



Cavanaugh Macdonald
CONSULTING, LLC

The experience and dedication you deserve

**Indiana Public
Retirement System**

Experience Study

Study Period: July 1, 2014 through June 30, 2019

February 14, 2020





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February 14, 2020

Board of Trustees
Indiana Public Retirement System
1 North Capitol, Suite 001
Indianapolis, IN 46204

Dear Members of the Board:

It is our pleasure to submit this report of our investigation of the experience of the Indiana Public Retirement System for the five-year period beginning July 1, 2014 and ending June 30, 2019. The study was based on the data submitted by the System for the annual valuations of the System. In preparing our report we relied, without audit, on the data provided.

The results of the experience study are the basis for recommended changes in the actuarial assumptions, which if adopted by the Board, will be first be used for the July 1, 2020 valuation. With the Board's approval of the recommendations in the report, we believe the actuarial condition of the System will be more accurately portrayed.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

In particular, we have prepared the assumptions developed in this report in keeping with our understanding of Actuarial Standards of Practice No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations).



Board of Trustees
February 14, 2020
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We would like to acknowledge the help in the preparation of the data for this investigation given by the INPRS staff.

We, Brent A. Banister, Edward J. Koebel, and Virginia Fritz, are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Sincerely,

A handwritten signature in blue ink that reads 'Brent A. Banister'.

Brent A. Banister, PhD, FSA, EA, FCA, MAAA
Chief Actuary

A handwritten signature in blue ink that reads 'Edward J. Koebel'.

Edward J. Koebel, EA, FCA, MAAA
Chief Executive Officer

A handwritten signature in blue ink that reads 'Virginia Fritz'.

Virginia Fritz, FSA, EA, FCA, MAAA
Senior Actuary



SECTION 1 - BOARD SUMMARY

Introduction

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs related to benefits expected to be paid by a retirement system. Actuarial valuations of the Funds in the Indiana Public Retirement System (INPRS) are prepared annually to determine the employer contribution rate required to fund the System on an actuarial reserve basis, i.e. the current assets plus future contributions, along with investment earnings will be sufficient to provide the benefits promised by the System. The valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, termination of employment, retirement age, and salary changes to estimate the obligations of the System.

The basic purpose of an experience study is to determine whether the actuarial assumptions currently in use have adequately projected actual emerging experience. This information, along with the professional judgment of System personnel and advisors, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to recognize that actual experience is reported short term while assumptions are intended to be long term estimates of experience.

At the request of the Board of Trustees, Cavanaugh Macdonald Consulting, LLC (CMC) performed a study of the experience of July 1, 2014 through June 30, 2019 for INPRS. This report presents the results and recommendations of our study, which if approved by the Board, will be implemented in the July 1, 2020 actuarial valuations.

These assumptions have been developed in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the applicable Standards of Practice adopted by the Actuarial Standards Board (ASB). While the recommended assumptions represent our best estimate of future experience, there are other reasonable assumption sets that could be supported by the results of this experience study. Those other sets of reasonable assumptions could produce liabilities and costs that either are higher or lower.

Since this is the first experience study that CMC has prepared for INPRS, we are proposing some changes that are more extensive than we might usually make because we have some style preferences. However, if changes aren't needed, we did not change just for our preferences. Further, when experience studies were last performed, the studies were done by two different actuarial firms who developed some assumptions using different approaches. In our study, we have attempted to minimize these differences between funds where appropriate.

Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process. From one actuary to another, you would expect to see very little difference. However, the setting of assumptions is a different story, as it is more art than science. In this report, we have recommended changes to certain assumptions. To allow you to better understand our thought process, we offer a brief summary of our philosophy:

- **Don't Overreact:** When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period



SECTION 1 - BOARD SUMMARY

shows the same result, we will probably recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Anticipate Trends:** If there is an identified trend that is expected to continue, we believe that this should be recognized. An example is the retiree mortality assumption. It is an established trend that people are living longer. Therefore, we believe the best estimate of liabilities in the valuation should reflect an expected increase in life expectancy.
- **Simplify:** In general, we attempt to identify which factors are significant and eliminate or ignore the ones that do not materially improve the accuracy of the liability projections.

Actuarial Methods

The basic actuarial methodologies used in the valuation process include the actuarial cost method, the asset valuation method and the unfunded actuarial accrued liability (UAAL) amortization methodology. We recommend all these methods be retained. Generally, these methods are:

- Cost Method - Entry Age Normal
- Asset Valuation - Five-year recognition of gains and losses with a 20% corridor
- Amortization method – Layered bases with new experience bases amortized over a closed 20-year period as a level dollar amount.

Economic Assumptions

The following table summarizes the current and proposed key economic assumptions:

	Current Assumptions	Proposed Assumptions
Price Inflation	2.25%	2.25%
General Wage Inflation	Implied 2.50%	2.75%
Cost-of-Living Adjustments		
'77 Fund (based on CPI)	2.00%	2.10%
JRS (based on salary growth)	2.50%	2.75%
PERF, TRF, EG&C, LE DB	Graded	Graded (no change)
PARF	None	None
Interest Crediting Rate on Member Balances		
'77 Fund, EG&C, JRS, and PARF	3.50%	3.50%
PERF, TRF, LE DB	None	None
Investment Return	6.75%	TBD



SECTION 1 - BOARD SUMMARY

As the table indicates, we are not presenting a recommendation for the investment return assumption at this time. Currently INPRS is in the process of a significant asset-liability study which is likely to result in recommended changes to the current asset allocation. Because our recommended assumption will depend heavily upon the asset allocation, we believe it is appropriate to wait until the portfolio allocation decision is made. If the decision is not reached in time for us to provide a recommendation and implement a possible change for the 2020 valuations, we believe the current 6.75% would be reasonable.

The most significant change in the economic assumptions is the increase of the wage inflation assumption. This assumption is our assessment of how wages grow as a result of price inflation and general productivity improvements throughout the national labor force. This assumption is an underpinning to all of wage and salary assumptions utilized in the valuation. While there was not an explicit wage inflation assumption in the past, there was an implicit assumption of 2.50% for many of the funds. This change to a uniform 2.75%, or 0.50% above price inflation for all funds, will tend to increase liabilities in that future salaries are expected to grow at a faster rate than previously estimated.

Demographic Assumptions

The major demographic assumptions include mortality, retirement, disability, terminations, and salary merit increases. There are some additional minor assumptions that are required as well. For each of these assumptions, we considered the observed behavior patterns during the study period to determine what adjustments might be appropriate. Because the last experience studies were performed by two different actuarial firms, some or proposed changes include moving toward a common approach to different funds, especially PERF and TRF.

Mortality is typically the most significant demographic assumption. As we discuss in the report, we are recommending that INPRS adopt the Society of Actuaries Pub-2010 family of mortality tables issued in 2019 that were developed based on public retirement plan data. We recommend the continued use of generational mortality, a technique in which mortality rates are assumed to improve slightly each year in the future. Based on the approach in which some of the mortality tables (PERF males, for example) were selected in the last study, the adoption of these new tables in some cases is resulting in noticeable reductions in liabilities. This is not happening because mortality is not improving; rather, it is more a result of a different philosophy in setting mortality rates.

Another noteworthy change is that we are proposing to directly reflect the utilization of the Deferred Retirement Option Program (DROP) for the '77 Fund and EG&C. Because the DROP results in some changes in the timing and amounts of benefits, this direct reflection will result in an improvement of the estimation of cash flows. This direct reflection will also help when assessing the value of certain proposed legislative changes where the DROP is a relevant feature in the proposal.

For the other assumptions, we have recommended a number of changes, many minor, and a few of moderate impact. The following pages contain a summary by fund of the changes made, while the report and appendices provide greater detail. Included on the summaries on the following pages is information regarding the cost impact of the proposed changes, estimated with the 2019 valuations. While the adoption of assumptions should not hinge on the cost impact, it can be helpful in understanding the relative significance of the assumption changes. Of course, the proposed changes will be implemented with the 2020 valuations, and so the actual amount of the impact will differ.



SECTION 1 - BOARD SUMMARY

PERF ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$ 16,576,060,167	\$ 15,973,750,164	\$ (602,310,003)
Actuarial Value of Assets	13,157,802,020	13,157,802,020	0
Unfunded Actuarial Accrued Liability (UAAL)	3,418,258,147	2,815,948,144	(602,310,003)
Funded Ratio	79.4%	82.4%	3.0%
<u>Actuarially Determined Contribution (ADC)</u>			
- Base Normal Cost Rate	3.60%	3.56%	-0.04%
- Amortization of UAAL Rate	4.47%	3.54%	-0.93%
ADC Rate - Base Plan	8.07%	7.10%	-0.97%
Projected Payroll for FY 2020	\$ 5,335,373,772	\$ 5,348,386,878	\$ 13,013,106

Actuarial Assumptions

Economic	Current	Proposed
Salary Increases	2.50% + Merit (age-based)	2.75% + Merit (service-based)
Cost-of-Living Adjustment	Graded by calendar year (0.4/0.5/0.6)	No change
Demographic	Current	Proposed
Mortality Tables	RP-2014 projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 General Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set forward 3 years, females set forward 1 year.
Retirement	Age and service based	Age based tables for early and unreduced retirement
Termination	Split by State/PSD, earnings of \$20K, and sex. Age and service based tables	State – Service-based, unisex table PSD – Some modifications to under \$20K rates. Over \$20K - unisex, service-based table
Disability	Age based rates, sex distinct	Some modifications



SECTION 1 - BOARD SUMMARY

TRF '96 ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$ 5,980,426,336	\$ 5,979,905,952	\$ (520,384)
Actuarial Value of Assets	6,056,316,893	6,056,316,893	0
Unfunded Actuarial Accrued Liability (UAAL)	(75,890,557)	(76,410,941)	(520,384)
Funded Ratio	101.3%	101.3%	0.0%
<u>Actuarially Determined Contribution (ADC)</u>			
- Base Normal Cost Rate	5.04%	5.07%	0.03%
- Amortization of UAAL Rate	-0.74%	-0.75%	-0.01%
ADC Rate - Base Plan	4.30%	4.32%	0.02%
Projected Payroll for FY 2020	\$ 3,451,731,086	\$ 3,462,217,752	\$ 10,486,666

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50% + Merit (service-based)	2.75% + Merit (service-based)
Cost-of-Living Adjustment	Graded by calendar year (0.4/0.5/0.6)	No change
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 White Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 Teachers Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set forward 1 year, females set forward 1 year.
Retirement	Age based for early and unreduced	Rate modifications
Termination	Service based, sex distinct	Rate modifications
Disability	Age based rates, unisex	Rate modifications



SECTION 1 - BOARD SUMMARY

TRF PRE-'96 ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$ 14,389,164,104	\$ 14,223,359,514	\$ (165,804,590)
Actuarial Value of Assets	3,694,211,101	3,694,211,101	0
Unfunded Actuarial Accrued Liability (UAAL)	10,694,953,003	10,529,148,413	(165,804,590)
Funded Ratio	25.7%	26.0%	0.3%
Actuarially Determined Contribution (ADC)			
- Base Normal Cost Rate	4.75%	4.75%	0.00%
- Scheduled Contribution for FYE June 30, 2019	\$ 892,200,000	\$ 892,200,000	\$ 0
- Scheduled Contribution for FYE June 30, 2020:			
- Prior year increased by 3%	919,000,000	919,000,000	0
- Expected FYE June 30, 2020 benefit payments	1,215,734,139	1,204,824,866	(10,909,273)
ADC Amount - Base Plan	\$ 919,000,000	\$ 919,000,000	\$ 0

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50% + Merit (service-based)	2.75% + Merit (service-based)
Cost-of-Living Adjustment	Graded by calendar year (0.4/0.5/0.6)	No change
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 White Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 Teachers Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set forward 1 year, females set forward 1 year.
Retirement	Age based for early and unreduced	Rate modifications
Termination	Service based, sex distinct	Rate modifications
Disability	Age based rates, unisex	Rate modifications



SECTION 1 - BOARD SUMMARY

'77 FUND ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$ 6,389,001,606	\$ 6,393,994,921	\$ 4,993,315
Actuarial Value of Assets	6,299,748,211	6,299,748,211	0
Unfunded Actuarial Accrued Liability (UAAL)	89,253,395	94,246,710	4,993,315
Funded Ratio	98.6%	98.5%	-0.1%
Actuarially Determined Contribution (ADC)			
- Total Normal Cost Rate	18.30%	19.36%	1.06%
- Amortization of UAAL Rate	0.87%	0.92%	0.05%
- Less Employee Contribution Rate	5.93%	5.93%	0.00%
ADC Rate	13.24%	14.35%	1.11%
Projected Payroll for FY 2020	\$ 887,956,760	\$ 890,122,508	\$ 2,165,748
Actuarially Determined Contribution Amount	117,565,475	127,732,580	10,167,105

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50%	2.75%
Cost-of-Living Adjustment	2.00% (2.50% Catastrophic Disability)	2.10% (2.75% Catastrophic Disability)
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 Blue Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 Safety Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set forward 3 years, females not adjusted.
Retirement	Age and service (split at 32) based	Age based
Termination	Service based, unisex	No change
Disability	Age based rates, unisex	Rate modifications
DROP Election	None	Service based; In DROP 3 years



SECTION 1 - BOARD SUMMARY

EG&C ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$ 152,206,710	\$ 150,532,925	\$ (1,673,785)
Actuarial Value of Assets	140,558,668	140,558,668	0
Unfunded Actuarial Accrued Liability (UAAL)	11,648,042	9,974,257	(1,673,785)
Funded Ratio	92.3%	93.4%	1.1%
Actuarially Determined Contribution (ADC)			
- Base Normal Cost Rate	11.09%	11.41%	0.32%
- Amortization of UAAL Rate	1.29%	0.98%	-0.31%
- Less Employee Contribution Rate	4.00%	4.00%	0.00%
ADC Rate - Base Plan	8.38%	8.39%	0.01%
Projected Payroll for FY 2020	\$ 34,103,346	\$ 34,186,525	\$ 83,179
Actuarially Determined Contribution Amount	2,857,860	2,868,249	10,389

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50%	2.75%
Cost-of-Living Adjustment	Graded by calendar year (0.4/0.5/0.6)	No change
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 Blue Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 Safety Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set forward 3 years, females not adjusted.
Retirement	Age based rates, unisex	Age based for early and unreduced
Termination	Service based, unisex	No change
Disability	Age based rates, unisex	Rate modifications
DROP Election	None	50% enter DROP for 3 years



SECTION 1 - BOARD SUMMARY

JRS ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$586,499,053	\$559,254,182	\$ (27,244,871)
Actuarial Value of Assets	538,600,244	538,600,244	0
Unfunded Actuarial Accrued Liability (UAAL)	47,898,809	20,653,938	(27,244,871)
Funded Ratio	91.8%	96.3%	4.5%
Actuarially Determined Contribution (ADC)			
- Base Normal Cost Rate	33.79%	30.62%	-3.17%
- Amortization of UAAL Rate	8.27%	4.19%	-4.08%
- Less Employee Contribution Rate	6.00%	6.00%	0.00%
ADC Rate	36.06%	28.81%	-7.25%
Projected Payroll for FY 2020 ¹	\$ 57,902,162	\$ 57,902,162	\$ 0
Actuarially Determined Contribution Amount	20,879,520	16,681,613	(4,197,907)

¹ Payroll projected using known salary increase.

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50%	2.75%
Cost-of-Living Adjustment	2.50%	2.75%
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 White Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 General Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set back 1 year, females set back 1 year.
Retirement	Age and service (split at 22) based	Age based for early and unreduced
Termination	3% per year	No change
Disability	Age based rates, unisex	Rate modifications



SECTION 1 - BOARD SUMMARY

PARF ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$110,081,262	\$104,610,101	\$ (5,471,161)
Actuarial Value of Assets	64,908,695	64,908,695	0
Unfunded Actuarial Accrued Liability (UAAL)	45,172,567	39,701,406	(5,471,161)
Funded Ratio	59.0%	62.0%	3.0%
Actuarially Determined Contribution (ADC)			
- Total Normal Cost Rate	9.24%	7.98%	-1.26%
- Amortization of UAAL Rate	17.49%	15.37%	-2.12%
- Less Employee Contribution Rate	6.00%	6.00%	0.00%
ADC Rate	20.73%	17.35%	-3.38%
Projected Payroll for FY 2020 ¹	\$ 22,379,048	\$ 22,379,048	\$ 0
Actuarially Determined Contribution Amount	4,639,177	3,882,765	(756,412)

¹ Payroll projected using known salary increase.

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50%	2.75%
Cost-of-Living Adjustment	None	No change
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 White Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 General Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set back 1 year, females set back 1 year.
Retirement	Age and service (split at 22) based	Age based for early and unreduced
Termination	10% per year	No change
Disability	Age based rates, sex distinct	Rate modifications



SECTION 1 - BOARD SUMMARY

LE DB ASSUMPTIONS

6/30/2019 Valuation	Current Assumptions	Proposed Assumptions	Impact
Actuarial Accrued Liability	\$ 3,362,832	\$ 3,270,259	\$ (92,573)
Actuarial Value of Assets	3,025,792	3,025,792	0
Unfunded Actuarial Accrued Liability (UAAL)	337,040	244,467	(92,573)
Funded Ratio	90.0%	92.5%	2.5%
Actuarially Determined Contribution (ADC)			
- Amortization of UAAL Amount	\$ 155,810	\$ 135,603	\$ (20,207)
- Expenses	37,710	37,710	0
ADC Amount - Base Plan	\$ 193,520	\$ 173,313	\$ (20,207)

Actuarial Assumptions

Economic	Current Assumption	Proposed Assumption
Salary Increases	2.50%	2.75%
Cost-of-Living Adjustment	Graded by calendar year (0.4/0.5/0.6)	No change
Demographic	Current Assumption	Proposed Assumption
Mortality Tables	RP-2014 White Collar projected from 2006 with Social Security Administration's 2014 Trustee report (generational)	Pub-2010 General Amount-Weighted Mortality projected with MP-2019 (generational). Male ages set back 1 year, females set back 1 year.
Retirement	Age based	No change
Termination	Age and service based, unisex	Eliminated Termination Rates
Disability	Age based rates, unisex	Eliminated Disability Rates

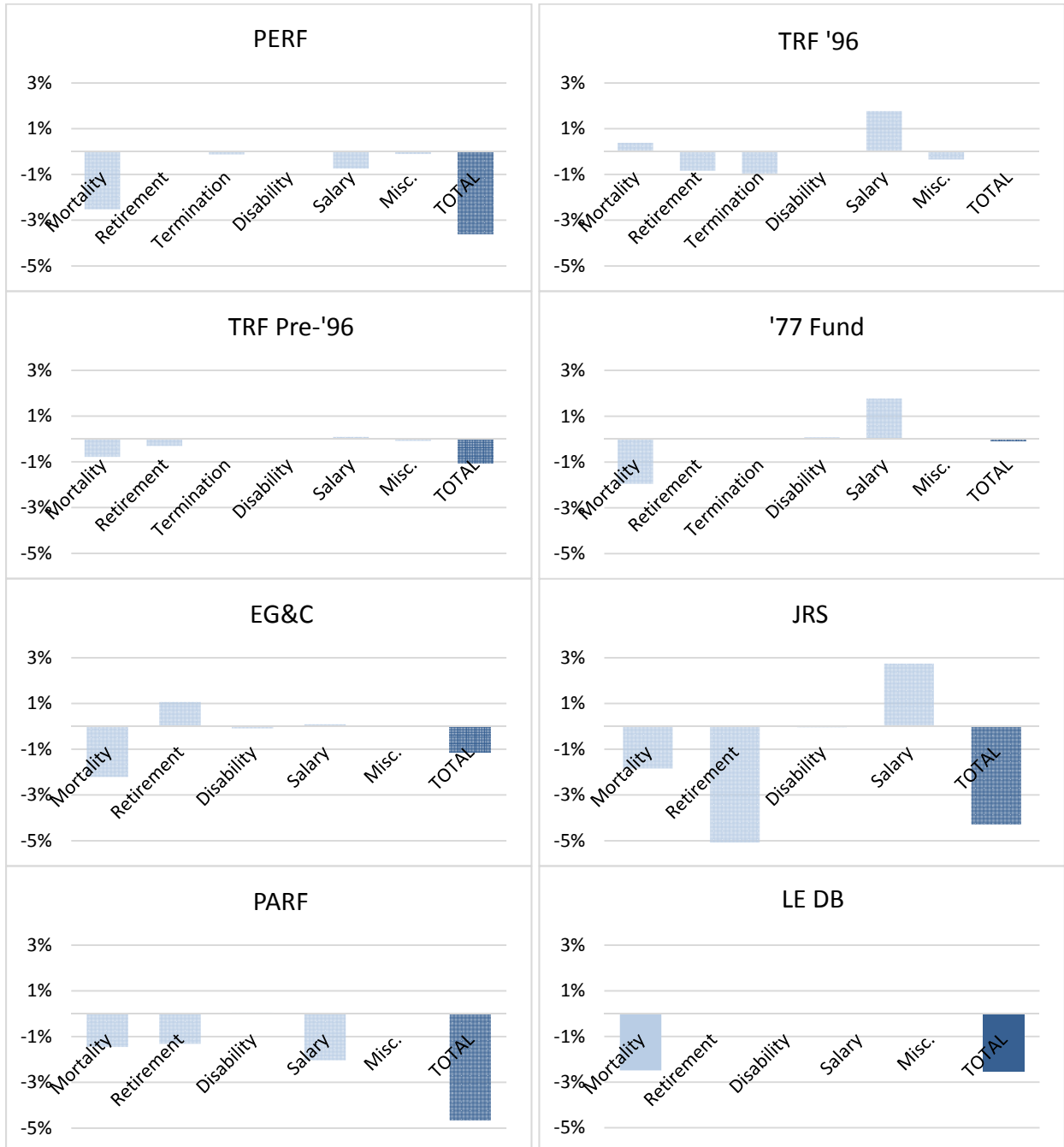


SECTION 1 - BOARD SUMMARY

IMPACT ON PLAN LIABILITIES

Actuarial assumptions are set to anticipate future payouts of a plan, which means as assumptions change, so will the plan's liabilities. The impact on liabilities is a measure of how important the assumption is to the plan and the degree to which an assumption changed. The charts below give a sense of the importance of each change.

Change in Actuarial Accrued Liability by Type of Assumption





SECTION 2 – ACTUARIAL METHODS

ACTUARIAL COST METHOD

The systematic financing of a pension plan requires that contributions be made in an orderly fashion while a member is actively employed, so that the accumulation of these contributions, together with investment earnings should be sufficient to provide promised benefits and cover administration expenses. The actuarial valuation is the process used to determine when money should be contributed; i.e., as part of the budgeting process.

The actuarial valuation will not impact the amount of benefits paid or the actual cost of those benefits. In the long run, actuaries cannot change the costs of the pension plan, regardless of the funding method used or the assumptions selected. However, actuaries will influence the incidence of costs by their choice of methods and assumptions.

The valuation or determination of the present value of all future benefits to be paid by the funds reflects the assumptions that best describe anticipated future experience. The choice of a funding method does not impact the determination of the present value of future benefits. The funding method determines only the incidence of cost. In other words, the purpose of the funding method is to allocate the present value of future benefits determination into annual costs. In order to do this allocation, it is necessary for the funding method to “break down” the present value of future benefits into two components: (1) that which is attributable to the past, (2) and that which is attributable to the future. The excess of that portion attributable to the past over the plan assets is then amortized over a period of years. Actuarial terminology calls the part attributable to the past the “past service liability” or the “actuarial accrued liability”. The portion of the present value of future benefits allocated to the future is commonly known as “the present value of future normal costs”, with the specific piece of it allocated to the current year being called “the normal cost”. The difference between the plan assets and actuarial accrued liability is called the “unfunded actuarial accrued liability”.

Two key points should be noted. First, there is no single “correct” funding method, since different funding methods simply change the timing of the funding. Second, the allocation of the present value of future benefits and hence cost to the past for amortization and to the future for annual normal cost payments is not necessarily in a one-to-one relationship with service earned in the past and future service to be earned.

Entry Age Normal

There are various actuarial cost methods, each of which has different characteristics, advantages and disadvantages. However, Governmental Accounting Standard Board Statement Numbers 67 and 68 require that the Entry Age Normal cost method be used for financial reporting. Most retirement systems will not want to use a different actuarial cost method for funding and financial reporting. In addition, the Entry Age Normal method has been the most popular funding method for public systems for many years. This is the cost method currently used by INPRS for all plans, except the Legislators’ Defined Benefit Plan (LE DB) which has no active members accruing benefits.

The rationale of the entry age normal (EAN) funding method is that the cost of each member’s benefit is determined to be a level percentage of salary from date of hire to the end of employment. This level percentage multiplied by the member’s annual salary is referred to as the normal cost and is that portion of the total cost of the employee’s benefit which is allocated to the current year. The portion of the present value of future benefits allocated to the future is determined by multiplying this percentage times the present value of the member’s assumed earnings for all future years including the current year. The entry age normal



SECTION 2 – ACTUARIAL METHODS

actuarial accrued liability is then developed by subtracting from the present value of future benefits that portion of costs allocated to the future. To determine the unfunded actuarial accrued liability, the actuarial value of plan assets is subtracted from the entry age normal actuarial accrued liability. The current year's cost to amortize the unfunded actuarial accrued liability is developed by applying an amortization factor based on the funding policy.

It is to be expected that future events will not occur exactly as predicted by the actuarial assumptions in each year. Actuarial gains/losses from experience under this actuarial cost method can be directly calculated and are reflected as a decrease/increase in the unfunded actuarial accrued liability. Consequently, the gain/loss results in a decrease/increase in the amortization payment, and therefore the contribution rate or amount.

Traditional Unit Credit

The Legislators' Defined Benefit Plan (LE DB) plan uses the Entry Age Normal actuarial cost method, as required, for Governmental Accounting Standard Board Statement (GASB) Numbers 67 and 68. However, for funding purposes, the plan uses the Traditional Unit Credit cost method.

Under the Traditional Unit Credit (TUC) method, the actuarial accrued liability on any valuation date is the actuarial present value of the benefits earned for service prior to the valuation date. The normal cost is calculated separately for each active member and is equal to the actuarial present value of additional benefits expected to be accrued during the year following the valuation date. Since the benefits for all members of the LE DB plan are fixed and no longer increasing with future service credits or future salary increases, applying the TUC cost method results in the Actuarial Accrued Liability being equal to the Present Value of Future Benefits (i.e. all benefits are treated as though they are attributable to past service) and the Normal Cost is equal to \$0. The rationale for using the TUC method is that this is consistent with the actual status of member benefit accruals.

Recommendation

Considering that the Entry Age Normal cost method is the most commonly used cost method by public plans, that it develops a normal cost rate that tends to be stable and less volatile, and will be the required cost method under calculations required by Governmental Accounting Standard Numbers 67 and 68, **we recommend the Entry Age Normal actuarial cost method be retained by INPRS for all plans, except the Legislators' Defined Benefit Plan.** Due to the nature of the LE DB plan, where there are no future service credits or salary increases and few actives remain, **we recommend the Traditional Unit Credit actuarial cost method be retained for the LE DB plan.** Note that because of GASB 67 and 68 requirements, the Entry Age Normal method will still be used by the LE DB plan for accounting disclosures.



SECTION 2 – ACTUARIAL METHODS

ACTUARIAL VALUE OF ASSETS

In preparing an actuarial valuation, the actuary must assign a value to the assets of the fund. An adjusted market value is often used to smooth out the volatility in the market value. This is because most plan sponsors would rather have annual costs remain smooth, as percentage of payroll or in actual dollars, as opposed to a cost pattern that is extremely volatile.

The actuary does not have complete freedom in assigning this value. The Actuarial Standards Board also has basic principles regarding the calculation of a smoothed asset value, Actuarial Standard of Practice No. 44 (ASOP 44), *Selection and Use of Asset Valuation Methods for Pension Valuations*.

ASOP 44 provides that the asset valuation method should bear a reasonable relationship to the market value. Furthermore, the asset valuation method should be likely to satisfy both of the following:

- Produce values within a reasonable range around market value, AND
- Recognize differences from market value in a reasonable amount of time.

In lieu of both of the above, the standard will be met if either of the following requirements is satisfied:

- There is a sufficiently narrow range around the market value, OR
- The method recognizes differences from market value in a sufficiently short period.

These rules or principles prevent the asset valuation methodology from being used to distort annual funding patterns. No matter what asset valuation method is used, it is important to note that, like a cost method or actuarial assumptions, the asset valuation method does not affect the true cost of the plan; it only impacts the incidence of cost.

INPRS values assets, for actuarial valuation purposes, based on the principle that the difference between actual and expected investment returns on market value should be subject to partial recognition to smooth out fluctuations in the total return achieved by the fund from year to year. This philosophy is consistent with the long-term nature of a retirement system. Under the current method, the difference between the actual investment return on the market value of assets and the assumed investment return on the market value of assets is recognized equally over a five-year period. This methodology is the asset smoothing method most commonly used by public plans. Additionally, the actuarial value of assets is subject to a 20% corridor, meaning the smoothed asset value must be between 80% and 120% of the current market value of assets. For plans with separate assets for their base benefits and supplemental benefits, the market value of the supplemental assets is separated from the base assets; therefore, the actuarial value of assets is also determined separately for both components using the methodology described above. We believe that this method meets actuarial standards under ASOP 44. Note that this method would, in our opinion, also be acceptable without the application of the corridor.

Recommendation

An asset valuation method is used to “smooth out” the volatility that occurs in the market value of assets. We believe the current method is reasonable and acceptable under actuarial standards of practice. **We recommend the current asset valuation method be retained.**



SECTION 2 – ACTUARIAL METHODS

AMORTIZATION OF UNFUNDED ACTUARIAL ACCRUED LIABILITY

As described earlier, actuarial liabilities are the portion of the actuarial present value of future benefits that are not included in future normal costs. Thus, it represents the liability that, in theory, should have been funded through normal costs for past service. Unfunded actuarial accrued liabilities (UAAL) exist when actuarial liabilities exceed plan assets. These deficiencies can result from (i) plan improvements that have not been completely paid for, (ii) experience that is less favorable than expected, (iii) assumption changes that increase liabilities, or (iv) contributions that are less than the actuarial contribution rate.

There are a variety of different methods that can be used to amortize the UAAL. Each method results in a different payment stream and, therefore, has cost implications. For each methodology, there are three characteristics:

- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

Amortization Period

The amortization period can be either closed or open. If it is a closed amortization period, the number of years remaining in the amortization period declines by one in each future year. Alternatively, if the amortization period is an open or rolling period, the amortization period does not decline but is reset to the same number each year. This approach essentially “refinances” the debt (UAAL) every year.

Amortization Payment

The level dollar amortization method is similar to the method in which a home owner pays off a mortgage. The liability, once calculated, is financed by a constant fixed dollar amount, based on the amortization period until the liability is extinguished. This results in the liability steadily decreasing while the payments, though remaining level in dollar terms, in all probability decrease as a percentage of payroll. (Even if a plan sponsor’s population is not growing, inflationary salary increases will usually be sufficient to increase the aggregate covered payroll).

The rationale behind the level percentage of payroll amortization method is that since normal cost is calculated to be a constant percentage of pay, unfunded actuarial accrued liabilities should be paid off in the same manner. When this method of amortizing the unfunded actuarial accrued liability is adopted, the initial amortization payments are lower than they would be under a level dollar amortization payment method, but the payments increase at a fixed rate each year so that ultimately the annual payment far exceeds the level dollar payment. The expectation is that total payroll will increase as rapidly so that the amortization payments will remain constant as a percentage of payroll. In the initial years, the level percentage of payroll amortization payment is often less than the interest accruing on the unfunded actuarial accrued liability meaning that even if there are no experience losses, the dollar amount of the unfunded actuarial accrued liability will grow (called negative amortization). This is particularly true if the plan sponsor is paying off the unfunded actuarial accrued liability over a long period, such as 20 or more years.



SECTION 2 – ACTUARIAL METHODS

Amortization Bases

The UAAL can either be amortized as one single amount or as components or “layers”, each with a separate amortization base, payment and period. If the UAAL is amortized as one amount, the UAAL is recalculated each year in the valuation and experience gains/losses or other change in the UAAL are folded into the single UAAL amortization base. The amortization payment is then the total UAAL divided by an amortization factor for the applicable amortization period.

If separate amortization bases are maintained, the UAAL is composed of multiple amortization bases, each with its own payment and remaining amortization period. In each valuation, the unexpected change in the UAAL is established as a new amortization base over the appropriate amortization period beginning on the valuation date. The UAAL is then the sum of all of the outstanding amortization bases on the valuation date and the UAAL payment is the sum of all of the amortization payments on the existing amortization bases. This approach provides transparency in that the current UAAL is paid off over a fixed period of time and the remaining components of the UAAL are clearly identified. Adjustments to the UAAL in future years are also separately identified in each future year. One downside of this approach is that it can create some discontinuities in contribution rates when UAAL layers/components are fully paid off. If this occurs, it likely would be far in the future, with adequate time to address any adjustments needed.

INPRS’ Actuarial Amortization Method

The current amortization method used by INPRS for funding is a closed, level dollar amortization method maintaining separate, layered amortization bases. The gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period (five years for the LE DB Fund) with level payments each year. A new gain or loss base is established each year based on the gain or loss during that year and that base is amortized over a new 20-year period. (Gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over the remaining period.) However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. Effective June 30, 2018, the SRA plans that have separate funding methods for the base benefits and supplemental benefits no longer include the COLA provisions in determining the amortization bases. Funding for the supplemental benefits is determined under a separate methodology (described later in Section 2). The purpose of INPRS’ amortization method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

Recommendation

The Government Finance Officers Association (GFOA) and the Conference of Consulting Actuaries (CCA) have published guidance on public pension plan funding, including the amortization period. Although these recommendations are not binding, they do point to an increased focus on developing amortization policies that are designed to pay down the UAAL in a meaningful way over a reasonable period. The Actuarial Standards Board is also considering some additional required disclosures regarding amortization. The INPRS current method aligns with the objectives set forth by all three of these organizations. **Therefore, we recommend the current amortization methods be retained by INPRS.**



SECTION 2 – ACTUARIAL METHODS

SPECIAL SITUATIONS

PERF, TRF '96, EG&C, and LE DB – Cost-of-Living Adjustment (COLA) Surcharge

Beginning with the June 30, 2018 actuarial valuation, an additional asset account was set up for the purpose of funding future post-retirement benefit increases, such as a COLA or 13th check, through a surcharge. Contributions are now split between the guaranteed base plan benefits or by the surcharge for supplemental plan benefits. The COLA Surcharge was developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur. The methodology for determining the Surcharge contributions was set quite recently and it is still too early to analyze what benefits will actually be granted under the new arrangement, therefore **we recommend retaining the COLA surcharge methodology.**

TRF Pre-'96

Historically, the TRF Pre-'96 program was funded on a “pay-as-you-go” basis. The current funding strategy is based on the state increasing contributions by 3% each year until the contributions meet or exceed the annual base benefit payments. Contributions will then continue to be equal to anticipated benefit payments until the fund reaches a 100% funding ratio, at which point contributions will be limited to the UAAL, if any. Lottery proceeds will be used to fund the supplemental benefits. **We recommend retaining this funding methodology.**

ANTICIPATED TOTAL PAYROLL

Currently, the actuarial valuation sets the anticipated total payroll for the next fiscal year as equal to the actual total payroll during the year ending on the valuation date, increased with one year of wage inflation. This methodology takes into account the most recent information about total payroll to help avoid the one-year lag in the valuation census data. **We recommend retaining the current methodology.**

EMPLOYER CONTRIBUTION RATES AND APPROPRIATION AMOUNTS

The actuarial valuation calculates the actuarially determined contribution rate or amount using the assumptions and methods. The Board considers this information, but has ultimate authority in setting the employer contributions or recommending state appropriations. The funds operate differently as outlined below. **We recommend retaining the current methodology.**

Contribution Rate Plans

The INPRS Board of Trustees has established a funding policy where contributions are computed in accordance with a stable contribution rate.

PERF State and TRF '96 – The actuarially determined employer contribution rate determined in the valuation will be used for the *fiscal year* beginning one year in the future. For example, the June 30, 2019 actuarially determined employer contribution rate will be used by the Board to set the July 1, 2020 through June 30, 2021 contribution rate.



SECTION 2 – ACTUARIAL METHODS

PERF PSD, '77 FUND and EG&C – The actuarially determined employer contribution rate determined in the valuation will be used for the *calendar year* beginning during two fiscal years in the future. For example, the June 30, 2019 actuarially determined employer contribution rate will be used by the Board to set the 2021 calendar year rate.

Appropriation Plans

JRS, PARF, and LE DB – The INPRS Board of Trustees has established a funding policy of requesting appropriations from the State in an amount equal to the actuarially determined contribution. Appropriations are set on a biennial cycle, and so the actuarially determined employer contribution amount determined in the valuation will be used for two consecutive fiscal years. For example, the June 30, 2018 amount was used for fiscal years 2020 and 2021. Therefore, the June 30, 2019 actuarial valuation will not be used, while the fiscal years 2022 and 2023 will be based on the June 30, 2020 valuation.

TRF Pre-'96 – The appropriation amounts for this fund follow the funding method described earlier.

MEMBER CENSUS DATA ROLLFORWARD

Currently, the actuarial valuation uses member census data from one year prior to the valuation date, which is adjusted, as appropriate, to reflect known changes such as granted COLAs between the census date and valuation date. A standard actuarial roll-forward is used to project the liabilities to the valuation date, reflecting benefit accruals during the year, interest for the passage of time, and benefits paid. **We recommend retaining the current methodology.**



SECTION 3 – ECONOMIC ASSUMPTIONS

ECONOMIC ASSUMPTIONS

The economic assumptions for INPRS include price inflation, wage inflation (the across-the-board portion of salary increases), cost-of-living adjustments, long-term investment return, and the interest crediting rate for member account balances. Unlike demographic assumptions, economic assumptions do not lend themselves to analysis largely on the basis of internal historical patterns because economic assumptions are impacted by external forces in the economy. The investment return and general wage increase assumptions are selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for inflation.

Sources of data considered in the analysis and selection of the economic assumptions included:

- The 2019 Social Security Trustees Report
- Data from the Bureau of Labor Statistics
- Bond pricing from the Department of the Treasury
- Future expectations of INPRS investment consultant, Verus.
- Historical observations of price and wage inflation statistics and investment returns
- Survey information from other large public retirement systems

Actuarial Standard of Practice Number 27

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment.

ASOP 27 requires the actuary to select a “reasonable” assumption. For this purpose, an assumption is reasonable if it has the following characteristics:

- a. it is appropriate for the purpose of the measurement;
- b. it reflects the actuary’s professional judgment;
- c. it takes into account historical and current economic data that is relevant as of the measurement date;
- d. it reflects the actuary’s estimate of future experience, the actuary’s observation of the estimates inherent in market data, or a combination thereof; and
- e. it has no significant bias (i.e., it is neither significantly optimistic nor pessimistic) except when provisions for adverse deviation or plan provisions that are difficult to measure are included.

With respect to relevant data, the standard recommends the actuary review appropriate recent and long-term historical economic data, but advises the actuary not to give undue weight to recent experience. Furthermore, it advises the actuary to consider that some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying environment. In addition, with respect to any particular valuation, each economic assumption should be consistent with all other economic assumptions over the measurement period.



SECTION 3 – ECONOMIC ASSUMPTIONS

ASOP 27 recognizes that economic data and analyses are available from a variety of sources, including representatives of the plan sponsor, investment advisors, economists, and other professionals. The actuary is permitted to incorporate the views of experts, but the selection or advice must reflect the actuary’s professional judgment.

The standard also notes that “the actuary should also recognize that different actuaries will apply professional judgment and may choose different reasonable assumptions.” As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice. For this study, we have selected a single set of proposed economic assumptions as shown in the table below.

	Current Assumptions	Proposed Assumptions
Price Inflation	2.25%	2.25%
General Wage Inflation	Implied 2.50%	2.75%
Cost-of-Living Adjustments		
’77 Fund (based on CPI)	2.00%	2.10%
JRS (based on salary growth)	2.50%	2.75%
PERF, TRF, EG&C, LE DB	Graded	Graded (no change)
PARF	None	None
Interest Crediting Rate on Member Balances		
’77 Fund, EG&C, JRS, and PARF	3.50%	3.50%
PERF, TRF, LE DB	None	None
Investment Return	6.75%	TBD

As the table indicates, we are not presenting a recommendation for the investment return assumption at this time. Currently INPRS is in the process of a significant asset-liability study which is likely to result in recommended changes to the current asset allocation. Because our recommended assumption will depend heavily upon the asset allocation, we believe it is appropriate to wait until the portfolio allocation decision is made. If the decision is not reached in time for us to provide a recommendation and implement a possible change for the 2020 valuations, we believe the current 6.75% would not be unreasonable.

The remaining section of this report will address the relevant types of economic assumptions used in the actuarial valuation to determine the obligations of the System. In our opinion, the economic assumptions proposed in this report have been developed in accordance with ASOP No. 27.



SECTION 3 – ECONOMIC ASSUMPTIONS

PRICE INFLATION

Use in the Valuation

Future price inflation has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, member balance interest crediting rate, cost-of-living adjustment, wage inflation, and individual salary increases.

The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level “real return” – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates are expected to result in lower expected investment returns, at least in the long run.

The current assumption for price inflation is 2.25% per year.

Past Experience

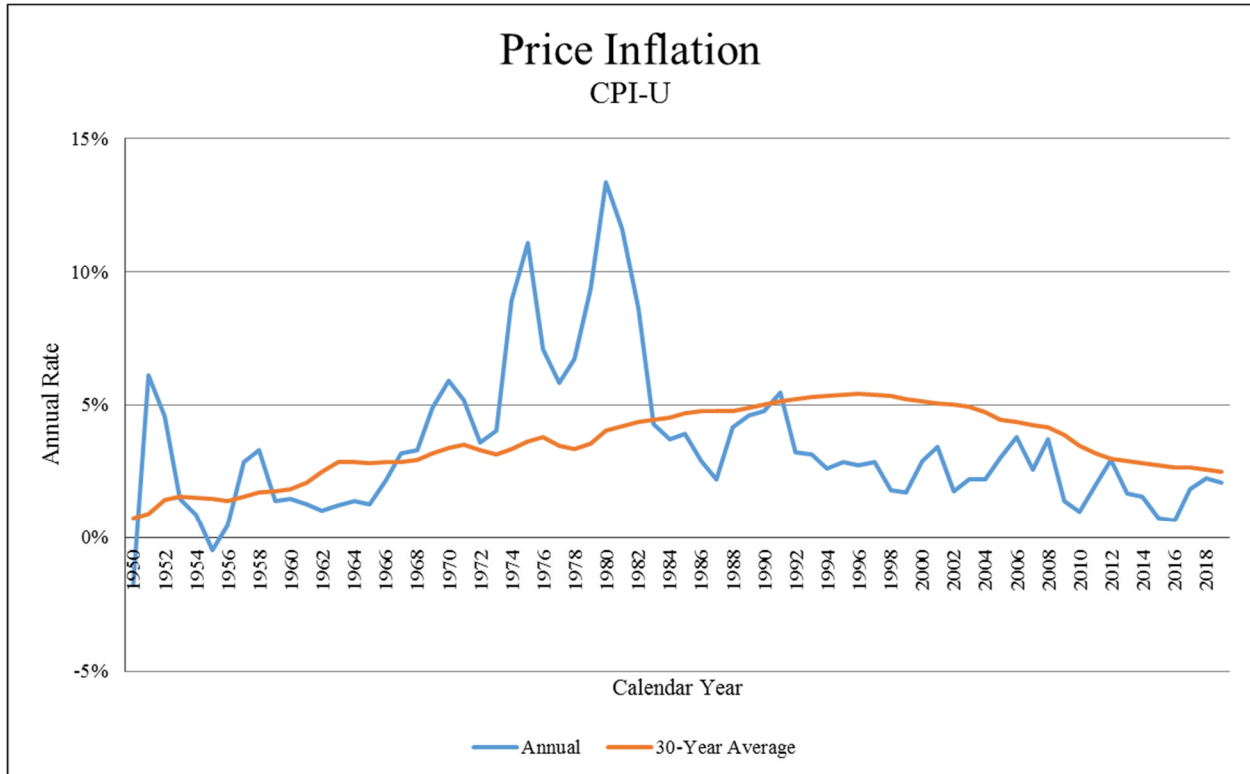
Although economic activities, in general, and inflation in particular, do not lend themselves to prediction solely on the basis of historical analysis, historical patterns and long term trends are factors to be considered in developing the inflation assumption. The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The following table provides historical annualized rates and annual standard deviations of the CPI-U over periods ending June 30th.

Period	Number of Years	Annualized Rate of Inflation	Annual Standard Deviation
1926 – 2019	93	2.90%	3.86%
1959 – 2019	60	3.68	2.73
1969 – 2019	50	4.00	2.83
1979 – 2019	40	3.32	2.53
1989 – 2019	30	2.49	1.07
1999 – 2019	20	2.18	0.89
2009 - 2019	10	1.67	0.68



SECTION 3 – ECONOMIC ASSUMPTIONS

The following graph illustrates the historical annual change in price inflation, measured as of June 30 for each of the last 70 years, as well as the thirty-year rolling average.



Over more recent periods, measured from June 30, 2019, the average annual rate of increase in the CPI-U has been below 2.50%. The period of high inflation from 1973 to 1982 has a significant impact on the averages over periods which include these years, but now appears to be an isolated historical event.

Forecasts Implied from the Bond Market

Additional information to consider in formulating this assumption is obtained from measuring the spread on Treasury Inflation Protected Securities (TIPS) and from the prevailing economic forecasts. The spread between the nominal yield on treasury securities (bonds) and the inflation indexed yield on TIPS of the same maturity is referred to as the “breakeven rate of inflation” and represents the bond market’s expectation of inflation over the period to maturity.



SECTION 3 – ECONOMIC ASSUMPTIONS

The table below provides the calculation of the breakeven rate of inflation as of December 31, 2019.

Years to Maturity	Nominal Bond Yield	TIPS Yield	Breakeven Rate of Inflation
10	1.92%	0.15%	1.77%
20	2.25	0.39	1.86
30	2.39	0.58	1.81

As this data indicates, the bond market is anticipating very low inflation, around 1.8%, for both the short and long term. The bond market expectations may be heavily influenced by the low interest rate environment created by the Federal Reserve Bank’s manipulation of the bond market. Whether inflation returns to the higher rates observed historically remains to be seen. We note that measures can move fairly significantly over just a few months.

Forecasts from the Social Security Administration

Although many economists forecast lower inflation than the assumptions used by retirement systems, they are generally looking at a shorter time horizon (10 years) than is appropriate for a pension valuation. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the most recent report (April 2019), the projected average annual increase in the CPI over the next 75 years was estimated to be 2.6%, under the intermediate (best estimate) cost assumption. The range of price inflation used in the Social Security 75-year modeling, which includes a low and high cost scenario, in addition to the intermediate cost projection, was 2.0% to 3.2%.

Forecasts from Investment Consulting Firms and Other Professionals

In setting their capital market assumptions, most investment consulting firms use an inflation assumption. INPRS receives investment consulting advice from Verus and we believe it is especially appropriate to give consideration to their analysis. Their 2020 capital market assumptions include a 10-year forecast of inflation to be 1.9%.

Horizon Actuarial Services, LLC publishes a survey of capital market assumptions obtained from various investment consultants. The 2019 Horizon Survey includes the assumptions, including the expected rate of inflation, for sixteen advisors who develop longer-term assumptions (20 years or more). The Survey showed a range of expected inflation for the next 20 years, for these sixteen consultants, of 1.8% to 2.7%, with a median of 2.3%. Inflation over a shorter time horizon, for the next 10 years, was very similar range of 1.7% to 2.7%, with a median of 2.2%.

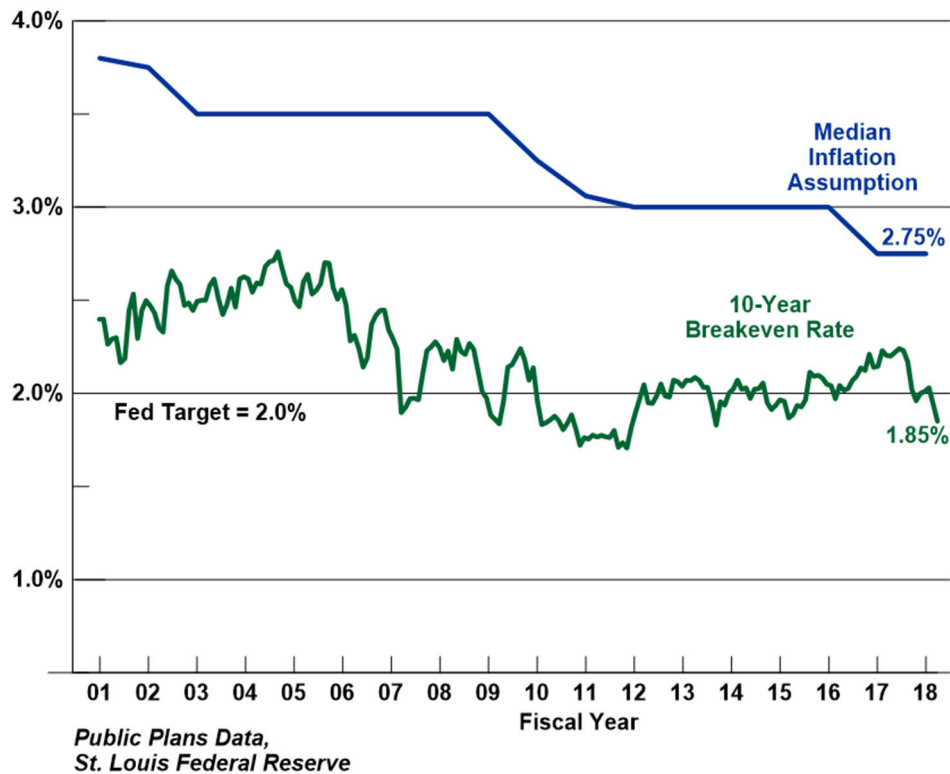
Another source to consider in setting this assumption is a quarterly survey of the Society of Professional Forecasters that is conducted by the Philadelphia Federal Reserve of economists. Their most recent forecast (fourth quarter of 2019) was for inflation over the next ten years (2019 to 2028) to average 2.20%.



SECTION 3 – ECONOMIC ASSUMPTIONS

Forecasts from Peer System Comparison

While we do not recommend the selection of any assumption based on what other systems use, it does provide another set of relevant information to consider. Based on the Public Plan Database (a survey of over 125+ state and local retirement systems maintained by a collaboration between the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average inflation assumption for governmental plans has been steadily declining. Based on the current data, both the average and median inflation assumption is 2.75%. This data is largely based on actuarial valuations prepared with measurement dates in 2018. Based on our experience, we believe that further declines in the inflation assumption have occurred for some systems over the last year. The following chart shows the public plan median inflation assumption compared with the difference of 10-year Treasuries and TIPS as reported by the St. Louis Federal Reserve.





SECTION 3 – ECONOMIC ASSUMPTIONS

Recommendation

The following table provides a comparison of the current levels of expected inflation.

Source	Expected Inflation
INPRS' Consultant (Verus)	1.90%
2019 Horizon Survey	2.30%
Bond Market	1.80%
2019 SSA Trustees Report	2.60%
Survey of Professional Forecasters	2.20%
Peer Group	2.75%

While actuarial standards caution against too much consideration of recent events, the lower inflation over the last 10, 20 and even 30 years, coupled with the low future inflation anticipated by the bond markets, investment consultants, and professional economic forecasters suggests that there may have been a fundamental change away from the longer term historical norms. We believe the current price inflation assumption remains reasonable with a small degrees of conservatism in light of the the various forecasts reviewed. Based on the information presented above, **we recommend the inflation assumption remain at 2.25%**. We do note that there is an Asset-Liability Study in progress. Depending upon the conclusions of that study, it may be appropriate to reassess the inflation recommendation to ensure consistency among all of the assumptions.



SECTION 3 – ECONOMIC ASSUMPTIONS

WAGE INFLATION

Background

Wage inflation, thought of as the “across the board” rate of salary increases, is composed of the price inflation assumption combined with an assumption for the real rate of wage increases. In constructing the individual salary increase assumption, the wage inflation assumption is further combined with an assumption for age- or service-based salary increases (called a merit scale). The merit scale assumption is discussed later in this report.

Currently, there is no specified wage inflation assumption, although several of the funds have an ultimate salary scale of 2.50%, which implies an assumed real rate of wage increase or real wage inflation of 0.25% for many plans (2.50% less the current inflation assumption of 2.25%). The excess of wage inflation over price inflation represents the increase in the standard of living, also called productivity growth. There has been debate on the issue of whether public sector employees will receive, over the long term, the same rewards for productivity as employees in the private sector, where productivity is more readily measurable. To our knowledge, no definitive research has been completed on this topic. Nevertheless, it is our opinion that public sector employees will eventually be rewarded with the same productivity increases as those participating in the remainder of the economy, even if there is a time lag.

Historical Perspective

Wage statistics from the Social Security System on the National Average Wage back to 1951 are used because that is the most comprehensive database available. Because the National Average Wage is based on all wage earners in the country, it can be influenced by the mix of jobs (full-time vs. part-time, manufacturing vs. service, etc.) as well as by changes in some segments of the workforce that are not seen in all segments (e.g. regional changes or growth in computer technology). Furthermore, if compensation is shifted between wages and benefits, the wage index would not accurately reflect increases in total compensation. INPRS’ membership is composed exclusively of governmental employees working in Indiana. Because the competition for workers can, in the long term, extend across industries and geography, the broad national earnings growth will have some impact on INPRS’ members. In the shorter term, however, the wage growth of INPRS and the nation may be less correlated.

There are numerous ways to review this data. For consistency with our observations of CPI, the table below shows the compound annual rates of wage growth for various 10-year periods based on the calendar year, and for longer periods ended in 2018 (most recent available data).

The excess of wage inflation over price inflation represents the real wage inflation rate. Although real wage inflation has been very low in recent years, likely due to the slow recovery from the 2008 financial crisis, our focus must remain on the long term. The following tables show the compounded wage growth over various periods, along with the comparable price inflation rate for the same period. The differences represent the real wage inflation rate. The table on the left shows the real wage inflation over different 10-year periods while the table on the right shows the real wage inflation over increasing periods of 10 to 60 years.

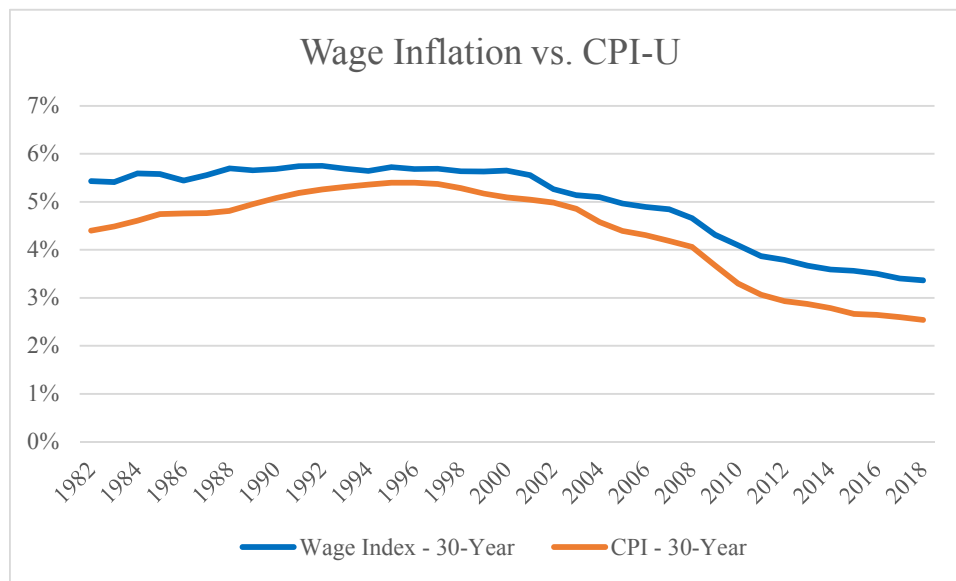


SECTION 3 – ECONOMIC ASSUMPTIONS

Decade	General Wage Inflation	CPI Incr.	Real Wage Inflation
2008-2018	2.4%	1.6%	0.8%
1998-2008	3.7%	2.8%	0.9%
1988-1998	4.1%	3.3%	0.8%
1978-1988	6.2%	6.1%	0.1%
1968-1978	6.6%	6.5%	0.1%
1958-1968	4.3%	1.9%	2.4%

Period	General Wage Inflation	CPI Incr.	Real Wage Inflation
2008-2018	2.4%	1.6%	0.8%
1998-2018	3.0%	2.2%	0.8%
1988-2018	3.4%	2.5%	0.9%
1978-2018	4.1%	3.4%	0.7%
1968-2018	4.6%	4.0%	0.6%
1958-2018	4.5%	3.7%	0.8%

Similar information over rolling thirty year periods is shown in the following graph:



Forecasts of Future Wages

The wage index used for the historical analysis is projected forward by the Office of the Chief Actuary of the Social Security Administration in their 75-year projections. In the April, 2019 Trustees Report, the annual increase in the National Average Wage Index under the intermediate cost assumption (best estimate) was 3.81%, 1.21% higher than the Social Security intermediate inflation assumption of 2.60% per year. The range of the assumed real wage inflation in the 2019 Trustees Report was 0.60% to 1.84% per year.

Public Sector Compensation and Wages

The Bureau of Labor Statistics publishes the Employment Cost Index, including detail for real (net of inflation) total compensation and wages and salaries. Further, this index is also broken down for state and local government workers. From 2001 through 2019, real compensation grew by at an annualized rate of 0.78%, while wages and salaries grew at a rate of 0.17%. This difference is a reflection that state and local government workers have had much of their compensation increase delivered through benefits rather than



SECTION 3 – ECONOMIC ASSUMPTIONS

wages and salaries. While it is certainly reasonable to anticipate that total compensation will continue to increase faster than wages and salaries, it is also reasonable to anticipate that the difference between the two will moderate over time.

Salary Increases for Long-Service Employees

Most of the factors that result in merit salary increases, such as step or service-related increases and promotions, have stopped or are minimal for longer-service employees. Theoretically, salary increases for longer-service employees are typically driven by wage inflation, i.e., the increase in wages for all members of the work force. Therefore, we analyzed the actual salary increases for long-service employees as another consideration in setting this assumption.

The actual salary increases over the past 5 years (2014 through 2019) were calculated and we observed that salary increases level off after about 25 years for most of the groups. The following table summarizes our analysis for long-service employees for the plans. Because of the year-to-year volatility, we are unable to assign any significant credibility to these results.

Plan	Actual Increase	Price Inflation	Increase Over Actual Inflation
PERF – 5 year average	2.66%	1.51%	1.15%
2014	0.58%	0.73%	(0.15%)
2015	5.15%	0.67%	4.48%
2016	2.62%	1.84%	0.78%
2017	4.43%	2.25%	2.18%
2018	0.56%	2.07%	(1.51%)
TRF – 5 year average	0.78%	1.51%	(0.73%)
2014	(2.35%)	0.73%	(3.08%)
2015	1.55%	0.67%	0.88%
2016	2.15%	1.84%	0.31%
2017	1.44%	2.25%	(0.81%)
2018	1.35%	2.07%	(0.72%)

Recommendation

While national wage statistics for the last 30 years indicate a productivity increase of around 0.80%, the Social Security projections assume larger increases (over 1.0%). Public sector compensation, however, also has a significant portion of its growth in non-wage areas. Based on the available data and our professional judgment, **we recommend that the long-term assumed real wage inflation be set at 0.50% per year, an increase from the implied current assumption of 0.25%. When coupled with the price inflation assumption, the resulting general wage inflation assumption is 2.75%.**



SECTION 3 – ECONOMIC ASSUMPTIONS

COST-OF-LIVING ADJUSTMENT

The provisions of the plans outlined below provide an adjustment to retiree benefits to increase at a rate known as the cost-of-living adjustment (COLA). This benefit adjustment can maintain or stabilize the purchasing power of the member's benefit by offsetting increasing costs due to general inflation over time.

'77 FUND

In-payment retirees, disableds (resulting from non-catastrophic injuries), and beneficiaries automatically receive a COLA in an amount that is tied to actual price inflation, with a cap of 3% and a minimum of 0%. The COLA on July 1 is determined as the average of the January, February, and March amounts for the current year over the January, February, and March amounts for the prior year.

Recognizing that annual inflation has a random component, we simulated the expected effective (compound) COLAs that would apply to the '77 Fund with the cap and floor reflected. Based on the price inflation assumption of 2.25% and estimated standard deviation, **we recommend a slight increase in the current COLA assumption from 2.00% to 2.10%.**

For disableds resulting from catastrophic physical injuries (degree of impairment of at least 67% and member permanently prevented from performing any gainful work), the member receives a COLA in an amount that is tied to the increase in the First Class Officer base salary. We therefore believe this should be set at the wage inflation assumption. **We recommend the disableds COLA assumption be increased from 2.50% to 2.75%.**

JRS

In-payment retirees and disableds automatically receive a COLA in an amount that is tied to the annual increase granted for the position the member held at retirement. Beneficiaries do not receive the COLA. We therefore believe this should be set at the wage inflation assumption. **We recommend the COLA assumption be increased from 2.50% to 2.75%.**

PARF

No COLA is provided.

PERF, TRF Pre-'96, TRF '96, EG&C, and LE DB

There is no guaranteed COLA under these plans, though in-payment retirees, disableds, and beneficiaries may receive a discretionary COLA or other post-retirement adjustment in an amount set by statute. In recent history, 13th checks have been provided in lieu of a COLA, which valuations take into account once legislation is passed. Beginning July 1, 2018 or January 1, 2019 (depending on the fund), a Supplemental Retirement Account was established for these funds that will be used eventually to provide the additional post-retirement benefits. The funds are accumulated separately from the guaranteed base plan benefits through a surcharge on the actuarially determined contribution, where the board is responsible for setting the actual surcharge funded. (Lottery proceeds provide the funding for the TRF Pre-'96 fund and may be shared with other funds, as determined by the Board.)

Beginning as soon as the 2021 legislative session, specific benefit increases may be authorized to be paid from these funds. A proposed benefit will only be granted through statute if the Supplemental Retirement Account for all five plans each has enough money to fund the present value of the current and future benefits resulting from the proposed COLA or 13th check. Because there are five plans that must, by law, provide the same COLA or 13th check, the funding strategy needs to consider the funding needs of the entire System, as well as the specific fund. Therefore, the surcharge relies heavily on the COLA assumption. However,



SECTION 3 – ECONOMIC ASSUMPTIONS

because there has yet to be an opportunity to consider a COLA, there is no history upon which to base an assumption. Based on analysis performed during the design phase of the Supplemental Reserve Account legislation, the long-term COLA assumption was set to a COLA of 0.4% starting in 2022, 0.5% starting in 2034, and then 0.6% in 2039 and beyond. Given that there is no additional information at this time, **we recommend no change in the supplemental account COLA assumption.**

INTEREST CREDITED ON MEMBER ACCOUNTS

'77 FUND, JRS, EG&C, and PARF

EG&C members contribute 4% of their salaries, whereas the other members in these contributory plans contribute 6% of their salaries. In the event a member receives a refund of their contributions (e.g. non-vested termination), interest is included. Indiana code stipulates the interest rate is “established by rule of the board”. In April 2013, the board approved the methodology to set the interest rate as the average of the January, February, and March month-end 10-year U.S. Treasury Note yields for the current calendar year. The rates would be established annually by the Board no later than June 30th. Interest is credited at least once annually on the prior fiscal year-end balance in accordance with 35 IAC 1.2-1-6. However, in practice, interest is posted daily to the active member’s full account balance on that date. The current member balance interest crediting rate assumption is 3.50%.

The 10-year U.S. Treasury bond yield generally reflects the expected price inflation plus the real return. To get an understanding of the real return, we can look at the yield on 10-year inflation protected U.S. Treasuries (TIPS), as the financial markets typically estimate expected inflation by using the difference between the Treasury bonds and TIPS. Using our price inflation assumption of 2.25% and a real return expectation of 1.25% would result in the current interest crediting rate assumption of 3.50%. In the past few years, the TIPS return has generally bounced between 0% and 1.15%. **We recommend leaving the member balance interest crediting rate assumption at 3.50% as a slightly conservative view of future long-term expectations.**



SECTION 3 – ECONOMIC ASSUMPTIONS

INVESTMENT RETURN

Use in the Valuation

The investment return assumption reflects the anticipated returns on the current and future assets. It is one of the primary determinants in the allocation of the expected cost of the promised benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. Generally, the investment return assumption should be set with consideration of the asset allocation policy, expected long term real rates of return on the specific asset classes, the underlying inflation rate, and any investment expenses.

The current investment return assumption is 6.75% per year, net of all investment-related and administrative expenses. The 6.75% rate of return is referred to as the nominal rate of return and is composed of two components. The first component is price inflation (previously discussed). Any excess return over price inflation is referred to as the real rate of return. The real rate of return, based on the current set of assumptions, is 4.50% (6.75% nominal return less 2.25% inflation).

Forward Looking Analysis

In developing our investment return assumption, we generally give the greatest consideration to the expected returns based on the portfolio composition and expected capital market assumptions. Currently, INPRS is conducting an extensive Asset-Liability Study which may result in a change in the asset allocation of the portfolio. Consequently, we believe that the complete development of this assumption should wait until the study is complete. We note that the current assumption does not appear unreasonable and will most likely be appropriate for use in the 2020 valuation in case the study is not completed in time for us to propose a revised assumption.

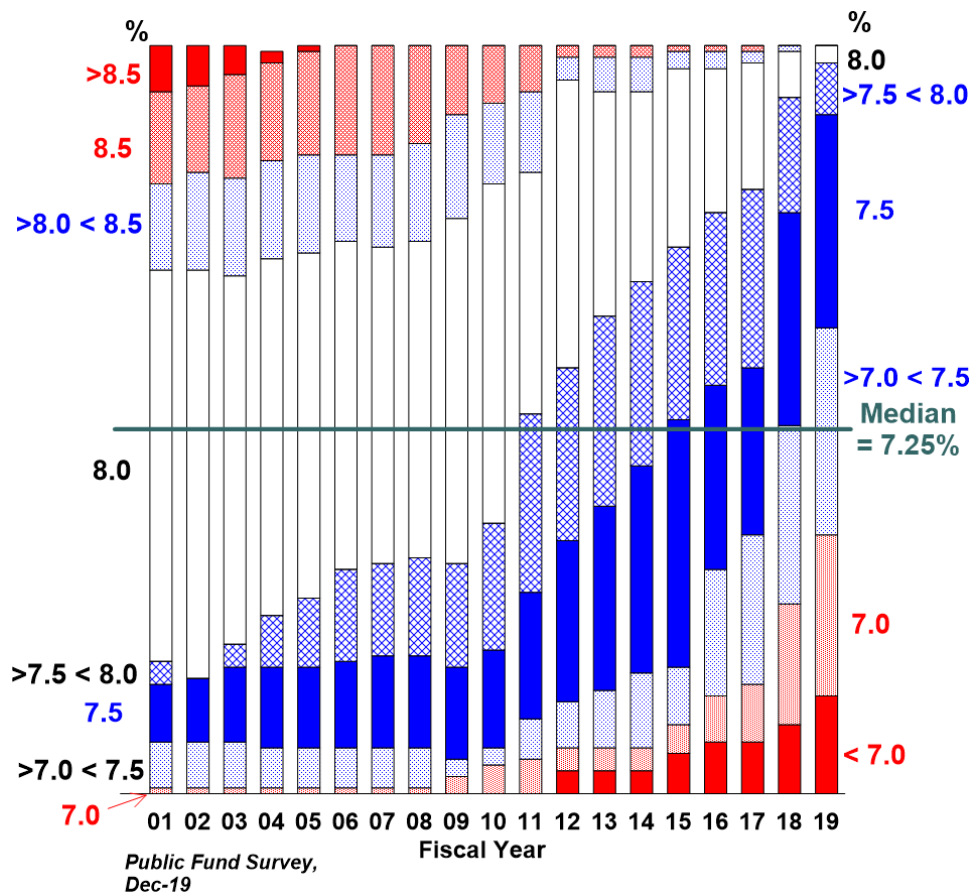
Peer System Comparison

While we do not recommend the selection of an investment return assumption be based on the assumptions used by other systems, this information does provide another set of relevant data to consider as long as we recognize that asset allocation varies from system to system. The graph on the following page shows the change in the distribution of the investment return assumption from fiscal year 2001 through 2018 (and some 2019 information) for the 120+ large public retirement systems included in the NASRA Public Fund Survey.

As the graph below indicates, the investment return assumptions used by public plans have decreased over the last decade, likely impacted by a corresponding decrease in the underlying inflation assumption from 4.00% to 2.75% over the same period. INPRS has been among the lowest for a number of years, although more systems are now selecting assumptions near 6.75%.



SECTION 3 – ECONOMIC ASSUMPTIONS



Recommendation

As noted in the Board summary, because INPRS is conducting an Asset-Liability Study, we wish to defer making a recommendation until that study is complete. We note that the current assumption does not appear unreasonable and will most likely be appropriate for use in the 2020 valuation in case the study is not completed in time for us to propose a revised assumption.

When we do recommend an assumption, it should be noted that by actuarial standards, we are required to maintain a long-term perspective in setting all assumptions, including the investment return assumption. Therefore, we believe we must be careful not to let recent experience or short-term expectations impact our judgment regarding an appropriate investment return assumption over the long term.



SECTION 3 – ECONOMIC ASSUMPTIONS

DEMOGRAPHIC ASSUMPTIONS

Actuarial Standard of Practice (ASOP) No. 35 provides guidance to actuaries regarding the selection of demographic and other non-economic assumptions for measuring pension obligations. ASOP 35 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

The actuary should follow the following steps in selecting the demographic assumptions:

1. Identify the types of assumptions. Types of demographic assumptions include but are not limited to retirement, mortality, termination of employment, disability, election of optional forms of payment, administrative expenses, family composition, and treatment of missing or incomplete data. The actuary should consider the purpose and nature of the measurement, the materiality of each assumption, and the characteristics of the covered group in determining which types of assumptions should be incorporated into the actuarial model.
2. Consider the relevant assumption universe. The relevant assumption universe includes experience studies or published tables based on the experience of other representative populations, the experience of the plan sponsor, the effects of plan design, and general trends.
3. Consider the assumption format. The assumption format includes whether assumptions are based on parameters such as gender, age or service. The actuary should consider the impact the format may have on the results, the availability of relevant information, the potential to model anticipated plan experience, and the size of the covered population.
4. Select the specific assumptions. In selecting an assumption the actuary should consider the potential impact of future plan design as well as the factors listed above.
5. Evaluate the reasonableness of the selected assumption. The assumption should be expected to appropriately model the contingency being measured. The assumption should not be anticipated to produce significant actuarial gains or losses.

ASOP 35 General Considerations and Application

Each individual demographic assumption should satisfy the criteria of ASOP 35. In selecting demographic assumptions the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date, the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In addition, a recent change to ASOP 35 requires the actuary to include a specific assumption with respect to expected mortality improvements after the measurement date. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP 35.



SECTION 3 – ECONOMIC ASSUMPTIONS

Overview of Analysis

The purpose of a study of demographic experience is to compare what actually happened to the individual members of the System during the study period (July 1, 2014 through June 30, 2019) with what was expected to happen based on the actuarial assumptions.

Studies of demographic experience generally involve three steps:

- First, the number of members changing membership status, called decrements, during the study is tabulated by age, duration, gender, group, and membership class (active, retired, etc.).
- Next, the number of members expected to change status is calculated by multiplying certain membership statistics, called exposure, by the expected rates of decrement.
- Finally, the number of actual decrements is compared with the number of expected decrements. The comparison is called the Actual-to-Expected ratio (A/E Ratio), and is expressed as a percentage.

In general, if the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, sex, or duration deviates significantly from the expected pattern, new assumptions are considered. Recommended revisions are normally not an exact representation of the experience during the observation period. Judgment is required to anticipate future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

For many of the decrements we analyze the experience using a liability-weighted approach. This is approximated by using the member's compensation and years of service to estimate the member's benefit level. (For retirees, the benefit is determined directly from the data.) The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. This approach is particularly insightful when analyzing experience from a non-homogenous group. While we reviewed experience on both a count and liability-weighted basis, we generally used the liability-weighted results to evaluate experience and develop new assumptions, if necessary.

Revised rates of decrement are tested by using them to recalculate the expected number of decrements during the study period, and the results are shown as revised Actual-to-Expected Ratios.

It takes a fair amount of data to perform a credible study of demographic assumptions. Because the membership or certain subsets of the membership are relatively small, some assumptions have been selected based more on our professional judgment of reasonable future outcomes than actual experience.



SECTION 5 –MORTALITY

MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females), by group (PERF, TRF, '77 Fund and EG&C, and Judges, prosecuting attorneys, and Legislators), and by status (healthy retirees, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age adjustments or scaling to these standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a “setback” or a “set forward”. A one-year age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. So, a one year set back would treat a 61 year old retiree as if he will exhibit the mortality of a 60 year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to “scale” a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. (There are still other breakdowns that are not relevant for INPRS.) We anticipate that this family of tables will be a good starting point in developing a recommended mortality assumption.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.



SECTION 5 –MORTALITY

There are two widely-used ways to reflect future improvements in mortality:

- (1) Static table with “margin”
- (2) Generational mortality

The first approach to reflecting mortality improvements is through the use of a static mortality table with “margin.” Under this approach, the Actual to Expected Ratio is intentionally targeted to be over 100% so that mortality can improve without creating actuarial losses. This has been the approach used historically by many other systems because of its computational simplicity.

Another approach, referred to as generational mortality, directly anticipates future improvements in mortality by using a different set of mortality rates based on each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain “built-in” mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the Actual to Expected Ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process. The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last 10-15 years, this method has become quite common as computing power has increased. This is the method currently used in the valuation and we recommend it continue to be used.

In developing our recommendations for mortality tables, we have not only considered how the table fits the experience in total, but we have also looked at the quality of the fit at just the younger ages and just the older ages when there is sufficient data. One tool to assist with this has been to plot the actual and observed data on a logarithmic graph, allowing the comparison of fit across the entire age range to be readily assessed.



SECTION 5 –MORTALITY

MORTALITY – Healthy Retirees

The valuation currently uses three separate mortality assumptions for healthy members: (1) for PERF; (2) for TRF, PARF, JRS, and LE DB funds; and (3) for the '77 Fund and EG&C. These three groups are further divided for male and female members. The underlying mortality tables are from the Society of Actuaries RP-2006 tables, using the Blue Collar version for '77 Fund/EG&C, the White Collar version for TRF/PARF/JRS/LE DB and the all-collar version for PERF. No age adjustments or scaling factors were applied. Generational improvement was projected using the 2014 Social Security Administration mortality improvement assumption.

A review of the prior experience study shows there was consideration of using an age set forward for the PERF males and the '77 Fund males. While there was some indication that these changes would improve the fit of the proposed assumption to the recently observed data, the actuaries at the time decided to not make such adjustments. We note this now because these two groups have had actual deaths well above the assumed deaths, providing evidence in hindsight that the age set forwards would have been appropriate for anticipating the most recent study period.

The results of the experience study for healthy retirees ages 55 to 100, on a count basis, are summarized in the following chart. Because of the limited amount of data for females in funds other than PERF and TRF, no meaningful analysis could be performed.

Healthy Retiree Deaths Count Basis			
	<u>Actual</u>	<u>Expected</u>	<u>A/E Ratio</u>
PERF			
Male	5,133	3,638	141%
Female	7,802	7,194	108
TRF			
Male	2,624	2,394	110
Female	3,866	3,950	98
'77 Fund/EG&C			
Male	267	223	120
PARF/JRS/LE DB			
Male	54	48	113

Because the mortality assumption uses a generational improvement assumption, we would like the A/E Ratios to be closer to 100%. An examination of this table indicates that some groups – most notably, PERF males and '77 Fund/EGC males – have ratios well above 100%. As noted above, had the contemplated two-year set forward been used, the resulting A/E ratios would have been quite a bit closer to 100%.

In this experience study, we also analyzed recent experience on a benefit-weighted basis where the exposures and deaths are multiplied by the monthly retirement benefit amount. This helps to reflect any differences that arise from better mortality experience among those with larger benefits. Because a valuation is designed to measure the amount and timing of future benefit payments (liability) rather than simply the



SECTION 5 –MORTALITY

number of retirees leaving pay status, this benefit-weighted approach is an important factor in valuing plan obligations. The Actual to Expected Ratios on the benefit-weighted basis were different from the Actual to Expected Ratios on a count basis, confirming that members with higher benefits also tend to have better mortality. Please note that we are not saying that larger benefits definitely lead to better mortality, but simply that there is a correlation between the two.

The Actual to Expected Ratios on a benefit-weighted basis are summarized and compared to those on a count basis in the following table. The fact that the ratios are lower on a weighted basis than on a count basis is an indication that individuals with larger benefits do indeed have slightly better mortality on average, as was anticipated. (Note that most mortality tables used by actuaries are developed on a weighted basis.)

Healthy Retiree Mortality A/E Ratios		
	<u>Count</u>	<u>Weighted</u>
PERF		
Male	141%	135%
Female	108	106
TRF		
Male	110	103
Female	98	92
'77 Fund/EG&C		
Male	120	113
PARF/JRS/LE DB		
Male	113	112

In order to more closely anticipate future liability experience, we believe that assigning more credibility to the benefit-weighted analysis is the better approach. Based on the observations summarized in the table above, we believe that mortality assumption changes are appropriate for several of the groups. Since several of the groups are to be changed and we believe the new Pub-2010 tables would be a good choice, we recommend changing the mortality basis for all of the groups so that all of INPRS can share a common family of tables. We also recommend the most recent mortality improvement scale, MP-2019, be used to anticipate future mortality improvements in the valuation process through at least the next experience study.

Therefore, our recommended mortality assumptions are based on the Pub-2010 healthy annuitant tables, with adjustments as outlined below to better fit actual experience, projected generationally with the MP-2019 scale.

<u>Group</u>	<u>Membership Table</u>	<u>Set Forward/Setback</u>
PERF	General	Male: +3, Female: +1
TRF	Teachers	Male: +1, Female: +1
'77 Fund/EG&C	Safety	Male: +3, Female: +0
JRS/PARF/LE DB	General	Male: -1, Female: -1



SECTION 5 –MORTALITY

The resulting Actual to Expected Ratios, based on the proposed assumption for ages 55 to 100, are shown in the following table.

Healthy Mortality A/E Ratios (Weighted)		
	<u>Current</u>	<u>Proposed</u>
PERF		
Male	135%	103%
Female	106	109
TRF		
Male	103	98
Female	92	101
'77 Fund/EG&C		
Male	113	103
PARF/JRS/LE DB		
Male	112	107

MORTALITY – Beneficiaries

The mortality of beneficiaries applies to the survivors of members who retired with a joint and survivor option. There are significantly fewer members receiving survivor benefits under the joint and survivor options which limits the ability to analyze this group in detail. Because of this, we analyzed beneficiaries from all funds together and developed a common assumption. The results are summarized in the following table:

Beneficiary Mortality A/E Ratios (Weighted)		
	<u>Current</u>	<u>Proposed</u>
Male	103%	94%
Female	124	103

We recommend Pub-2010 Contingent Survivors Table be used with no adjustment for males and a two-year set-forward for females, projected generationally with the MP-2019 scale.



SECTION 5 –MORTALITY

MORTALITY – Disabled Retirees

The valuation assumes that disabled members, in general, will not live as long as retired members who met the regular service retirement eligibility. There tends to be more fluctuation in disabled mortality than healthy mortality because of differences in the types of disabilities. In addition, the smaller number of exposures makes the results more volatile. Because the requirements to receive a disability retirement for public safety groups require a lower threshold than other groups, we have analyzed the '77 Fund and EG&C separately from the other groups.

Disabled Mortality A/E Ratios (Weighted)		
	<u>Current</u>	<u>Proposed</u>
77 Fund/EG&C		
Male	91%	94%
All Others		
Male	165	129
Female	170	118

In order to stay with the same family of mortality tables, we recommend the Pub-2010 General Disabled Table be used for '77 Fund and EG&C, projected generationally with the MP-2019 scale. For the other groups, we recommend using 140% of the Pub-2010 General Disabled Table be used, projected generationally with the MP-2019 scale.

MORTALITY – Actives

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so can be misleading. Finally, the probability of active death is very small so volatility is not uncommon. Consequently, we prefer to set this assumption by utilizing the more reliable analysis performed on the retiree data.

Our recommended mortality assumptions are based on the Pub-2010 employee tables, with adjustments as outlined below, projected generationally with the MP-2019 scale.

<u>Group</u>	<u>Membership Table</u>	<u>Set Forward/Setback</u>
PERF	General	Male: +3, Female: +1
TRF	Teachers	Male: +1, Female: +1
'77 Fund/EG&C	Safety	Male: +3, Female: +0
JRS/PARF/LE DB	General	Male: -1, Female: -1



SECTION 5 –MORTALITY

LINE-OF-DUTY DEATHS

For the '77 Fund and EG&C, active member death benefits may vary depending upon whether or not the death was in the line of duty. INPRS provided a complete listing for the past five years of all active member deaths for these funds along with an indication of which deaths were in the line of duty. Currently, the assumption is that 10% of active deaths are line-of-duty deaths. Of the 58 deaths reported for the '77 Fund, 15 of them, or 26%, were in the line of duty. Similarly, even though the counts are not high enough to be credible, the EG&C plan had one death in the line of duty out of a total of 4 active deaths, or 25%. Because of the limited number, we do not view these observations as fully credible, but still believe that the assumption should be increased. In conjunction with our professional judgment and experience with similar systems, **we recommend that the assumption be revised to assume that 20% of active deaths for the '77 Fund and EG&C are in the line of duty.** (EG&C death benefits currently are the same for all active deaths, though this assumption would be utilized for plan design cost studies as necessary.)



SECTION 6 – RETIREMENT

RETIREMENT RATES

Service retirement measures the change in status from active membership directly to retirement. This assumption does not include the retirement patterns of the retirees who terminated from active membership prior to their retirement.

The decision to retire is influenced by many factors, but certain patterns emerge from the data that can help us in setting the assumption. First, the member’s age is generally a factor. Retirement rates increase with age, although sometimes there are certain ages such as 62 or 65 that may be higher than the ages that follow because of Social Security and Medicare provisions. Second, plan design features may influence the decision as well. We typically observe lower rates of retirement when a member is eligible for an early retirement benefit that includes a reduction for the early commencement. Once members reach unreduced retirement age, rates of retirement typically increase. Finally, other plan features such as service maximum for the benefit formula or the existence of a Deferred Retirement Option Program (DROP) can have an influence as well. All of these factors combine to form a retirement plan’s experience, and the uniqueness of each plan means that the structure and pattern of the retirement assumption will also be unique.

RETIREMENT – PERF

We separately analyzed the retirement rates for members who were eligible for early retirement with reduced benefits and those eligible for unreduced retirement. Early retirements include those who terminate and are eligible to retire, even if benefits did not commence immediately. There is a separate assumption regarding when benefits commence for those who terminate when they are eligible for an early retirement.

PERF Retirements Count Basis					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
Early	79,416	3,991	3,565	112%	90%
Unreduced	106,254	18,563	20,358	91%	91%

Early retirement was utilized by more members than expected, but because those taking early retirement tended to have lower service and salary than the group as a whole, the liability-weighted A/E ratio was less than 100%. Because of the low utilization (assumed rates are 4% to 5%), we do not see any reason to adjust this assumption at this time.

Of the 3,991 early retirees, 596 commenced benefits immediately, while 3,395 deferred commencement. Currently, 33% of early retirees are assumed to commence immediately, but this data suggests that the assumed rate should be lower. **We recommend assuming that 30% of PERF early retirements commence immediately and 70% are deferred.** We will be watching this assumption through time and anticipate that it might be adjusted again in the next experience study.

Unreduced retirements were observed at a lower level than expected. In general, the pattern of retirement by age was reasonably in line with the assumptions. For those who were first eligible for unreduced retirement between ages 55 and 59, there is currently a retirement assumption of 14% rather than 10%. We observed about 9% utilization (on both a count and weighted basis). Therefore, **we recommend that the**



SECTION 6 – RETIREMENT

current PERF retirement rates for early and unreduced retirement be retained, but that the additional probability for those first eligible for unreduced retirement be eliminated.

RETIREMENT – TRF

As with PERF, we separately analyzed the retirement rates for members who were eligible for early retirement with reduced benefits and those eligible for unreduced retirement. The results are summarized below:

TRF Retirements Count Basis					
				A/E Ratio	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
Early	23,228	1,003	999	100%	86%
Unreduced	12,428	2,640	3,495	76%	79%

The number of people taking early retirement was close to expected, but because those taking early retirement tended to have lower service and/or salary than the group as a whole, the liability-weighted A/E ratio was less than 100%. Because of the low utilization, we do not see any reason to adjust this assumption at this time.

Of the 1,003 early retirees, 99 commenced benefits immediately, while 904 deferred commencement. Unlike PERF where there is a current assumption regarding the proportion who commence immediately versus defer, TRF has not had such an assumption. Because PERF and TRF have virtually identical benefit provisions and have similar retirement patterns, we believe that it is reasonable to use the same assumption for TRF as is used for PERF. **We recommend assuming that 30% of TRF early retirements commence immediately and 70% are deferred.** As with PERF, we will be watching this assumption through time and anticipate that it might be adjusted again in the next experience study.

For this study period, there were fewer unreduced retirements than expected. We propose that rates from ages 59 to 74 be decreased to better reflect the observed patterns. In keeping with our general philosophy, we suggest moving part way from the current rates to the observed rates, resulting in a weighted A/E Ratio of 94%. Therefore, **we recommend that the TRF retirement rates for early retirement be retained and that the unreduced retirement rates at ages 59 and above be decreased as indicated in Appendix D.**

RETIREMENT – '77 FUND

The '77 Fund retirement provisions include early (reduced) retirement at age 50 with 20 years of service and unreduced retirement at age 52, also with 20 years of service. The benefit provisions are such that no further accruals are earned after 32 years of service, although a member's benefit may still increase as the applicable First Class Officer's salary increases. The '77 Fund also has a Deferred Retirement Option Program (DROP) which allows members who are eligible to retire to continue as active employees, but be treated from a retirement program perspective as though they had retired. Monthly benefits are accumulated to be paid out upon cessation of employment, at which point a benefit (calculated as of the DROP entrance date) is paid for life.

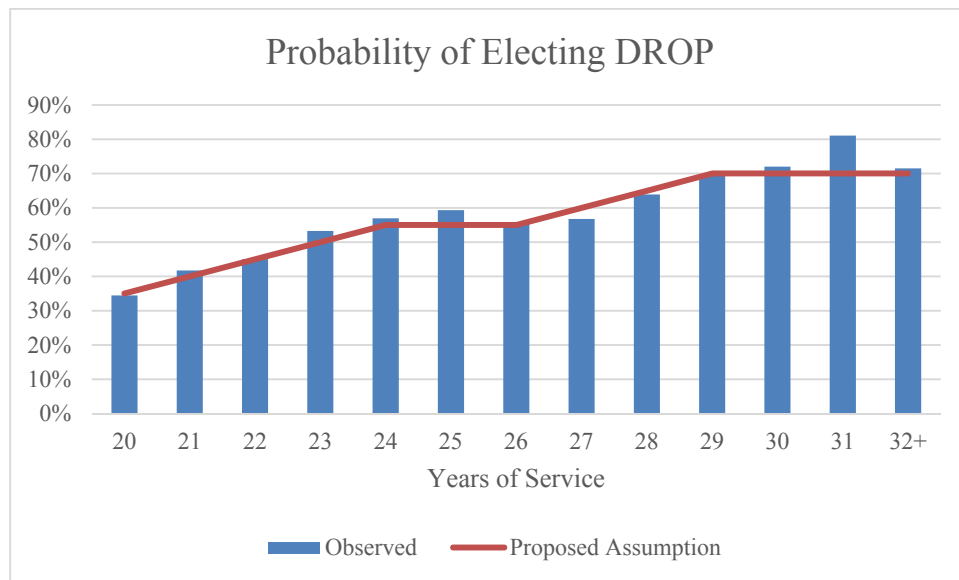


SECTION 6 – RETIREMENT

The current assumptions for retirement include a table of rates for members with under 32 years of service, and a second table of rates for members with at least 32 years of service. No direct recognition of DROP is made, which essentially treats the retirement rates as the rate of either retiring or entering DROP. We first examined the experience over the study period on this basis. The results are summarized below:

'77 Fund Retirements Count Basis					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
Under 32 Years	12,018	1,593	1,334	119%	120%
At Least 32 Years	935	286	208	138	137
Total Members	12,953	1,879	1,542	122	123

The current rates are considerably lower than what has been observed. As we worked to develop rates more reflective of the recent patterns, we also analyzed the patterns of DROP election by members. As would be expected from the benefit design perspective, these patterns are connected with service as the following graph illustrates:



With the addition of probabilities of electing DROP, we will begin to directly reflect the DROP benefits in our valuation. This represents a significant change in the retirement rate approach, and will improve the estimation of projected cash flows. Although informally DROP is equated with starting retirement, the monthly payments during the DROP period are deferred and paid without interest at the end of the DROP period and there are no COLAs granted during DROP.

While the current assumed retirement rates are generally lower than actual observations, we did observe that early retirement is not utilized much, and so we believe those rates should be reduced. Otherwise, we suggest generally increasing rates through age 65. The resulting weighted A/E ratio is now 110%. Once in DROP, experience over the 5 year period showed that approximately 75% of members who enter DROP



SECTION 6 – RETIREMENT

chose a retirement date three years into the future and that the average length in DROP was approximately 2.75 years. **We recommend that the '77 Fund retirement rates and probability of DROP election be changed as indicated in Appendix D and that members elect to remain in DROP for three years, the maximum period allowed.**

RETIREMENT – EG&C

The EG&C retirement provisions include early (reduced) retirement at age 45 with 15 years of service and unreduced retirement at age 65 (mandatory retirement), age 50 with 25 years of service, age 55 with 85 points, or upon 10 years of service if a member was hired after age 50. The benefit provisions are such that no further accruals are earned after 40 years of service, although a member's benefit may still increase as salary increases. The EG&C plan also has a Deferred Retirement Option Program (DROP) which allows members who are eligible to retire to continue as active employees, but be treated from a retirement program perspective as though they had retired. Monthly benefits are accumulated to be paid out upon cessation of employment, at which point a benefit (calculated as of the DROP entrance date) is paid for life.

The current assumptions for retirement include a table of rates for all members, regardless of eligibility for early versus unreduced retirement. No direct recognition of DROP is currently made, but for this purpose we treat the retirement rates as the rate of either retiring or entering DROP. We first examined the experience over the study period on this basis. The results are summarized below:

EG&C Retirements Count Basis					
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>A/E Ratio</u>	
				<u>Count</u>	<u>Weighted</u>
All Members	396	49	39	126%	132%

The current rates are considerably lower than what has been observed. Upon further review of the retirement patterns, a better fit could be obtained by using different assumed rates for members eligible for reduced and unreduced benefits. During the period, it was observed 45 of the 49 actual retirements were eligible for normal retirement with a significant difference in rates between the two groups. As we worked to develop rates more reflective of the recent patterns, we also analyzed the patterns of DROP election by members. While there is volatility year to year due to the small number of people involved, the following data indicates about an even split between entering DROP and retiring:

EG&C DROP Election Rate						
	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>Total</u>
Enter DROP	5	14	2	4	0	25
Retire without DROP	1	6	8	3	8	26
Percent Elect DROP	83%	70%	20%	57%	0%	49%

While the current rates are generally lower than actual observations, we did observe that early retirement is not utilized much, and so we believe those rates should be reduced more in line with general terminations.



SECTION 6 – RETIREMENT

For those normal retirement eligible, we suggest increasing rates through mandatory retirement at age 65. The weighted A/E Ratio is now 59% for early retirement and 101% for unreduced (both reflect a movement toward actual experience). With the addition of probabilities of electing DROP, we will begin to directly reflect the DROP benefits in our valuation. This represents a significant change in the retirement rate approach, more directly reflecting how DROP experience may affect the plan. For further explanation, please see the comments regarding DROP in the '77 Fund section just ahead of this section. **We recommend that the EG&C retirement rates be changed as indicated in Appendix D and probability of DROP election be set at 50% with members assumed to elect to remain in DROP for three years, the maximum period allowed.**

RETIREMENT – JRS

The JRS retirement provisions include early (reduced) retirement at age 62 with 8 years of service and unreduced retirement at age 65, also with 8 years of service, or at age 55 with 85 points. The benefit provisions are such that no further accruals are earned after 22 years of service, although a member's benefit may still increase as their applicable position's salary increases.

The current assumptions for retirement include a table of rates for members with under 22 years of service, and a second table of rates for member with at least 22 years of service. We first examined the experience over the study period on this basis. The results are summarized below:

JRS Retirements Count Basis					
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>A/E Ratio</u>	
				<u>Count</u>	<u>Weighted</u>
Under 22 Years	404	53	110	48%	51%
At Least 22 Years	102	18	72	25%	23%
Total	506	71	182	39%	39%

The current rates are considerably higher than what has been observed. While the current rates are generally higher than actual observations, there are a limited number of exposures. Past rates may have been influenced by the fact that active member data is not reported once a member reached 22 years of service and contributions stop. Therefore, the proposed rates move part way toward the current experience, in keeping with our philosophy to not over-react. Similar to other funds, we found that separate assumptions for early and unreduced retirement result in a better fit than ignoring this distinction. The weighted A/E Ratio for unreduced retirement is now 70%. We will continue to observe this group and revisit this assumption in the future. **We recommend that the JRS retirement rates be changed as indicated in Appendix D.**



SECTION 6 – RETIREMENT

RETIREMENT – PARF

The PARF retirement provisions include early (reduced) retirement at age 62 with 8 years of service and unreduced retirement at age 65, also with 8 years of service, or at age 55 with 85 points. The benefit provisions are such that no further accruals are earned after 22 years of service, although a member’s benefit may still increase as their applicable position’s salary increases.

The current assumptions for retirement include a table of rates for members with under 22 years of service, and a second table of rates for member with at least 22 years of service. We first examined the experience over the study period on this basis. The results are summarized below:

PARF Retirements Count Basis					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
Under 22 Years	67	19	54	35%	34%
At Least 22 Years	40	12	30	40%	37%
Total	107	31	84	37%	35%

The current rates are considerably higher than what has been observed. While the current rates are generally higher than actual observations, there are a limited number of exposures. As with the JRS fund, data for active members is not reported after 22 years. The proposed changes are designed to move toward the observations in a predictable manner. Similar to other funds, we found that separate assumptions for early and unreduced retirement result in a better fit than ignoring this distinction. With movement toward the study experience, the weighted A/E ratio is now 62%. We will continue to observe this group and revisit this assumption in the future. **We recommend that the PARF retirement rates be changed as indicated in Appendix D.**

RETIREMENT – LE DB

The LE DB plan has been closed to new hires for many years and has 7 active members as of June 30, 2019, all of whom are eligible for an unreduced retirement benefit. The current age based retirement rates are reasonable and conservatively assume members retire by age 65, though most remaining actives are currently working past this age. Given the low count of active members and minimal impact of this assumption on the overall plan, **we recommend the current assumption be retained.**



SECTION 6 – RETIREMENT

INACTIVE VESTED MEMBER RETIREMENT

Inactive vested members are those who have left employment with the right to a future benefit upon meeting retirement eligibility requirements. Some of the funds have reductions for early retirement that we would classify as subsidized, while others have factors that are approximately actuarially equivalent. The current assumption for JRS and EG&C, which have significant subsidies, is that inactive vested members retire at their earliest retirement date. While PARF has the same subsidy as JRS, because of the linkage with PERF, the assumption is that deferred members will retire at their first unreduced age. For PERF, TRF, and the '77 Fund, the assumption is that members retire at their first unreduced retirement date. Such an approach to setting the assumption is logical if members tend to act in their personal best financial interest. This approach also provides a small degree of conservatism in protecting the plan from actuarial losses. The observations discussed later in the report regarding PERF and TRF members who end employment while eligible for early retirement help further substantiate the reasonableness of this approach, so we see no reason to change. **We recommend the current assumption be retained for all funds.**



SECTION 7 – DISABILITY

DISABILITY

Disability rates reflect the likelihood of a member transitioning from active status to a disability retirement. In cases where a member is not entitled to a disability benefit, the data will only indicate that a termination of employment has occurred. Because the definition of disability usually has some sort of reference to the ability to perform one’s job, the disability requirements and the nature of the work for public safety are generally such that these job groups have higher rates. There also tends to be a strong relationship with disability rates and age.

DISABILITY – PERF and PARF

Historically, PERF and PARF have utilized the same assumption for disability rates. We see no compelling reason to change this practice, and have analyzed disability experience for the two groups combined. Because of the population sizes, this is, of course, essentially utilizing PERF experience for PARF. The analysis, performed separately for males and females, is shown in the following table:

PERF and PARF Disability Count Basis, Ages 25-60					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
Males	207,915	234	399	59%	55%
Females	328,306	284	477	60%	53%

Based on these results, we believe that it is appropriate to reduce the assumed rates. In keeping with our general philosophy, we move part way from the current rates toward the observed rates. Our proposed rates resulted in weighted A/E ratios of 80% for males and 77% for females. If the observations in this study were typical of long-term experience, we would anticipate that there will be a further reduction of the assumed rates in the next study. **We recommend the rates be adjusted as shown in Appendix D.**

DISABILITY – TRF

TRF disability rates have been utilized on a unisex basis, in contrast with the PERF and PARF rates that are sex-distinct. This is a reasonable approach, especially since the active population is approximately 75% female. Our review of the data indicates a sufficiently similar pattern between males and females that we are comfortable with retaining the unisex assumption for now. The observed data is summarized below.

TRF Disability Count Basis, Ages 25-60					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
All Members	319,830	63	103	61%	60%



SECTION 7 – DISABILITY

As with PERF and PARF, we recommend reducing the disability rates part way from the current rates toward the observed rates. Our proposed rates resulted in a weighted A/E ratios of 88%. Again, if the observations in this study were typical of long-term experience, we would anticipate that there will be a further reduction of the assumed rates in the next study. **We recommend the rates be adjusted as shown in Appendix D.**

DISABILITY – '77 FUND

Like TRF, the '77 Fund disability assumption is on a unisex basis. There is minimal female data available, and so we did not consider a sex-distinct analysis. The observed data is summarized below.

'77 Fund Disability Count Basis, Ages 25-60					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
All Members	64,161	204	193	106%	88%

The difference between the count and weighted A/E ratios is more pronounced for the '77 Fund than the other funds. This may result from a lag effect, reflecting that between a disabling event and the start of the disability retirement there can be a period of time without regular pay. It may also reflect that older, longer-service members who become disabled elect a service retirement and so are under-represented in the observed disablements. In either case, we believe that it may be more appropriate to give more credence to the count-based measure in this case. While the observed A/E ratio is relatively close to 100%, our analysis indicated that this is partly a result of underestimating disabilities for those in their 30's and 40's, but overestimating disabilities for those who are over 50. We believe that adjusting the rates part way for each age range will better align the assumption with the observations in the study. The resulting A/E ratio on a count basis is 99%, while the weighted ratio is 85%. **We recommend the rates be adjusted as shown in Appendix D.**

A further assumption for the '77 Fund disability valuation is an assessment of the type, or “class”, and severity of disabilities. The classes of disability are defined as Catastrophic (with a degree of impairment of at least 67%) or non-catastrophic. For members hired after 1989, the non-catastrophic disabilities are further broken into Class 1 (occurs while on duty or due to an occupational disease), Class 2 (proven duty-related disease), and Class 3 (any other disability). Currently, the assumption is that 1% are Catastrophic and 99% are non-catastrophic. For members hired after 1989, the non-catastrophic disabilities include 44% in Class 1, 10% in Class 2, and 45% in Class 3.

The severity is a measure of the degree of impairment between 0% and 100% as determined by medical experts. Disability benefits are currently assumed to be paid out as a flat percent of pay, ranging from 100% for a Catastrophic disability down to 36% for a Class 3 disability, where the assumption accounts for both service and the degree of impairment. **We recommend that the benefit for each Class be determined by its respective formula using the member's service and an assumption for the degree of impairment.**

We reviewed the detail behind 237 recent disabilities and determined that it would be appropriate to change the proportions to indicate that more are duty related (Class 1). For the severity assessment, the average degree of impairment for disabled members is slightly less than 20%. This degree of impairment is used by



SECTION 7 – DISABILITY

the INPRS medical authority to determine the additional benefit percentage the member is entitled to per IC 36-8-8-135(f), which ranges from 10% to 45%. A degree of impairment of 20% would result in an additional benefit percentage of 17% of pay. **We recommend the type and severity assumptions be adjusted as shown in Appendix D.**

DISABILITY – EG&C

There were no observed disabilities in the EG&C fund during the study period, although 12 were expected under the current assumptions. This suggests that the current assumptions are likely too high. Because of the limited data and because of the somewhat similar nature of the jobs, **we recommend that the EG&C fund utilize the same disability rates proposed for the '77 Fund.**

Like the '77 Fund, there is also an assumption required for the class and severity of disabilities. This assumption is simplified in its form because of the limited number of expected disabilities in the fund. Because there are only three disabled retirees, the most recent of whom was disabled in 2012, we could only do a general assessment of the reasonableness of the current assumption. Based on this review and professional judgment, **we recommend that the current type and severity combined assumption be retained.**

DISABILITY – JRS

There was one observed disability among the Judges during the study period, although 11 were expected under the current assumptions. The current assumptions for JRS are actually higher than the assumptions for the '77 Fund at ages over 45 which we find very atypical in comparison with other groups of judges that we are familiar with. Because there is limited data, our adjustments are made primarily on the basis of professional judgment, but will continue to be monitored. **We recommend the rates be adjusted as shown in Appendix D.**

DISABILITY – LE DB

The legislator plan has fewer than 10 active members, all of whom are able to retire. While it is theoretically possible that one of them could become disabled, we would anticipate that the individual would likely just retire instead. We see no reason to have an assumption for disability for this group. **We recommend the disability assumption be eliminated for the Legislators' DB fund.**



SECTION 8 – TERMINATION OF EMPLOYMENT (WITHDRAWAL)

TERMINATION

The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service as a result of resignation or dismissal that will occur prior to attaining the eligibility requirement for a retirement benefit. The number of withdrawals includes all members reported to have terminated employment.

This section of the report summarizes the results of our study of terminations of employment for reasons other than death, retirement, or disability. Rates of termination tend to be higher in the earliest years of employment, and so service-based tables are frequently used. In certain cases, however, age may be a better indicator of termination patterns. Even when not discussed in this report, we examined the actual terminations along both service and age to find an appropriate fit.

TERMINATION – PERF

Currently, the termination assumption for PERF has rates that are based on sex, on employment by the State of Indiana or a political subdivision (PSD), and on salary level above or below \$20,000 per year. Within these categories, the termination rates are based either on age or on age and service. The analysis, performed separately for each group, is shown in the following table:

PERF Termination Rates Count Basis					
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>A/E Ratio</u>	
				<u>Count</u>	<u>Weighted</u>
PSD Sal <\$20k Male	15,538	4,584	3,432	134%	109%
PSD Sal <\$20k Female	71,993	16,554	12,352	134%	101%
PSD Sal >=\$20k Male	83,621	8,587	7,630	113%	108%
PSD Sal >=\$20k Female	120,197	11,119	10,282	108%	110%
State Sal<\$20k Male	4,701	1,752	1,391	126%	99%
State Sal<\$20k Female	7,735	2,592	2,175	119%	94%
State Sal>=\$20k Male	17,280	1,108	834	133%	114%
State Sal>=\$20k Female	63,581	8,184	7,025	116%	144%

For most of these categories, the A/E Ratio on a count basis exceeds the ratio on the weighted basis. This typically indicates that those terminating earn less, on average, than those who are not terminating. In order to best measure the liabilities of the fund, this means that we need to select termination rates that may predict fewer terminations than observed so that they can predict more accurately the amount of liability that leaves active status due to termination.

While other assumptions for PERF are not split by the employer (PSD and State), the two groups exhibit clear differences in patterns of termination, and so the difference in assumptions by group is warranted. We find that a difference between state and local governments is often present in other states, so we are not surprised to observe this pattern in Indiana.

The tables for PSD males and females earning under \$20,000 are sex-distinct age-based tables. The termination rates in these tables are quite high, reflecting that individuals who have these jobs are more likely to leave employment. We considered whether a service-based table might be a better fit as well as



SECTION 8 – TERMINATION OF EMPLOYMENT (WITHDRAWAL)

whether or not the sex-distinct tables could be combined. We concluded that the current tables should be continued to be used with some minor adjustments. One factor that influenced this is the large proportion of PSD members with wages under \$20,000. The resulting weighted A/E Ratios were 94% for males and 98% for females.

The tables for PSD males and females earning over \$20,000 are sex-distinct age-based tables, with separate tables for each of the first 10 years of service, and then for all years of service thereafter. In our review, we determined that a single unisex service-based table of termination rates could also explain the observed data. We prefer, where possible, to use a simpler model to explain patterns of data since it allows each estimate of rates to be based on more data, and typically be more stable through time. The resulting weighted A/E was 100%.

The tables for the State data were constructed in the same manner as the PSD tables. We noted that there are proportionately fewer State (versus PSD) members earning under \$20,000, and did not find a strong case to retain a separate assumption. As with the PSD members, we were able to simplify this assumption and develop a single service-based termination table of termination rates that we believe can be appropriately used for the entire State membership group. With this assumption, the weighted A/E Ratio is 108% for the State membership group.

The changes we are proposing for the PERF termination assumption provide a significant degree of simplification, but change the actuarial accrued liability by only 0.1%. **We recommend the rates be adopted as shown in Appendix D.**

TERMINATION – TRF

Currently, the termination assumption for TRF utilizes sex-distinct service-based rates. The analysis, performed separately for males and females, is shown in the following table:

TRF Termination Rates Count Basis					
				<u>A/E Ratio</u>	
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>Count</u>	<u>Weighted</u>
Males	67,714	4,792	4,023	119%	94%
Females	192,537	13,893	11,771	118%	108%

In general, the current assumptions are providing a reasonable estimate of the observed data. We believe some minor adjustments can improve the quality of fit of the assumption to the data observed in the study. The weighted A/E Ratios with the adjustments are 110% for males and 98% for females. **We recommend the rates be adopted as shown in Appendix D.**



SECTION 8 – TERMINATION OF EMPLOYMENT (WITHDRAWAL)

TERMINATION – '77 FUND

The '77 Fund uses a single service-based table of termination rates. The analysis is shown in the following table:

'77 Fund Termination Rates					
Count Basis					
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>A/E Ratio</u>	
				<u>Count</u>	<u>Weighted</u>
All	51,843	1,312	1,222	107%	122%

For the first 20 years of service, the current table is providing a reasonable estimate of the observed experience. For service after 20 years of service, the observed data is higher than the current assumption, however, there is not enough credible data to warrant us recommending a change at this time. **We recommend the current rates be retained.**

TERMINATION – JRS, PARF, and EG&C

The small funds utilize service based tables for termination. The analysis is shown in the following table:

Termination Rates					
Count Basis					
	<u>Exposures</u>	<u>Actual</u>	<u>Expected</u>	<u>A/E Ratio</u>	
				<u>Count</u>	<u>Weighted</u>
JRS	1,534	40	46	87%	91%
PARF	858	104	86	121%	123%
EG&C	1,723	66	77	86%	95%

Based on our review of each fund, we find that the current assumptions are reasonable given the amount of data available. **We recommend that the current termination assumption be retained for these three funds.**

TERMINATION – LE DB

The Legislators' DB fund currently utilizes a service based table for termination. However, all remaining actives are eligible to retire and a termination assumption is no longer needed. **We recommend the termination assumption be eliminated for the Legislators' DB fund.**



SECTION 9 – SALARY MERIT SCALE

SALARY MERIT SCALE

Estimates of future salaries for each member are based on assumptions for two types of increases:

- Increases in each individual's salary due to promotion or longevity (often called merit scale), and
- Increases in the general wage increase of the membership, which is directly related to price and wage inflation.

Earlier in this report, we recommended using a 2.75% wage inflation assumption (2.25% price inflation and 0.50% real wage growth). Therefore, the merit scale will be added to the applicable wage inflation assumption to develop the total individual salary increase assumption.

Several of the funds are excluded from this analysis for various reasons. Active members in JRS and PARF have their salaries set based on the position they hold, regardless of length of time on the job. There is very little movement in these funds due to promotion, and so we believe it is appropriate to ignore any merit component. Likewise, the '77 Fund benefits are all linked to the First Class Officer pay, regardless of the rank of the member. For this reason, we believe merit should be excluded from consideration. Since the Legislators' DB plan has frozen benefits, no salary assumption at all is needed for it.

Analysis of the merit salary scale is complicated by the fact that only total salary is reported to INPRS, which includes both the general wage inflation component of salary increases and the merit salary scale. Furthermore, there is often a delay in actual price inflation compared to when it has an impact on salary increases. As a result, it is difficult to isolate the merit scale for purposes of measuring the actual salary experience. One technique we used to help reduce the effect of inflation was to look at the individual salary increases for each of the five years in the study period and adjust the results so that the longer service individuals had increases of approximately 2.75%. This allows us to focus on the shape of the increases and determine the reasonableness of a possible salary merit scale. In addition, salary increases for governmental employees during this study period have been lower than those observed in corporate America. Consequently, the selection of a merit scale has a significant component of professional judgment.

PERF

The current salary merit assumption is an age-based assumption that ranges from 2.00% for those 30 and under to 0.25% for those over 60, a relatively flat scale in our experience. The observed data reflected a more pronounced age trend, with increases of over 10% at younger ages. When we examined salary increases based on service, we also observed a strong relationship. In our experience, service is frequently a better indicator than age for salary merit increases, and so that gives us further reason to propose making this change. **We recommend the salary merit rates be adopted as shown in Appendix D.**

TRF

The current salary merit assumption is a service-based assumption and has a shape consistent with what we generally observe. For the study period, the observed merit increases were lower than expected in service periods up to around 15 years, and so we propose a partial reflection of this. We are cognizant that public employment salaries since the Great Recession have been subject to a number of atypical pressures, and so we are assigning only partial credibility to the experience. **We recommend the salary merit rates be adjusted as shown in Appendix D.**



SECTION 9 – SALARY MERIT SCALE

EG&C

Currently, EG&C is valued using a 2.5% salary growth assumption regardless of age or service. Our analysis of the data from the study period does not indicate any clear age or service trend, partly due to the limited amount of data available in this small fund. Based on our professional judgment, we believe that it is appropriate to have a merit scale that starts at 2.25% and grades down to 0% over the first 9 years of service. **We recommend the salary merit rates be adopted as shown in Appendix D.**



SECTION 10 – MISCELLANEOUS ASSUMPTIONS

FORM OF PAYMENT

Upon commencement, members elect between the normal form of payment and all other optional forms (if any) offered by statute. Optional form benefits are determined on an actuarial equivalence basis and, therefore, do not have a material impact on the valuation of the plan if an alternative election is made. Currently, members are assumed to elect the normal form of payment, and **we recommend the current assumption be retained.**

MARITAL STATUS – PERCENT MARRIED

'77 FUND, EG&C, JRS, PARF, and LE DB

These plans automatically provide a joint life annuity for married members. Therefore, one way to review this assumption is to look at newly retired and disabled members within the past five years to see whether or not they received a joint life annuity.

	Optional Form			
	<u>Single life</u>	<u>Joint Life</u>	<u>Total</u>	<u>Joint Life Percent</u>
'77 Fund	419	1,632	2,051	80%
EG&C	45	2	47	96%
JRS	104	8	112	93%
PARF	13	51	64	80%
LE DB	3	13	16	81%

The current marriage assumption for EG&C, JRS, PARF, and LE DB is that 90% of members are assumed to be married or to have a dependent beneficiary. In general, this is close enough to the Joint Life Percent in the table above, that with the limited amount of data, **we recommend the current assumption be retained for these plans.**

The '77 Fund has a current marriage assumption that is split between males and females, where 80% of males and 50% of females are assumed to be married. A review of the past five years for new retirees and disabilities, show that 80% of members are listed on the data as married, which aligns with the 80% Joint Life Percent in the table above. A further breakdown shows 81% of males and 57% of females are married. **We recommend the current assumption of 80% be retained for males and to change the female marriage assumption to 60% for the '77 Fund.**

PERF and TRF

The current marriage assumption for PERF is that 75% of males and 60% of females are assumed to be married. For TRF, it is assumed 100% of participants are married. This assumption is less important compared to the others plans because the normal form of payment is based only on the life of the member. However, the assumption is used for other things, such as valuing pre-retirement death benefits. Based on our analysis of TRF, approximately 80% of males and 75% of females were married. For PERF, approximately 80% of males and 65% of females were married. **We recommend changing the marriage assumption for males to 80% and the female marriage assumption to 65% for PERF and 75% for TRF.**



SECTION 10 – MISCELLANEOUS ASSUMPTIONS

MARITAL STATUS – SPOUSE AGE

The current assumption for male members is consistent across all plans, where males are assumed to be three years older than their spouses. Experience showed a difference between two and three years for all plans for males, which is in line with the current assumption. The assumption for females differs between the plans, ranging from being the same age as their spouse to three years younger than their spouse (two years for PERF and JRS, 3 years for TRF, EG&C, and PARF, and LE DB, and the '77 Fund shows female as the same age as their spouse). Female data is limited for the small plans, but most showed a difference of no more than two years. The '77 Fund had a 2 year age difference, and PERF and TRF also have around a 2 year age difference when only considering beneficiaries who are spouses. Based on this analysis, **we recommend the current assumption be retained for male members, but to change the female assumption to be two years younger than their spouses for all plans.**

LOAD ON AVERAGE ANNUAL COMPENSATION

PERF and TRF

The PERF and TRF plans currently have a \$400 load on their average annual compensation for wages received due to severance, unused sick leave, or other pay upon the commencement of employment (IC 5-10.2-4-3). The current assumption assumes that all employees receive the maximum allowed compensation of \$2,000, which when spread over the five year average annual compensation results in a \$400 load. Upon reviewing the data, it is clear that not everyone is receiving this level of additional pay. For PERF, the average additional pay due to termination of employment when spread over the five year average annual compensation was just over \$100 for new retirees during the past five years. It was approximately half that for TRF. In order to move in the direction of plan experience during this time period, **we recommend changing the assumption from \$400 to \$200 for active members.** We also note that any additional pay for deferred vested members is already included on the data, since any severance pay would have been paid in the past.



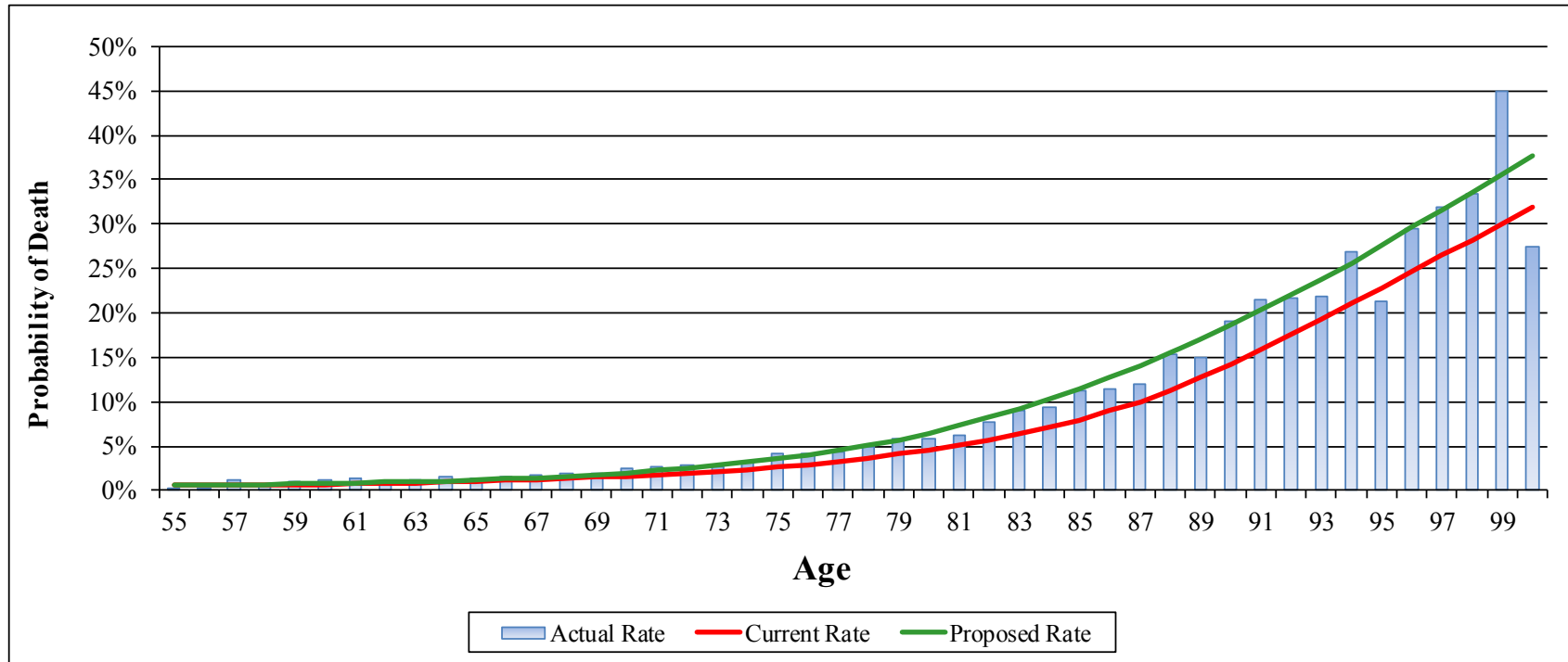
Probability of Death – Healthy Retirees

PERF Males

Exhibit A – 1

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	3,932	2,922	3,806
Actual/Expected		135%	103%



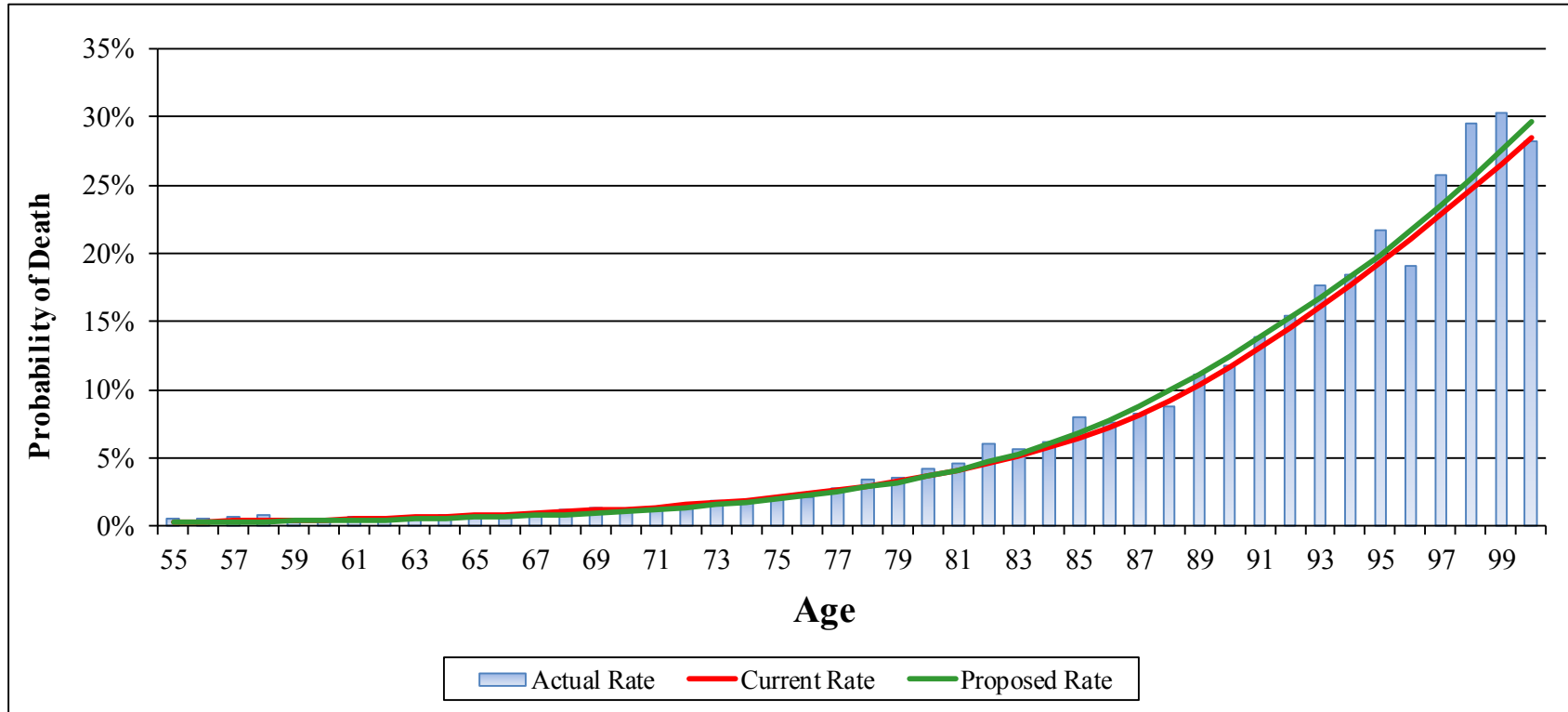
Probability of Death – Healthy Retirees

PERF Females

Exhibit A – 2

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	4,145	3,904	3,809
Actual/Expected		106%	109%



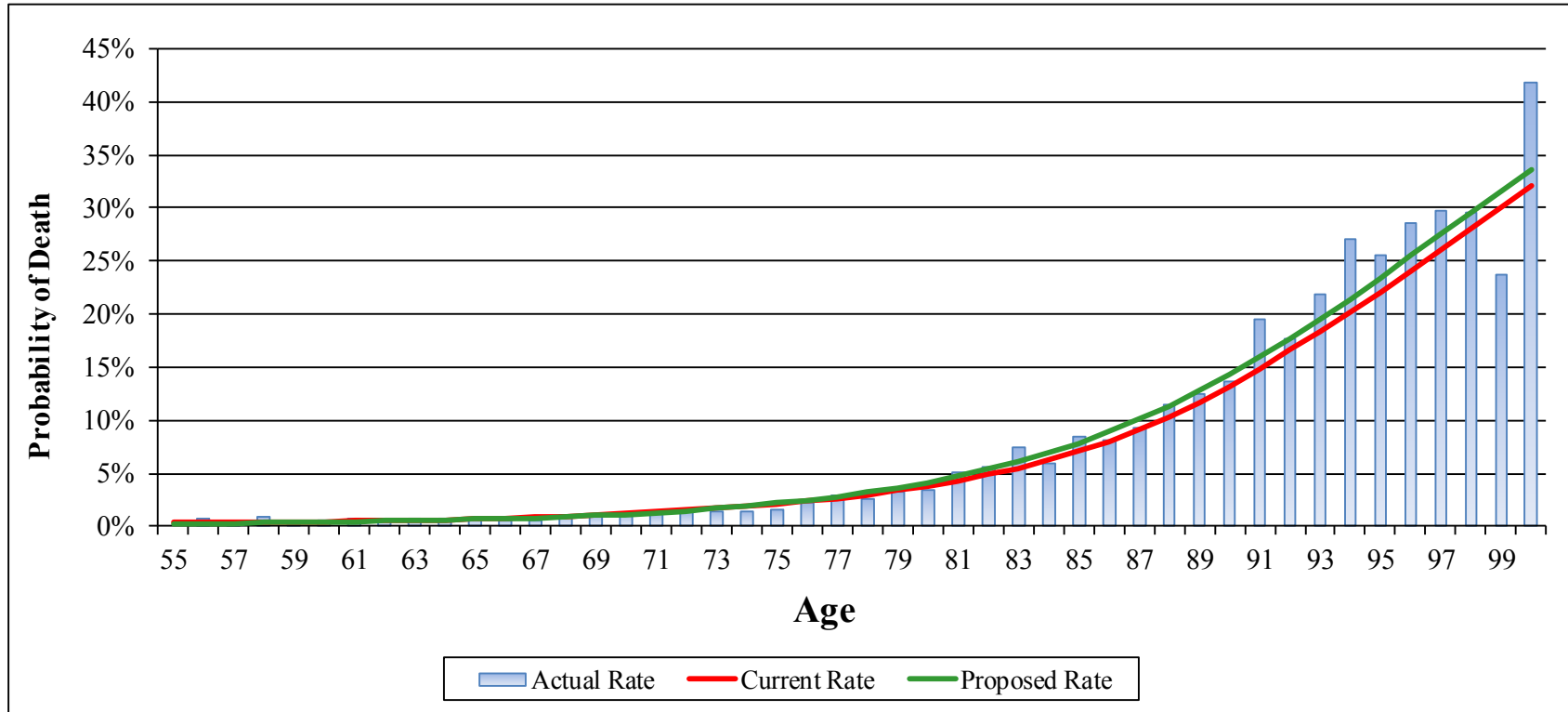
Probability of Death – Healthy Retirees

TRF Males

Exhibit A – 3

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	4,246	4,127	4,319
Actual/Expected		103%	98%



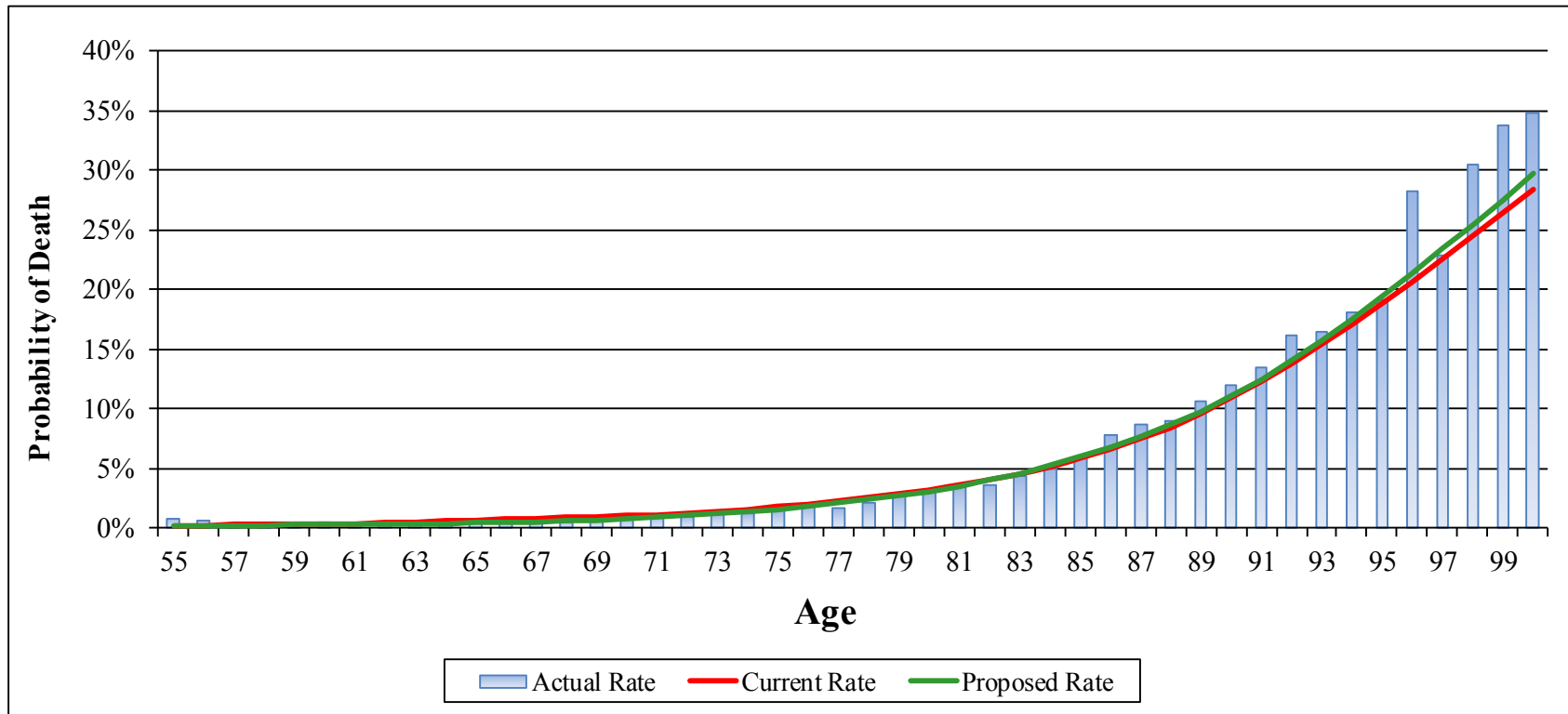
Probability of Death – Healthy Retirees

TRF Females

Exhibit A – 4

Indiana Public Retirement System

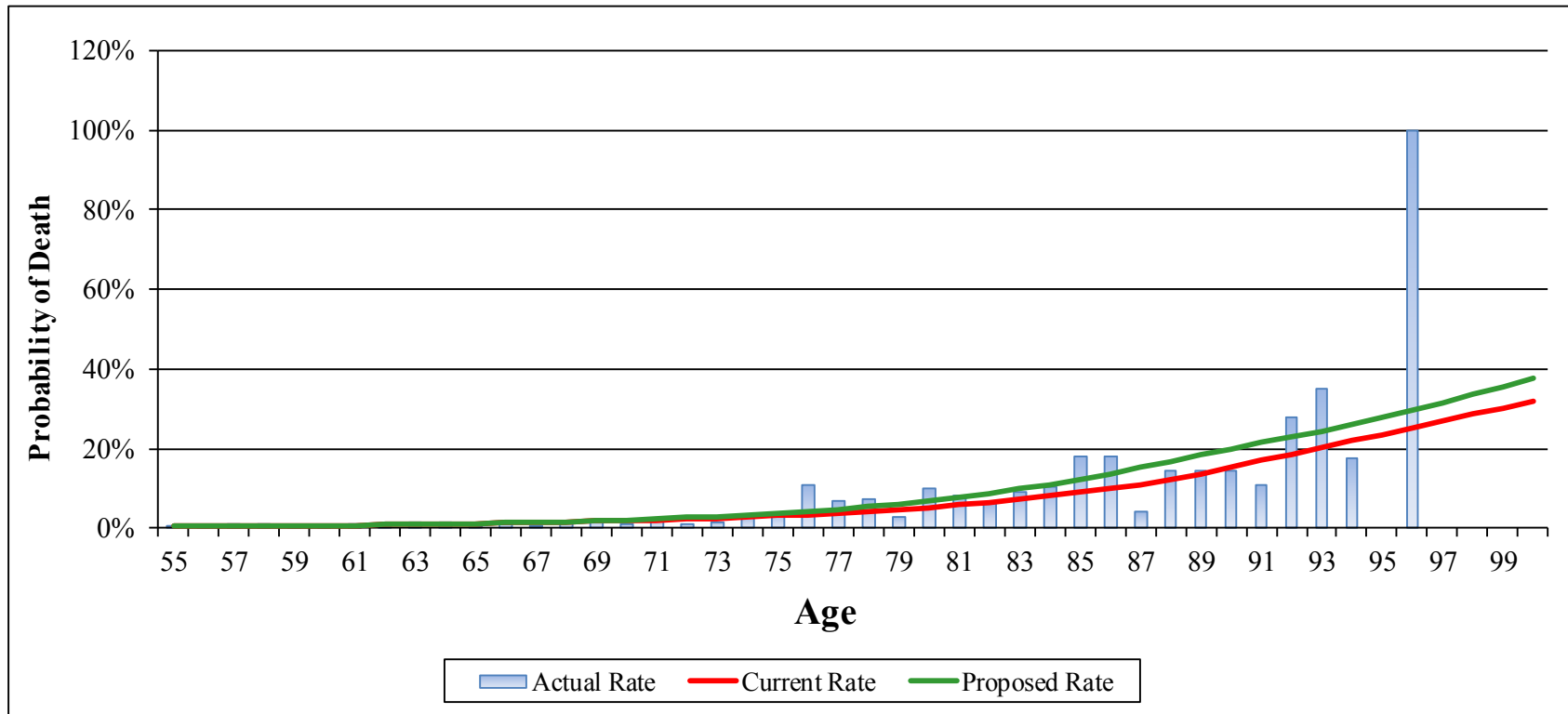
2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	4,799	5,211	4,775
Actual/Expected		92%	101%



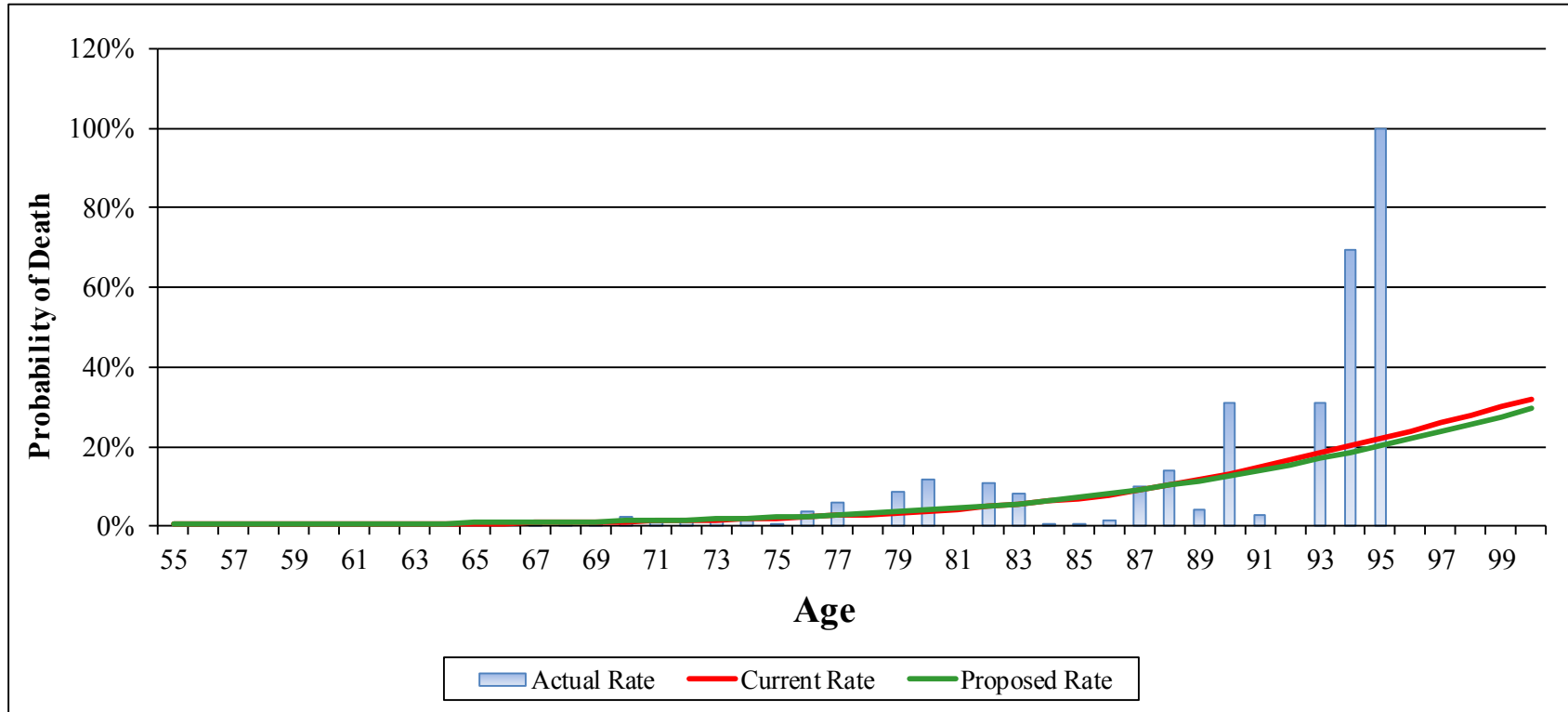
Probability of Death – Healthy Retirees
'77 FUND and EG&C Males
Exhibit A – 5
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	584	515	567
Actual/Expected		113%	103%



Probability of Death – Healthy Retirees
JRS, PARF, and LE DB Males
Exhibit A – 6
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	226	202	211
Actual/Expected		112%	107%



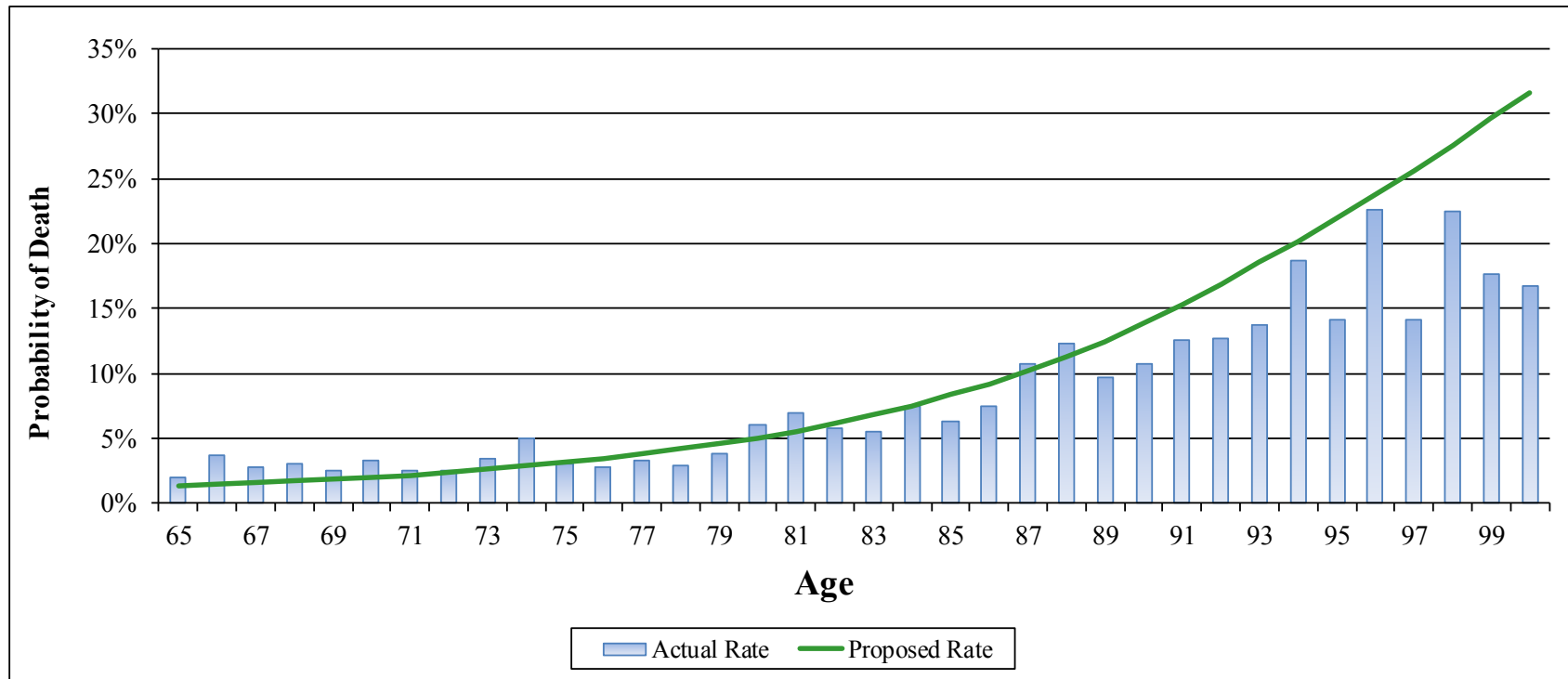
Probability of Death – In Pay Beneficiaries

All Plans – Males

Exhibit A – 7

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	1,111	1,187
Actual/Expected		94%



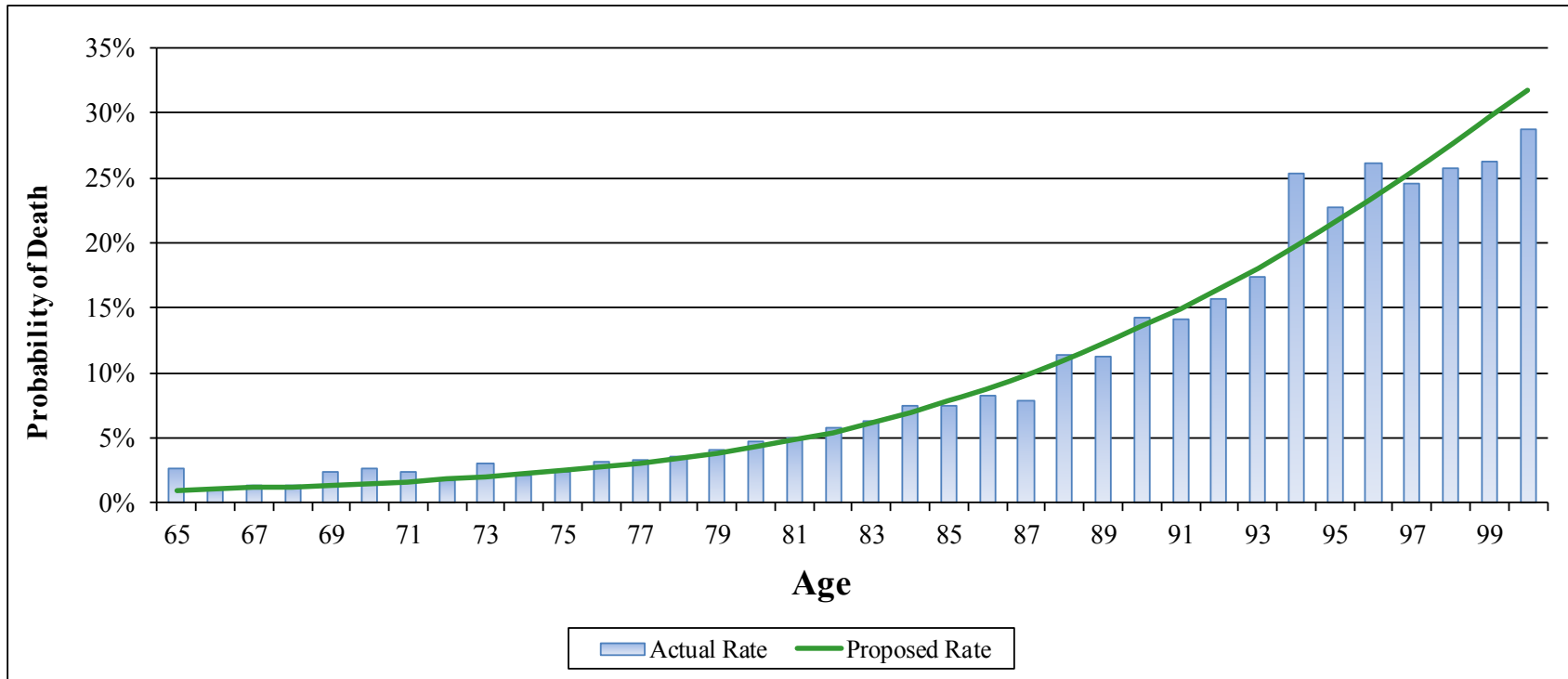
Probability of Death – In Pay Beneficiaries

All Plans – Females

Exhibit A – 8

Indiana Public Retirement System

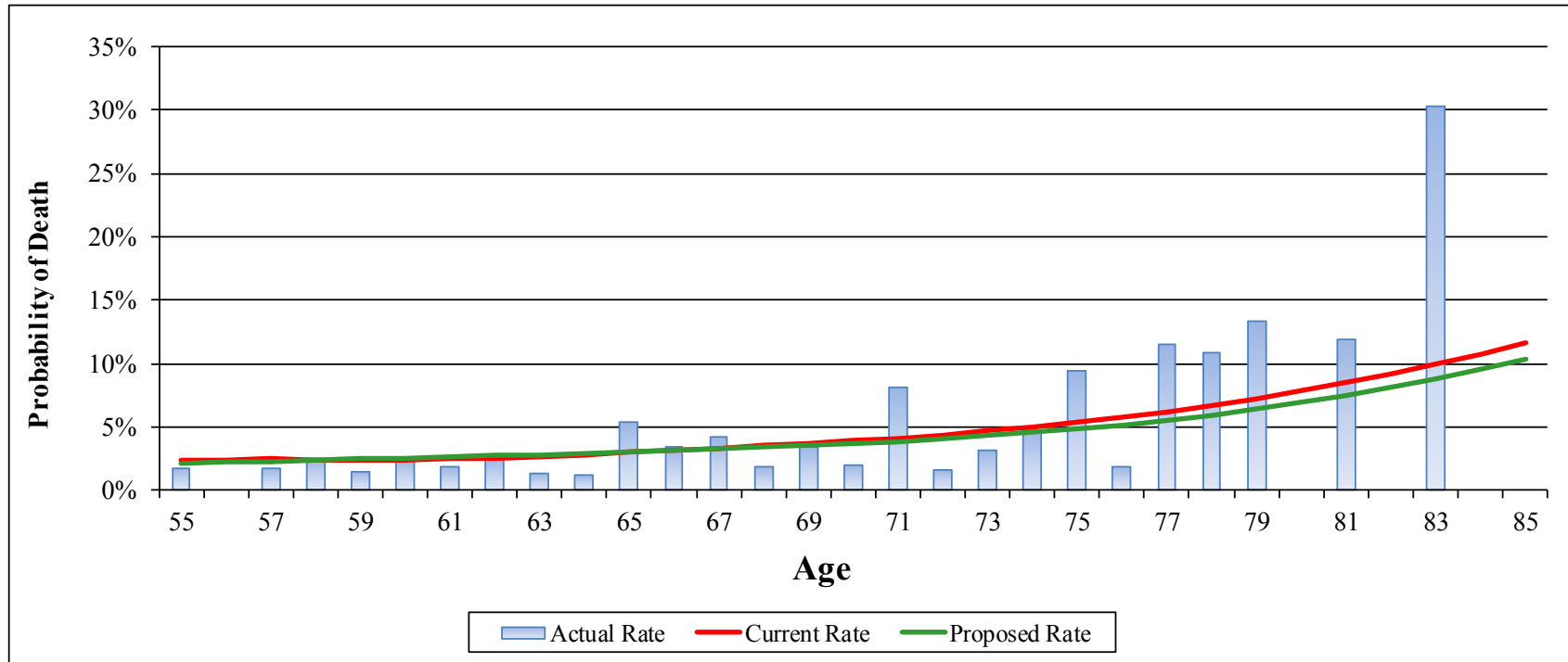
2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	2,158	2,095
Actual/Expected		103%



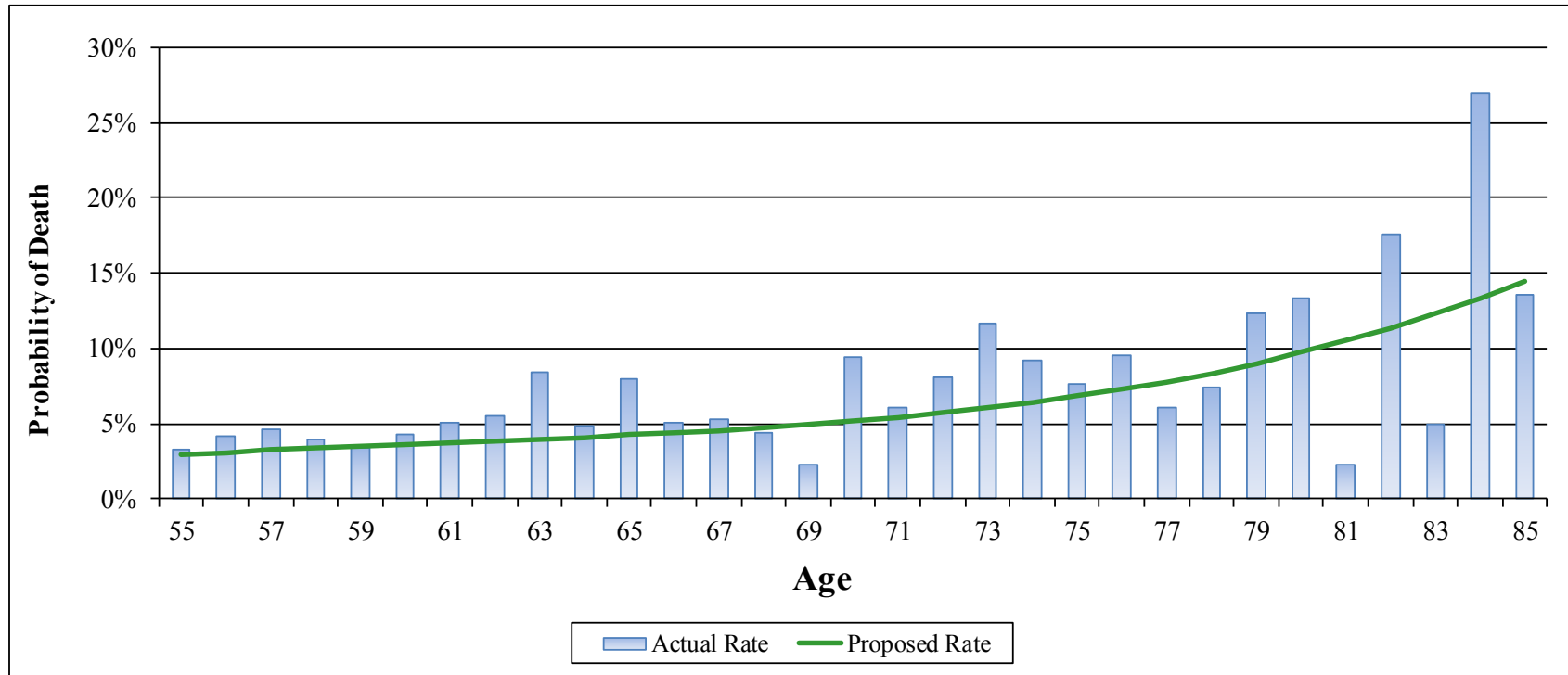
Probability of Death – Disabled Participants
'77 FUND and EG&C Males
Exhibit A – 9
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	119	132	128
Actual/Expected		91%	94%



Probability of Death – Disabled Participants
All Other Plans – Males
Exhibit A – 10
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	292	226
Actual/Expected		129%



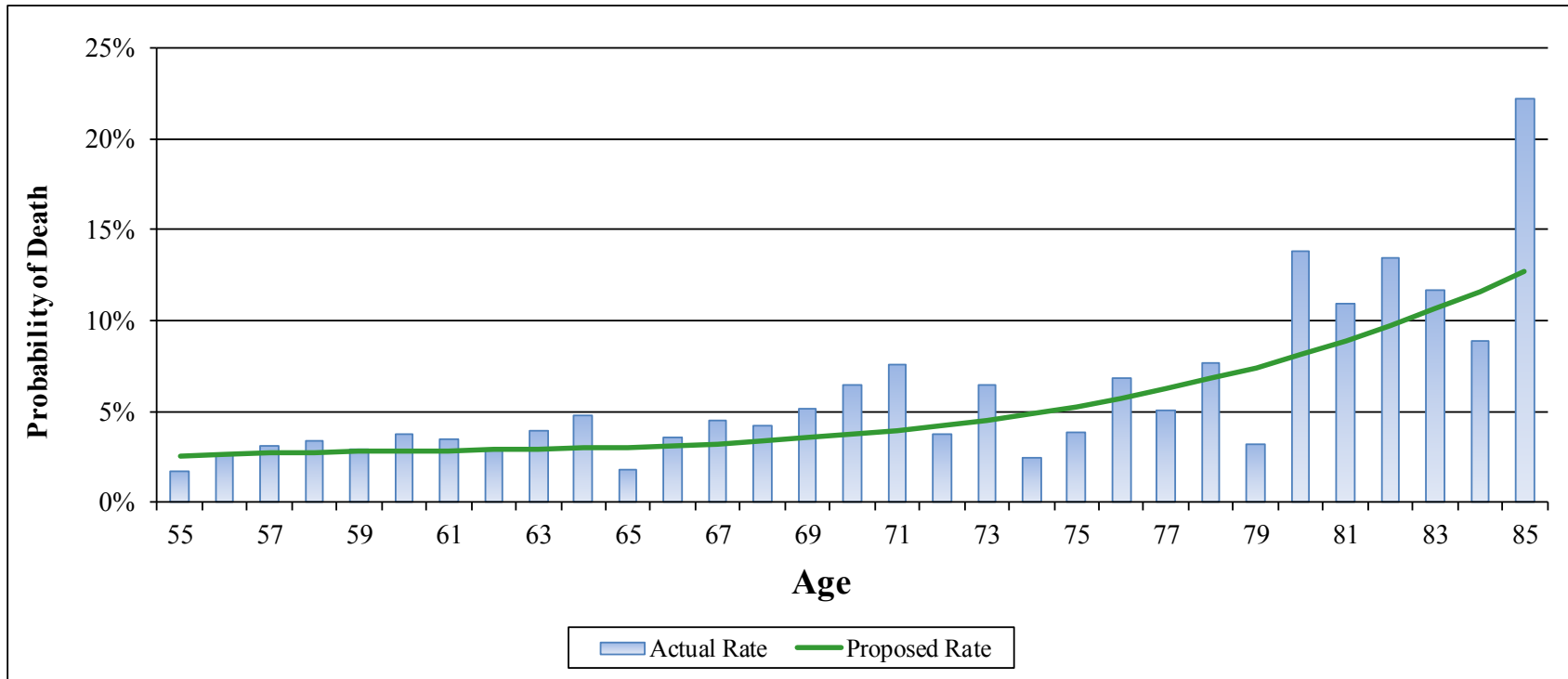
Probability of Death – Disabled Participants

All Other Plans – Females

Exhibit A – 11

Indiana Public Retirement System

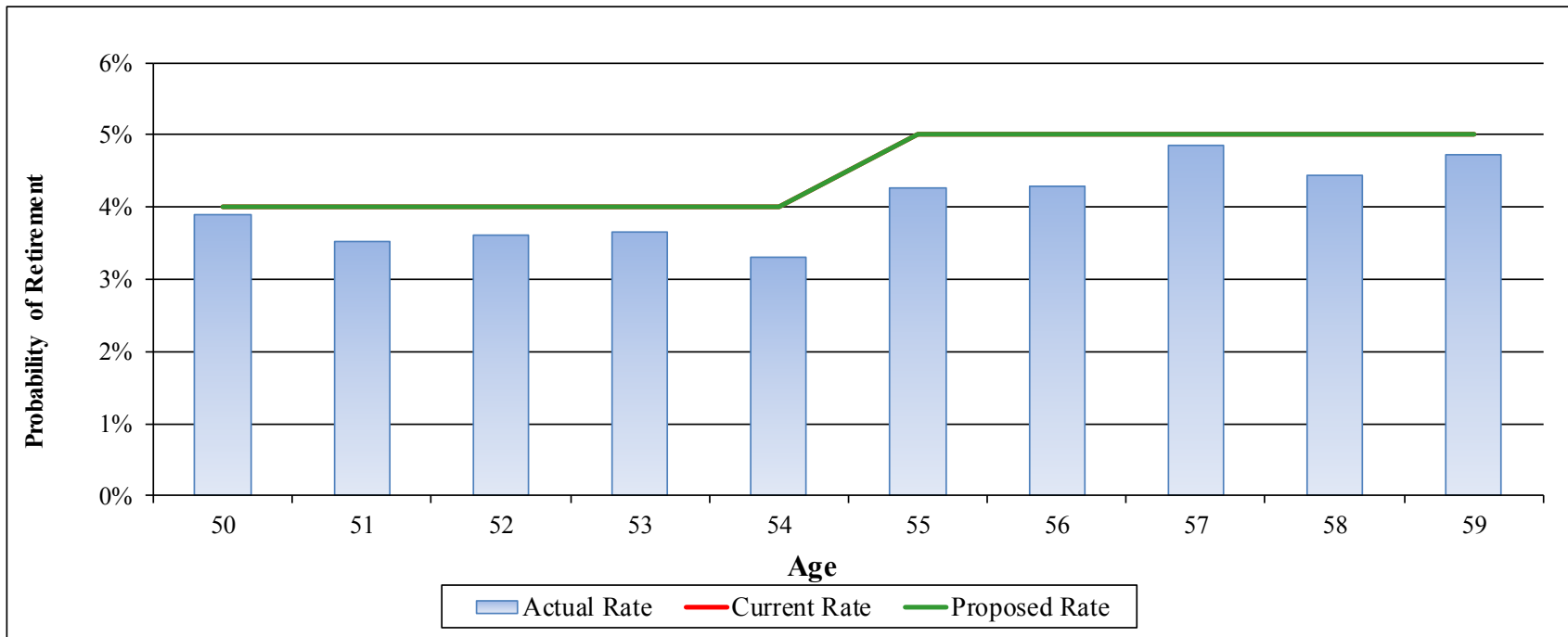
2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	265	224
Actual/Expected		118%



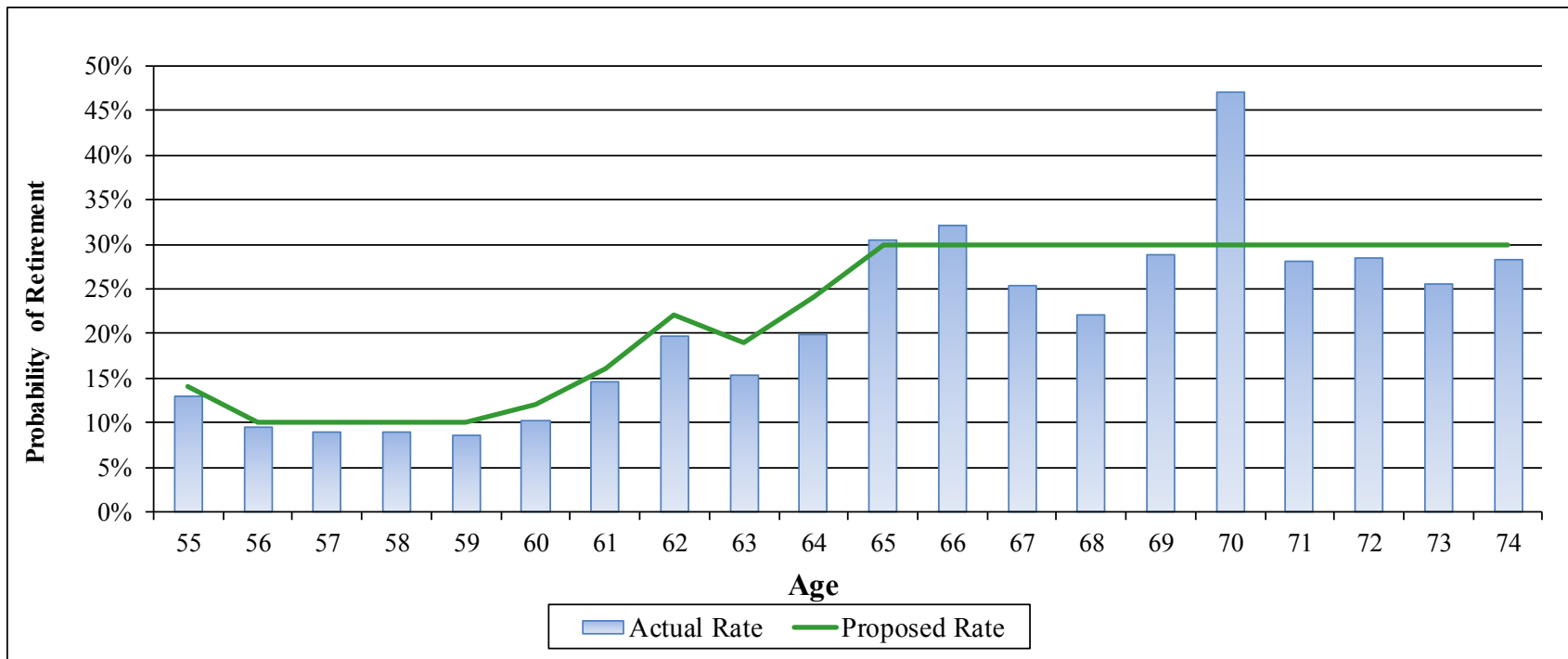
Probability of Retirement
PERF Early Retirement
Exhibit A – 12
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	2,731	3,046	3,046
Actual/Expected		90%	90%



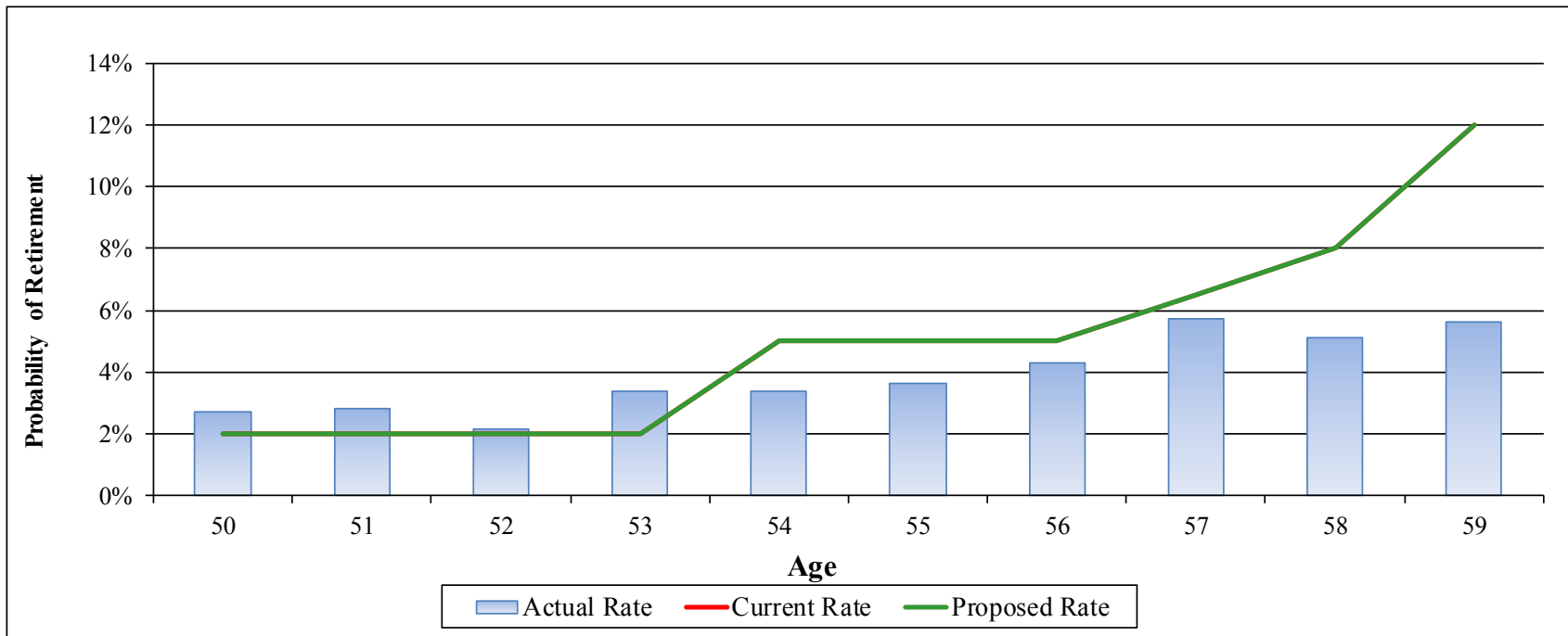
Probability of Retirement
PERF Unreduced Retirement
Exhibit A – 13
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	18,658	20,415
Actual/Expected		91%



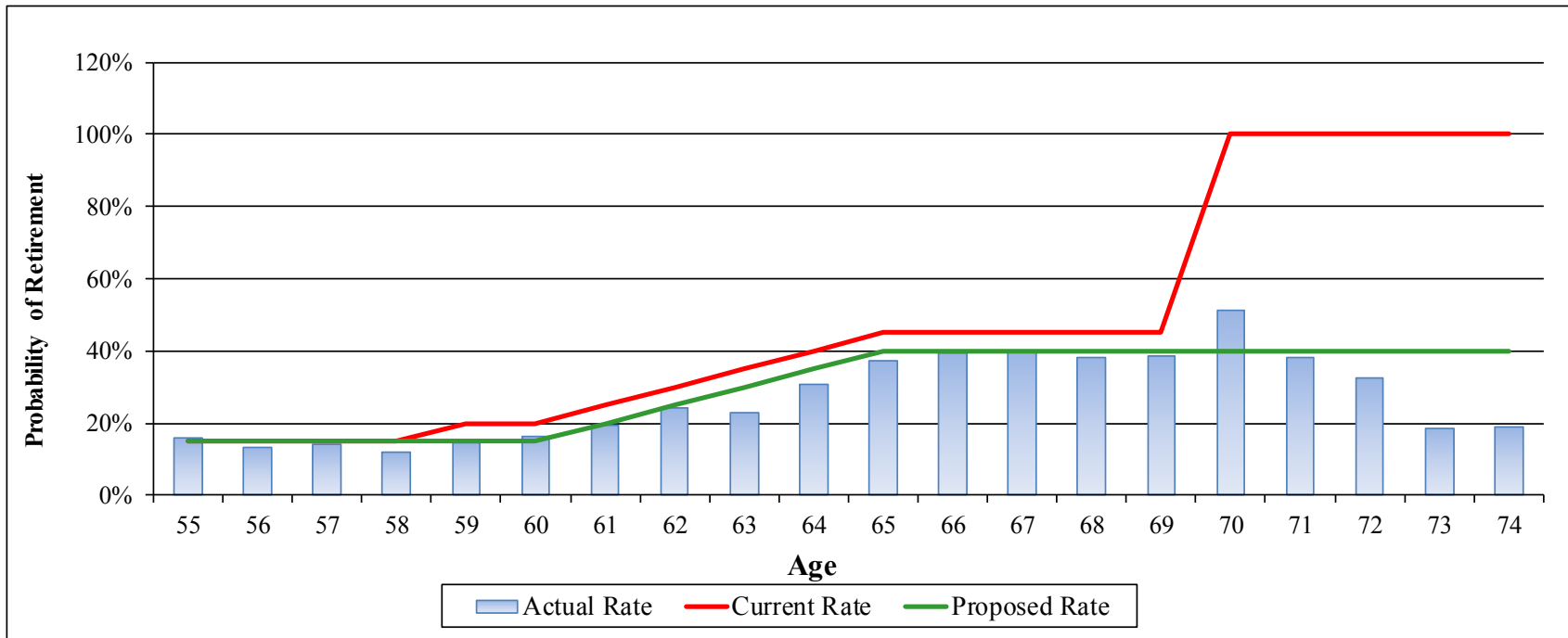
Probability of Retirement
TRF Early Retirement
Exhibit A – 14
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	1,117	1,298	1,298
Actual/Expected		86%	86%



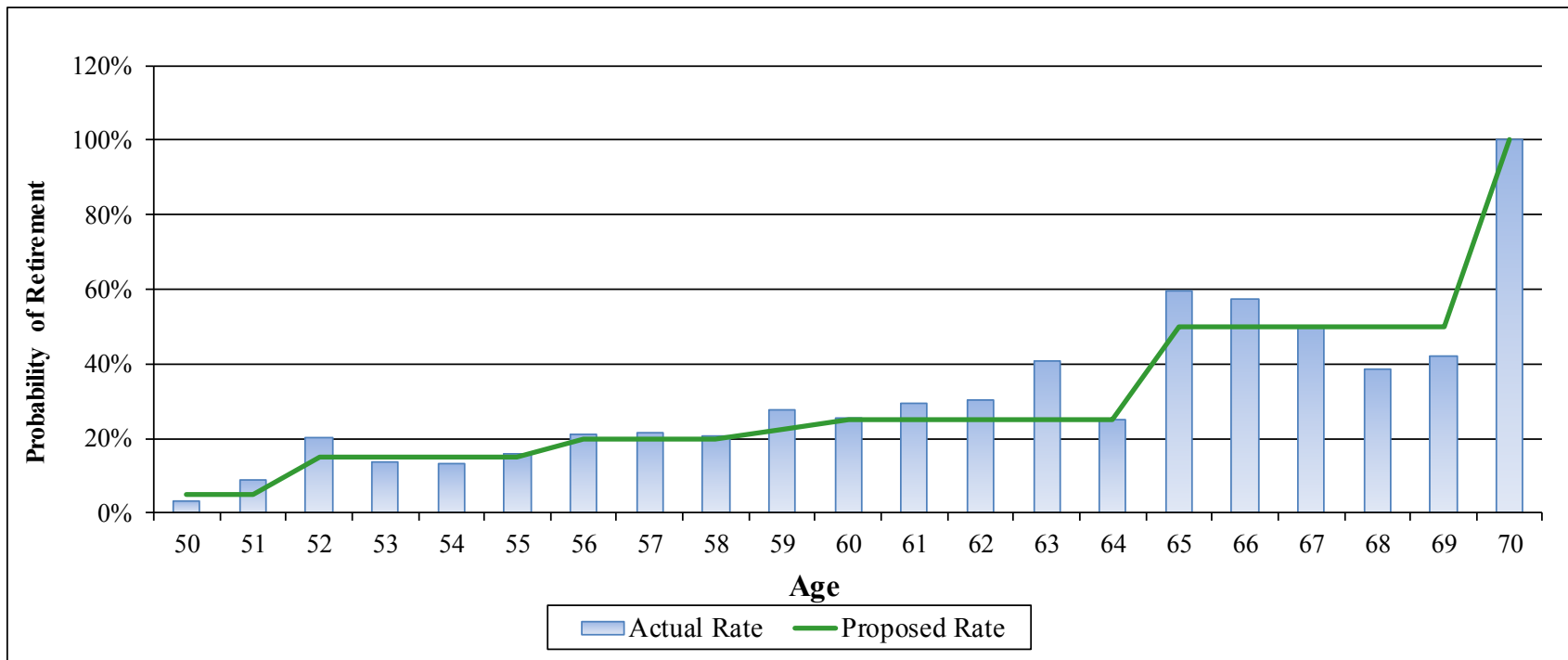
**Probability of Retirement
TRF Unreduced Retirement
Exhibit A – 15
Indiana Public Retirement System
2014-2019 Experience**



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	4,336	5,473	4,608
Actual/Expected		79%	94%



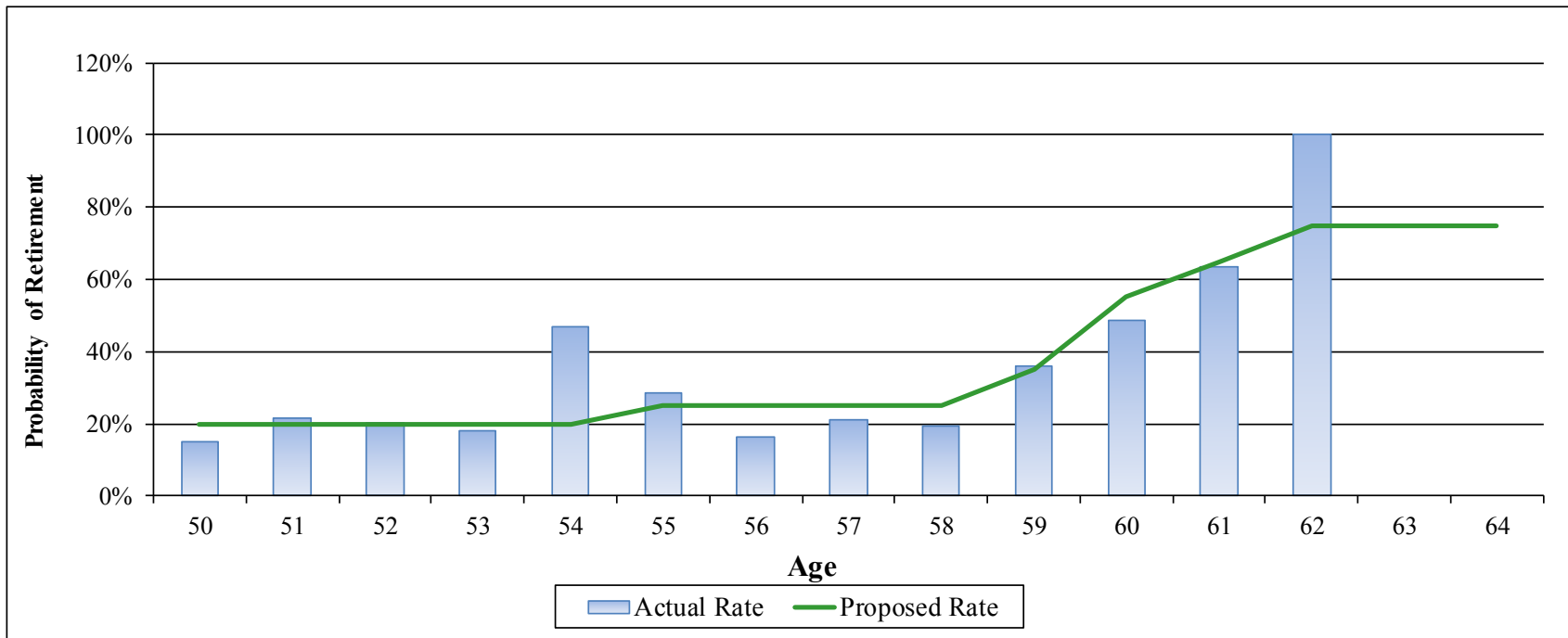
Probability of Retirement
'77 FUND Retirement
Exhibit A – 16
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	2,883	2,620
Actual/Expected		110%



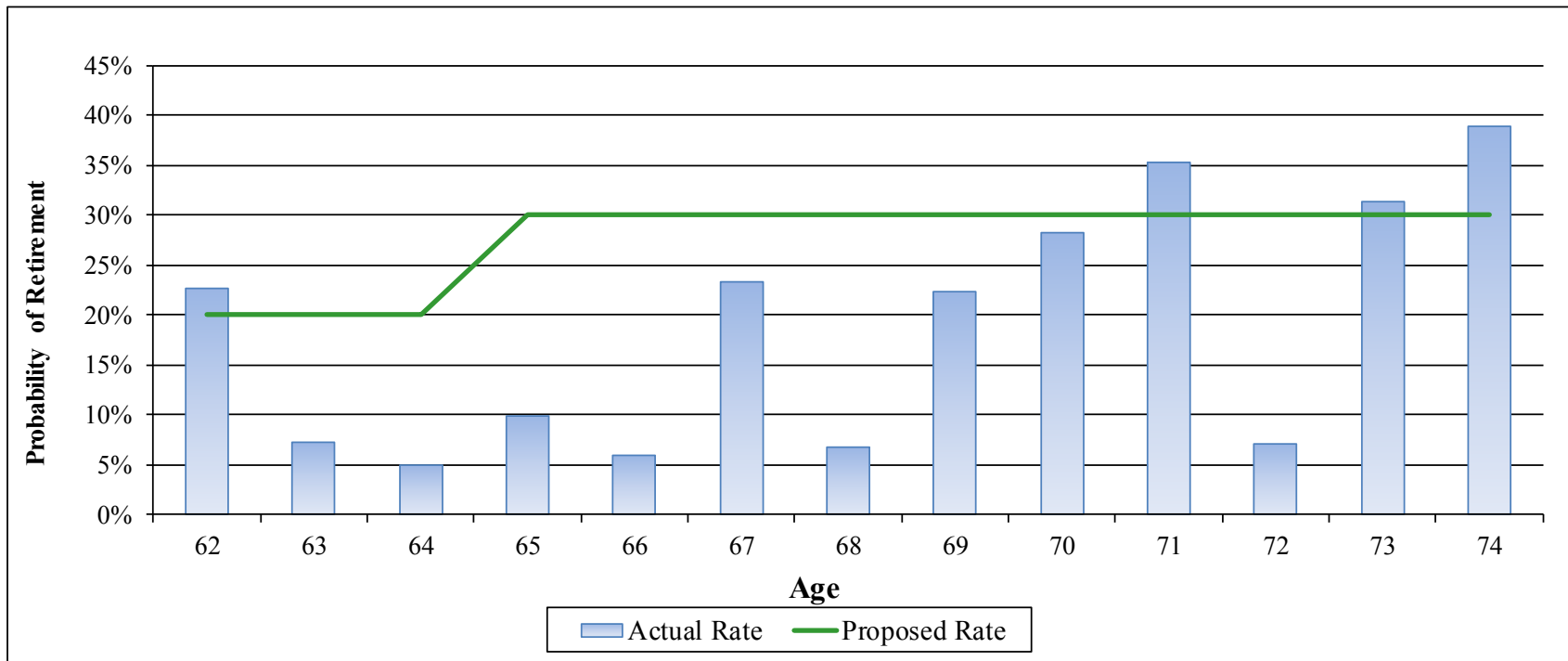
Probability of Retirement
EG&C Unreduced Retirement
Exhibit A – 17
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	93	92
Actual/Expected		101%



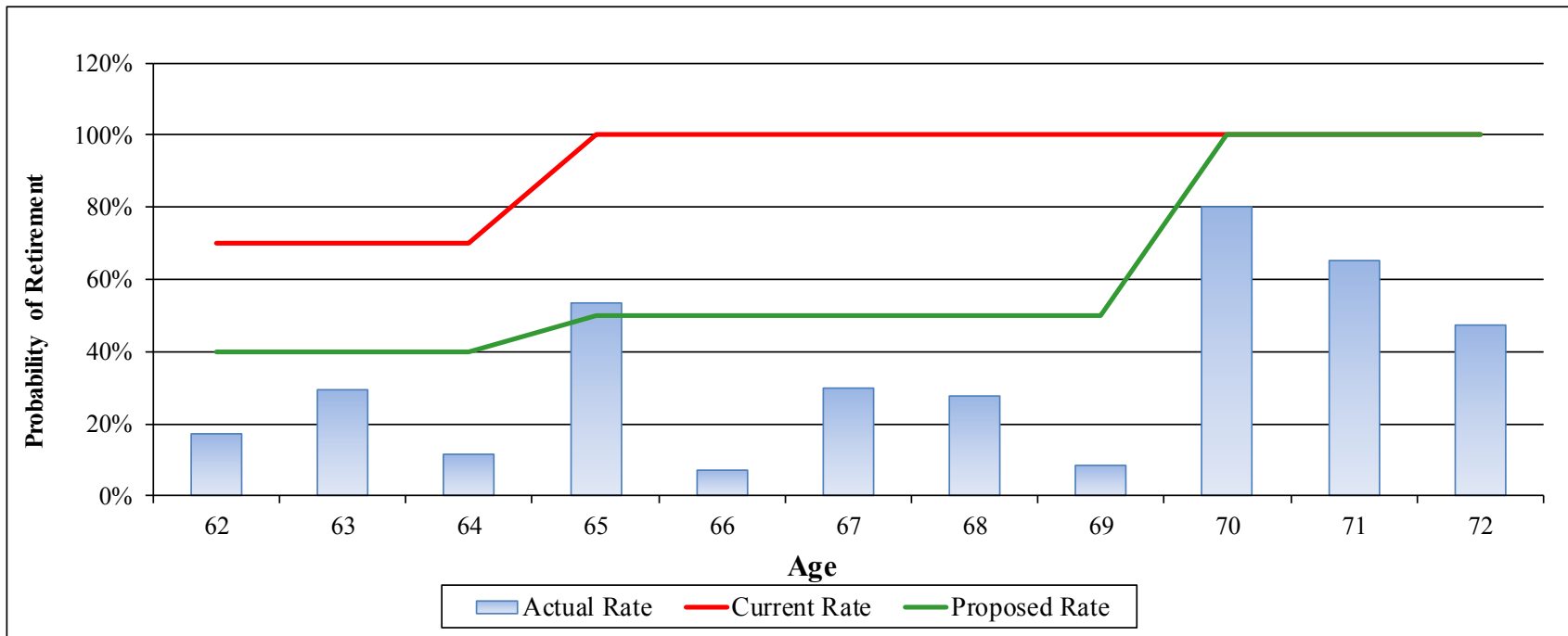
Probability of Retirement
JRS Unreduced Retirement
Exhibit A – 18
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	148	243
Actual/Expected		61%



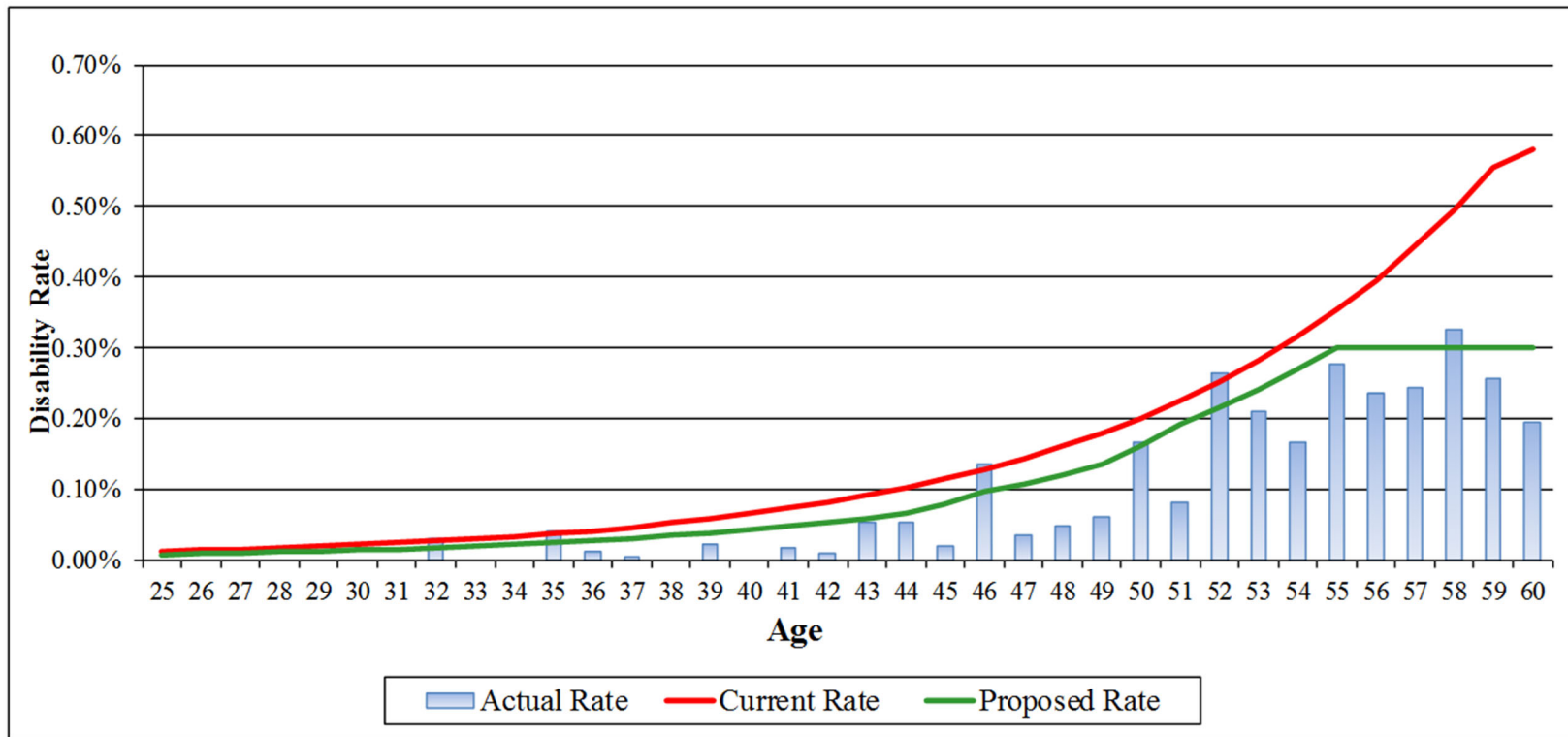
Probability of Retirement
PARF Unreduced Retirement
Exhibit A – 19
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	54	147	87
Actual/Expected		37%	62%



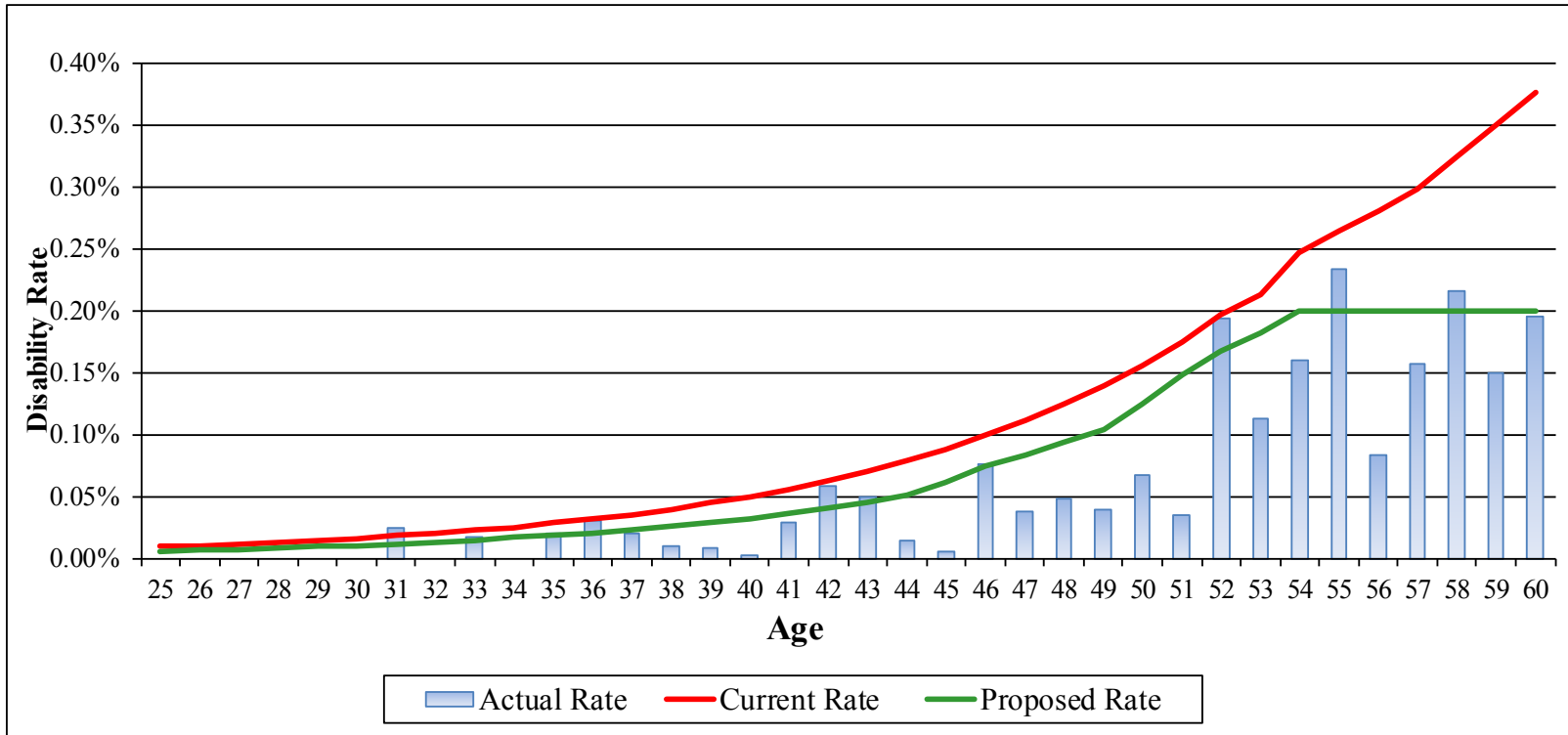
Rate of Disability – Active Lives
PERF and PARF Males
Exhibit A – 20
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	164	297	206
Actual/Expected		55%	80%



Rate of Disability – Active Lives
PERF and PARF Females
Exhibit A – 21
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	126	237	164
Actual/Expected		53%	77%



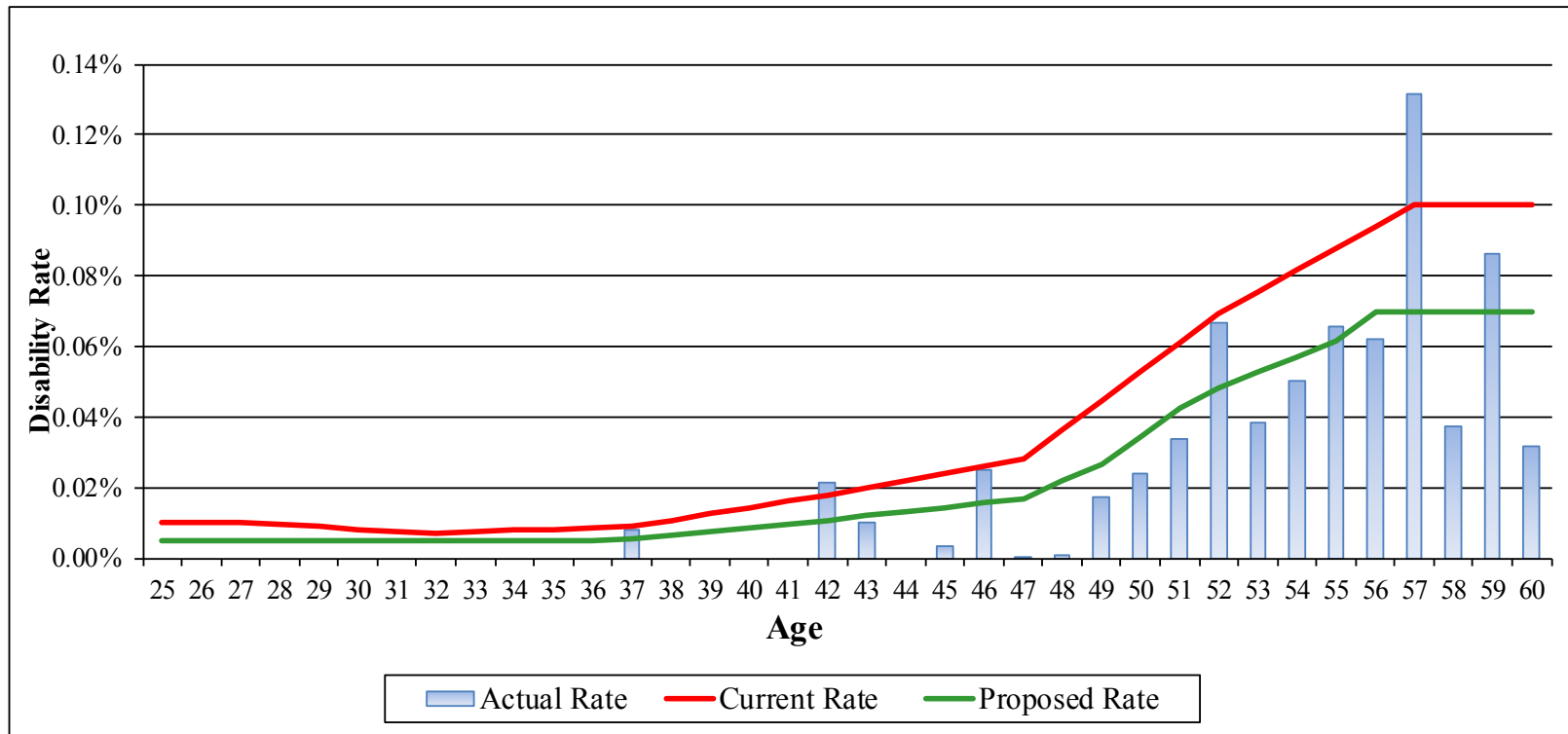
Rate of Disability – Active Lives

TRF

Exhibit A – 22

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	79	132	90
Actual/Expected		60%	88%



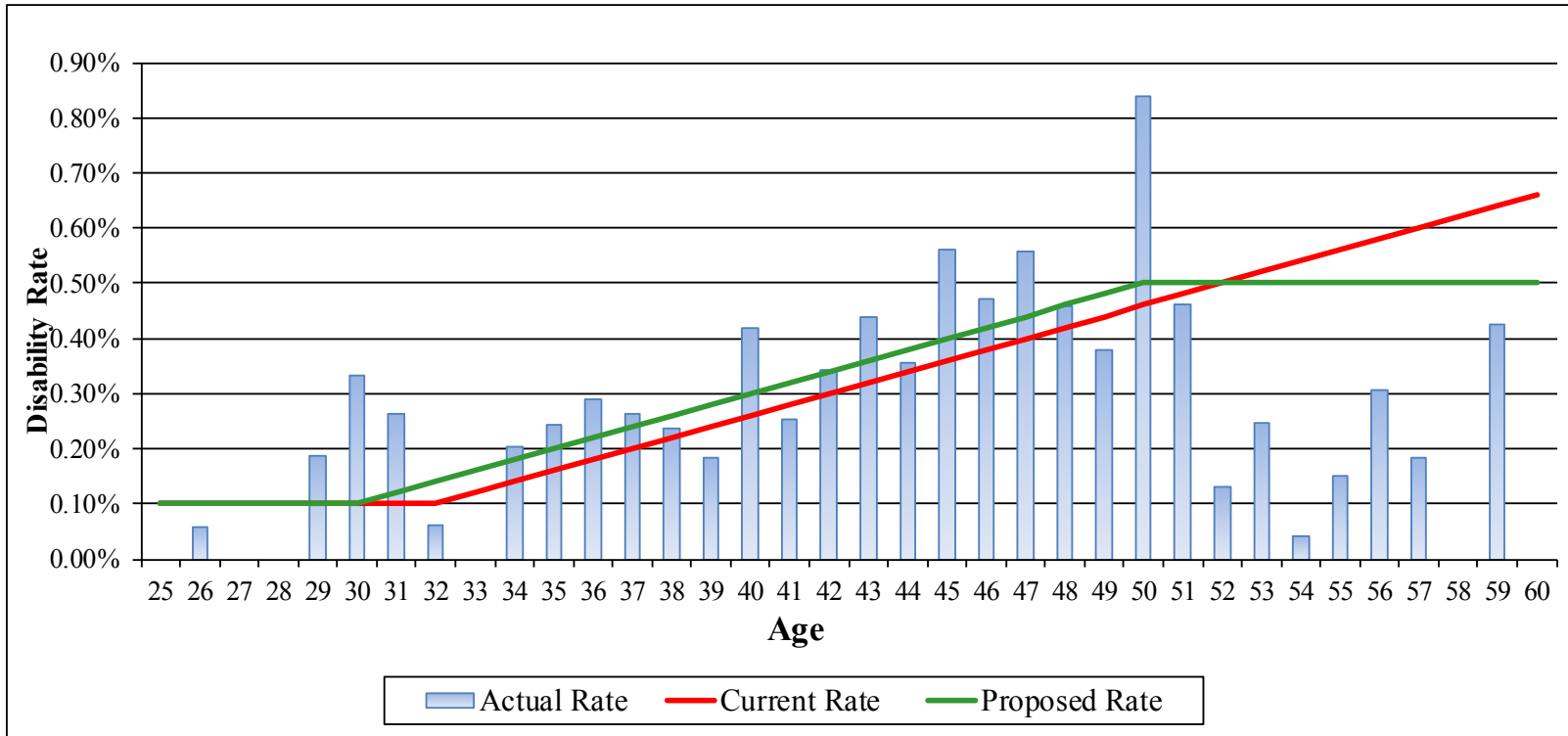
Rate of Disability – Active Lives

'77 FUND

Exhibit A – 23

Indiana Public Retirement System

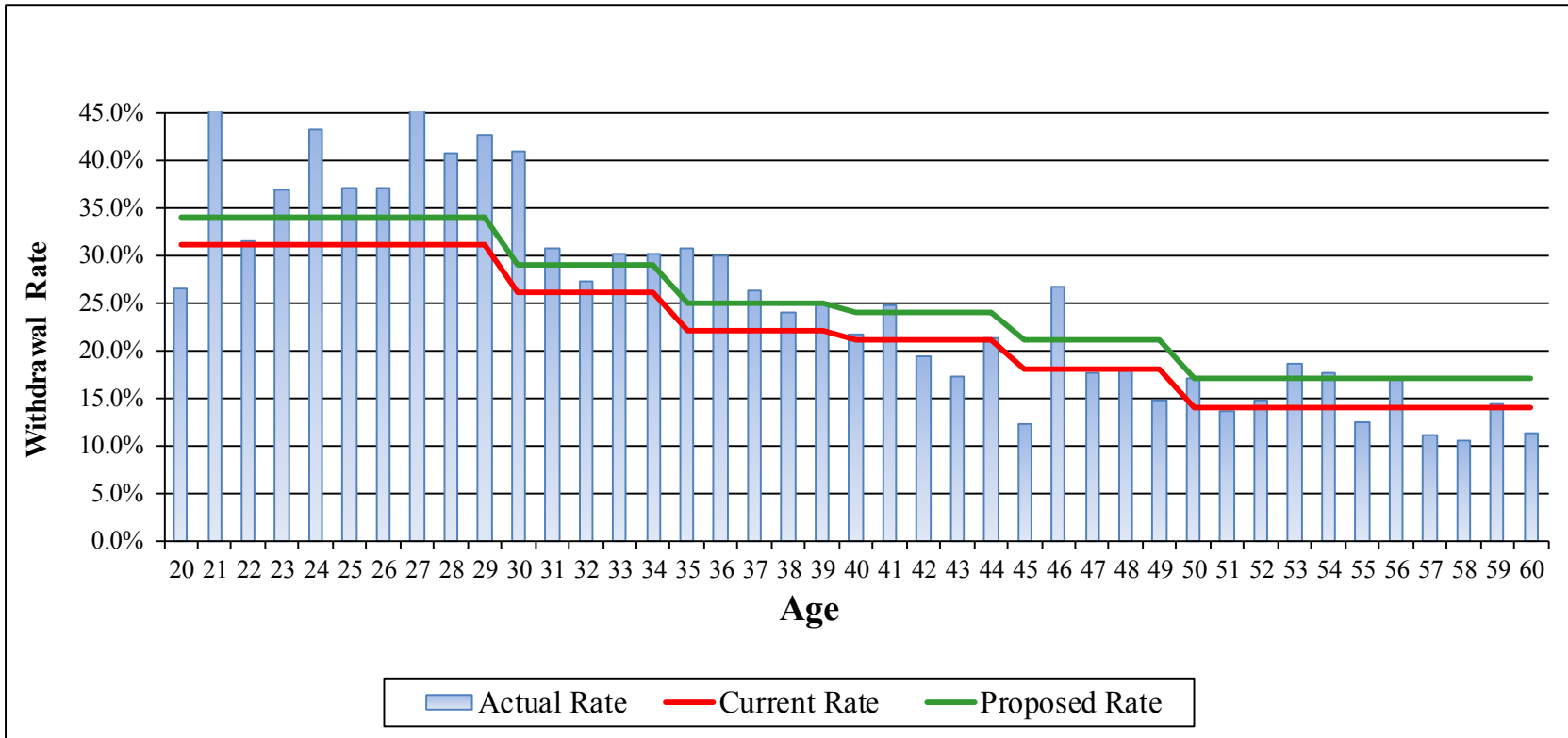
2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	174	198	204
Actual/Expected		88%	85%



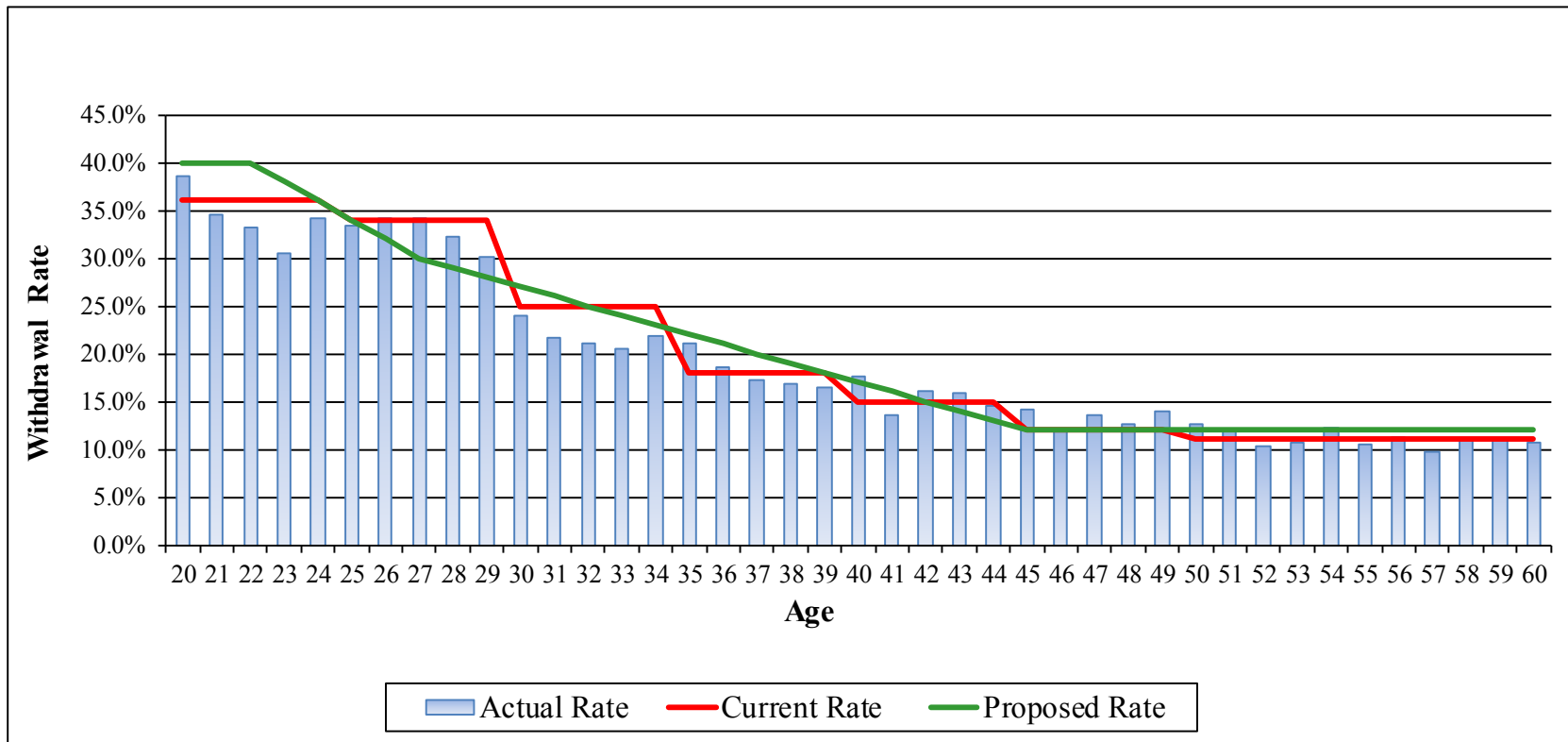
Rate Actives Terminate Employment
PERF Political Subdivision < \$20,000, Males
Exhibit A – 24
 Indiana Public Retirement System



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	109,980,783	100,671,612	116,752,785
Actual/Expected		109%	94%



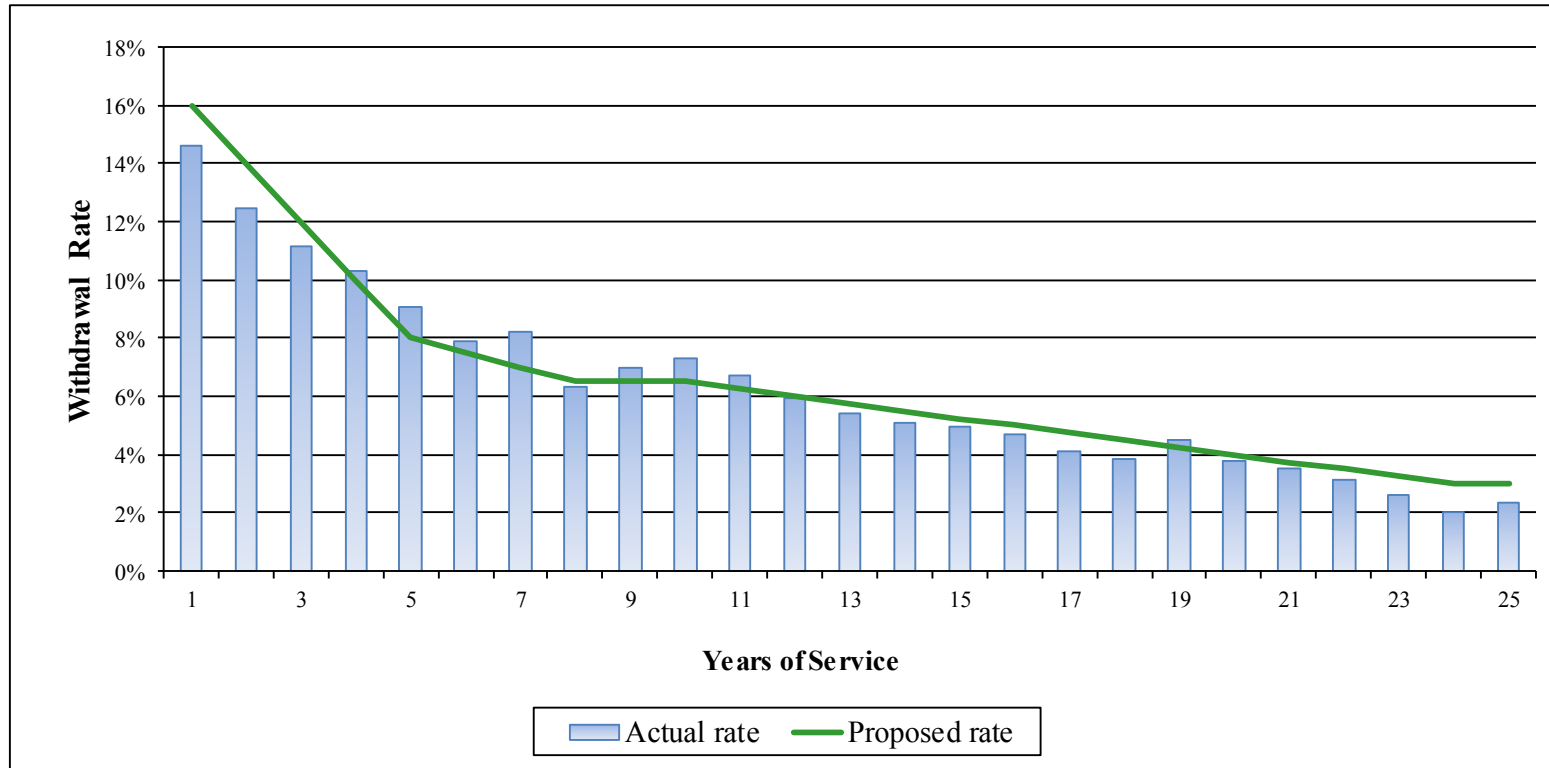
Rate Actives Terminate Employment
PERF Political Subdivision < \$20,000, Females
Exhibit A – 25
 Indiana Public Retirement System



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	573,218,653	566,188,340	584,725,711
Actual/Expected		101%	98%



Rate Actives Terminate Employment
PERF Political Subdivision – Salary At Least \$20,000
Exhibit A – 26
 Indiana Public Retirement System
 2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	4,519	4,500
Actual/Expected		100%



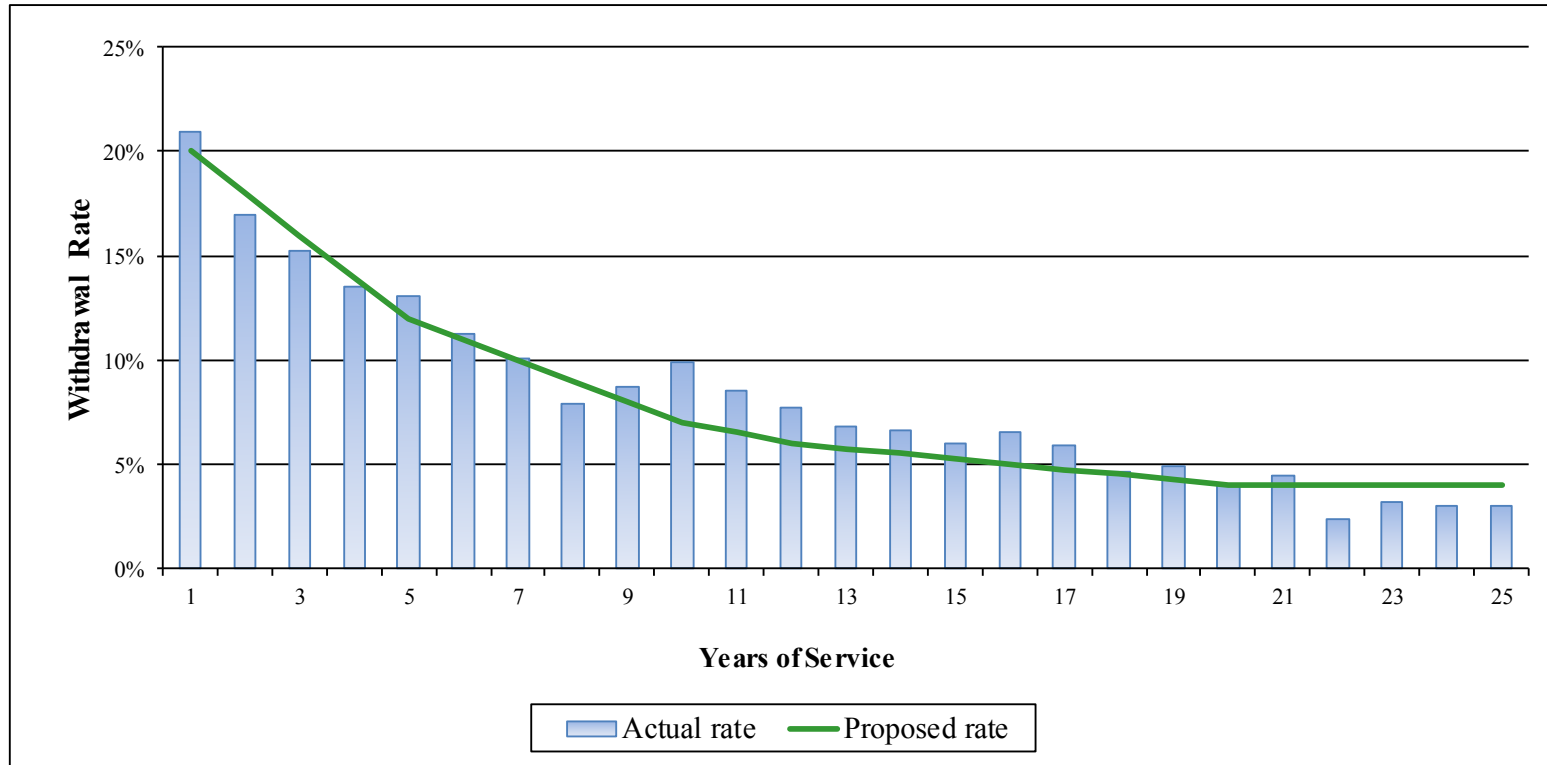
Rate Actives Terminate Employment

PERF State

Exhibit A – 27

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	3,046	2,809
Actual/Expected		108%



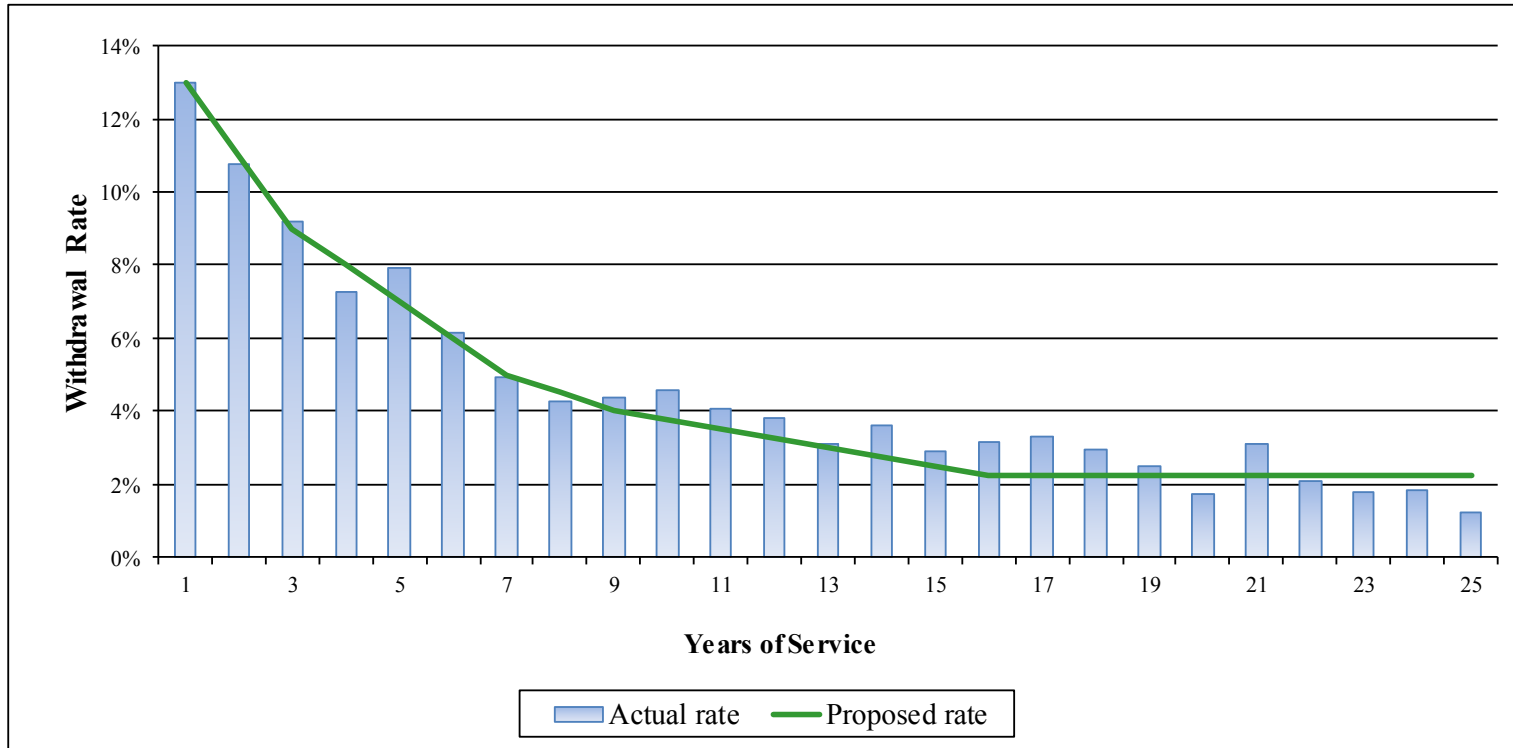
Rate Actives Terminate Employment

TRF Males

Exhibit A – 28

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	1,454	1,323
Actual/Expected		110%



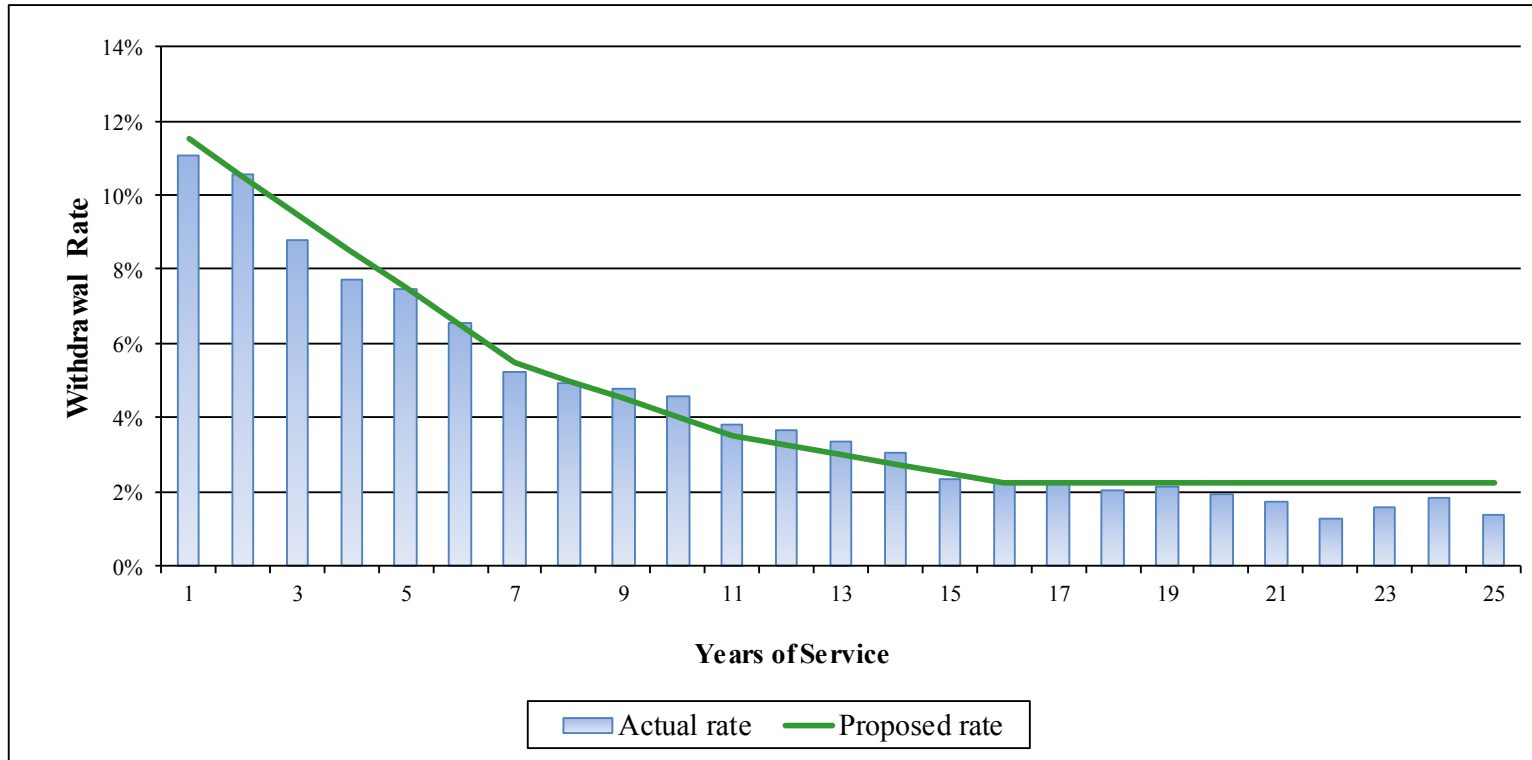
Rate Actives Terminate Employment

TRF Females

Exhibit A – 29

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Proposed Assumptions
Weighted Count	3,233	3,300
Actual/Expected		98%



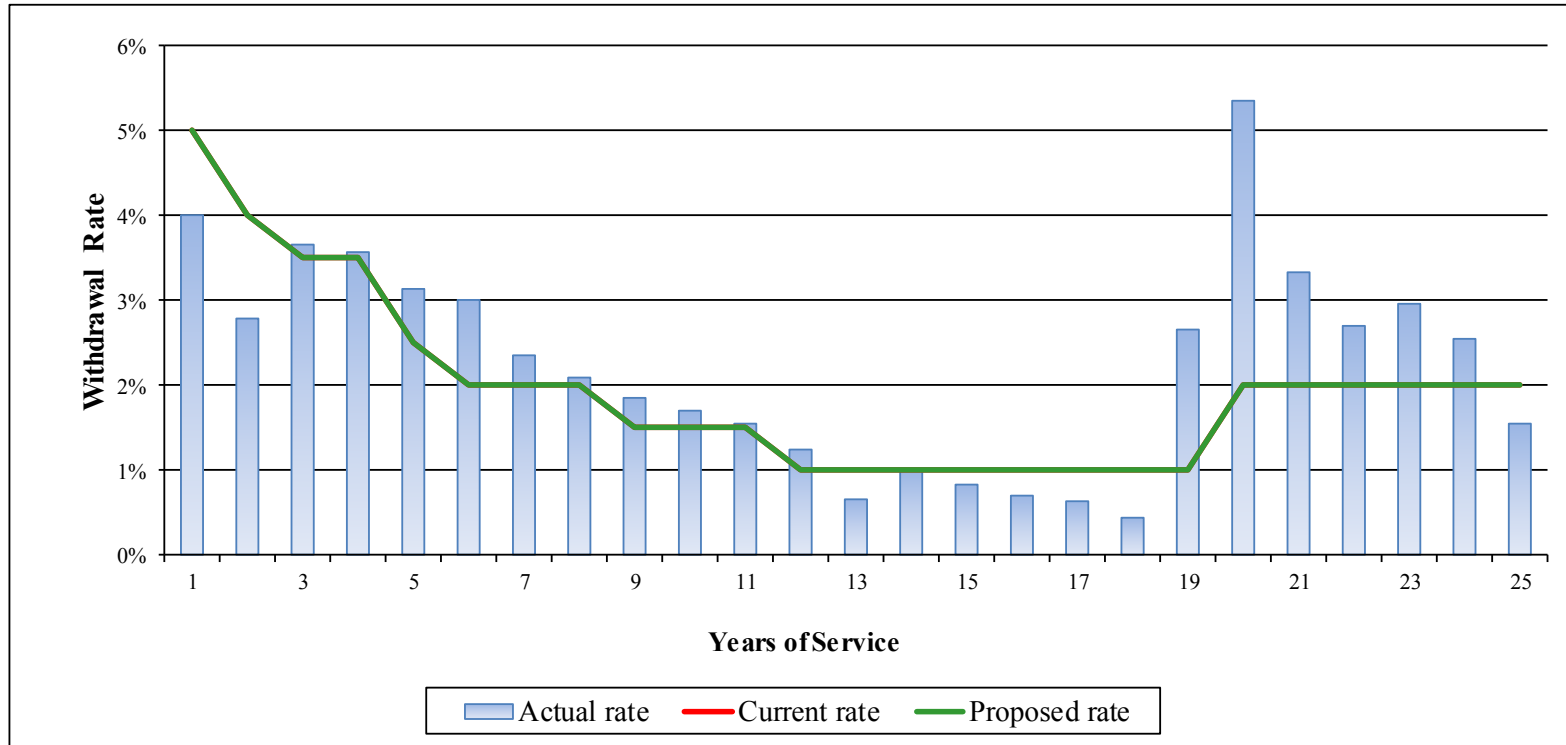
Rate Actives Terminate Employment

'77 FUND

Exhibit A – 30

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	567	466	466
Actual/Expected		122%	122%



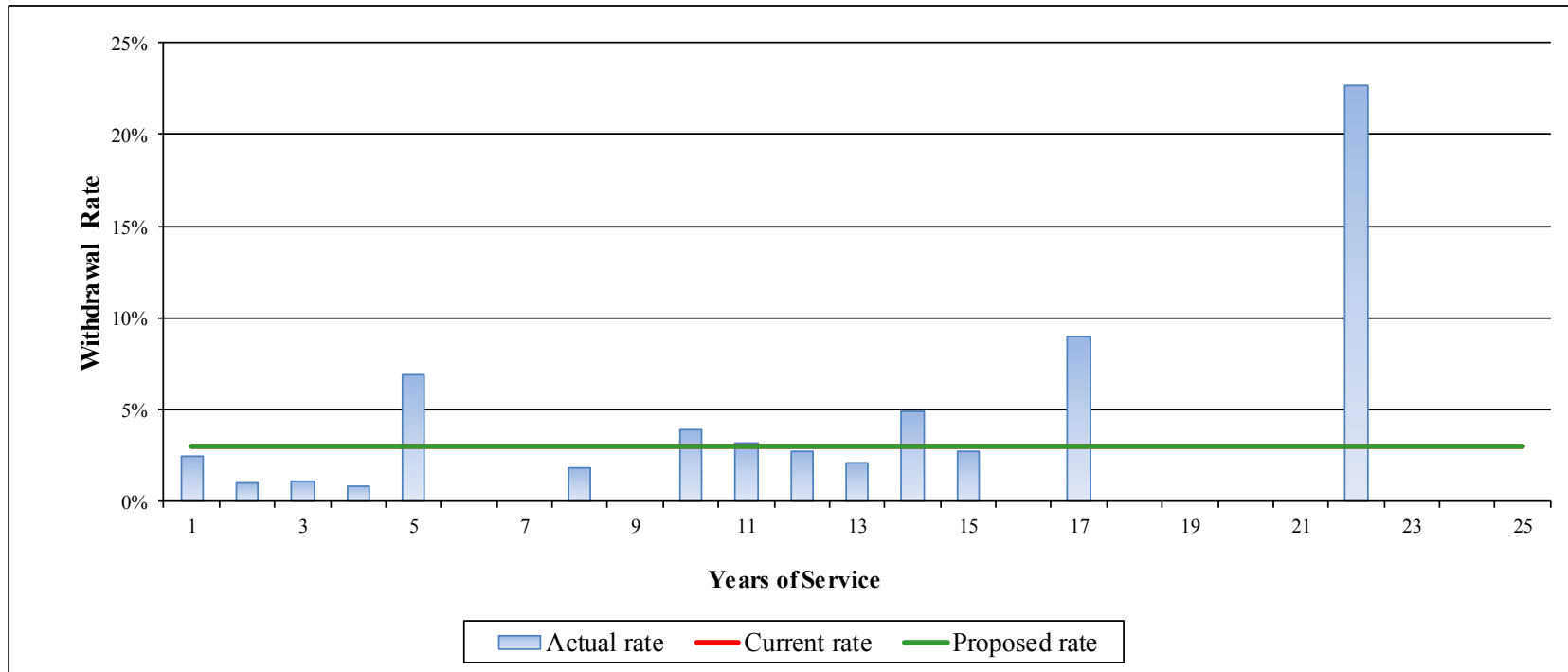
Rate Actives Terminate Employment

JRS

Exhibit A – 31

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Total Count	37,038,554	40,868,852	40,868,852
Actual/Expected		91%	91%



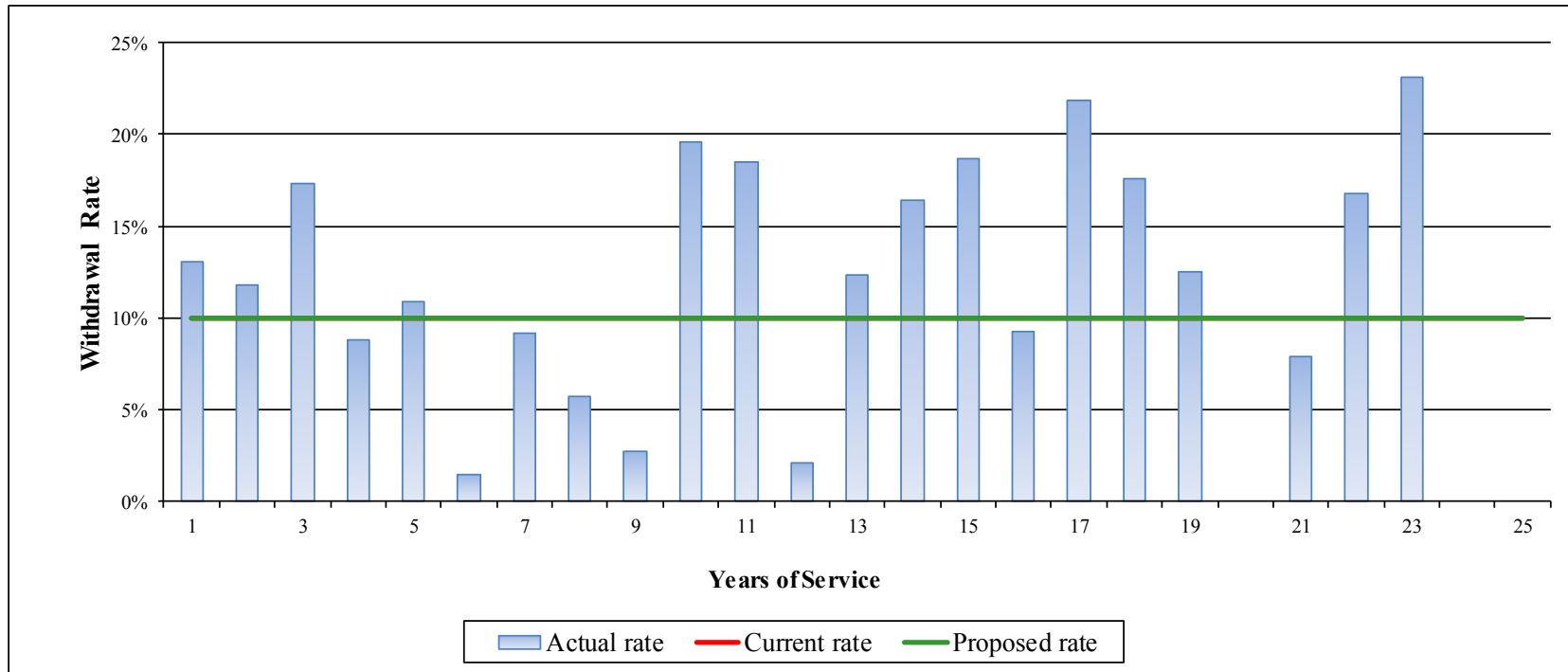
Rate Actives Terminate Employment

PARF

Exhibit A – 32

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	95	77	77
Actual/Expected		123%	123%



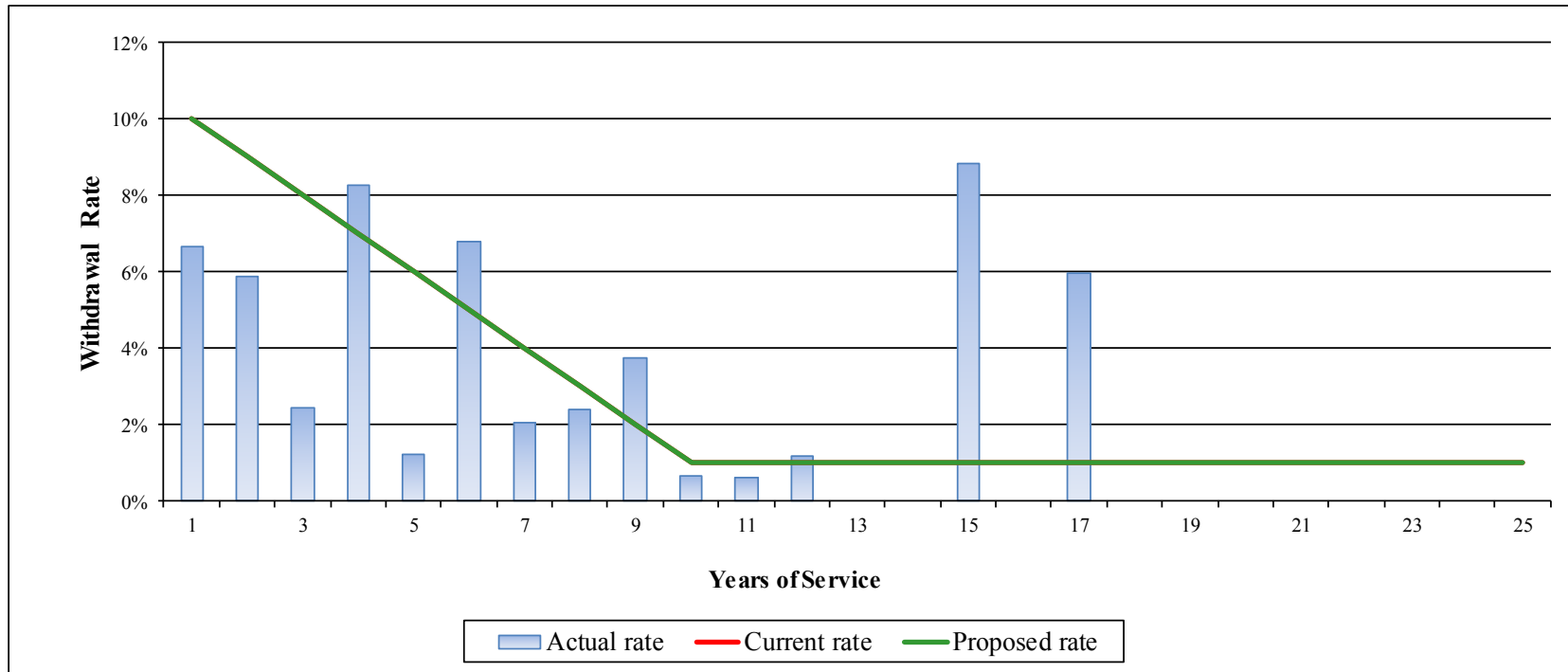
Rate Actives Terminate Employment

EG&C

Exhibit A – 33

Indiana Public Retirement System

2014-2019 Experience



	Actual	Expected - Current Assumptions	Expected - Proposed Assumptions
Weighted Count	17	18	18
Actual/Expected		95%	95%



APPENDIX B – DATA SUMMARY TABLES

Probability of Death – Healthy Retirees

PERF – Males

Data Summary B – 1

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	280	0	0.136%	1.7	0.593%	1.5	0.546%
56	897	3	0.311%	5.6	0.624%	5.3	0.590%
57	1,346	16	1.160%	8.7	0.650%	8.6	0.635%
58	1,719	11	0.611%	11.5	0.670%	11.7	0.683%
59	2,246	22	0.988%	15.5	0.689%	16.5	0.733%
60	2,769	32	1.162%	19.7	0.712%	21.7	0.785%
61	3,429	47	1.369%	25.6	0.746%	28.9	0.844%
62	4,137	33	0.808%	32.9	0.795%	37.6	0.910%
63	5,163	61	1.189%	44.5	0.861%	51.0	0.987%
64	5,634	86	1.526%	53.2	0.944%	60.7	1.077%
65	6,164	86	1.403%	64.0	1.039%	72.9	1.182%
66	7,150	105	1.473%	81.6	1.142%	93.3	1.304%
67	7,561	135	1.781%	94.6	1.251%	109.3	1.445%
68	7,397	142	1.913%	100.9	1.365%	118.7	1.605%
69	6,849	132	1.929%	101.9	1.487%	122.5	1.789%
70	6,181	148	2.400%	100.4	1.625%	123.4	1.997%
71	5,624	148	2.633%	100.3	1.783%	125.7	2.235%
72	5,021	141	2.808%	98.5	1.962%	125.8	2.505%
73	4,407	119	2.711%	95.5	2.167%	123.9	2.811%
74	4,001	130	3.250%	96.0	2.399%	126.4	3.159%
75	3,715	152	4.080%	98.8	2.660%	132.1	3.555%
76	3,353	138	4.110%	99.1	2.954%	134.2	4.003%
77	2,935	130	4.426%	96.5	3.286%	132.4	4.512%
78	2,642	132	4.985%	96.7	3.662%	134.5	5.090%
79	2,375	140	5.916%	97.0	4.086%	136.4	5.743%
80	2,135	123	5.764%	97.6	4.573%	138.3	6.477%
81	1,866	116	6.211%	95.5	5.120%	136.1	7.296%
82	1,618	125	7.726%	92.6	5.724%	132.8	8.205%
83	1,448	130	8.969%	92.5	6.388%	133.2	9.201%
84	1,262	118	9.375%	90.0	7.132%	129.9	10.289%
85	1,093	124	11.319%	87.1	7.973%	125.3	11.471%
86	964	110	11.451%	86.1	8.933%	122.9	12.746%
87	874	105	12.067%	87.7	10.030%	123.4	14.117%
88	759	116	15.345%	85.6	11.275%	118.1	15.567%
89	642	96	14.914%	81.3	12.674%	109.6	17.086%
90	540	103	19.028%	76.9	14.236%	100.8	18.661%
91	458	98	21.454%	72.7	15.896%	92.9	20.295%
92	334	72	21.669%	58.8	17.607%	73.4	21.979%
93	253	55	21.895%	49.0	19.339%	60.3	23.801%
94	203	55	26.865%	42.8	21.072%	52.1	25.677%
95	127	27	21.281%	28.9	22.778%	35.0	27.620%
96	80	24	29.535%	19.7	24.605%	23.7	29.611%
97	50	16	31.903%	13.2	26.441%	15.7	31.633%
98	35	12	33.482%	10.0	28.291%	11.9	33.667%
99	25	11	45.042%	7.4	30.135%	8.8	35.690%
100	18	5	27.500%	5.9	32.002%	6.9	37.675%
	117,780	3,932	3.338%	2,921.9	2.481%	3,806.2	3.232%



APPENDIX B – DATA SUMMARY TABLES

Probability of Death – Healthy Retirees

PERF – Females

Data Summary B – 2

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	216	1	0.512%	0.8	0.347%	0.7	0.317%
56	694	4	0.551%	2.5	0.365%	2.3	0.335%
57	1,132	8	0.682%	4.4	0.387%	4.0	0.354%
58	1,592	12	0.780%	6.6	0.414%	6.0	0.374%
59	2,067	8	0.370%	9.2	0.446%	8.2	0.397%
60	2,786	12	0.427%	13.4	0.482%	11.8	0.425%
61	3,872	25	0.657%	20.3	0.525%	17.7	0.457%
62	4,760	30	0.623%	27.5	0.578%	23.6	0.495%
63	5,973	44	0.736%	38.4	0.642%	32.1	0.538%
64	6,645	53	0.799%	47.7	0.718%	39.1	0.589%
65	7,567	66	0.867%	60.8	0.803%	49.0	0.648%
66	8,999	80	0.887%	80.5	0.894%	64.4	0.716%
67	9,516	91	0.953%	94.0	0.988%	75.6	0.795%
68	9,488	110	1.160%	102.6	1.082%	84.0	0.886%
69	9,054	122	1.345%	106.8	1.180%	89.7	0.990%
70	8,470	101	1.194%	109.1	1.288%	94.1	1.111%
71	8,052	108	1.347%	113.7	1.413%	100.5	1.248%
72	7,371	102	1.385%	114.9	1.559%	103.4	1.403%
73	6,755	128	1.889%	117.1	1.734%	106.7	1.579%
74	6,405	112	1.753%	123.9	1.934%	113.9	1.779%
75	5,980	128	2.139%	129.1	2.159%	119.7	2.002%
76	5,455	118	2.157%	131.1	2.404%	123.0	2.255%
77	4,889	138	2.822%	130.6	2.671%	124.3	2.542%
78	4,379	148	3.386%	129.7	2.963%	125.5	2.867%
79	3,958	142	3.589%	130.1	3.287%	128.1	3.238%
80	3,581	153	4.273%	131.1	3.659%	131.1	3.660%
81	3,173	147	4.642%	129.7	4.089%	131.4	4.142%
82	2,857	172	6.017%	130.6	4.571%	134.0	4.690%
83	2,518	141	5.603%	128.7	5.113%	133.9	5.318%
84	2,276	141	6.215%	130.4	5.729%	137.3	6.032%
85	2,075	166	8.025%	133.4	6.431%	142.0	6.846%
86	1,819	138	7.596%	131.6	7.235%	141.3	7.767%
87	1,600	133	8.296%	130.5	8.152%	140.8	8.796%
88	1,401	123	8.754%	128.7	9.185%	139.2	9.931%
89	1,222	136	11.101%	126.4	10.341%	136.5	11.164%
90	1,055	125	11.807%	122.8	11.634%	131.6	12.473%
91	934	129	13.860%	121.8	13.037%	129.2	13.835%
92	752	116	15.375%	109.2	14.529%	114.7	15.254%
93	601	106	17.589%	96.7	16.090%	100.6	16.731%
94	472	87	18.490%	83.6	17.707%	86.3	18.275%
95	356	77	21.705%	69.0	19.362%	71.1	19.931%
96	248	47	19.059%	52.4	21.101%	53.9	21.692%
97	179	46	25.769%	41.0	22.882%	42.1	23.547%
98	123	36	29.530%	30.3	24.703%	31.3	25.498%
99	74	23	30.336%	19.8	26.545%	20.5	27.538%
100	42	12	28.211%	12.0	28.426%	12.5	29.644%
	163,437	4,145	2.536%	3,904.4	2.389%	3,808.7	2.330%



Probability of Death – Healthy Retirees

TRF – Males

Data Summary B – 3

Indiana Public Retirement System
2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	94	-	0.000%	0.4	0.404%	0.2	0.246%
56	416	3	0.726%	1.8	0.422%	1.1	0.273%
57	712	1	0.113%	3.1	0.437%	2.2	0.303%
58	1,079	10	0.971%	4.8	0.450%	3.6	0.335%
59	1,575	2	0.153%	7.3	0.463%	5.8	0.369%
60	2,150	11	0.500%	10.3	0.479%	8.7	0.406%
61	3,102	20	0.657%	15.6	0.503%	13.8	0.446%
62	4,095	21	0.510%	22.0	0.537%	20.0	0.489%
63	5,289	36	0.673%	30.9	0.585%	28.4	0.537%
64	6,399	42	0.654%	41.2	0.644%	37.8	0.590%
65	7,463	58	0.776%	53.4	0.715%	48.6	0.651%
66	8,456	54	0.635%	67.2	0.794%	61.1	0.722%
67	9,407	54	0.576%	82.9	0.882%	75.7	0.805%
68	9,861	111	1.123%	96.3	0.976%	88.8	0.901%
69	9,589	106	1.108%	103.7	1.082%	97.2	1.013%
70	9,260	111	1.200%	111.3	1.202%	105.9	1.144%
71	8,814	102	1.161%	118.1	1.340%	114.2	1.296%
72	8,011	114	1.421%	120.0	1.498%	117.9	1.472%
73	7,337	107	1.454%	123.1	1.677%	122.8	1.673%
74	6,899	93	1.345%	129.8	1.881%	131.4	1.905%
75	6,329	95	1.509%	133.5	2.110%	137.4	2.170%
76	5,736	127	2.208%	135.9	2.368%	141.8	2.471%
77	5,248	153	2.909%	139.7	2.661%	147.6	2.812%
78	4,720	121	2.554%	141.4	2.995%	150.9	3.198%
79	4,331	142	3.277%	146.2	3.375%	157.4	3.635%
80	3,984	138	3.469%	152.0	3.814%	164.6	4.132%
81	3,583	180	5.013%	154.6	4.316%	168.3	4.698%
82	3,207	178	5.563%	156.5	4.879%	171.4	5.345%
83	2,986	223	7.484%	164.5	5.508%	181.5	6.079%
84	2,691	160	5.937%	167.4	6.222%	185.9	6.911%
85	2,408	203	8.428%	169.5	7.036%	188.9	7.845%
86	2,146	175	8.151%	171.1	7.973%	190.8	8.889%
87	1,874	175	9.349%	169.5	9.050%	188.3	10.052%
88	1,555	179	11.502%	159.8	10.276%	176.3	11.338%
89	1,308	164	12.522%	152.5	11.663%	166.9	12.759%
90	1,066	146	13.653%	140.9	13.218%	152.5	14.305%
91	832	162	19.455%	123.9	14.886%	132.9	15.965%
92	621	110	17.701%	103.3	16.630%	110.0	17.715%
93	488	107	21.836%	90.0	18.420%	95.5	19.545%
94	331	89	27.026%	66.9	20.239%	70.9	21.428%
95	223	57	25.588%	49.3	22.060%	52.4	23.435%
96	143	41	28.535%	34.3	24.027%	36.3	25.464%
97	80	24	29.812%	20.9	26.031%	22.1	27.522%
98	58	17	29.586%	16.3	28.079%	17.2	29.583%
99	44	10	23.748%	13.3	30.135%	14.0	31.633%
100	35	15	41.808%	11.3	32.002%	11.9	33.667%
	166,039	4,246	2.557%	4,127.5	2.486%	4,319.0	2.601%



Probability of Death – Healthy Retirees

TRF – Females

Data Summary B – 4

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	238	2	0.782%	0.6	0.260%	0.5	0.220%
56	1,059	6	0.592%	2.9	0.274%	2.5	0.238%
57	1,810	2	0.116%	5.3	0.291%	4.7	0.258%
58	2,695	10	0.363%	8.4	0.310%	7.5	0.277%
59	3,727	9	0.242%	12.5	0.334%	11.1	0.297%
60	5,153	25	0.491%	18.6	0.361%	16.4	0.319%
61	7,306	23	0.318%	29.6	0.406%	24.9	0.341%
62	9,695	30	0.312%	44.3	0.457%	35.5	0.366%
63	12,561	40	0.316%	64.7	0.515%	49.6	0.395%
64	15,168	58	0.382%	88.2	0.581%	65.0	0.429%
65	17,435	75	0.430%	114.0	0.654%	81.5	0.467%
66	19,116	83	0.436%	139.5	0.730%	98.3	0.514%
67	19,947	101	0.506%	160.9	0.807%	113.7	0.570%
68	19,086	95	0.498%	168.8	0.884%	121.6	0.637%
69	17,468	129	0.737%	168.7	0.966%	125.3	0.717%
70	15,711	125	0.797%	165.9	1.056%	127.6	0.812%
71	14,164	138	0.973%	164.5	1.162%	130.8	0.923%
72	12,101	113	0.930%	155.7	1.287%	127.5	1.054%
73	10,493	125	1.195%	150.8	1.437%	126.4	1.205%
74	9,527	118	1.241%	153.7	1.613%	131.5	1.380%
75	8,512	134	1.580%	154.2	1.812%	134.7	1.582%
76	7,367	142	1.924%	149.8	2.033%	133.5	1.813%
77	6,403	111	1.728%	145.8	2.277%	132.9	2.075%
78	5,838	125	2.134%	148.7	2.547%	138.7	2.375%
79	5,261	141	2.680%	149.8	2.848%	142.8	2.715%
80	4,708	142	3.006%	150.4	3.195%	146.0	3.102%
81	4,155	151	3.644%	149.4	3.595%	147.1	3.540%
82	3,774	139	3.688%	152.7	4.046%	152.3	4.037%
83	3,352	145	4.316%	152.7	4.556%	154.2	4.601%
84	3,071	154	5.026%	157.8	5.138%	160.8	5.236%
85	2,941	174	5.901%	170.7	5.805%	175.0	5.951%
86	2,727	212	7.782%	179.3	6.574%	184.2	6.754%
87	2,355	204	8.672%	175.7	7.459%	180.3	7.656%
88	2,071	186	8.993%	175.4	8.465%	179.6	8.668%
89	1,769	188	10.634%	169.8	9.601%	173.5	9.806%
90	1,419	170	12.003%	154.4	10.882%	157.2	11.085%
91	1,144	154	13.444%	140.6	12.286%	143.0	12.500%
92	945	153	16.193%	130.3	13.794%	132.7	14.052%
93	733	120	16.418%	112.8	15.389%	115.3	15.725%
94	544	98	18.097%	92.8	17.059%	95.2	17.501%
95	459	88	19.070%	86.3	18.789%	89.1	19.397%
96	386	109	28.192%	79.6	20.624%	82.5	21.373%
97	300	69	22.843%	67.7	22.525%	70.3	23.397%
98	250	76	30.438%	61.2	24.491%	63.6	25.454%
99	176	60	33.738%	46.7	26.503%	48.6	27.538%
100	136	47	34.838%	38.5	28.426%	40.2	29.644%
	285,253	4,799	1.682%	5,210.6	1.827%	4,775.0	1.674%



Probability of Death – Healthy Retirees
'77 FUND and EG&C – Males
Data Summary B – 5
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	1,250	7	0.529%	7.8	0.621%	5.3	0.422%
56	1,597	13	0.836%	10.5	0.658%	7.5	0.471%
57	1,924	22	1.137%	13.3	0.691%	10.1	0.525%
58	2,225	28	1.274%	16.0	0.717%	13.0	0.585%
59	2,477	9	0.348%	18.4	0.743%	16.1	0.649%
60	2,643	8	0.302%	20.5	0.775%	19.0	0.718%
61	2,810	25	0.897%	23.0	0.820%	22.3	0.794%
62	2,677	20	0.733%	23.6	0.882%	23.5	0.878%
63	2,522	40	1.588%	24.4	0.967%	24.5	0.971%
64	2,142	32	1.493%	22.9	1.071%	23.1	1.076%
65	1,763	9	0.534%	21.0	1.190%	21.1	1.195%
66	1,472	15	1.013%	19.4	1.319%	19.6	1.330%
67	1,214	8	0.684%	17.7	1.454%	18.0	1.485%
68	956	14	1.497%	15.2	1.594%	15.9	1.662%
69	756	14	1.905%	13.2	1.743%	14.1	1.864%
70	603	5	0.846%	11.5	1.908%	12.6	2.094%
71	511	12	2.255%	10.7	2.095%	12.0	2.355%
72	447	5	1.196%	10.3	2.306%	11.9	2.650%
73	434	7	1.516%	11.0	2.547%	12.9	2.985%
74	440	12	2.732%	12.4	2.819%	14.8	3.363%
75	414	16	3.895%	12.9	3.124%	15.7	3.792%
76	404	44	10.933%	14.0	3.466%	17.3	4.276%
77	368	26	7.087%	14.2	3.849%	17.7	4.823%
78	310	22	7.217%	13.3	4.279%	16.9	5.439%
79	267	8	3.039%	12.7	4.759%	16.4	6.131%
80	259	26	9.872%	13.7	5.302%	17.9	6.903%
81	184	15	7.999%	10.9	5.905%	14.3	7.765%
82	144	9	6.215%	9.4	6.561%	12.5	8.724%
83	120	11	8.950%	8.7	7.270%	11.8	9.787%
84	104	11	10.547%	8.3	8.055%	11.4	10.961%
85	94	17	18.239%	8.4	8.933%	11.5	12.258%
86	87	16	18.265%	8.6	9.927%	11.9	13.686%
87	68	3	4.399%	7.5	11.056%	10.3	15.260%
88	73	11	14.689%	9.0	12.329%	12.2	16.867%
89	61	9	14.569%	8.3	13.754%	11.2	18.448%
90	54	8	14.298%	8.3	15.336%	10.8	19.970%
91	47	5	10.982%	8.1	16.997%	10.2	21.448%
92	37	10	27.693%	7.0	18.686%	8.6	22.901%
93	26	9	34.965%	5.3	20.369%	6.3	24.461%
94	11	2	17.547%	2.5	22.026%	3.0	26.080%
95	4	-	0.000%	1.0	23.627%	1.2	27.815%
96	1	1	100.000%	0.3	25.326%	0.4	29.668%
97	-	-	0.000%	-	27.003%	-	31.633%
98	-	-	0.000%	-	28.666%	-	33.667%
99	-	-	0.000%	-	30.294%	-	35.690%
100	-	-	0.000%	-	32.002%	-	37.675%
	34,001	584	1.719%	515.2	1.515%	566.5	1.666%



APPENDIX B – DATA SUMMARY TABLES

Probability of Death – Healthy Retirees
JRS, PARF and LE DB Males
Data Summary B – 6
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	-	-	0.000%	-	0.404%	-	0.394%
56	-	-	0.000%	-	0.422%	-	0.428%
57	3	-	0.000%	0.0	0.437%	0.0	0.465%
58	9	-	0.000%	0.0	0.450%	0.0	0.504%
59	10	-	0.000%	0.0	0.463%	0.1	0.546%
60	14	-	0.000%	0.1	0.479%	0.1	0.590%
61	17	-	0.000%	0.1	0.503%	0.1	0.635%
62	43	-	0.000%	0.2	0.537%	0.3	0.683%
63	126	-	0.000%	0.7	0.585%	0.9	0.733%
64	174	-	0.000%	1.1	0.644%	1.4	0.785%
65	254	-	0.000%	1.8	0.715%	2.1	0.844%
66	293	-	0.000%	2.3	0.794%	2.7	0.910%
67	433	1	0.223%	3.8	0.882%	4.3	0.987%
68	514	6	1.259%	5.0	0.976%	5.5	1.077%
69	568	0	0.065%	6.1	1.082%	6.7	1.182%
70	699	15	2.209%	8.4	1.202%	9.1	1.304%
71	623	7	1.100%	8.3	1.340%	9.0	1.445%
72	541	9	1.739%	8.1	1.498%	8.7	1.605%
73	470	10	2.084%	7.9	1.677%	8.4	1.789%
74	448	8	1.716%	8.4	1.881%	8.9	1.997%
75	348	0	0.060%	7.4	2.110%	7.8	2.235%
76	334	13	3.740%	7.9	2.368%	8.4	2.505%
77	302	19	6.145%	8.0	2.661%	8.5	2.811%
78	193	-	0.000%	5.8	2.995%	6.1	3.159%
79	221	19	8.549%	7.5	3.375%	7.9	3.555%
80	222	26	11.730%	8.5	3.814%	8.9	4.003%
81	218	-	0.000%	9.4	4.316%	9.8	4.512%
82	230	25	10.955%	11.2	4.879%	11.7	5.090%
83	186	15	8.100%	10.2	5.508%	10.7	5.743%
84	129	1	0.464%	8.0	6.222%	8.4	6.477%
85	126	1	0.412%	8.9	7.037%	9.2	7.296%
86	94	1	1.489%	7.5	7.973%	7.7	8.205%
87	67	7	9.888%	6.1	9.050%	6.2	9.201%
88	60	8	13.994%	6.2	10.276%	6.2	10.289%
89	46	2	4.010%	5.4	11.663%	5.3	11.471%
90	38	12	30.945%	5.0	13.218%	4.8	12.746%
91	32	1	2.730%	4.8	14.886%	4.5	14.117%
92	23	-	0.000%	3.8	16.630%	3.6	15.567%
93	23	7	30.842%	4.2	18.420%	3.9	17.086%
94	9	6	69.612%	1.8	20.239%	1.7	18.661%
95	7	7	100.000%	1.5	22.060%	1.4	20.295%
96	-	-	0.000%	-	24.027%	-	21.979%
97	-	-	0.000%	-	26.031%	-	23.801%
98	-	-	0.000%	-	28.078%	-	25.677%
99	-	-	0.000%	-	30.135%	-	27.620%
100	-	-	0.000%	-	32.002%	-	29.611%
	8,149	226	2.770%	201.8	2.476%	211.0	2.589%



Probability of Death – In Pay Beneficiaries

All Plans – Males

Data Summary B – 7

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Proposed Expected	Proposed Rate
65	616	12	1.978%	8.5	1.379%
66	639	24	3.687%	9.4	1.473%
67	672	19	2.824%	10.6	1.583%
68	702	22	3.082%	12.0	1.708%
69	712	18	2.493%	13.2	1.853%
70	675	23	3.334%	13.6	2.016%
71	698	17	2.479%	15.4	2.201%
72	731	18	2.508%	17.6	2.407%
73	706	24	3.429%	18.6	2.637%
74	706	35	5.024%	20.4	2.891%
75	689	21	3.005%	21.9	3.172%
76	652	18	2.831%	22.7	3.479%
77	664	22	3.315%	25.3	3.817%
78	661	20	2.961%	27.7	4.190%
79	702	27	3.877%	32.3	4.604%
80	693	42	6.031%	35.1	5.066%
81	638	45	6.973%	35.6	5.585%
82	601	34	5.736%	37.1	6.167%
83	591	33	5.504%	40.3	6.818%
84	598	45	7.495%	45.1	7.542%
85	560	35	6.274%	46.8	8.350%
86	572	43	7.471%	52.9	9.242%
87	572	61	10.736%	58.5	10.224%
88	497	61	12.301%	56.2	11.299%
89	465	45	9.751%	58.1	12.475%
90	428	46	10.779%	59.3	13.873%
91	393	50	12.630%	60.4	15.352%
92	338	43	12.666%	57.1	16.903%
93	296	40	13.686%	54.7	18.511%
94	245	46	18.726%	49.5	20.179%
95	185	26	14.192%	40.5	21.894%
96	169	38	22.569%	40.2	23.746%
97	128	18	14.178%	32.9	25.645%
98	98	22	22.461%	27.1	27.605%
99	58	10	17.600%	17.3	29.606%
100	42	7	16.779%	13.3	31.633%
	18,393	1,111	6.039%	1,187.1	6.454%



Probability of Death – In Pay Beneficiaries

All Plans – Females

Data Summary B – 8

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Proposed Expected	Proposed Rate
65	748	19	2.602%	7.4	0.991%
66	813	8	1.040%	8.7	1.070%
67	913	13	1.406%	10.6	1.158%
68	1,013	13	1.327%	12.8	1.261%
69	1,096	27	2.452%	15.1	1.378%
70	1,086	29	2.667%	16.4	1.513%
71	1,081	27	2.459%	18.0	1.666%
72	1,127	19	1.698%	20.7	1.837%
73	1,160	35	3.054%	23.6	2.032%
74	1,242	27	2.170%	27.9	2.249%
75	1,321	32	2.405%	33.0	2.495%
76	1,348	43	3.193%	37.4	2.772%
77	1,333	44	3.326%	41.1	3.086%
78	1,362	48	3.541%	46.9	3.443%
79	1,354	55	4.030%	52.2	3.851%
80	1,384	65	4.716%	59.7	4.315%
81	1,328	67	5.044%	64.3	4.846%
82	1,333	76	5.731%	72.7	5.451%
83	1,320	83	6.316%	81.0	6.140%
84	1,307	97	7.435%	90.5	6.925%
85	1,306	98	7.493%	102.0	7.808%
86	1,306	108	8.290%	114.8	8.791%
87	1,226	96	7.862%	120.9	9.863%
88	1,198	137	11.420%	131.9	11.011%
89	1,068	121	11.311%	130.8	12.242%
90	905	130	14.316%	122.7	13.556%
91	727	103	14.114%	108.7	14.961%
92	636	100	15.647%	104.7	16.457%
93	510	89	17.403%	92.0	18.046%
94	395	100	25.286%	78.1	19.763%
95	300	68	22.711%	64.7	21.586%
96	228	60	26.128%	53.5	23.496%
97	165	40	24.518%	42.0	25.482%
98	131	34	25.706%	35.9	27.538%
99	107	28	26.254%	31.7	29.644%
100	66	19	28.754%	20.8	31.762%
	33,944	2,158	6.359%	2,095.4	6.173%



Probability of Death – Disabled Participants

'77 FUND and EG&C Males

Data Summary B – 9

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	240	4	1.697%	5.8	2.417%	5.0	2.099%
56	252	-	0.000%	6.2	2.450%	5.6	2.211%
57	241	4	1.715%	5.9	2.462%	5.6	2.314%
58	237	6	2.519%	5.8	2.453%	5.7	2.411%
59	234	3	1.469%	5.7	2.440%	5.8	2.501%
60	238	6	2.556%	5.8	2.438%	6.2	2.586%
61	247	5	1.830%	6.1	2.469%	6.6	2.668%
62	248	6	2.501%	6.3	2.540%	6.8	2.751%
63	224	3	1.301%	6.0	2.660%	6.4	2.840%
64	196	2	1.221%	5.5	2.814%	5.8	2.935%
65	188	10	5.453%	5.6	2.989%	5.7	3.034%
66	168	6	3.377%	5.3	3.170%	5.3	3.142%
67	166	7	4.177%	5.6	3.350%	5.4	3.260%
68	155	3	1.907%	5.5	3.526%	5.2	3.389%
69	168	6	3.409%	6.2	3.708%	6.0	3.534%
70	167	3	1.993%	6.5	3.910%	6.2	3.694%
71	148	12	8.197%	6.1	4.140%	5.7	3.876%
72	118	2	1.631%	5.2	4.400%	4.8	4.082%
73	97	3	3.210%	4.5	4.694%	4.2	4.314%
74	73	3	4.727%	3.6	5.022%	3.3	4.575%
75	62	6	9.410%	3.3	5.383%	3.0	4.869%
76	52	1	1.914%	3.0	5.780%	2.7	5.198%
77	50	6	11.499%	3.1	6.218%	2.8	5.566%
78	40	4	10.917%	2.7	6.703%	2.4	5.977%
79	26	4	13.335%	1.9	7.235%	1.7	6.436%
80	18	-	0.000%	1.4	7.833%	1.3	6.945%
81	16	2	11.910%	1.3	8.489%	1.2	7.509%
82	6	-	0.000%	0.6	9.188%	0.5	8.128%
83	6	2	30.359%	0.6	9.933%	0.6	8.805%
84	2	-	0.000%	0.3	10.749%	0.2	9.539%
85	-	-	0.000%	-	11.657%	-	10.329%
	4,084	119	2.924%	131.6	3.222%	127.5	3.123%



Probability of Death - Disabled Participants

All Other Plans - Males

Data Summary B – 10

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Proposed Expected	Proposed Rate
55	168	6	3.319%	4.9	2.939%
56	201	8	4.194%	6.2	3.095%
57	242	11	4.586%	7.8	3.240%
58	283	11	3.992%	9.5	3.375%
59	308	11	3.435%	10.8	3.501%
60	314	14	4.301%	11.4	3.621%
61	312	16	5.120%	11.7	3.736%
62	281	16	5.553%	10.8	3.852%
63	283	24	8.372%	11.3	3.976%
64	290	14	4.882%	11.9	4.109%
65	287	23	8.000%	12.2	4.247%
66	266	13	5.041%	11.7	4.399%
67	212	11	5.283%	9.7	4.564%
68	190	8	4.384%	9.0	4.745%
69	187	4	2.241%	9.3	4.947%
70	179	17	9.486%	9.2	5.172%
71	159	10	6.047%	8.6	5.427%
72	121	10	8.111%	6.9	5.715%
73	106	12	11.639%	6.4	6.040%
74	92	9	9.236%	5.9	6.405%
75	74	6	7.610%	5.0	6.817%
76	62	6	9.598%	4.5	7.277%
77	66	4	6.031%	5.1	7.792%
78	57	4	7.391%	4.8	8.367%
79	45	6	12.379%	4.0	9.010%
80	39	5	13.293%	3.8	9.723%
81	37	1	2.282%	3.9	10.513%
82	32	6	17.558%	3.7	11.379%
83	17	1	5.000%	2.0	12.328%
84	17	5	27.009%	2.3	13.354%
85	14	2	13.591%	2.0	14.460%
	4,941	292	5.902%	226.5	4.584%



Probability of Death - Disabled Participants

All Other Plans – Females

Data Summary B – 11

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Deaths	Actual Rate	Proposed Expected	Proposed Rate
55	195	3	1.679%	5.0	2.548%
56	227	6	2.664%	6.0	2.635%
57	251	8	3.102%	6.8	2.706%
58	304	10	3.382%	8.4	2.761%
59	369	11	2.902%	10.3	2.801%
60	389	15	3.771%	11.0	2.833%
61	420	15	3.511%	12.0	2.859%
62	416	12	2.929%	12.0	2.887%
63	408	16	3.957%	11.9	2.924%
64	400	19	4.808%	11.9	2.972%
65	377	7	1.768%	11.4	3.035%
66	345	12	3.594%	10.8	3.120%
67	287	13	4.516%	9.3	3.229%
68	272	12	4.260%	9.2	3.366%
69	239	12	5.134%	8.4	3.533%
70	214	14	6.488%	8.0	3.733%
71	173	13	7.618%	6.9	3.967%
72	153	6	3.800%	6.5	4.238%
73	153	10	6.483%	6.9	4.546%
74	132	3	2.495%	6.5	4.897%
75	126	5	3.891%	6.7	5.293%
76	101	7	6.831%	5.8	5.739%
77	78	4	5.037%	4.8	6.238%
78	73	6	7.681%	5.0	6.795%
79	62	2	3.184%	4.6	7.416%
80	52	7	13.829%	4.2	8.103%
81	38	4	10.924%	3.3	8.862%
82	35	5	13.490%	3.4	9.696%
83	25	3	11.706%	2.7	10.610%
84	20	2	8.839%	2.3	11.609%
85	18	4	22.232%	2.3	12.699%
	6,350	265	4.173%	224.2	3.530%



Probability of Retirement
PERF Early Retirement
Data Summary B – 12
Indiana Public Retirement System
2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
50	6,249	243	3.892%	250.0	4.000%	250.0	4.000%
51	6,989	246	3.520%	279.5	4.000%	279.5	4.000%
52	7,774	280	3.608%	310.9	4.000%	310.9	4.000%
53	8,636	316	3.659%	345.5	4.000%	345.5	4.000%
54	9,667	320	3.311%	386.7	4.000%	386.7	4.000%
55	6,973	298	4.275%	348.6	5.000%	348.6	5.000%
56	6,392	274	4.290%	319.6	5.000%	319.6	5.000%
57	5,864	285	4.864%	293.2	5.000%	293.2	5.000%
58	5,389	239	4.434%	269.5	5.000%	269.5	5.000%
59	4,845	229	4.727%	242.3	5.000%	242.3	5.000%
	68,788	2,730	3.969%	3,045.8	4.432%	3,045.8	4.432%



Retirement Rates
PERF Unreduced Retirement
Data Summary B-13
Indiana Public Retirement System
2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Proposed Expected	Proposed Rate
55	5,034	653	12.981%	704.7	14.000%
56	5,919	559	9.446%	591.9	10.000%
57	6,889	613	8.905%	688.9	10.000%
58	7,687	691	8.985%	768.7	10.000%
59	12,482	1,073	8.596%	1,248.2	10.000%
60	12,436	1,279	10.289%	1,492.3	12.000%
61	11,819	1,730	14.638%	1,891.1	16.000%
62	10,554	2,077	19.676%	2,321.8	22.000%
63	8,814	1,346	15.270%	1,674.7	19.000%
64	8,531	1,704	19.975%	2,047.4	24.000%
65	6,927	2,112	30.488%	2,078.0	30.000%
66	4,929	1,584	32.136%	1,478.7	30.000%
67	3,415	869	25.448%	1,024.4	30.000%
68	2,563	567	22.100%	769.0	30.000%
69	1,988	573	28.832%	596.5	30.000%
70	1,395	656	47.019%	418.5	30.000%
71	737	207	28.021%	221.2	30.000%
72	536	153	28.503%	160.8	30.000%
73	447	114	25.472%	134.1	30.000%
74	348	98	28.280%	104.4	30.000%
	113,450	18,658	16.465%	20,415.3	17.993%



Retirement Rates
TRF – Early Retirement Eligible
Data Summary B-14
Indiana Public Retirement System
2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
50	4,490	123	2.735%	89.8	2.000%	89.8	2.000%
51	4,250	119	2.808%	85.0	2.000%	85.0	2.000%
52	4,026	87	2.166%	80.5	2.000%	80.5	2.000%
53	3,833	129	3.369%	76.7	2.000%	76.7	2.000%
54	3,770	127	3.373%	188.5	5.000%	188.5	5.000%
55	2,744	100	3.647%	137.2	5.000%	137.2	5.000%
56	2,355	101	4.275%	117.7	5.000%	117.7	5.000%
57	2,215	126	5.709%	144.0	6.500%	144.0	6.500%
58	2,032	104	5.098%	162.5	8.000%	162.5	8.000%
59	1,796	101	5.597%	215.6	12.000%	215.6	12.000%
	31,511	1,117	3.545%	1,297.5	4.118%	1,297.5	4.118%



Retirement Rates
TRF – Unreduced Retirement
Data Summary B-15
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
55	1,252	197	15.704%	187.8	15.000%	187.8	15.000%
56	1,283	170	13.228%	192.4	15.000%	192.4	15.000%
57	1,361	195	14.299%	204.2	15.000%	204.2	15.000%
58	1,327	161	12.143%	199.1	15.000%	199.1	15.000%
59	2,990	440	14.725%	598.0	20.000%	448.5	15.000%
60	2,710	443	16.359%	542.1	20.000%	406.6	15.000%
61	2,398	467	19.474%	599.5	25.000%	479.6	20.000%
62	1,979	481	24.293%	593.8	30.000%	494.8	25.000%
63	1,632	374	22.908%	571.1	35.000%	489.5	30.000%
64	1,441	443	30.729%	576.5	40.000%	504.4	35.000%
65	1,015	377	37.143%	456.7	45.000%	406.0	40.000%
66	611	241	39.470%	274.8	45.000%	244.3	40.000%
67	388	155	39.847%	174.7	45.000%	155.3	40.000%
68	213	81	38.001%	95.8	45.000%	85.1	40.000%
69	129	50	38.625%	58.1	45.000%	51.6	40.000%
70	77	39	51.129%	76.7	100.000%	30.7	40.000%
71	37	14	38.361%	36.6	100.000%	14.6	40.000%
72	20	6	32.428%	19.6	100.000%	7.8	40.000%
73	9	2	18.478%	9.4	100.000%	3.7	40.000%
74	6	1	19.072%	6.0	100.000%	2.4	40.000%
	20,878	4,337	20.773%	5,472.7	26.213%	4,608.4	22.073%



Retirement Rates
77 Fund Retirement (Including DROP)
Data Summary B-16
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Proposed Expected	Proposed Rate
50	2,102	63	2.987%	105.1	5.000%
51	2,218	198	8.929%	110.9	5.000%
52	2,171	440	20.277%	325.6	15.000%
53	1,905	261	13.722%	285.8	15.000%
54	1,796	234	13.057%	269.4	15.000%
55	1,656	266	16.059%	248.4	15.000%
56	1,373	293	21.307%	274.6	20.000%
57	1,129	242	21.406%	225.9	20.000%
58	900	187	20.806%	180.0	20.000%
59	680	188	27.640%	153.0	22.500%
60	516	131	25.341%	129.0	25.000%
61	374	110	29.338%	93.5	25.000%
62	281	85	30.363%	70.2	25.000%
63	180	73	40.609%	44.9	25.000%
64	106	27	25.075%	26.5	25.000%
65	80	47	59.395%	39.9	50.000%
66	37	21	57.306%	18.4	50.000%
67	14	7	49.976%	7.1	50.000%
68	8	3	38.706%	4.1	50.000%
69	7	3	42.046%	3.3	50.000%
70	4	4	100.000%	4.1	100.000%
	17,537	2,883	16.440%	2,619.6	14.938%



Retirement Rates
EG&C Unreduced Retirement
Data Summary B-17
Indiana Public Retirement System
2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Proposed Expected	Proposed Rate
50	26	4	15.080%	5.1	20.000%
51	28	6	21.549%	5.6	20.000%
52	35	7	20.401%	7.1	20.000%
53	37	7	17.861%	7.5	20.000%
54	30	14	46.736%	6.0	20.000%
55	35	10	28.471%	8.7	25.000%
56	30	5	16.375%	7.4	25.000%
57	23	5	20.897%	5.7	25.000%
58	19	4	19.399%	4.7	25.000%
59	26	9	36.010%	8.9	35.000%
60	22	11	48.533%	12.0	55.000%
61	14	9	63.662%	9.4	65.000%
62	3	3	100.000%	2.2	75.000%
63	-	-	0.000%	-	75.000%
64	2	-	0.000%	1.7	75.000%
	330	94	28.485%	92.0	27.879%



Retirement Rates
JRS Unreduced Retirement
Data Summary B-18
Indiana Public Retirement System
2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Proposed Expected	Proposed Rate
62	41	9	22.742%	8.1	20.000%
63	42	3	7.336%	8.4	20.000%
64	54	3	4.927%	10.8	20.000%
65	102	10	9.844%	30.5	30.000%
66	98	6	5.867%	29.3	30.000%
67	120	28	23.397%	36.0	30.000%
68	86	6	6.766%	25.9	30.000%
69	81	18	22.322%	24.3	30.000%
70	79	22	28.294%	23.7	30.000%
71	55	19	35.284%	16.4	30.000%
72	34	2	7.152%	10.2	30.000%
73	39	12	31.277%	11.8	30.000%
74	23	9	38.869%	7.0	30.000%
	854	147	17.213%	242.6	28.384%



Retirement Rates
PARF Unreduced Retirement
Data Summary B-19
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Age	Exposure	Actual Retirements	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
62	13	2	17.047%	8.8	70.000%	5.0	40.000%
63	21	6	29.512%	14.8	70.000%	8.4	40.000%
64	21	2	11.679%	14.5	70.000%	8.3	40.000%
65	33	18	53.225%	33.0	100.000%	16.5	50.000%
66	14	1	6.964%	14.4	100.000%	7.2	50.000%
67	15	4	29.915%	14.8	100.000%	7.4	50.000%
68	15	4	27.639%	14.8	100.000%	7.4	50.000%
69	10	1	8.539%	10.4	100.000%	5.2	50.000%
70	13	10	80.147%	12.9	100.000%	12.9	100.000%
71	3	2	65.056%	3.2	100.000%	3.2	100.000%
72	5	2	47.308%	5.3	100.000%	5.3	100.000%
	163	52	31.902%	146.8	90.123%	86.8	53.252%



APPENDIX B – DATA SUMMARY TABLES

Rate of Disability – Active Lives

PERF and PARF Males

Data Summary B – 20

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Disabilities	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
25	185	-	0.000%	0.0	0.012%	0.0	0.008%
26	262	-	0.000%	0.0	0.013%	0.0	0.009%
27	344	-	0.000%	0.1	0.015%	0.0	0.010%
28	450	-	0.000%	0.1	0.017%	0.0	0.011%
29	561	-	0.000%	0.1	0.019%	0.1	0.012%
30	666	-	0.000%	0.1	0.021%	0.1	0.014%
31	795	-	0.000%	0.2	0.023%	0.1	0.015%
32	947	0	0.029%	0.2	0.026%	0.2	0.017%
33	1,065	-	0.000%	0.3	0.029%	0.2	0.019%
34	1,220	-	0.000%	0.4	0.033%	0.3	0.021%
35	1,383	1	0.040%	0.5	0.037%	0.3	0.024%
36	1,529	0	0.011%	0.6	0.041%	0.4	0.027%
37	1,632	0	0.004%	0.8	0.046%	0.5	0.030%
38	1,721	-	0.000%	0.9	0.052%	0.6	0.033%
39	1,820	0	0.021%	1.1	0.058%	0.7	0.038%
40	1,929	-	0.000%	1.2	0.065%	0.8	0.042%
41	2,109	0	0.016%	1.5	0.072%	1.0	0.047%
42	2,294	0	0.009%	1.9	0.081%	1.2	0.053%
43	2,553	1	0.052%	2.3	0.091%	1.5	0.059%
44	2,828	1	0.052%	2.9	0.102%	1.9	0.066%
45	3,088	1	0.020%	3.5	0.114%	2.5	0.080%
46	3,311	4	0.135%	4.2	0.128%	3.2	0.096%
47	3,509	1	0.036%	5.0	0.143%	3.8	0.107%
48	3,640	2	0.049%	5.8	0.160%	4.4	0.120%
49	3,829	2	0.060%	6.9	0.179%	5.1	0.134%
50	4,196	7	0.165%	8.4	0.201%	6.7	0.160%
51	4,611	4	0.082%	10.4	0.225%	8.8	0.191%
52	5,125	14	0.264%	12.9	0.252%	11.0	0.214%
53	5,706	12	0.211%	16.1	0.282%	13.7	0.239%
54	6,262	10	0.165%	19.8	0.315%	16.8	0.268%
55	6,608	18	0.276%	23.3	0.353%	19.8	0.300%
56	6,636	16	0.234%	26.2	0.396%	19.9	0.300%
57	6,751	16	0.243%	29.9	0.443%	20.3	0.300%
58	6,816	22	0.325%	33.8	0.496%	20.4	0.300%
59	6,723	17	0.257%	37.3	0.555%	20.2	0.300%
60	6,598	13	0.194%	38.4	0.582%	19.8	0.300%
	109,704	164	0.150%	297.1	0.271%	206.1	0.188%



Rate of Disability – Active Lives

PERF and PARF Females

Data Summary B – 21

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Disabilities	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
25	149	-	0.000%	0.0	0.009%	0.0	0.006%
26	225	-	0.000%	0.0	0.010%	0.0	0.007%
27	307	-	0.000%	0.0	0.011%	0.0	0.007%
28	398	-	0.000%	0.1	0.013%	0.0	0.008%
29	510	-	0.000%	0.1	0.014%	0.0	0.009%
30	634	-	0.000%	0.1	0.016%	0.1	0.010%
31	767	0	0.024%	0.1	0.018%	0.1	0.012%
32	930	-	0.000%	0.2	0.020%	0.1	0.013%
33	1,097	0	0.016%	0.2	0.022%	0.2	0.014%
34	1,241	-	0.000%	0.3	0.025%	0.2	0.016%
35	1,399	0	0.019%	0.4	0.028%	0.3	0.018%
36	1,547	0	0.031%	0.5	0.031%	0.3	0.020%
37	1,707	0	0.020%	0.6	0.035%	0.4	0.023%
38	1,853	0	0.010%	0.7	0.040%	0.5	0.026%
39	1,999	0	0.008%	0.9	0.044%	0.6	0.029%
40	2,171	0	0.002%	1.1	0.050%	0.7	0.032%
41	2,334	1	0.029%	1.3	0.056%	0.8	0.036%
42	2,517	1	0.058%	1.6	0.062%	1.0	0.041%
43	2,777	1	0.050%	1.9	0.070%	1.3	0.045%
44	3,080	0	0.013%	2.4	0.078%	1.6	0.051%
45	3,356	0	0.005%	2.9	0.088%	2.1	0.061%
46	3,702	3	0.076%	3.7	0.099%	2.7	0.074%
47	4,069	2	0.038%	4.5	0.110%	3.4	0.083%
48	4,331	2	0.048%	5.4	0.124%	4.0	0.093%
49	4,591	2	0.039%	6.4	0.139%	4.8	0.104%
50	4,978	3	0.067%	7.7	0.156%	6.2	0.124%
51	5,361	2	0.035%	9.3	0.174%	7.9	0.148%
52	5,754	11	0.194%	11.3	0.196%	9.6	0.166%
53	6,234	7	0.113%	13.3	0.213%	11.3	0.181%
54	6,805	11	0.160%	16.7	0.246%	13.6	0.200%
55	7,073	16	0.233%	18.6	0.263%	14.1	0.200%
56	7,301	6	0.084%	20.5	0.281%	14.6	0.200%
57	7,646	12	0.156%	22.8	0.298%	15.3	0.200%
58	7,742	17	0.216%	25.1	0.324%	15.5	0.200%
59	7,716	12	0.149%	27.0	0.350%	15.4	0.200%
60	7,722	15	0.194%	29.0	0.375%	15.4	0.200%
	122,025	126	0.103%	236.7	0.194%	164.1	0.135%



Rate of Disability – Active Lives

TRF

Data Summary B – 22

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Disabilities	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
25	439	-	0.000%	0.0	0.010%	0.0	0.005%
26	708	-	0.000%	0.1	0.010%	0.0	0.005%
27	1,001	-	0.000%	0.1	0.010%	0.1	0.005%
28	1,271	-	0.000%	0.1	0.009%	0.1	0.005%
29	1,566	-	0.000%	0.1	0.009%	0.1	0.005%
30	1,935	-	0.000%	0.2	0.008%	0.1	0.005%
31	2,386	-	0.000%	0.2	0.008%	0.1	0.005%
32	2,944	-	0.000%	0.2	0.007%	0.1	0.005%
33	3,493	-	0.000%	0.3	0.007%	0.2	0.005%
34	4,083	-	0.000%	0.3	0.008%	0.2	0.005%
35	4,712	-	0.000%	0.4	0.008%	0.2	0.005%
36	5,301	-	0.000%	0.5	0.009%	0.3	0.005%
37	5,927	0	0.008%	0.5	0.009%	0.3	0.005%
38	6,379	-	0.000%	0.7	0.011%	0.4	0.006%
39	6,821	-	0.000%	0.9	0.013%	0.5	0.008%
40	7,149	-	0.000%	1.0	0.014%	0.6	0.009%
41	7,523	-	0.000%	1.2	0.016%	0.7	0.010%
42	7,808	2	0.021%	1.4	0.018%	0.8	0.011%
43	8,325	1	0.010%	1.7	0.020%	1.0	0.012%
44	8,956	-	0.000%	2.0	0.022%	1.2	0.013%
45	9,547	0	0.004%	2.3	0.024%	1.4	0.014%
46	9,905	2	0.025%	2.6	0.026%	1.5	0.016%
47	10,246	0	0.000%	2.9	0.028%	1.7	0.017%
48	10,255	0	0.001%	3.7	0.036%	2.2	0.022%
49	10,020	2	0.017%	4.4	0.044%	2.7	0.027%
50	10,121	2	0.024%	5.3	0.053%	3.5	0.034%
51	10,386	3	0.034%	6.3	0.061%	4.4	0.043%
52	10,771	7	0.067%	7.4	0.069%	5.2	0.048%
53	11,422	4	0.038%	8.6	0.075%	6.0	0.053%
54	11,963	6	0.050%	9.7	0.081%	6.8	0.057%
55	11,997	8	0.065%	10.5	0.088%	7.4	0.061%
56	11,585	7	0.062%	10.9	0.094%	8.1	0.070%
57	11,630	15	0.132%	11.6	0.100%	8.1	0.070%
58	11,376	4	0.037%	11.4	0.100%	8.0	0.070%
59	11,217	10	0.086%	11.2	0.100%	7.9	0.070%
60	10,809	3	0.032%	10.8	0.100%	7.6	0.070%
	261,979	79	0.030%	131.5	0.050%	89.6	0.034%



Rate of Disability – Active Lives

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Data Summary B – 23

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Age	Exposure	Actual Disabilities	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
25	50	-	0.000%	0.0	0.100%	0.0	0.100%
26	84	0	0.057%	0.1	0.100%	0.1	0.100%
27	128	-	0.000%	0.1	0.100%	0.1	0.100%
28	182	-	0.000%	0.2	0.100%	0.2	0.100%
29	254	0	0.189%	0.3	0.100%	0.3	0.100%
30	343	1	0.331%	0.3	0.100%	0.3	0.100%
31	442	1	0.264%	0.4	0.100%	0.5	0.120%
32	558	0	0.062%	0.6	0.100%	0.8	0.140%
33	667	-	0.000%	0.8	0.120%	1.1	0.160%
34	772	2	0.205%	1.1	0.140%	1.4	0.180%
35	876	2	0.242%	1.4	0.160%	1.8	0.200%
36	1,022	3	0.288%	1.8	0.180%	2.2	0.220%
37	1,188	3	0.265%	2.4	0.200%	2.9	0.240%
38	1,331	3	0.235%	2.9	0.220%	3.5	0.260%
39	1,477	3	0.185%	3.5	0.240%	4.1	0.280%
40	1,654	7	0.417%	4.3	0.260%	5.0	0.300%
41	1,841	5	0.254%	5.2	0.280%	5.9	0.320%
42	1,942	7	0.343%	5.8	0.300%	6.6	0.340%
43	2,170	10	0.439%	6.9	0.320%	7.8	0.360%
44	2,378	8	0.356%	8.1	0.340%	9.0	0.380%
45	2,536	14	0.561%	9.1	0.360%	10.1	0.400%
46	2,613	12	0.472%	9.9	0.380%	11.0	0.420%
47	2,676	15	0.558%	10.7	0.400%	11.8	0.440%
48	2,635	12	0.457%	11.1	0.420%	12.1	0.460%
49	2,598	10	0.379%	11.4	0.440%	12.5	0.480%
50	2,612	22	0.838%	12.0	0.460%	13.1	0.500%
51	2,603	12	0.462%	12.5	0.480%	13.0	0.500%
52	2,454	3	0.130%	12.3	0.500%	12.3	0.500%
53	2,145	5	0.246%	11.2	0.520%	10.7	0.500%
54	1,966	1	0.042%	10.6	0.540%	9.8	0.500%
55	1,779	3	0.151%	10.0	0.560%	8.9	0.500%
56	1,496	5	0.305%	8.7	0.580%	7.5	0.500%
57	1,218	2	0.184%	7.3	0.600%	6.1	0.500%
58	1,002	-	0.000%	6.2	0.620%	5.0	0.500%
59	763	3	0.426%	4.9	0.640%	3.8	0.500%
60	610	-	0.000%	4.0	0.660%	3.1	0.500%
	51,066	174	0.341%	198.2	0.388%	204.3	0.400%



Rate Actives Terminate Employment
PERF Political Subdivision – Salary < \$20,000, Males
Data Summary B – 24
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Age	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
20	0	0	26.465%	0.1	31.000%	0.1	34.000%
21	1	0	46.066%	0.2	31.000%	0.3	34.000%
22	2	0	31.390%	0.5	31.000%	0.5	34.000%
23	2	1	36.820%	0.7	31.000%	0.7	34.000%
24	3	1	43.143%	0.9	31.000%	0.9	34.000%
25	4	1	36.998%	1.2	31.000%	1.4	34.000%
26	5	2	37.079%	1.7	31.000%	1.8	34.000%
27	6	3	45.840%	1.7	31.000%	1.9	34.000%
28	7	3	40.611%	2.0	31.000%	2.2	34.000%
29	6	3	42.522%	1.9	31.000%	2.1	34.000%
30	7	3	40.943%	1.7	26.000%	1.9	29.000%
31	10	3	30.658%	2.5	26.000%	2.8	29.000%
32	9	2	27.222%	2.3	26.000%	2.6	29.000%
33	10	3	30.127%	2.7	26.000%	3.0	29.000%
34	10	3	30.047%	2.7	26.000%	3.0	29.000%
35	12	4	30.673%	2.6	22.000%	3.0	25.000%
36	10	3	29.996%	2.3	22.000%	2.6	25.000%
37	11	3	26.168%	2.4	22.000%	2.7	25.000%
38	12	3	23.880%	2.6	22.000%	3.0	25.000%
39	11	3	24.934%	2.4	22.000%	2.7	25.000%
40	13	3	21.655%	2.8	21.000%	3.2	24.000%
41	13	3	24.652%	2.8	21.000%	3.2	24.000%
42	16	3	19.313%	3.3	21.000%	3.8	24.000%
43	18	3	17.270%	3.7	21.000%	4.2	24.000%
44	19	4	21.211%	4.0	21.000%	4.6	24.000%
45	18	2	12.178%	3.2	18.000%	3.7	21.000%
46	23	6	26.600%	4.2	18.000%	4.9	21.000%
47	23	4	17.572%	4.1	18.000%	4.8	21.000%
48	24	4	17.921%	4.4	18.000%	5.1	21.000%
49	15	2	14.742%	2.8	18.000%	3.2	21.000%
50	17	3	17.093%	2.4	14.000%	2.9	17.000%
51	16	2	13.515%	2.3	14.000%	2.8	17.000%
52	19	3	14.763%	2.6	14.000%	3.2	17.000%
53	19	4	18.603%	2.7	14.000%	3.3	17.000%
54	20	4	17.564%	2.8	14.000%	3.4	17.000%
55	18	2	12.351%	2.5	14.000%	3.1	17.000%
56	20	3	17.048%	2.9	14.000%	3.5	17.000%
57	21	2	11.130%	3.0	14.000%	3.6	17.000%
58	21	2	10.524%	2.9	14.000%	3.6	17.000%
59	23	3	14.370%	3.2	14.000%	3.9	17.000%
60	21	2	11.249%	3.0	14.000%	3.6	17.000%
	536	110	20.517%	101	18.781%	117	21.781%



APPENDIX B – DATA SUMMARY TABLES

Rate Actives Terminate Employment
PERF Political Subdivision – Salary < \$20,000, Females
Data Summary B – 25
Indiana Public Retirement System
2014-2019 Experience (Weighted)

Table with 8 columns: Age, Exposure, Actual Terminations, Actual Rate, Current Expected, Current Rate, Proposed Expected, Proposed Rate. Rows include ages 20-60 and a total row at the bottom.



Rate Actives Terminate Employment
PERF Political Subdivision – Salary At Least \$20,000
Data Summary B – 26
 Indiana Public Retirement System
 2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Proposed Expected	Proposed Rate
1	833	122	14.645%	133.3	16.000%
2	1,536	192	12.480%	215.1	14.000%
3	2,054	229	11.156%	246.5	12.000%
4	2,415	249	10.315%	241.5	10.000%
5	2,762	250	9.052%	220.9	8.000%
6	3,241	257	7.924%	243.0	7.500%
7	3,861	318	8.229%	270.3	7.000%
8	4,386	279	6.357%	285.1	6.500%
9	4,726	329	6.957%	307.2	6.500%
10	5,193	380	7.320%	337.6	6.500%
11	5,304	356	6.706%	331.5	6.250%
12	5,246	312	5.950%	314.8	6.000%
13	5,546	301	5.419%	318.9	5.750%
14	2,715	138	5.065%	149.3	5.500%
15	2,689	133	4.941%	141.2	5.250%
16	2,687	126	4.705%	134.3	5.000%
17	2,656	109	4.118%	126.2	4.750%
18	2,468	96	3.884%	111.1	4.500%
19	2,202	100	4.538%	93.6	4.250%
20	1,940	73	3.786%	77.6	4.000%
21	1,654	58	3.535%	62.0	3.750%
22	1,388	44	3.152%	48.6	3.500%
23	1,172	30	2.590%	38.1	3.250%
24	989	20	2.003%	29.7	3.000%
25	763	18	2.369%	22.9	3.000%
	70,427	4,519	6.416%	4,500.2	6.390%



Rate Actives Terminate Employment

PERF State

Data Summary B – 27

Indiana Public Retirement System
2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Proposed Expected	Proposed Rate
1	466	97	20.900%	93.2	20.000%
2	831	141	16.986%	149.7	18.000%
3	1,114	169	15.215%	178.2	16.000%
4	1,259	170	13.526%	176.2	14.000%
5	1,457	190	13.017%	174.9	12.000%
6	1,749	197	11.281%	192.4	11.000%
7	2,067	209	10.113%	206.7	10.000%
8	2,328	183	7.851%	209.5	9.000%
9	2,453	213	8.665%	196.2	8.000%
10	2,758	273	9.894%	193.1	7.000%
11	2,724	232	8.503%	177.1	6.500%
12	2,507	193	7.694%	150.4	6.000%
13	2,582	176	6.802%	148.5	5.750%
14	1,356	89	6.594%	74.6	5.500%
15	1,316	79	5.979%	69.1	5.250%
16	1,221	80	6.570%	61.1	5.000%
17	1,221	72	5.875%	58.0	4.750%
18	1,171	55	4.673%	52.7	4.500%
19	1,126	56	4.935%	47.9	4.250%
20	1,089	44	4.018%	43.6	4.000%
21	1,032	46	4.492%	41.3	4.000%
22	933	22	2.375%	37.3	4.000%
23	808	26	3.182%	32.3	4.000%
24	647	20	3.036%	25.9	4.000%
25	492	15	3.022%	19.7	4.000%
	36,709	3,046	8.297%	2,809.3	7.653%



Rate Actives Terminate Employment

TRF Males

Data Summary B – 28

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Proposed Expected	Proposed Rate
1	178	23	12.999%	23.2	13.000%
2	394	42	10.774%	43.3	11.000%
3	549	50	9.167%	49.4	9.000%
4	683	49	7.245%	54.6	8.000%
5	803	64	7.943%	56.2	7.000%
6	937	57	6.137%	56.2	6.000%
7	1,084	53	4.908%	54.2	5.000%
8	1,298	55	4.258%	58.4	4.500%
9	1,534	67	4.385%	61.4	4.000%
10	1,796	82	4.579%	67.4	3.750%
11	1,991	81	4.061%	69.7	3.500%
12	2,146	82	3.837%	69.7	3.250%
13	2,328	72	3.105%	69.8	3.000%
14	2,194	79	3.609%	60.3	2.750%
15	2,333	67	2.890%	58.3	2.500%
16	2,465	78	3.157%	55.5	2.250%
17	2,577	85	3.313%	58.0	2.250%
18	2,589	76	2.937%	58.2	2.250%
19	2,613	65	2.484%	58.8	2.250%
20	2,435	42	1.745%	54.8	2.250%
21	2,365	73	3.087%	53.2	2.250%
22	2,121	45	2.108%	47.7	2.250%
23	1,699	30	1.770%	38.2	2.250%
24	1,308	24	1.821%	29.4	2.250%
25	763	9	1.243%	17.2	2.250%
	41,182	1,454	3.532%	1,323.2	3.213%



Rate Actives Terminate Employment

TRF Females

Data Summary B – 29

Indiana Public Retirement System
2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Proposed Expected	Proposed Rate
1	497	55	11.064%	57.2	11.500%
2	1,122	118	10.534%	117.8	10.500%
3	1,588	140	8.797%	150.8	9.500%
4	1,930	149	7.703%	164.1	8.500%
5	2,196	163	7.440%	164.7	7.500%
6	2,498	164	6.576%	162.4	6.500%
7	2,879	150	5.212%	158.4	5.500%
8	3,463	171	4.946%	173.2	5.000%
9	4,137	197	4.765%	186.2	4.500%
10	4,873	224	4.589%	194.9	4.000%
11	5,332	204	3.832%	186.6	3.500%
12	5,687	207	3.647%	184.8	3.250%
13	6,117	206	3.366%	183.5	3.000%
14	4,990	153	3.068%	137.2	2.750%
15	5,136	121	2.361%	128.4	2.500%
16	5,354	120	2.232%	120.5	2.250%
17	5,400	122	2.259%	121.5	2.250%
18	5,437	110	2.027%	122.3	2.250%
19	5,229	111	2.131%	117.6	2.250%
20	4,915	96	1.951%	110.6	2.250%
21	4,443	78	1.750%	100.0	2.250%
22	3,987	51	1.281%	89.7	2.250%
23	3,264	52	1.578%	73.4	2.250%
24	2,553	47	1.828%	57.4	2.250%
25	1,651	23	1.400%	37.1	2.250%
	94,680	3,233	3.414%	3,300.4	3.486%



Rate Actives Terminate Employment

'77 FUND

Data Summary B – 30

Indiana Public Retirement System
2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	170	7	4.005%	8.5	5.000%	8.5	5.000%
2	285	8	2.791%	11.4	4.000%	11.4	4.000%
3	370	14	3.665%	13.0	3.500%	13.0	3.500%
4	399	14	3.578%	14.0	3.500%	14.0	3.500%
5	458	14	3.143%	11.5	2.500%	11.5	2.500%
6	618	19	3.008%	12.4	2.000%	12.4	2.000%
7	890	21	2.357%	17.8	2.000%	17.8	2.000%
8	1,118	23	2.096%	22.4	2.000%	22.4	2.000%
9	1,296	24	1.855%	19.4	1.500%	19.4	1.500%
10	1,485	25	1.690%	22.3	1.500%	22.3	1.500%
11	1,577	24	1.546%	23.7	1.500%	23.7	1.500%
12	1,616	20	1.233%	16.2	1.000%	16.2	1.000%
13	1,714	11	0.655%	17.1	1.000%	17.1	1.000%
14	2,050	20	0.996%	20.5	1.000%	20.5	1.000%
15	2,320	19	0.835%	23.2	1.000%	23.2	1.000%
16	2,405	17	0.693%	24.1	1.000%	24.1	1.000%
17	2,753	18	0.643%	27.5	1.000%	27.5	1.000%
18	2,796	12	0.432%	28.0	1.000%	28.0	1.000%
19	1,930	51	2.661%	19.3	1.000%	19.3	1.000%
20	1,739	93	5.348%	34.8	2.000%	34.8	2.000%
21	1,287	43	3.334%	25.7	2.000%	25.7	2.000%
22	979	26	2.694%	19.6	2.000%	19.6	2.000%
23	738	22	2.959%	14.8	2.000%	14.8	2.000%
24	580	15	2.544%	11.6	2.000%	11.6	2.000%
25	370	6	1.545%	7.4	2.000%	7.4	2.000%
	31,944	567	1.775%	465.9	1.458%	465.9	1.458%



Rate Actives Terminate Employment

JRS

Data Summary B – 31

Indiana Public Retirement System

2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	18	0	2.452%	0.5	3.000%	0.5	3.000%
2	32	0	1.024%	1.0	3.000%	1.0	3.000%
3	61	1	1.062%	1.8	3.000%	1.8	3.000%
4	53	0	0.826%	1.6	3.000%	1.6	3.000%
5	84	6	6.920%	2.5	3.000%	2.5	3.000%
6	81	-	0.000%	2.4	3.000%	2.4	3.000%
7	78	-	0.000%	2.3	3.000%	2.3	3.000%
8	61	1	1.796%	1.8	3.000%	1.8	3.000%
9	82	-	0.000%	2.5	3.000%	2.5	3.000%
10	67	3	3.940%	2.0	3.000%	2.0	3.000%
11	87	3	3.171%	2.6	3.000%	2.6	3.000%
12	61	2	2.708%	1.8	3.000%	1.8	3.000%
13	85	2	2.087%	2.6	3.000%	2.6	3.000%
14	70	3	4.870%	2.1	3.000%	2.1	3.000%
15	75	2	2.743%	2.2	3.000%	2.2	3.000%
16	58	-	0.000%	1.7	3.000%	1.7	3.000%
17	77	7	8.966%	2.3	3.000%	2.3	3.000%
18	30	-	0.000%	0.9	3.000%	0.9	3.000%
19	59	-	0.000%	1.8	3.000%	1.8	3.000%
20	44	-	0.000%	1.3	3.000%	1.3	3.000%
21	57	-	0.000%	1.7	3.000%	1.7	3.000%
22	31	7	22.641%	0.9	3.000%	0.9	3.000%
23	10	-	0.000%	0.3	3.000%	0.3	3.000%
24	-	-	0.000%	-	3.000%	-	3.000%
25	-	-	0.000%	-	3.000%	-	3.000%
	1,362	37	2.719%	40.9	3.000%	40.9	3.000%



Rate Actives Terminate Employment

PARF

Data Summary B – 32

Indiana Public Retirement System
2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	7	1	13.088%	0.7	10.000%	0.7	10.000%
2	11	1	11.755%	1.1	10.000%	1.1	10.000%
3	26	5	17.326%	2.6	10.000%	2.6	10.000%
4	19	2	8.771%	1.9	10.000%	1.9	10.000%
5	24	3	10.890%	2.4	10.000%	2.4	10.000%
6	28	0	1.482%	2.8	10.000%	2.8	10.000%
7	42	4	9.205%	4.2	10.000%	4.2	10.000%
8	37	2	5.724%	3.7	10.000%	3.7	10.000%
9	43	1	2.769%	4.3	10.000%	4.3	10.000%
10	41	8	19.604%	4.1	10.000%	4.1	10.000%
11	57	10	18.538%	5.7	10.000%	5.7	10.000%
12	36	1	2.127%	3.6	10.000%	3.6	10.000%
13	40	5	12.317%	4.0	10.000%	4.0	10.000%
14	42	7	16.433%	4.2	10.000%	4.2	10.000%
15	58	11	18.678%	5.8	10.000%	5.8	10.000%
16	44	4	9.261%	4.4	10.000%	4.4	10.000%
17	43	9	21.890%	4.3	10.000%	4.3	10.000%
18	36	6	17.605%	3.6	10.000%	3.6	10.000%
19	44	5	12.541%	4.4	10.000%	4.4	10.000%
20	27	-	0.000%	2.7	10.000%	2.7	10.000%
21	21	2	7.872%	2.1	10.000%	2.1	10.000%
22	25	4	16.739%	2.5	10.000%	2.5	10.000%
23	12	3	23.084%	1.2	10.000%	1.2	10.000%
24	3	-	0.000%	0.3	10.000%	0.3	10.000%
25	-	-	0.000%	-	10.000%	-	10.000%
	766	95	12.338%	76.6	10.000%	76.6	10.000%



Rate Actives Terminate Employment

EG&C

Data Summary B – 33

Indiana Public Retirement System
2014-2019 Experience (Weighted)

Duration	Exposure	Actual Terminations	Actual Rate	Current Expected	Current Rate	Proposed Expected	Proposed Rate
1	6	0	6.669%	0.6	10.000%	0.6	10.000%
2	12	1	5.897%	1.1	9.000%	1.1	9.000%
3	17	0	2.457%	1.3	8.000%	1.3	8.000%
4	20	2	8.252%	1.4	7.000%	1.4	7.000%
5	26	0	1.229%	1.5	6.000%	1.5	6.000%
6	37	3	6.769%	1.9	5.000%	1.9	5.000%
7	49	1	2.045%	1.9	4.000%	1.9	4.000%
8	79	2	2.407%	2.4	3.000%	2.4	3.000%
9	82	3	3.746%	1.6	2.000%	1.6	2.000%
10	100	1	0.667%	1.0	1.000%	1.0	1.000%
11	94	1	0.600%	0.9	1.000%	0.9	1.000%
12	69	1	1.183%	0.7	1.000%	0.7	1.000%
13	34	-	0.000%	0.3	1.000%	0.3	1.000%
14	26	-	0.000%	0.3	1.000%	0.3	1.000%
15	21	2	8.848%	0.2	1.000%	0.2	1.000%
16	20	-	0.000%	0.2	1.000%	0.2	1.000%
17	20	1	5.953%	0.2	1.000%	0.2	1.000%
18	14	-	0.000%	0.1	1.000%	0.1	1.000%
19	14	-	0.000%	0.1	1.000%	0.1	1.000%
20	5	-	0.000%	0.1	1.000%	0.1	1.000%
21	2	-	0.000%	0.0	1.000%	0.0	1.000%
22	-	-	0.000%	-	1.000%	-	1.000%
23	-	-	0.000%	-	1.000%	-	1.000%
24	-	-	0.000%	-	1.000%	-	1.000%
25	-	-	0.000%	-	1.000%	-	1.000%
	744	17	2.289%	17.9	2.407%	17.9	2.407%



Exhibit C-1: PERF

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. Effective June 30, 2018, the bases are calculated without regards to the COLA provisions. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. COLA Surcharge

The COLA Surcharge is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur.

3. Asset Valuation Method

Actuarial Value of Assets is equal to a five-year smoothing of gains and losses on the Market Value of Assets subject to a 20% corridor.



4. Anticipated Payroll

The Anticipated Payroll for the fiscal year beginning July 1, year (x+1) is equal to the actual payroll during the year ending June 30, year (x+1), increased with one year of salary scale.

5. Employer Contribution Rates

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed for each employer. The Board considers this information, but has ultimate authority in setting the employer contribution rates.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)

2. Inflation 2.25% per year

3. Salary increase

Age	Inflation	Productivity, Merit, and Promotion	Total Salary Growth
<31	2.25%	2.00%	4.25%
31-45	2.25%	1.50%	3.75%
46-55	2.25%	1.00%	3.25%
56-60	2.25%	0.50%	2.75%
>=61	2.25%	0.25%	2.50%

4. Cost-of-Living Adjustment (COLA) In lieu of a COLA on January 1, 2020 and January 1, 2021, members in pay were provided a 13th check on October 1, 2019 and October 1, 2020. Thereafter, the following COLAs, compounded annually, were assumed:

0.4% beginning on January 1, 2022

0.5% beginning on January 1, 2034

0.6% beginning on January 1, 2039

Demographic Assumptions

1. Mortality The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

a. Healthy mortality RP-2014 (with MP-2014 improvement removed) Total Data Set Mortality Tables projected on a fully generational basis using the future mortality improvement scale inherent in the mortality projection included in the Social Security Administration's 2014 Trustee Report.

b. Disabled mortality RP-2014 (with MP-2014 improvement removed) Disability Mortality Tables projected on a fully generational basis using the future mortality improvement scale inherent in the mortality projection included in the Social Security Administration's 2014 Trustee Report.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

2. Disability

Attained Age	Sample Rates	
	Male	Female
20	0.0067%	0.0050%
30	0.0208%	0.0158%
40	0.0646%	0.0496%
50	0.2005%	0.1556%
60	0.5815%	0.3751%
70	0.1000%	0.1000%
80	0.0000%	0.0010%

3. Retirement

Age	Service						
	10-14	15-25	26	27	28	29	30+
50-54	-	4%	4%	4%	4%	4%	4%
55	-	5%	5%	5%	5%	5%	14%
56	-	5%	5%	5%	5%	14%	10%
57	-	5%	5%	5%	14%	10%	10%
58	-	5%	5%	14%	10%	10%	10%
59	-	5%	14%	10%	10%	10%	10%
60	-	12%	12%	12%	12%	12%	12%
61	-	16%	16%	16%	16%	16%	16%
62	-	22%	22%	22%	22%	22%	22%
63	-	19%	19%	19%	19%	19%	19%
64	-	24%	24%	24%	24%	24%	24%
65-74	30%	30%	30%	30%	30%	30%	30%
75+	100%	100%	100%	100%	100%	100%	100%

4. Termination

Earnings < \$20,000

Age	State	
	Male	Female
20-24	32%	34%
25-29	32%	33%
30-34	32%	30%
35-39	29%	30%
40-44	29%	24%
45-49	26%	24%
50-54	25%	22%
55-59	22%	20%
60+	22%	20%

Age	Political Subdivision	
	Male	Female
20-24	31%	36%
25-29	31%	34%
30-34	26%	25%
35-39	22%	18%
40-44	21%	15%
45-49	18%	12%
50-54	14%	11%
55-59	14%	11%
60+	14%	11%



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

State (Male)
Earnings >= \$20,000

Age	Service										
	0	1	2	3	4	5	6	7	8	9	10+
20-24	23%	23%	23%	20%	20%	17%	17%	12%	12%	7%	7%
25-29	23%	23%	23%	19%	17%	17%	17%	12%	12%	7%	7%
30-34	22%	22%	19%	18%	16%	13%	13%	12%	7%	7%	7%
35-39	17%	17%	17%	17%	16%	10%	10%	9%	7%	6%	6%
40-44	17%	17%	14%	12%	12%	10%	9%	9%	7%	5%	5%
45-49	14%	14%	14%	10%	10%	10%	9%	7%	4%	4%	4%
50-54	14%	14%	9%	9%	9%	9%	9%	7%	4%	4%	4%
55-59	13%	13%	7%	7%	7%	7%	7%	7%	4%	4%	4%
60+	13%	13%	7%	7%	7%	7%	7%	7%	4%	4%	4%

State (Female)
Earnings >= \$20,000

Age	Service										
	0	1	2	3	4	5	6	7	8	9	10+
20-24	23%	23%	23%	23%	17%	17%	13%	12%	11%	8%	8%
25-29	23%	23%	22%	21%	17%	17%	13%	12%	11%	8%	8%
30-34	21%	21%	21%	17%	15%	14%	12%	12%	11%	8%	8%
35-39	19%	19%	16%	16%	12%	12%	12%	12%	9%	8%	7%
40-44	18%	18%	16%	13%	12%	12%	9%	9%	8%	8%	6%
45-49	16%	16%	16%	13%	10%	10%	9%	9%	8%	8%	6%
50-54	16%	16%	15%	12%	10%	9%	9%	9%	6%	6%	6%
55-59	16%	16%	11%	11%	10%	9%	9%	9%	6%	6%	6%
60+	16%	16%	11%	11%	10%	9%	9%	9%	6%	6%	6%

Political Subdivisions (Male)
Earnings >= \$20,000

Age	Service										
	0	1	2	3	4	5	6	7	8	9	10+
20-24	18%	18%	18%	18%	14%	12%	11%	11%	7%	7%	5%
25-29	18%	18%	18%	16%	14%	12%	11%	11%	7%	7%	5%
30-34	16%	16%	16%	15%	13%	11%	11%	11%	7%	7%	5%
35-39	15%	15%	12%	12%	12%	10%	9%	9%	7%	7%	5%
40-44	13%	13%	11%	11%	10%	10%	9%	9%	7%	7%	4%
45-49	11%	11%	11%	11%	9%	7%	7%	7%	7%	7%	4%
50-54	11%	11%	9%	9%	9%	7%	7%	6%	6%	4%	4%
55-59	11%	11%	7%	7%	7%	7%	7%	5%	5%	4%	4%
60+	8%	8%	7%	7%	7%	7%	7%	5%	5%	4%	4%



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

Political Subdivisions (Female)
Earnings >= \$20,000

Age	Service										
	0	1	2	3	4	5	6	7	8	9	10+
20-24	22%	22%	19%	16%	14%	14%	11%	11%	9%	7%	7%
25-29	21%	21%	18%	16%	14%	14%	11%	11%	9%	7%	7%
30-34	16%	16%	16%	14%	14%	14%	11%	11%	9%	7%	7%
35-39	14%	14%	14%	12%	12%	12%	9%	9%	9%	7%	6%
40-44	13%	13%	12%	11%	10%	8%	8%	8%	8%	7%	4%
45-49	12%	12%	12%	10%	8%	8%	8%	7%	6%	6%	4%
50-54	11%	11%	10%	8%	8%	6%	6%	6%	6%	5%	4%
55-59	11%	11%	8%	8%	8%	6%	6%	6%	6%	4%	4%
60+	11%	11%	8%	8%	8%	6%	6%	6%	6%	4%	4%

Other Assumptions

1. Form of payment 100% of members are assumed to elect a single life annuity with a five-year certain period (Option 10).

2. Marital status
 - a. Percent married 75% of male members and 60% of female members are assumed to be married and or to have a dependent beneficiary.

 - b. Spouse’s age Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

3. Pay increase timing Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year.

4. Decrement timing Decrements are assumed to occur at the beginning of the year.

5. Benefit commencement timing
 - Active members If eligible for a reduced early retirement benefit upon termination from employment, 33% commence immediately and 67% defer to earliest unreduced retirement age.

 - If eligible for an unreduced retirement benefit upon termination from employment, 100% commence immediately.

 - Terminated vested members 100% defer to earliest unreduced retirement age. If currently eligible for an unreduced retirement benefit, 100% commence immediately.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

6. Miscellaneous adjustments For active and inactive vested members, a salary load of \$400 was added to approximate the impact on average monthly earnings of unused sick leave accumulated at termination of employment.

Data Adjustments

Actives and inactives with no date of birth are assumed to be the average age of the member population with their respective status. Additionally, payroll for new hires is annualized, and actives missing a salary are assumed to earn the average active salary amount.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit C-2: TRF

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period. However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. COLA Surcharge

The COLA Surcharge is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur.

3. Asset Valuation Method

Actuarial Value of Assets is equal to a five-year smoothing of gains and losses on the Market Value of Assets subject to a 20% corridor.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

4. Anticipated Payroll

The Anticipated Payroll for the fiscal year beginning July 1, year (x+1) is equal to the actual payroll during the year ending June 30, year (x+1), increased with one year of salary scale.

5. Employer Contribution Rates

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed for each employer. The Board considers this information, but has ultimate authority in setting the employer contribution rates.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- 1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)
- 2. Inflation 2.25% per year

3. Salary increase

Sample Rates			
Years of Service	Merit & Seniority	Inflation	Total
1	10.25%	2.25%	12.50%
5	2.75%	2.25%	5.00%
10	2.75%	2.25%	5.00%
15	1.50%	2.25%	3.75%
20	0.25%	2.25%	2.50%
25	0.25%	2.25%	2.50%
30	0.25%	2.25%	2.50%
35	0.25%	2.25%	2.50%
40	0.25%	2.25%	2.50%

- 4. Cost-of-Living Adjustment (COLA) In lieu of a COLA on January 1, 2020 and January 1, 2021, members in pay were provided a 13th check on October 1, 2019 and October 1, 2020. Thereafter, the following COLAs, compounded annually, were assumed:

- 0.4% beginning on January 1, 2022
- 0.5% beginning on January 1, 2034
- 0.6% beginning on January 1, 2039

Demographic Assumptions

- 1. Mortality The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

- a. Healthy mortality RP-2014 (with MP-2014 improvement removed) White Collar Mortality Tables projected on a fully generational basis using the future mortality improvement scale inherent in the mortality projection included in the Social Security Administration's 2014 Trustee Report.

- b. Disabled mortality RP-2014 (with MP-2014 improvement removed) Disability Mortality Tables projected on a fully generational basis using the future mortality improvement scale inherent in the mortality projection included in the Social Security Administration's 2014 Trustee Report.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

2. Disability

Attained Age	Sample Rates
25	0.0001
30	0.0001
35	0.0001
40	0.0001
45	0.0002
50	0.0005
55	0.0009
60	0.0010

3. Retirement

Regular Retirement		Rule of 85 Retirement		Early Retirement	
Age	Probability	Age	Probability	Age	Probability
				50-53	0.020
				54	0.050
		55	0.150	55	0.050
		56	0.150	56	0.050
		57	0.150	57	0.065
		58	0.150	58	0.080
		59	0.200	59	0.120
60	0.200	60	0.200		
61	0.250	61	0.250		
62	0.300	62	0.300		
63	0.350	63	0.350		
64	0.400	64	0.400		
65	0.450	65	0.450		
66	0.450	66	0.450		
67	0.450	67	0.450		
68	0.450	68	0.450		
69	0.450	69	0.450		
70+	1.000	70+	1.000		

Inactive vested members are assumed to commence their retirement benefit at their earliest normal retirement date.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

4. Termination

Years of Service	Service-Based	
	Male	Female
0	0.3500	0.3500
1	0.1400	0.1400
2	0.1100	0.1100
3	0.0900	0.0900
4	0.0800	0.0800
5	0.0700	0.0700
6	0.0600	0.0600
7	0.0500	0.0550
8	0.0450	0.0500
9	0.0450	0.0450

Attained Age	Sample Age-Based*	
	Male	Female
30	0.0225	0.0300
35	0.0225	0.0300
40	0.0225	0.0200
45	0.0225	0.0200
50	0.0225	0.0200
55	0.0225	0.0200
60	0.0225	0.0200

*Age-Based rates apply only if 10 or more years of service.

Other Assumptions

1. Form of payment

100% of members are assumed to elect the normal form of benefit payment (Option A-1), a single life annuity with a five-year certain period.

2. Marital status

a. Percent married

100% of members are assumed to be married for purposes of valuing death-in-service benefits.

b. Spouse's age

Male spouses are assumed to be three years older than female spouses.

3. Pay increase timing

Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year.

4. Decrement timing

Decrements are assumed to occur at the beginning of the year.

5. Miscellaneous adjustments

The Average Annual Compensation was increased by \$400 to account for the inclusion of unused sick leave in the calculation of Average Annual Compensation.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

Data Adjustments

For members reported with no gender, the member is assumed to be female. Additionally, active members missing a salary are assumed to have earned the average salary.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit C-3: '77 Fund

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a closed 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period. However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over an open 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different from assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

3. Employer Contribution Rate

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed. The Board considers this information, but has ultimate authority in setting the employer contribution rate.

4. Anticipated Payroll

The anticipated payroll for the fiscal year following the valuation date is equal to the actual payroll during the year ending on the valuation date, increased with one year of salary scale.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- | | |
|-------------------------------------|--|
| 1. Investment return | 6.75% per year, compounded annually (net of administrative and investment expenses) |
| 2. Inflation | 2.25% per year |
| 3. Salary increase | 2.50% per year |
| 4. Interest on member balances | 3.50% per year |
| 5. Cost-of-Living Adjustment (COLA) | 2.0% compounded annually, beginning July 1, 2020. Actual COLA increases at July 1, 2018 (2.2%) and July 1, 2019 (1.6%) are reflected in the valuation. For benefits paid under the 2017 House Enrolled Act No. 1617, the annual cost-of-living assumption is 2.5%, which is the same as the salary increase assumption for active members. |

Demographic Assumptions

- | | |
|-----------------------|--|
| 1. Mortality | The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement. |
| a. Healthy mortality | RP-2014 (with MP-2014 improvement removed) Blue Collar mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report. |
| b. Disabled mortality | RP-2014 (with MP-2014 improvement removed) Disability mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report. |

2. Disability

Attained Age	Sample Rates
<=30	0.10%
35	0.16%
40	0.26%
45	0.36%
50	0.46%
55	0.56%
60	0.66%
62+	0.70%



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

3. Retirement

Attained Age	Service <32	Service ≥32
50-57	10%	20%
58-61	15%	20%
62-64	20%	20%
65-69	50%	50%
70+	100%	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date (age 50, or current age if greater).

4. Termination

Years of Service	Rate
0	10.0%
1	5.0%
2	4.0%
3-4	3.5%
5	2.5%
6-8	2.0%
9-11	1.5%
12-19	1.0%
20+	2.0%

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 70% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

80% of male members and 50% of female members are assumed to be married or to have a dependent beneficiary.

b. Spouse's age

Male members are assumed to be three (3) years older than females and female members are assumed to be the same age as males.

3. Pay increase timing

Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year.

4. Decrement timing

Decrements are assumed to occur at the beginning of the year.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

5. Active members in DROP Members who are participating in the DROP are assumed to receive an annuity benefit commencing at the end of their DROP period as well as a lump sum payment equal to the number of years they were in the DROP times their annual annuity benefit. The annuity benefit is estimated based on salary and service at the time the member entered the DROP.
6. Pre-retirement death Of active member deaths, 10% are assumed to be in the line of duty and 90% are other than in the line of duty.
7. Disability retirement For members hired after 1989 that become disabled, 1% are assumed to sustain a catastrophic disability and receive the enhanced disability benefit (100% of salary) added by 2017 House Enrolled Act No. 1617, 44% are assumed to sustain a Class 1 disability (at 65% of salary), 10% are assumed to sustain a Class 2 disability (at 50% of salary), and 45% are assumed to sustain a Class 3 disability (at 36% of salary). For members hired before 1989 that become disabled, 1% are assumed to sustain a catastrophic disability and receive the enhanced disability benefit (100% of salary) added by 2017 House Enrolled Act No. 1617 and 99% are assumed to sustain a non-catastrophic disability and receive their accrued retirement benefit.

TECHNICAL VALUATION PROCEDURES

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit C-4: Judges

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different from assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

3. State Appropriations

Based on the assumptions and methods previously described, an actuarially determined contribution amount is computed. The Board considers this information when requesting funds from the State.



4. Anticipated Payroll

The anticipated payroll for the fiscal year following the valuation date is equal to the actual payroll during the year ending on the valuation date, increased with the actual pay adjustment as of the valuation date. The proportion of pay attributable to active members with more than 22 years of service is presumed constant.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- | | |
|-------------------------------------|---|
| 1. Investment return | 6.75% per year, compounded annually (net of administrative and investment expenses) |
| 2. Inflation | 2.25% per year |
| 3. Salary increase | 2.50% per year beginning July 1, 2020. Actual salary increases on July 1, 2018 (2.1%) and July 1, 2019 (2.7%) are reflected in the in the liability valuation at June 30, 2018. |
| 4. Interest on member balances | 3.50% per year |
| 5. Cost-of-Living Adjustment (COLA) | 2.5% compounded annually, beginning July 1, 2020. Actual COLA increases at July 1, 2018 (2.1%) and July 1, 2019 (2.7%) are reflected in the valuation. |

Demographic Assumptions

- | | |
|-----------------------|---|
| 1. Mortality | The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement. |
| a. Healthy mortality | RP-2014 (with MP-2014 improvement removed) White Collar mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report. |
| b. Disabled mortality | RP-2014 (with MP-2014 improvement removed) Disability mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report. |



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

2. Disability

Age	Sample Rates
20	0.060%
25	0.085%
30	0.110%
35	0.147%
40	0.220%
45	0.360%
50	0.606%
55	1.009%
60	1.627%
65+	0.000%

3. Retirement

Age	Service <22	Age	Service >=22
62	25%	55-74	70%
63	15%	75+	100%
64	10%		
65	50%		
66-74	30%		
75+	100%		

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date.

4. Termination

3% per year for all members prior to retirement eligibility.

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

90% of members are assumed to be married or to have a dependent beneficiary.

b. Spouse's age

Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

3. Pay increase timing

Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year.

4. Decrement timing

Decrements are assumed to occur at the beginning of the year.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit C-5: PARF

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

3. Anticipated Payroll

The anticipated payroll for the fiscal year following the valuation date is equal to the actual payroll during the year ending on the valuation date, increased with the actual pay adjustment as of the valuation date. The proportion of pay attributable to active members with more than 22 years of service is presumed constant.

4. Employer Contribution Rate

Based on the assumptions and methods previously described, an actuarially determined contribution amount is computed for each employer. The Board considers this information when requesting funds from the State.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- 1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)
- 2. Inflation 2.25% per year
- 3. Salary increase 4.00% per year
- 4. Interest on member balances 3.50% per year
- 5. Cost-of-Living Adjustment (COLA) None

Demographic Assumptions

- 1. Mortality
 - The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.
 - a. Healthy mortality RP-2014 (with MP-2014 improvement removed) White Collar mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report.
 - b. Disabled mortality RP-2014 (with MP-2014 improvement removed) Disability mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report.

2. Disability

Attained Age	Sample Rates	
	Male	Female
20	0.0067%	0.0050%
30	0.0208%	0.0158%
40	0.0646%	0.0496%
50	0.2005%	0.1556%
60	0.6220%	0.4881%
70	0.1000%	0.1000%
71+	0.0000%	0.0000%



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

3. Retirement

Age	Service <22	Age	Service >=22
62-64	20%	55-64	70%
65+	100%	65+	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest unreduced eligible retirement date (age 62, or current age if greater).

4. Termination

10% per year for all members prior to retirement eligibility.

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

90% of participants are assumed either to be married or to have a dependent beneficiary.

b. Spouse's age

Males are assumed to be three (3) years older than their spouses.

3. Pay increase timing

Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year.

4. Decrement timing

Decrements are assumed to occur at the beginning of the year.

5. PERF benefit commencement timing

For active and inactive vested members, 75% are assumed to commence their benefit at earliest PERF eligibility and 25% are assumed to commence at the assumed PARF commencement.

Elected officials can commence their PERF benefit while active in PARF. Non-elected officials need to terminate their employment prior to commence their PERF benefit.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

Data Adjustments

Spouse gender is assumed to be the opposite gender of the member. Additionally, payroll for new hires is annualized.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit C-6: EG&C

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants (active and inactive). Gains and losses occurring from investment experience different from assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. COLA Surcharge

The COLA Surcharge is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur.

3. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

4. Anticipated Payroll

The Anticipated Payroll for the fiscal year beginning July 1, year (x+1) is equal to the actual payroll during the year ending June 30, year (x+1), increased with one year of salary scale.

5. Employer Contribution Rate

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed. The Board considers this information, but has ultimate authority in setting the employer contribution rate.



ACTUARIAL ASSUMPTIONS

Economic Assumptions

- | | |
|-------------------------------------|---|
| 1. Investment return | 6.75% per year, compounded annually (net of administrative and investment expenses) |
| 2. Inflation | 2.25% per year |
| 3. Salary increase | 2.50% per year |
| 4. Interest on member balances | 3.50% per year |
| 5. Cost-of-Living Adjustment (COLA) | In lieu of a COLA on January 1, 2020 and January 1, 2021, members in pay are provided a 13 th check on October 1, 2019 and October 1, 2020. Thereafter, the following COLAs, compounded annually, were assumed:
0.4% beginning on January 1, 2022
0.5% beginning on January 1, 2034
0.6% beginning on January 1, 2039 |

Demographic Assumptions

- | | |
|-----------------------|--|
| 1. Mortality | The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement. |
| a. Healthy mortality | RP-2014 (with MP-2014 improvement removed) Blue Collar mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report. |
| b. Disabled mortality | RP-2014 (with MP-2014 improvement removed) Disability mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report. |



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

2. Disability

Age	Sample Rates
20	0.0900%
25	0.1275%
30	0.1650%
35	0.2205%
40	0.3300%
45	0.5400%
50	0.9090%
55	1.5135%
60	2.4405%
65+	0.0000%

Active members who become disabled are assumed to receive 20% of their salary if they have less than 5 years of service and 40% of their salary if they have 5 or more years of service.

3. Retirement

Age	Rate
<=44	0%
45	3%
46-49	2%
50	3%
51-59	15%
60-64	40%
65+	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date (age 45, or current age if greater).

4. Termination

Years of Service	Rate
0-1	10%
2	9%
3	8%
4	7%
5	6%
6	5%
7	4%
8	3%
9	2%
10+	1%



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

Other Assumptions

- | | |
|---------------------------|---|
| 1. Form of payment | Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below. |
| 2. Marital status | |
| a. Percent married | 90% of members are assumed to be married or to have a dependent beneficiary. |
| b. Spouse's age | Males are assumed to be three (3) years older than females. |
| 3. Pay increase timing | Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year. |
| 4. Decrement timing | Decrements are assumed to occur at the beginning of the year. |
| 5. Active members in DROP | Members who are participating in the DROP are assumed to receive an annuity benefit commencing at the end of their DROP period as well as a lump sum payment equal to the number of years they were in the DROP times their annual annuity benefit. The annuity benefit is estimated based on salary and service at the time the member entered the DROP. |

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit C-7: LE DB

ACTUARIAL METHODS

1. Actuarial Cost Method

Funding:

The actuarial cost method is Traditional Unit Credit.

The normal cost is calculated separately for each active member and is equal to actuarial present value of additional benefits expected to be accrued during the year following the valuation date. The actuarial accrued liability on any valuation date is the actuarial present value of the benefits earned for service prior to the valuation date. Since the benefits for all members of the Legislator's Defined Benefit Plan are fixed and no longer increasing with future service credit or future salary increases, applying the Traditional Unit Credit cost method results in the Actuarial Accrued Liability being equal to the Present Value of Future Benefits (i.e. all benefits are treated as though they are attributable to past service) and the Normal Cost being equal to \$0. This is consistent with the actual status of member benefit accruals.

Gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 5-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 5-year period. However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

Accounting:

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

Gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants (active and inactive). Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.



2. COLA Funding Amount

The COLA may be funded by either direct State appropriations or by allocation of a portion of the lottery proceeds. For consistency with other funds should annual lottery amounts be determined to be desirable, a funding amount is developed. The COLA Funding Amount is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium.

3. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

4. State Appropriations

Based on the assumptions and methods previously described, an actuarially determined contribution amount is computed. The Board considers this information when requesting funds from the State.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- 1. Investment return 6.75% per year, compounded annually
- 2. Inflation 2.25% per year
- 3. Salary increase 2.25% per year
- 4. Cost-of-Living Adjustment (COLA) No COLA has been granted through Fiscal Year 2022, which is reflected.

Thereafter, the following COLAs, compounded annually, were assumed:
 - 0.4% beginning on January 1, 2022
 - 0.5% beginning on January 1, 2034
 - 0.6% beginning on January 1, 2039.

Demographic Assumptions

- 1. Mortality
 - The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.
 - a. Healthy mortality RP-2014 (with MP-2014 improvement removed) White Collar mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report.
 - b. Disabled mortality RP-2014 (with MP-2014 improvement removed) Disability mortality tables, with future mortality improvement projected generationally using future mortality improvement inherent in the Social Security Administration's 2014 Trustee report.

2. Disability

Age	Sample Rates
20	0.045%
25	0.064%
30	0.083%
35	0.111%
40	0.165%
45	0.270%
50	0.454%
55	0.757%
60	1.220%
65+	0.000%



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

3. Retirement

Age	Rate
55	10%
56-57	8%
58-61	2%
62-64	5%
65+	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date (age 55, or current age if greater).

4. Termination

Age	Sample Rates
20	5.4384%
25	5.2917%
30	5.0672%
35	4.6984%
40	3.5035%
45	1.7686%
50	0.4048%
55+	0.0000%

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

90% of members are assumed to be married or to have a dependent beneficiary.

b. Spouse's age

Male members are assumed to be three (3) years older than females.

3. Pay increase timing

Beginning of (fiscal) year. Payroll amounts stated in the valuation data are amounts projected to be paid during the current year.

4. Decrement timing

Decrements are assumed to occur at the beginning of the year.

5. Administrative expense

Replacement basis. Administrative expenses incurred during the year prior to the valuation date are included in the calculation of funds to be appropriated to the LE DB Fund by the State.



APPENDIX C – CURRENT ACTUARIAL ASSUMPTIONS AND METHODS

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur at the beginning of the year. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit D-1: PERF

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. Effective June 30, 2018, the bases are calculated without regards to the COLA provisions. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. COLA Surcharge

The COLA Surcharge is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur.

3. Asset Valuation Method

Actuarial Value of Assets is equal to a five-year smoothing of gains and losses on the Market Value of Assets subject to a 20% corridor.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

4. Anticipated Payroll

The Anticipated Payroll for the fiscal year beginning July 1, year (x+1) is equal to the actual payroll during the year ending June 30, year (x+1), increased with one year of salary scale.

5. Employer Contribution Rates

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed. The Board considers this information, but has ultimate authority in setting the employer contribution rates.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)

2. Inflation 2.25% per year

3. Salary increase

Service	Wage Inflation	Merit	Salary Increase
0	2.75%	6.00%	8.75%
1	2.75%	5.00%	7.75%
2	2.75%	4.00%	6.75%
3	2.75%	3.00%	5.75%
4	2.75%	2.50%	5.25%
5	2.75%	2.00%	4.75%
6	2.75%	1.75%	4.50%
7	2.75%	1.50%	4.25%
8	2.75%	1.25%	4.00%
9	2.75%	1.00%	3.75%
10	2.75%	0.75%	3.50%
11	2.75%	0.50%	3.25%
12	2.75%	0.25%	3.00%
13+	2.75%	0.00%	2.75%

4. Cost-of-Living Adjustment (COLA) In lieu of a COLA on January 1, 2020 and January 1, 2021, members in pay were provided a 13th check on October 1, 2019 and October 1, 2020. Thereafter, the following COLAs, compounded annually, were assumed:

0.4% beginning on January 1, 2022

0.5% beginning on January 1, 2034

0.6% beginning on January 1, 2039



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

Demographic Assumptions

1. Mortality

Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.

Healthy Employees – General Employee table with a 3 year set forward for males and a 1 year set forward for females.

Retirees – General Retiree table with a 3 year set forward for males and a 1 year set forward for females.

Beneficiaries – Contingent Survivor table with no set forward for males and a 2 year set forward for females.

Disableds – General Disabled table with a 140% load.

2. Disability

Sample Rates		
Age	Male	Female
20	0.004%	0.003%
25	0.008%	0.006%
30	0.014%	0.010%
35	0.024%	0.018%
40	0.042%	0.032%
45	0.080%	0.061%
50	0.160%	0.124%
55+	0.300%	0.200%

3. Retirement

Age	Eligible for Reduced Benefit	Eligible for Unreduced Benefit
50-54	4%	N/A
55	5%	14%
56-59	5%	10%
60	N/A	12%
61	N/A	16%
62	N/A	22%
63	N/A	19%
64	N/A	24%
65-74	N/A	30%
75+	N/A	100%

Active members: 30% commence benefit immediately (reduced for early retirement, if applicable). 70% defer to earliest unreduced retirement date.

Inactive vested members are assumed to commence their retirement benefit at their earliest normal retirement date.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

4. Termination

Service	State	PSD, Salary >\$20K
	Unisex	Unisex
0	24.00%	18.00%
1	20.00%	16.00%
2	18.00%	14.00%
3	16.00%	12.00%
4	14.00%	10.00%
5	12.00%	8.00%
6	11.00%	7.50%
7	10.00%	7.00%
8	9.00%	6.50%
9	8.00%	6.50%
10	7.00%	6.50%
11	6.50%	6.25%
12	6.00%	6.00%
13	5.75%	5.75%
14	5.50%	5.50%
15	5.25%	5.25%
16	5.00%	5.00%
17	4.75%	4.75%
18	4.50%	4.50%
19	4.25%	4.25%
20	4.00%	4.00%
21	4.00%	3.75%
22	4.00%	3.50%
23	4.00%	3.25%
24	4.00%	3.00%
25	4.00%	3.00%
26	4.00%	3.00%
27+	1.00%	3.00%

Age	PSD, Salary <\$20k	
	Male	Female
15-22	34.00%	40.00%
23	34.00%	38.00%
24	34.00%	36.00%
25	34.00%	34.00%
26	34.00%	32.00%
27	34.00%	30.00%
28	34.00%	29.00%
29	34.00%	28.00%
30	29.00%	27.00%
31	29.00%	26.00%
32	29.00%	25.00%
33	29.00%	24.00%
34	29.00%	23.00%
35	25.00%	22.00%
36	25.00%	21.00%
37	25.00%	20.00%
38	25.00%	19.00%
39	25.00%	18.00%
40	24.00%	17.00%
41	24.00%	16.00%
42	24.00%	15.00%
43	24.00%	14.00%
44	24.00%	13.00%
45-49	21.00%	12.00%
50-60	17.00%	12.00%
61+	14.00%	12.00%



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

Other Assumptions

1. Form of payment
100% of members are assumed to elect the normal form of benefit payment, a single life annuity with a five-year certain period.

2. Marital status
 - a. Percent married
80% of male members and 65% of female members are assumed to be married and or to have a dependent beneficiary.

 - b. Spouse's age
Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

3. Decrement timing
Decrements are assumed to occur at the beginning of the year.

4. Miscellaneous adjustments
For active members, the Average Annual Compensation was increased by \$200 for additional wages received upon termination, such as severance or unused sick leave.

Data Adjustments

Actives and inactives with no date of birth are assumed to be the average age of the member population with their respective status. Additionally, payroll for new hires is annualized, and actives missing a salary are assumed to earn the average active salary amount.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts. No actuarial liability is included for participants who terminated without being vested prior to the valuation date.



Exhibit D-2: TRF

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period. However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. COLA Surcharge

The COLA Surcharge is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur.

3. Asset Valuation Method

Actuarial Value of Assets is equal to a five-year smoothing of gains and losses on the Market Value of Assets subject to a 20% corridor.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

4. Anticipated Payroll

The Anticipated Payroll for the fiscal year beginning July 1, year (x+1) is equal to the actual payroll during the year ending June 30, year (x+1), increased with one year of salary scale.

5. Employer Contribution Rates

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed. The Board considers this information, but has ultimate authority in setting the employer contribution rates.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)

2. Inflation 2.25% per year

3. Salary increase

Service	Wage Inflation	Merit	Salary Increase
0-1	2.75%	9.25%	12.00%
2	2.75%	4.25%	7.00%
3	2.75%	2.75%	5.50%
4-14	2.75%	1.75%	4.50%
15	2.75%	1.50%	4.25%
16	2.75%	1.25%	4.00%
17	2.75%	1.00%	3.75%
18	2.75%	0.75%	3.50%
19	2.75%	0.50%	3.25%
20	2.75%	0.25%	3.00%
21+	2.75%	0.00%	2.75%

4. Cost-of-Living Adjustment (COLA) In lieu of a COLA on January 1, 2020 and January 1, 2021, members in pay were provided a 13th check on October 1, 2019 and October 1, 2020. Thereafter, the following COLAs, compounded annually, were assumed:

- 0.4% beginning on January 1, 2022
- 0.5% beginning on January 1, 2034
- 0.6% beginning on January 1, 2039

Demographic Assumptions

1. Mortality

Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.

Healthy Employees – Teacher Employee table with a 1 year set forward for males and a 1 year set forward for females.

Retirees – Teacher Retiree table with a 1 year set forward for males and a 1 year set forward for females.

Beneficiaries – Contingent Survivor table with no set forward for males and a 2 year set forward for females.

Disableds – General Disabled table with a 140% load.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

2. Disability

Age	Sample Rates
<=36	0.005%
40	0.009%
45	0.014%
50	0.034%
55	0.061%
56-65	0.070%
65+	0.000%

3. Retirement

Age	Eligible for Reduced Benefit	Eligible for Unreduced Benefit
50-53	2.0%	N/A
54	5.0%	N/A
55-56	5.0%	15%
57	6.5%	15%
58	8.0%	15%
59	12.0%	15%
60	N/A	15%
61	N/A	20%
62	N/A	25%
63	N/A	30%
64	N/A	35%
65-74	N/A	40%
75+	N/A	100%

Active members: 30% commence benefit immediately (reduced for early retirement, if applicable). 70% defer to earliest unreduced retirement date.

Inactive vested members are assumed to commence their retirement benefit at their earliest normal retirement date.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

4. Termination

Service	Male	Female
0	15.00%	12.50%
1	13.00%	11.50%
2	11.00%	10.50%
3	9.00%	9.50%
4	8.00%	8.50%
5	7.00%	7.50%
6	6.00%	6.50%
7	5.00%	5.50%
8	4.50%	5.00%
9	4.00%	4.50%
10	3.75%	4.00%
11	3.50%	3.50%
12	3.25%	3.25%
13	3.00%	3.00%
14	2.75%	2.75%
15	2.50%	2.50%
16+	2.25%	2.25%

Other Assumptions

- 1. Form of payment 100% of members are assumed to elect the normal form of benefit payment (Option A-1), a single life annuity with a five-year certain period.

- 2. Marital status
 - a. Percent married 80% of male members and 75% of female members are assumed to be married and or to have a dependent beneficiary.

 - b. Spouse’s age Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

- 3. Decrement timing Decrements are assumed to occur at the beginning of the year.

- 4. Miscellaneous adjustments For active members, the Average Annual Compensation was increased by \$200 for additional wages received upon termination, such as severance or unused sick leave.

Data Adjustments

Actives and inactives with no date of birth are assumed to be the average age of the member population with their respective status. Additionally, payroll for new hires is annualized, and actives missing a salary are assumed to earn the average active salary amount. For members reported with no gender, the member is assumed to be female.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts. No actuarial liability is included for participants who terminated without being vested prior to the valuation date.



Exhibit D-3: '77 Fund

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a closed 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period. However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over an open 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different from assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

3. Employer Contribution Rate

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed. The Board considers this information, but has ultimate authority in setting the employer contribution rate.

4. Anticipated Payroll

The anticipated payroll for the fiscal year following the valuation date is equal to the actual payroll during the year ending on the valuation date, increased with one year of salary scale.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- 1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)
- 2. Inflation 2.25% per year
- 3. Salary increase 2.75% per year
- 4. Interest on member balances 3.50% per year
- 5. Cost-of-Living Adjustment (COLA) 2.1% compounded annually, beginning July 1, 2020. Actual COLA increases at July 1, 2018 (2.2%) and July 1, 2019 (1.6%) are reflected in the valuation. For benefits paid under the 2017 House Enrolled Act No. 1617, the annual cost-of-living assumption is 2.75%, which is the same as the salary increase assumption for active members.

Demographic Assumptions

- 1. Mortality Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.

Healthy Employees – Safety Employee table with a 3 year set forward for males an no set forward for females.

Retirees – Safety Retiree table with a 3 year set forward for males an no set forward for females.

Beneficiaries – Contingent Survivor table with no set forward for males and a 2 year set forward for females.

Disableds – General Disabled table.

- 2. Disability

Age	Sample Rates
<=30	0.100%
35	0.200%
40	0.300%
45	0.400%
50+	0.500%

Rates for ages 30-50 increase by 0.02% per year.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

3. Retirement

Retirement Rate		Of those who retire:		
Age	Rate	Service	Enter DROP	Commence Immediately
50-51	5.0%	<=20	35%	65%
52-55	15.0%	21	40%	60%
56-58	20.0%	22	45%	55%
59	22.5%	23	50%	50%
60-64	25.0%	24-26	55%	45%
65-69	50.0%	27	60%	40%
75+	100.0%	28	65%	35%
		29+	70%	30%

Active members who elect to enter DROP are assumed be in DROP for a period of 3 years, upon which time they take the full lump sum and commence their annuity benefit.

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date (age 50, or current age if greater).

4. Termination

Service	Rates
0	10.0%
1	5.0%
2	4.0%
3-4	3.5%
5	2.5%
6-8	2.0%
9-11	1.5%
12-19	1.0%
20+	2.0%

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 70% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

80% of male members and 60% of female members are assumed to be married or to have a dependent beneficiary.

b. Spouse’s age

Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

- | | |
|--|--|
| 3. Decrement timing | Decrements are assumed to occur at the beginning of the year. |
| 4. Members in DROP | Members who are participating in the DROP are assumed to receive an annuity benefit commencing at the end of their DROP period, as well as a lump sum payment equal to the number of years they were in the DROP times their annual annuity benefit. |
| 5. Active member death | 20% are assumed to be in the line of duty and 80% are other than in the line of duty. |
| 6. Active member disability retirement | <p>For members hired after 1989 who become disabled:
59% are assumed to be Class 1,
10% are assumed to be Class 2,
30% are assumed to be Class 3, and
1% are assumed to be a catastrophic disability (HEA 1617).</p> <p>The additional monthly amount determined under IC 36-8-8-13.5(f) based on the degree of impairment is assumed to be 17%.</p> <p>For members hired before 1989 who become disabled:
99% are assumed to be a non-catastrophic disability, and
1% are assumed to be a catastrophic disability (HEA 1617).</p> |

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts. No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit D-4: Judges

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different from assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

3. State Appropriations

Based on the assumptions and methods previously described, an actuarially determined contribution amount is computed. The Board considers this information when requesting funds from the State.



4. Anticipated Payroll

The anticipated payroll for the fiscal year following the valuation date is equal to the actual payroll during the year ending on the valuation date, increased with the actual pay adjustment as of the valuation date. The proportion of pay attributable to active members with more than 22 years of service is presumed constant.



ACTUARIAL ASSUMPTIONS

Economic Assumptions

- 1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)
- 2. Inflation 2.25% per year
- 3. Salary increase 2.75% per year beginning July 1, 2020. Actual salary increases on July 1, 2018 (2.1%) and July 1, 2019 (2.7%) are reflected in the in the valuation.
- 4. Interest on member balances 3.50% per year
- 5. Cost-of-Living Adjustment (COLA) 2.75% compounded annually, beginning July 1, 2020. Actual COLA increases at July 1, 2018 (2.1%) and July 1, 2019 (2.7%) are reflected in the valuation.

Demographic Assumptions

- 1. Mortality
 - Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.
 - Healthy Employees* – General Employee table with a 1 year setback for males and a 1 year setback for females.
 - Retirees* – General Retiree table with a 1 year setback for males and a 1 year setback for females.
 - Beneficiaries* – Contingent Survivor table with no set forward for males and a 2 year set forward for females.
 - Disableds* – General Disabled table with a 140% load.

- 2. Disability

Age	Sample Rates
20	0.057%
25	0.081%
30	0.105%
35	0.140%
40	0.210%
44-64	0.300%
65+	0.000%



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

3. Retirement

Age	Eligible for Reduced Benefit	Eligible for Unreduced Benefit
55-61	N/A	20%
62-64	8%	20%
65-74	N/A	30%
75+	N/A	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date.

4. Termination

3% per year for all members prior to retirement eligibility.

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

90% of members are assumed to be married or to have a dependent beneficiary.

b. Spouse's age

Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

3. Decrement timing

Decrements are assumed to occur at the beginning of the year.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts. No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit D-5: PARF

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants. Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

3. Anticipated Payroll

The anticipated payroll for the fiscal year following the valuation date is equal to the actual payroll during the year ending on the valuation date, increased with the actual pay adjustment as of the valuation date. The proportion of pay attributable to active members with more than 22 years of service is presumed constant.

4. Employer Contribution Rate

Based on the assumptions and methods previously described, an actuarially determined contribution amount is computed. The Board considers this information when requesting funds from the State.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- 1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)
- 2. Inflation 2.25% per year
- 3. Salary increase 2.75% per year
- 4. Interest on member balances 3.50% per year
- 5. Cost-of-Living Adjustment (COLA) None

Demographic Assumptions

- 1. Mortality Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.

Healthy Employees – General Employee table with a 1 year setback for males and a 1 year setback for females.

Retirees – General Retiree table with a 1 year setback for males and a 1 year setback for females.

Beneficiaries – Contingent Survivor table with no set forward for males and a 2 year set forward for females.

Disableds – General Disabled table with a 140% load.

- 2. Disability

Sample Rates		
Age	Male	Female
20	0.004%	0.003%
25	0.008%	0.006%
30	0.014%	0.010%
35	0.024%	0.018%
40	0.042%	0.032%
45	0.080%	0.061%
50	0.160%	0.124%
55+	0.300%	0.200%



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

3. Retirement

Age	Eligible for Reduced Benefit	Eligible for Unreduced Benefit
55-61	N/A	40%
62-64	20%	40%
65-69	N/A	50%
70+	N/A	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest unreduced eligible retirement date (age 62, or current age if greater).

4. Termination

10% per year for all members prior to retirement eligibility.

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

90% of participants are assumed either to be married or to have a dependent beneficiary.

b. Spouse's age

Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

3. Decrement timing

Decrements are assumed to occur at the beginning of the year.

4. PERF benefit commencement timing

For active and inactive vested members, 75% are assumed to commence their benefit at earliest PERF eligibility and 25% are assumed to commence at the assumed PARF commencement.

Elected officials can commence their PERF benefit while active in PARF. Non-elected officials need to terminate their employment prior to commence their PERF benefit.

Data Adjustments

Spouse gender is assumed to be the opposite gender of the member. Additionally, payroll for new hires is annualized.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts. No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit D-6: EG&C

ACTUARIAL METHODS

1. Actuarial Cost Method

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

For funding, gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 20-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 20-year period (gain or loss bases established prior to June 30, 2016 were amortized over 30 years and will continue to be amortized over 30 -year period). However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

For accounting, gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants (active and inactive). Gains and losses occurring from investment experience different from assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.

2. COLA Surcharge

The COLA Surcharge is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium. This amount is divided by the present value of expected payroll over which the accumulations will occur.

3. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

4. Anticipated Payroll

The Anticipated Payroll for the fiscal year beginning July 1, year (x+1) is equal to the actual payroll during the year ending June 30, year (x+1), increased with one year of salary scale.

5. Employer Contribution Rate

Based on the assumptions and methods previously described, an actuarially determined contribution rate is computed. The Board considers this information, but has ultimate authority in setting the employer contribution rate.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

1. Investment return 6.75% per year, compounded annually (net of administrative and investment expenses)

2. Inflation 2.25% per year

3. Salary increase

Service	Wage Inflation	Merit	Salary Increase
0	2.75%	2.25%	5.00%
1	2.75%	2.00%	4.75%
2	2.75%	1.75%	4.50%
3	2.75%	1.50%	4.25%
4	2.75%	1.25%	4.00%
5	2.75%	1.00%	3.75%
6	2.75%	0.75%	3.50%
7	2.75%	0.50%	3.25%
8	2.75%	0.25%	3.00%
9+	2.75%	0.00%	2.75%

4. Interest on member balances 3.50% per year

5. Cost-of-Living Adjustment (COLA) In lieu of a COLA on January 1, 2020 and January 1, 2021, members in pay are provided a 13th check on October 1, 2019 and October 1, 2020. Thereafter, the following COLAs, compounded annually, were assumed:
 0.4% beginning on January 1, 2022
 0.5% beginning on January 1, 2034
 0.6% beginning on January 1, 2039

Demographic Assumptions

1. Mortality Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.

Healthy Employees – Safety Employee table with a 3 year set forward for males an no set forward for females.

Retirees – Safety Retiree table with a 3 year set forward for males an no set forward for females.

Beneficiaries – Contingent Survivor table with no set forward for males and a 2 year set forward for females.

Disableds – General Disabled table.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

2. Disability

Age	Sample Rates
<=30	0.100%
35	0.200%
40	0.300%
45	0.400%
50+	0.500%

Rates for ages 30-50 increase by 0.02% per year.

Active members who become disabled are assumed to receive 20% of their salary if they have less than 5 years of service and 40% of their salary if they have 5 or more years of service.

3. Retirement

Age	Eligible for Reduced Benefit	Eligible for Unreduced Benefit
45-54	2%	20%
55-58	2%	25%
59	2%	35%
60	N/A	55%
61	N/A	65%
62-64	N/A	75%
65+	N/A	100%

Active members: Of those who retire, 50% enter DROP and the other 50% retire immediately. Those who elect to enter DROP are assumed be in DROP for a period of 3 years, upon which time they take the full lump sum and commence their annuity benefit.

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement date (age 45, or current age if greater).

4. Termination

Service	Rates
0-1	10.0%
2	9.0%
3	8.0%
4	7.0%
5	6.0%
6	5.0%
7	4.0%
8	3.0%
9	2.0%
12+	1.0%



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

Other Assumptions

1. Form of payment
Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.
2. Marital status
 - a. Percent married
90% of members are assumed to be married or to have a dependent beneficiary.
 - b. Spouse's age
Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.
3. Decrement timing
Decrements are assumed to occur at the beginning of the year.
4. Members in DROP
Members who are participating in the DROP are assumed to receive an annuity benefit commencing at the end of their DROP period as well as a lump sum payment equal to the number of years they were in the DROP times their annual annuity benefit. The annuity benefit is estimated based on salary and service at the time the member entered the DROP.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts. No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



Exhibit D-7: LE DB

ACTUARIAL METHODS

1. Actuarial Cost Method

Funding:

The actuarial cost method is Traditional Unit Credit.

The normal cost is calculated separately for each active member and is equal to actuarial present value of additional benefits expected to be accrued during the year following the valuation date. The actuarial accrued liability on any valuation date is the actuarial present value of the benefits earned for service prior to the valuation date. Since the benefits for all members of the Legislator's Defined Benefit Plan are fixed and no longer increasing with future service credit or future salary increases, applying the Traditional Unit Credit cost method results in the Actuarial Accrued Liability being equal to the Present Value of Future Benefits (i.e. all benefits are treated as though they are attributable to past service) and the Normal Cost being equal to \$0. This is consistent with the actual status of member benefit accruals.

Gains and losses occurring from census experience different than assumed, assumption changes, and benefit changes are amortized over a 5-year period with level payments each year. A new gain or loss base is established each year based on the additional gain or loss during that year and that base is amortized over a new 5-year period. However, when the plan is at or above 100% funded (based on Actuarial Value of Assets), the past amortization bases are considered fully amortized and a single amortization base equal to the surplus is amortized over a 30-year period with level payments each year. The purpose of the method is to give a smooth progression of the costs from year to year and, at the same time, provide for an orderly funding of the unfunded liabilities.

Accounting:

The actuarial cost method is Entry Age Normal - Level Percent of Payroll.

The normal cost is calculated separately for each active member and is equal to the level percentage of payroll needed as an annual contribution from entry age to retirement age to fund projected benefits. The actuarial accrued liability on any valuation date is the accumulated value of such normal costs from entry age to the valuation date.

Gains and losses occurring from census experience different than assumed and assumption changes are amortized into expense over the average expected future service of all plan participants (active and inactive). Gains and losses occurring from investment experience different than assumed are amortized into expense over a 5-year period. The effect of plan changes on the plan liability are fully recognized in expense in the year in which they occur.

Member census data as of June 30, year (x) was used in the valuation and adjusted, where appropriate, to reflect changes between June 30, year (x) and June 30, year (x+1). The valuation results from June 30, year (x) were rolled-forward to June 30, year (x+1) to reflect benefit accruals during the year less benefits paid.



2. COLA Funding Amount

The COLA may be funded by either direct State appropriations or by allocation of a portion of the lottery proceeds. For consistency with other funds, should annual lottery amounts be determined to be desirable, a funding amount is developed. The COLA Funding Amount is developed by determining the assets needed at the start of the next biennium to fund the post-retirement benefit increases anticipated to be granted in that biennium.

3. Asset Valuation Method

The Actuarial Value of Assets smoothes the recognition of gains and losses on the Market Value of Assets over five years, subject to a 20% corridor.

4. State Appropriations

Based on the assumptions and methods previously described, an actuarially determined contribution amount is computed. The Board considers this information when requesting funds from the State.



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

- | | |
|-------------------------------------|---|
| 1. Investment return | 6.75% per year, compounded annually |
| 2. Inflation | 2.25% per year |
| 3. Salary increase | 2.75% per year |
| 4. Cost-of-Living Adjustment (COLA) | No COLA has been granted through Fiscal Year 2022, which is reflected.

Thereafter, the following COLAs, compounded annually, were assumed:
0.4% beginning on January 1, 2022
0.5% beginning on January 1, 2034
0.6% beginning on January 1, 2039. |

Demographic Assumptions

- | | |
|----------------|--|
| 1. Mortality | Pub-2010 Public Retirement Plans Mortality Tables (Amount-Weighted) with a fully generational projection of mortality improvements using SOA Scale MP-2019.

<i>Healthy Employees</i> – General Employee table with a 1 year setback for males and a 1 year setback for females.

<i>Retirees</i> – General Retiree table with a 1 year setback for males and a 1 year setback for females.

<i>Beneficiaries</i> – Contingent Survivor table with no set forward for males and a 2 year set forward for females.

<i>Disableds</i> – General Disabled table with a 140% load. |
| 2. Disability | None |
| 3. Termination | None |



APPENDIX D – PROPOSED ACTUARIAL ASSUMPTIONS AND METHODS

4. Retirement

Age	Rate
55	10%
56-57	8%
58-61	2%
62-64	5%
65+	100%

Inactive vested members are assumed to commence their retirement benefit at their earliest eligible retirement age.

Other Assumptions

1. Form of payment

Members are assumed to elect either a single life annuity or a 50% joint survivor benefit based on the marriage assumptions below.

2. Marital status

a. Percent married

90% of members are assumed to be married or to have a dependent beneficiary.

b. Spouse's age

Male members are assumed to be three (3) years older than their spouses and female members are assumed to be two (2) years younger than their spouses.

3. Decrement timing

Decrements are assumed to occur at the beginning of the year.

4. Administrative expense

Replacement basis. Administrative expenses incurred during the year prior to the valuation date are included in the calculation of funds to be appropriated to the LE DB Fund by the State.

Other Technical Valuation Procedures

Salary increases are assumed to apply to annual amounts.