2.75	3.01
25	2.75	2.75
30	2.75	2.75

The current rates include a 2.75% across-the-board increase at each year of service. The proposed rates include a 2.75% across-the-board increase at each year of service.

APPENDIX A - SUMMARY OF ASSUMPTIONS
PARTICIPATING LOCAL DISTRICTS

4. Sample Rates of Termination (% at Selected Years of Service):

	Current Assumption		Proposed Assumption	
Service	Regular	Special	Regular	Special
0	25.0%	25.0%	28.0%	17.90%
1	20.0	12.5	21.0	14.4
2	15.0	10.0	15.0	10.5
3	12.0	7.5	12.0	9.5
4	10.0	5.0	10.0	7.8
5	9.0	4.0	9.0	7.9
10	6.0	2.5	5.0	4.5
15	4.0	2.5	3.5	2.9
20	2.5	2.5	3.5	2.7
25	2.5	2.5	3.0	0.0

Non-vested members are assumed to take a refund of contributions with interest. Once vested, the member is assumed to elect the greater of the deferred vested benefit or a refund of member contributions with interest based on present value at the time of termination.

5. Sample Rates of Mortality for Healthy Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
50	40	31	31	25
55	56	42	47	35
60	76	61	72	48
65	108	93	104	70
70	167	149	160	113
75	273	245	271	202
80	459	413	489	373
85	801	734	899	706
90	1,434	1,333	1,560	1,317
95	2,297	2,226	2,432	2,148

Current rates are based on 104% and 120% of the RP-2014 Total Dataset Healthy Annuitant Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Employee Mortality Table for ages prior to the start of the Healthy Annuitant Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model,

with an ultimate rate of 0.85% for ages 20-85 grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates are based on 112.1% and 118.5% of the 2010 Public Plan General Benefits-Weighted Healthy Retiree Mortality Table, respectively, for males and females. The proposed rates are projected generationally using the RPEC_2020 model, with an ultimate rate of 1.00% for ages 80 and under, grading down to 0.05% at age 95, and further grading down to 0.00% at age 115, along with convergence to the ultimate rates in the year 2027. All other parameters used in the RPEC_2020 model are those included in the published MP-2020 scale.

6. **Sample Rates of Mortality for Active Lives at Selected Ages (number of deaths per 10,000 members)*:**

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
20	4	2	3	1
25	4	2	3	1
30	4	2	4	2
35	5	3	6	3
40	6	5	7	4
45	9	7	8	5
50	16	12	12	7
55	27	19	18	11
60	46	28	28	17
65	81	43	40	25

* 5% of deaths assumed to arise out of and in the course of employment.

Current rates are based on 104% and 120% of the RP-2014 Total Dataset Employee Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Healthy Annuitant Mortality Table rates after the end of the Total Employee Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates are based on 83.5% and 88.6% of the 2010 Public Plan General Benefits-Weighted Employee Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model as described in the healthy annuitant mortality.

APPENDIX A - SUMMARY OF ASSUMPTIONS
PARTICIPATING LOCAL DISTRICTS

7. Sample Rates of Mortality for Disabled Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
25	80	23	36	21
30	77	29	53	37
35	90	41	72	57
40	108	56	89	76
45	168	88	112	99
50	206	116	161	144
55	238	146	220	185
60	270	173	280	213
65	323	211	331	223
70	418	286	390	264

Current rates are based on 108% and 105% of the RP-2014 Total Dataset Disabled Annuitant Mortality Table, respectively, for males and females, projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates for are based on 107.3% and 103.2% of the 2010 Public Plan Non-Safety Benefits-Weighted Disabled Retiree Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model described in the healthy annuitant mortality.

8. Sample Rates of Retirement at Selected Ages (number retiring per 1,000 members):

	Regular Plans			
	Current Assumption		Proposed Assumption	
	NRA 60	NRA 65	NRA 60	NRA 65
45	50	50	N/A	N/A
50	50	50	N/A	N/A
55	50	50	N/A	N/A
60	200	50	120	60
65	250	200	250	200
70	1,000	1,000	1,000	250
75	1,000	1,000	1,000	1,000

APPENDIX A - SUMMARY OF ASSUMPTIONS
PARTICIPATING LOCAL DISTRICTS

In the case of PLD employees, NRA 60 refers to those who were hired prior to July 1, 2014, and Tier 2NRA 65 refers to those who were hired on or after July 1, 2014.

	Special Plans	
Years of Service	Current Assumption	Proposed Assumption
20	400	350
21	300	300
22	300	280
23	300	250
24	300	200
25	400	350
26	300	250
27	300	230
28	300	250
29	300	400
30	400	250
31-33	300	250
34	300	330
35+	1,000	1,000

Note that all retirement rates are only applied once the member is eligible to retire, so those in 25-year Plans are not assumed to retire at 20 years of service. For Special Plan retirements with less than 20 years of service, we assume 250 retirements per 1,000 members.

APPENDIX A - SUMMARY OF ASSUMPTIONS
PARTICIPATING LOCAL DISTRICTS

9. Sample Rates of Disability at Selected Ages (number becoming disabled per 10,000 members)*:

Age	Current Assumption	Proposed Assumption Regular	Proposed Assumption Special
25	1.8	0.9	2.3
30	2.4	1.2	3.0
35	3.0	1.8	4.5
40	4.2	4.2	10.5
45	9.0	8.7	21.8
50	19.8	16.5	41.3
55	36.6	28.5	70.0
60	65.0	30.0	70.0

* 10% assumed to receive Workers Compensation benefits offsetting disability benefit.

10. Family Composition Assumptions:

80% of active members are assumed to be married and have two children born when the member is 24 and 28; children are assumed dependent until age 18; female spouse is assumed to be three years younger than male spouse; member is assumed to have no dependent parents; unmarried members are assumed to have beneficiaries entitled to benefits worth 80% as much as those of married members' beneficiaries.

No changes were proposed to these assumptions.

11. Technical and Miscellaneous Assumptions:

Decrement Timing: Middle of the valuation year

Pay Increase Timing: Salary provided is treated as the rate of pay as of the valuation date. Annual increases are applied as of the beginning of each subsequent valuation.

Member Contribution Interest Rate: 5% assumed for all future years. Proposed assumption: Reflect actual historical member contribution rates from 1970 through the valuation; future contribution interest to equal the inflation assumption of 2.75%.

COLA Timing: September 1

Member Contribution Rates: For purposes of developing liability amounts, the member contribution rates in effect for FY 2020 are assumed to continue for all periods in the future.

APPENDIX A - SUMMARY OF ASSUMPTIONS
PARTICIPATING LOCAL DISTRICTS

12. Rationale for Assumptions:

The assumptions were adopted by the Board of Trustees at their July 14, 2016 meeting. The demographic assumptions adopted are based on an experience study covering the period from June 30, 2012 through June 30, 2015, and the economic assumptions are based on this experience study along with the advice of the MainePERS investment consultants.

The proposed assumptions were adopted by the Board of Trustees at their March 11, 2021 meeting and the PLD Advisory Board at their May 5, 2021 meeting. The demographic assumptions adopted are based on an experience study covering the period from July 1, 2015 through June 30, 2020, and the economic assumptions are based on this experience study along with advice of the MainePERS investment consultants.

APPENDIX A - SUMMARY OF ASSUMPTIONS
JUDICIAL PLAN

1. Annual Rate of Investment Return:

	Current
Judicial	6.75%

Rate is net of both administrative and investment expense.

2. Cost-of-Living Adjustment (COLA) Assumed Rate:

	Current
Judicial	2.20%

3. Annual Rate of Individual Salary Increase:

	Current
Judicial	2.75%

4. Sample Rates of Termination (% at Selected Ages):

Age	Termination Rate
25	7%
30	6
35	5
40	4
45	3
50	2
55	1

Non-vested members are assumed to take a refund of contributions with interest. Once vested, the member is assumed to elect the greater of the deferred vested benefit or a refund of member contributions with interest-based on present value at time of termination. No changes were proposed to these assumptions.

APPENDIX A - SUMMARY OF ASSUMPTIONS
JUDICIAL PLAN

5. Sample Rates of Mortality for Healthy Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
50	40	31	31	25
55	56	42	47	35
60	76	61	72	48
65	108	93	104	70
70	167	149	160	113
75	273	245	271	202
80	459	413	489	373
85	801	734	899	706
90	1,434	1,333	1,560	1,317
95	2,297	2,226	2,432	2,148

Current rates are based on 104% and 120% of the RP-2014 Total Dataset Healthy Annuitant Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Employee Mortality Table for ages prior to the start of the Healthy Annuitant Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85 grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates are based on 112.1% and 118.5% of the 2010 Public Plan General Benefits-Weighted Healthy Retiree Mortality Table, respectively, for males and females. The proposed rates are projected generationally using the RPEC_2020 model, with an ultimate rate of 1.00% for ages 80 and under, grading down to 0.05% at age 95, and further grading down to 0.00% at age 115, along with convergence to the ultimate rates in the year 2027. All other parameters used in the RPEC_2020 model are those included in the published MP-2020 scale.

APPENDIX A - SUMMARY OF ASSUMPTIONS
JUDICIAL PLAN

6. Sample Rates of Mortality for Active Lives at Selected Ages (number of deaths per 10,000 members)*:

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
20	4	2	3	1
25	4	2	3	1
30	4	2	4	2
35	5	3	6	3
40	6	5	7	4
45	9	7	8	5
50	16	12	12	7
55	27	19	18	11
60	46	28	28	17
65	81	43	40	25

* 5% of deaths assumed to arise out of and in the course of employment.

Current rates are based on 104% and 120% of the RP-2014 Total Dataset Employee Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Healthy Annuitant Mortality Table rates after the end of the Total Employee Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates are based on 83.5% and 88.6% of the 2010 Public Plan General Benefits-Weighted Employee Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model as described in the healthy annuitant mortality.

APPENDIX A - SUMMARY OF ASSUMPTIONS
JUDICIAL PLAN

7. Sample Rates of Mortality for Disabled Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
25	80	23	36	21
30	77	29	53	37
35	90	41	72	57
40	108	56	89	76
45	168	88	112	99
50	206	116	161	144
55	238	146	220	185
60	270	173	280	213
65	323	211	331	223
70	418	286	390	264

Current rates are based on 108% and 105% of the RP-2014 Total Dataset Disabled Annuitant Mortality Table, respectively, for males and females, projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates for are based on 107.3% and 103.2% of the 2010 Public Plan Non-Safety Benefits-Weighted Disabled Retiree Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model described in the healthy annuitant mortality.

APPENDIX A - SUMMARY OF ASSUMPTIONS
JUDICIAL PLAN

8. Sample Rates of Retirement at Selected Ages (number retiring per 1,000 members):

Age	Current Assumptions			Proposed Assumptions		
	NRA 60	NRA 62	NRA 65	NRA 60	NRA 62	NRA 65
60-61	1,000	NA	NA	1,000	NA	NA
62	1,000	500	NA	1,000	200	NA
63	1,000	500	NA	1,000	275	NA
64	1,000	500	NA	1,000	350	NA
65	1,000	500	NA	1,000	425	400
66	1,000	500	500	1,000	500	500
67	1,000	500	500	1,000	450	450
68	1,000	500	500	1,000	400	400
69	1,000	500	500	1,000	350	350
70	1,000	500	500	1,000	300	300
71-75	1,000	1,000	1,000	1,000	250	250
76-79	1,000	1,000	1,000	1,000	500	500
80+	1,000	1,000	1,000	1,000	1,000	1,000

In the case of judicial employees, NRA 60 refers to those who had accrued at least 10 years of service by July 1, 1993. NRA 62 refers to those who had not accrued at least 10 years of service by July 1, 1993 or were hired after that date but had five years of service by July 1, 2011. NRA 65 refers to those who did not have five years of service by July 1, 2011.

9. Sample Rates of Disability at Selected Ages (number becoming disabled per 10,000 members):

No changes were proposed to these assumptions.

Age	Current Assumption
25	0.0
30	0.0
35	0.0
40	0.0
45	0.0
50	0.0
55	0.0
60	0.0

APPENDIX A - SUMMARY OF ASSUMPTIONS
JUDICIAL PLAN

10. Family Composition Assumptions:

80% of active members are assumed to be married and have two children born when the member is 24 and 28; children are assumed dependent until age 18; female spouse is assumed to be three years younger than male spouse; member is assumed to have no dependent parents; unmarried members are assumed to have beneficiaries entitled to benefits worth 80% as much as those of married members' beneficiaries.

No changes were proposed to these assumptions.

11. Technical and Miscellaneous Assumptions:

Decrement Timing: Middle of the valuation year

Pay Increase Timing: Salary provided is treated as the rate of pay as of the valuation date. Annual increases are applied as of the beginning of each subsequent valuation.

Member Contribution Interest Rate: 5% assumed for all future years. Revised assumption: Reflect actual historical member contribution rates from 1970 through the valuation; future contribution interest to equal the inflation assumption of 2.75. The assumptions were adopted by the Board of Trustees at their July 14, 2016 meeting. The demographic assumptions adopted are based on an experience study covering the period from June 30, 2012 through June 30, 2015, and the economic assumptions are based on this experience study along with advice of the MainePERS investment consultants. The Board continuously reviews the investment return assumption and adopted a reduced rate of 6.75% effective with the 2018 valuation, at the advice of its investment consultant.

The proposed assumptions were adopted by the Board of Trustees at their March 11, 2021 meeting. The demographic assumptions adopted are based on an experience study covering the period from July 1, 2015 through June 30, 2020, and the economic assumptions are based on this experience study along with advice of the MainePERS investment consultants.

APPENDIX A - SUMMARY OF ASSUMPTIONS
LEGISLATIVE PLAN

1. **Discount Rate:**

	Current
Legislative	6.75%

Rate is net of both administrative and investment expense.

2. **Cost-of-Living Adjustment (COLA) Assumed Rate:**

	Current
Legislative	2.20%

3. **Annual Rate of Individual Salary Increase:**

	Current
Legislative	2.75%

4. **Sample Rates of Termination (% at Selected Years of Service):**

Service	Current Assumption	Service	Proposed Assumption
0	0%	0	0%
1	0	1	5
2	30	2	10
3	30	3	15
4	25	4	20
5	25	5	25
6	10	6	30
7	10	7	40
8	50	8	50
9	50	9	50
10	25	10	50
11	25	11	50
12	25	12	50
13	25	13	50
14	25	14	50
15	25	15	50
16+	50	16+	50

The rates shown are only applicable in the fiscal years ending in odd years while zero terminations are assumed in the fiscal years ending in even years.

APPENDIX A - SUMMARY OF ASSUMPTIONS
LEGISLATIVE PLAN

5. Sample Rates of Mortality for Healthy Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
50	40	31	31	25
55	56	42	47	35
60	76	61	72	48
65	108	93	104	70
70	167	149	160	113
75	273	245	271	202
80	459	413	489	373
85	801	734	899	706
90	1,434	1,333	1,560	1,317
95	2,297	2,226	2,432	2,148

Current rates are based on 104% and 120% of the RP-2014 Total Dataset Healthy Annuitant Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Employee Mortality Table for ages prior to start of the Healthy Annuitant Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85 grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates are based on 112.1% and 118.5% of the 2010 Public Plan General Benefits-Weighted Healthy Retiree Mortality Table, respectively, for males and females. The proposed rates are projected generationally using the RPEC_2020 model, with an ultimate rate of 1.00% for ages 80 and under, grading down to 0.05% at age 95, and further grading down to 0.00% at age 115, along with convergence to the ultimate rates in the year 2027. All other parameters used in the RPEC_2020 model are those included in the published MP-2020 scale.

APPENDIX A - SUMMARY OF ASSUMPTIONS
LEGISLATIVE PLAN

6. Sample Rates of Mortality for Active Lives at Selected Ages (number of deaths per 10,000 members)*:

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
20	4	2	3	1
25	4	2	3	1
30	4	2	4	2
35	5	3	6	3
40	6	5	7	4
45	9	7	8	5
50	16	12	12	7
55	27	19	18	11
60	46	28	28	17
65	81	43	40	25

* 5% of deaths assumed to arise out of and in the course of employment.

Current rates are based on 104% and 120% of the RP-2014 Total Dataset Employee Mortality Table, respectively, for males and females, using the RP-2014 Total Dataset Healthy Annuitant Mortality Table rates after the end of the Total Employee Mortality Table, both projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates are based on 83.5% and 88.6% of the 2010 Public Plan General Benefits-Weighted Employee Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model as described in the healthy annuitant mortality.

APPENDIX A - SUMMARY OF ASSUMPTIONS
LEGISLATIVE PLAN

7. Sample Rates of Mortality for Disabled Annuitant Lives at Selected Ages (number of deaths per 10,000 members):

	Current Assumption (showing values in 2021)		Proposed Assumption (showing values in 2021)	
Age	Male	Female	Male	Female
25	80	23	36	21
30	77	29	53	37
35	90	41	72	57
40	108	56	89	76
45	168	88	112	99
50	206	116	161	144
55	238	146	220	185
60	270	173	280	213
65	323	211	331	223
70	418	286	390	264

Current rates are based on 108% and 105% of the RP-2014 Total Dataset Disabled Annuitant Mortality Table, respectively, for males and females, projected from the 2006 base rates using the RPEC_2015 model, with an ultimate rate of 0.85% for ages 20-85, grading down to an ultimate rate of 0.00% for ages 111-120, and convergence to the ultimate rate in the year 2020.

Proposed rates for are based on 107.3% and 103.2% of the 2010 Public Plan Non-Safety Benefits-Weighted Disabled Retiree Mortality Table, respectively, for males and females. These rates are generationally projected using the same version of the RPEC_2020 model described in the healthy annuitant mortality.

8. Sample Rates of Retirement at Selected Ages (number retiring per 1,000 members):

Age	Fiscal Years Ending Even	Fiscal Years Ending Odd
57-69	0	250
70+	0	1,000

Note that all retirement rates are only applied once the member is eligible to retire, so those in with 62 or 65 normal retirement ages are not assumed to retire until eligible. No retirements are assumed prior to age 57, regardless of service amount. No changes were proposed to these assumptions.

APPENDIX A - SUMMARY OF ASSUMPTIONS
LEGISLATIVE PLAN

9. Sample Rates of Disability at Selected Ages (number becoming disabled per 10,000 members):

No changes were proposed to these assumptions.

Age	Current Assumption
25	0.0
30	0.0
35	0.0
40	0.0
45	0.0
50	0.0
55	0.0
60	0.0

10. Family Composition Assumptions:

80% of active members are assumed to be married and have two children born when the member is 24 and 28; children are assumed dependent until age 18; female spouse is assumed to be three years younger than male spouse; member is assumed to have no dependent parents; unmarried members are assumed to have beneficiaries entitled to benefits worth 80% as much as those of married members' beneficiaries.

No changes were proposed to these assumptions.

11. Technical and Miscellaneous Assumptions:

Decrement Timing: Middle of the valuation year

Pay Increase Timing: Salary provided is treated as the rate of pay as of the valuation date. Annual increases are applied as of the beginning of each subsequent valuation.

Member Contribution Interest Rate: 5% assumed for all future years. Revised assumption: Reflect actual historical member contribution rates from 1970 through the valuation; future contribution interest to equal the inflation assumption of 2.75%.

COLA Timing: September 1

APPENDIX A - SUMMARY OF ASSUMPTIONS
LEGISLATIVE PLAN

12. Rationale for Actuarial Assumptions:

The assumptions were adopted by the Board of Trustees at their July 14, 2016 meeting. The demographic assumptions adopted are based on an experience study covering the period from June 30, 2012 through June 30, 2015, and the economic assumptions are based on this experience study along with the advice of the MainePERS investment consultants. The Board continuously reviews the investment return assumption and adopted a reduced rate of 6.75% effective with the 2018 valuation, at the advice of its investment consultant.

The proposed assumptions were adopted by the Board of Trustees at their March 11, 2021 meeting. The demographic assumptions adopted are based on an experience study covering the period from July 1, 2015 through June 30, 2020, and the economic assumptions are based on this experience study along with advice of the MainePERS investment consultants.

APPENDIX B - DISCLOSURE OF MODELS USED

ProVal

Cheiron utilizes ProVal, an actuarial valuation software leased from Winklevoss Technologies (WinTech) to calculate the liabilities, normal costs, and projected benefit payments. We have relied on WinTech as the developer of ProVal. We have reviewed ProVal and have a basic understanding of it and have used ProVal in accordance with its original intended purpose. We have not identified any material inconsistencies in the assumptions or output of ProVal that would affect this study.

Experience Study Tools

We have used Cheiron's Excel-based experience study tools to measure the actual versus expected experience before and after recommended assumption changes. We have not identified any material inconsistencies in the assumptions or output of the experience study tools that would affect this study.