Cavanaugh Macdonald
CONSULTING, LLC
*The experience and dedication you deserve*

# STATE OF IOWA
# PEACE OFFICERS' RETIREMENT, ACCIDENT AND DISABILITY SYSTEM

## Five Year Experience Study
## For Period Ending June 30, 2016

## Submitted By:

## Cavanaugh Macdonald Consulting, LLC
## June 19, 2017

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June 13, 2017

Board of Trustees
Iowa Department of Public Safety
Iowa Peace Officers' Retirement,
Accident & Disability System
215 East 7th Street, 4th Floor
Des Moines, IA 50319

Dear Trustees:

It is a pleasure to submit this report of our investigation of the experience of the Iowa Peace Officers' Retirement, Accident and Disability System (System) for the period of July 1, 2011 through June 30, 2016.

The purpose of this report is to communicate the results of our review of the actuarial methods and the economic and demographic assumptions to be used in the completion of the upcoming valuation. The recommended changes from the prior assumptions are designed to better anticipate the emerging experience of the Plan. Actual future experience, however, may still differ from these assumptions.

In preparing this report, we relied without audit on information supplied by the System staff. In our examination, we have found the data to be reasonably consistent and comparable with data used for other purposes. It should be noted that if any data or other information is inaccurate or incomplete, our calculations might need to be revised.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and is 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.

We further certify that the assumptions developed in this report satisfy ASB Standards of Practice, in particular, 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*.

3906 Raynor Pkwy, Suite 106, Bellevue, NE 68123
Phone (402) 905-4461 • Fax (402) 905-4464
www.CavMacConsulting.com
Offices in Englewood, CO • Kennesaw, GA • Bellevue, NE

We look forward to our discussions and the opportunity to respond to your questions and comments.

I, Patrice A. Beckham, am a member of the American Academy of Actuaries, an Enrolled Actuary and a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Patrice A. Beckham, FSA, EA, FCA, MAAA
Principal & Consulting Actuary

The purpose of an actuarial valuation is to provide a timely best estimate of the ultimate costs of a retirement system. Although the System is funded by fixed statutory contribution rates, actuarial valuations of the Iowa Peace Officers' Retirement, Accident and Disability System (POR) are prepared annually to determine the current funded status of the System and to calculate the actuarial contribution rate 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 actuarial contribution rate provides an important benchmark for evaluating the sufficiency of the fixed contribution rates. In order to estimate the future benefit payments from the System, and the corresponding obligations, the valuation requires the use of certain assumptions with respect to the occurrence of future events, such as rates of death, disability, termination of employment, retirement age and salary changes.

The basic purpose of an experience study is to review the actuarial assumptions currently in use to determine whether they should continue to be used or adjustments should be made. One key piece of information is to determine whether the actuarial assumptions currently in use have accurately anticipated actual emerging experience. This information, along with the professional judgment of System staff, its advisors, and the actuary, is used to evaluate the appropriateness of continued use of the current actuarial assumptions. When analyzing experience and assumptions, it is important to realize that actual experience is reported short term while assumptions are intended to be long term estimates of experience. Therefore, no single experience study period is given full credibility in setting actuarial assumptions. If significant differences exist between what is expected from our assumptions and actual experience, we first determine if the experience is credible. If so, our strategy is typically to recommend a change in assumptions that would produce results somewhere between the actual and expected experience.

***Our Philosophy***

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process. From one actuary to another, there should be very little difference in these results. However, the setting of assumptions is a different story as it is more art than science. In this report, we have recommended some changes to the current assumptions. To allow a better understanding of our thought process, we offer a brief summary of our philosophy:

- **Don't Overreact**: When we see significant differences in actual versus expected experience, we generally do not adjust our rates to reflect the entire difference. If the experience is credible and we believe it reflects future expectations, we will typically recommend rates somewhere between the old rates and the new experience. If the experience during the next study period 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 actual experience in the next study is closer to its prior level, we will not have overreacted, possibly causing volatility in the actuarial contribution rates.

- **Anticipate Trends**: We believe that any identified trend that is expected to continue should be recognized. An example of a trend is the retiree mortality assumption. Over the last few generations, rates of mortality have been declining, meaning that people are living longer. Therefore, we believe the best estimate of liabilities in the valuation should reflect some 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.

At the request of the Board of Trustees, Cavanaugh Macdonald Consulting, LLC performed a study of the experience of the Iowa Peace Officers' Retirement, Accident and Disability System, during the period July 1, 2011 through June 30, 2016. 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 of the American Academy of Actuaries.

### *SCOPE OF THIS REPORT*

The actuarial valuation utilizes various actuarial methods and two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its impact on the System. This portion of the experience study was accelerated and results and recommendations were made to the Board in May, 2016. The changes adopted by the Board were then reflected in the July 1, 2016 actuarial valuation. The demographic assumptions are based on the emergence of the specific experience of the System's members. The full set of recommended assumptions discussed in this report will first be reflected in the July 1, 2017 actuarial valuation.

The remainder of this report is divided as follows:

**SECTION 2 EXECUTIVE SUMMARY**
**SECTION 3 ACTUARIAL ASSUMPTIONS**
**SECTION 4 ECONOMIC ASSUMPTIONS**
**SECTION 5 DEMOGRAPHIC ASSUMPTIONS**
**SECTION 6 MORTALITY**
**SECTION 7 RETIREMENT**
**SECTION 8 DISABILITY**
**SECTION 9 TERMINATION OF EMPLOYMENT**
**SECTION 10 MERIT SALARY SCALE**

A brief summary of the results of our findings/recommendations is shown below:

## Actuarial Methods

### *Asset Smoothing Method*

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 four-year period. The methodology of smoothing over equal periods is the method most commonly used by public plans and we believe that it meets actuarial standards under ASOP 44. However, the amount of smoothing could be increased if gains and losses were recognized over 5 years (the most common smoothing period) rather than 4 years. Given that the System is funded using fixed contribution rates, the additional smoothing provided by use of a five-year smoothing period may be a desirable attribute. We are comfortable with either a four or five year smoothing period and would suggest we discuss it with the Board for their consideration.

### *Amortization of Unfunded Actuarial Accrued Liability*

The current amortization method used by POR includes one amortization base with payments determined as a level percentage of payroll. The amortization period was initially set at a closed 30-year period in 2008 with 21 years remaining as of July 1, 2017. Under this approach, the amortization period is reduced by one year each year until 2038 when the amortization of the UAAL base will be completed.

One weakness of a single closed amortization base is that, as the amortization period becomes shorter and shorter, there can be significant volatility in the actuarial contribution rate. When the volatility is at an undesirable level, many systems change to a different approach - such as the layered base approach or the existing method is retained with a "floor" (minimum number of years applicable to amortizing the UAAL) to address the undesired contribution volatility created by the end of the current amortization period. The amortization period could also be reset to a longer period, although this would not be our recommended solution.

Under the layered amortization bases approach, multiple amortization bases are created over time. For POR, the existing UAAL would continue to be paid off in 2038, as scheduled. However, experience gains and losses and bases created by assumption changes or benefit changes which occur in subsequent years would be amortized as a separate amortization base and payment over a specified period of time. This approach allows for a definite payoff date, something not possible with a floor. Because the current UAAL is much larger than the typical gain or loss in subsequent years, we would anticipate that the majority of the UAAL payment through 2038 would be for the current UAAL base. New layers would likely be composed of both experience gains and losses (on both assets and liabilities), so the total impact of all these bases are expected to be fairly small as the gains and losses should partially offset each other over time.

Our recommendation is to keep one base in the July 1, 2017 valuation, but then move to a layered approach in the July 1, 2018 valuation (when the remaining amortization period for the legacy base will be 20 years). New experience bases (gains and losses) will be amortized over a 20-year period, commencing on the valuation date on which the gain/loss is calculated.

## Economic Assumptions

The following set of economic assumptions was recommended and adopted by the Board in June, 2016. Note that these assumptions were used in the July 1, 2016 actuarial valuation.

- Investment Return: 7.50% (Decrease from 8.00%)
- Inflation Assumption: 2.75% (Decrease from 3.00%)
- General Wage Increase: 3.50% (Decrease from 3.75%)
- Total Payroll Growth: 3.00% (Decrease from 3.75%)

## Demographic Assumptions

The changes to the current demographic assumptions include:

- Change the mortality assumption to the most recent mortality table published by the Society of Actuaries, the RP-2014 Mortality Table. The MP-2016 Mortality Improvement Scale is used to model future mortality improvements.
- Modify the retirement rates for member with less than 30 years of service.
- Reduce the disability rates at the younger ages.
- Modify the termination of employments rates to provide a closer fit to actual experience.
- Modify the merit salary scale to better reflect future salary increases based on current pay scales and rules.

## Financial Impact

The estimated financial impact of the proposed changes to the demographic assumptions, based on results of the July 1, 2016 actuarial valuation, are summarized below. Note that the recommended set of economic assumptions was used in the July 1, 2016 actuarial valuation so only the impact of the recommended demographic assumptions is measured in these results. The actual dollar amount of the impact, which will be based on the July 1, 2017 actuarial valuation, may vary from the numbers shown on the exhibit on the following page. However, the impact on the liabilities and normal cost, as a percentage change, is expected to be similar.

**Estimate of Financial Impact of Assumption Changes**
**(Based on July 1, 2016 Valuation)**

| | Old Assumptions | New Assumptions | Difference |
|---|---|---|---|
| 1. Present Value of Future Benefits | $706,245,707 | $721,144,971 | $14,899,264 |
| 2. Present Value Future Normal Costs | 127,856,859 | 110,859,390 | (16,997,469) |
| 3. Actuarial Accrued Liability (1) – (2) | 578,388,848 | 610,285,581 | 31,896,733 |
| 4. Actuarial Value of Assets | 426,398,446 | 426,398,446 | 0 |
| 5. Unfunded Actuarial Accrued Liability (UAAL) (3) – (4) | $151,990,402 | $183,887,135 | $31,896,733 |
| 6. Normal Cost Rate | 28.70% | 26.47% | (2.23%) |
| 7. Administrative Expenses | 0.57% | 0.57% | 0.00% |
| 8. UAAL Payment | 24.17% | 29.24% | 5.07% |
| 9. Actuarial Contribution Rate | 53.44% | 56.28% | 2.84% |

Note: Actual dollar impact of the demographic assumption changes on the July 1, 2017 valuation results may vary from that shown in this table which is based on the July 1, 2016 actuarial valuation.

## *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, the choice of actuarial methods and assumptions **will** influence the incidence of costs.

The valuation or determination of the present value of all future benefits to be paid by the System reflects the assumptions that best seem to 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 or allocation 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. 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 credits earned in the past and future service credits to be earned.

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 systems do 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 common funding method for public systems for many years and is currently used for the POR valuation.

The rationale of the Entry Age Normal (EAN) cost method is that the cost of each member's benefit is determined to be a level percentage of his salary from date of hire to the end of his employment with the employer. 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 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 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.

It is to be expected that future events will not occur exactly as anticipated 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.

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 is 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.**

***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 that is reflected in the market value of assets. This is because most employers would rather have annual costs remain relatively smooth, as a 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.

POR values assets, for actuarial valuation purposes, based on the principle that the difference between actual and expected investment returns 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 four-year period. The methodology of smoothing over equal periods is the method most commonly used by public plans and we believe that it meets actuarial standards under ASOP 44. The amount of smoothing could be increased if gains and losses were recognized over 5 years (the

most common smoothing period) rather than 4 years. Given that the System is funded using fixed contribution rates, the additional smoothing provided by use of a five-year smoothing period may be attractive to the Board. **We are comfortable with either a four or five year smoothing period and would suggest we discuss it with the Board for their consideration.**

***AMORTIZATION OF UAAL***

As described earlier, actuarial accrued liability is 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 liability (UAAL) exists when the actuarial accrued liability exceeds the actuarial value of 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:

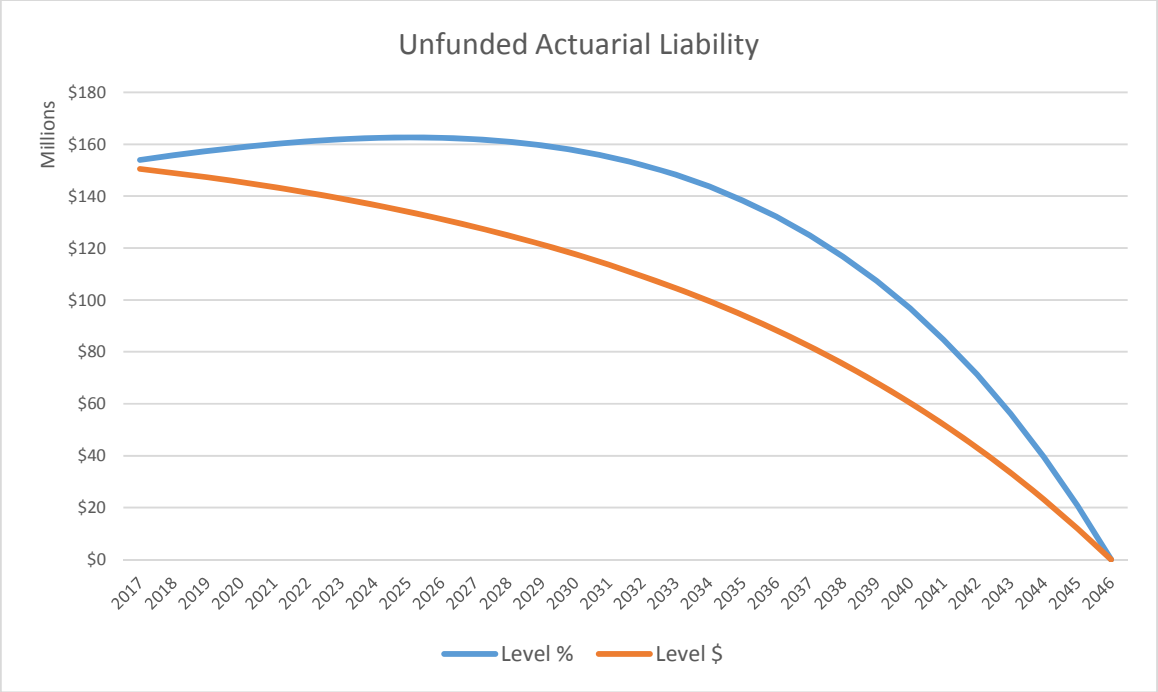
- The period over which the UAAL is amortized,
- The rate at which the amortization payment increases, and
- The number of components of UAAL (separate amortization bases).

**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 valuation. 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 System's debt (UAAL) every year and is not intended to move the system to fully funded status.

**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 costs are calculated to be a constant percentage of pay, the unfunded actuarial accrued liability 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 at the same rate 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.

Use of the level percentage of payroll amortization has its advantages and disadvantages. From a budgetary standpoint, it makes sense to develop UAL contribution rates that are level as a percentage of payroll, since the contributions made to fund the Plan are made as a percent of payroll. However, this approach clearly results in slower funding of the UAL, compared to level dollar amortization, as illustrated in the following graph:




**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 changes 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 schedule 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 that 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, and their source, 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.

**Current POR Actuarial Amortization Method:** The current amortization method used by POR includes one amortization base with payments determined as a level percentage of payroll. The amortization period was initially set at a closed 30-year period back in 2008 with 21 years remaining as of July 1, 2017. Under this approach, the amortization period is reduced by one year each year until 2038 when the amortization of the base will be completed.

One weakness of a single closed amortization base is that as the amortization period becomes shorter and shorter, there can be significant volatility in the actuarial contribution rate. When the volatilityis at an undesirable level, many systems change to a different approach, such as the layered base approach or the existing method is retained with a "floor" (minimum number of years applicable to amortizing the UAAL) to address the undesired contribution volatility created by the end of the current amortization period. The amortization period could also be reset to a longer period, although this would not be our recommended way to address the concern.

Under the layered amortization approach, multiple amortization bases are created over time. For POR, the existing UAAL would continue to be paid off in 2038, as scheduled. However, experience gains and losses and bases created by assumption changes or benefit changes which occur in subsequent years would be amortized as a separate amortization base and payment over a specified period of time. This approach allows for a definite payoff date, something not possible with a floor. Because the current UAAL is much larger than the typical gain or loss in subsequent years, we would anticipate that the majority of the UAAL payment through 2038 would be for the current UAAL base. New layers would likely be composed of both experience gains and losses (on both assets and liabilities), so the total impact of all these bases are expected to be fairly small as the gains and losses should partially offset each other over time.

**Our recommendation is to keep one amortization base in the July 1, 2017 valuation which includes the impact of changes in the demographic assumptions, but then move to a layered approach in the July 1, 2018 valuation (when the remaining amortization period for the legacy base will be 20 years). New experience bases (gains and losses) will be amortized over a 20-year period, commencing on the valuation date on which the gain/loss is calculated.** This provides some demographic matching as it is similar to the average expected remaining service life of active members. Using a shorter period, such as 10 years, would pay down the amortization base faster, but create more volatility in the actuarial contribution rate. Likewise, longer amortization periods reduce the volatility in the actuarial contribution rate, but delay recognition of the experience. Since the System is funded with fixed contribution rates, it is preferable for the time period to be neither overly short nor long. Changes in the UAAL resulting from other items, such as plan amendments or changes in assumptions or methods, will be amortized over an appropriate period, to be determined by the POR Board after discussion with the actuary.

While the current method is not unreasonable and is still quite common, we would note that over the last few years, 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 while balancing the need for some stability in the contribution rate. The layered approach seems to be a method that is becoming more common for public plans.

The economic assumptions used in the POR valuation include:

- Price inflation
- Investment return (net of investment expenses)
- Wage inflation (the across-the-board portion of individual salary increases).
- Payroll growth (increase in total covered payroll of active members).

The merit salary scale is actually a demographic assumption, and will be discussed with the demographic assumptions. Unlike demographic assumptions, economic assumptions do not lend themselves to analysis heavily based upon internal historical patterns because economic assumptions are influenced more by external forces in the economy. The investment return and general wage increase assumptions are generally selected on the basis of expectations in an inflation-free environment and then increased by the long-term expectation for price inflation, called the "building block" approach.

The economic assumptions were reviewed and analyzed in May, 2016 and presented to the Board at that time. Sources of data considered in the analysis and selection of the economic assumptions included:

- Historical observations of price and wage inflation statistics and investment returns
- The 2015 Social Security Trustees Report
- Future expectations of the State's investment consultant
- Future expectations of other investment consultants (2015 Horizon Survey)
- U. S. Department of the Treasury bond rates
- Assumptions used by other large public retirement systems, based on the Public Fund Survey, published by the National Association of State Retirement Administrators.

## ACTUARIAL STANDARD OF PRACTICE NUMBER 27

Actuarial Standards of Practice are issued by the Actuarial Standards Board to provide guidance to actuaries with respect to certain aspects of performing actuarial work. 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. Therefore, our analysis of the expected rate of return, as well as other economic assumptions, was performed following the guidance in ASOP 27.

Due to its required application, it may be informative for others to be aware of the basic content of ASOP 27. The standard applies to the selection of economic assumptions to measure obligations under any defined benefit pension plan that is not a social insurance program (e.g., Social Security).

Since the last experience study was performed, the Actuarial Standards Board has issued a revised ASOP 27. The prior standard included the use of a "best estimate range" in developing economic assumptions, but this approach is no longer acceptable. The current standard calls for 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.

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 discusses a "range of reasonable assumptions" which in part states "the actuary should also recognize that different actuaries will apply different professional judgment 1and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop both for an individual actuary and across actuarial practice."

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.

The following table summarizes the current and proposed economic assumptions:

| | Current Assumptions | Proposed Assumptions |
|---|---|---|
| Price Inflation | 3.00% | 2.75% |
| Investment Return | 8.00% | 7.50% |
| General Wage Increase | 3.75% | 3.50% |
| Total Payroll Growth* | 3.75% | 3.00% |

* Used to determine the amortization payment on the UAAL.

## 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 and general wage increases, which also impacts the assumptions for the post-retirement escalator and individual salary increases.

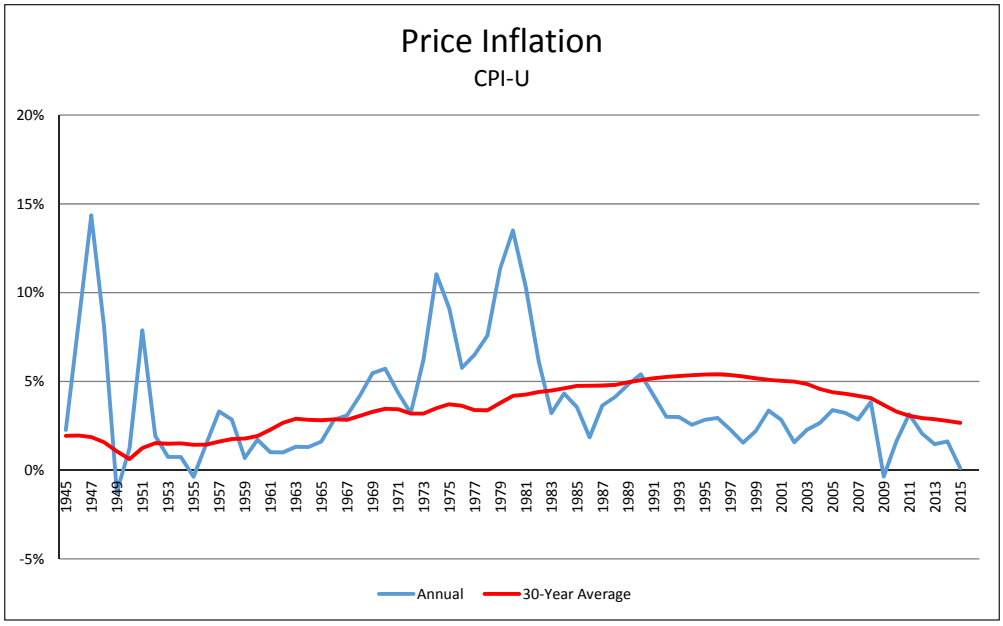
The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, 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 3.00% 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 of the CPI-U over periods ending December 31st.

| Period | Number of Years | Annualized Rate of Inflation |
|---|---|---|
| 1926 – 2015 | 89 | 2.96% |
| 1955 – 2015 | 60 | 3.70% |
| 1965 – 2015 | 50 | 4.12% |
| 1975 – 2015 | 40 | 3.78% |
| 1985 – 2015 | 30 | 2.67% |
| 1995 - 2015 | 20 | 2.23% |
| 2005 - 2015 | 10 | 1.95% |

The following graph illustrates the historical annual change in price inflation, measured as of December 31 for each of the last 70 years, as well as the thirty year rolling average.




Over more recent periods, measured from December 31, 2015, the average annual rate of increase in the CPI-U has been below the current assumption of 3.00%. The period of high inflation from 1973 to 1981 has a significant impact on the averages over periods which include these rates. There has clearly been a steady decline in inflation in the last 30 years, as shown in the data presented above.

***Forecasts of Inflation:*** 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. Market prices as of December 31, 2015 indicated that investors expected inflation to be around 1.7%. Similar data as of December 31, 2016 indicated that the bond market expected inflation of about 2.1% over the next 30 years.

As this data indicates, the bond market is anticipating low inflation of 2% or less over the long term. However, that expectation may be heavily influenced by the current low interest rate environment created by the Federal Reserve Bank's manipulation of the bond market. Whether price inflation returns to the higher rates observed historically and if so, when, remains to be seen.

***Social Security Projections***

Although many economists forecast lower inflation than the assumption used by retirement plans, they are generally looking at a shorter time horizon (10 years or less) 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 (May 2015), the projected average annual increase in the CPI over the next 75 years was estimated to be 2.70%, under the intermediate

cost assumption. The range of inflation assumptions used in the Social Security 75-year modeling, which includes a low and high cost scenario, in addition to the intermediate cost projection, was 2.00% to 3.40%. The May 2016 report, which was published after the economic assumptions were presented to the Board, showed a range of 2.0% to 3.2% with a best estimate of 2.6%.

Finally, it is worth noting that NEPC, the investment consultant retained by the State Treasurer's office, publishes 30 year assumptions which include inflation in the U.S. Their current long-term (30 year) inflation assumption is 2.75%, compared to their short-term inflation assumption of 2.25%.

***Peer System Comparison***

While we do not recommend the selection of any assumption based on those used by other public retirement systems, a comparison does provide another set of relevant information to consider. According to the Public Fund Survey (a survey of over 125 large public retirement systems maintained by a collaboration between the Center for Retirement Research, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators), the average investment assumption for public systems has been steadily declining. As of the most recent study, the most common assumption is 3.00%, which is consistent with POR's assumption. However, the survey is based on valuations that are almost entirely from 2013 and 2014. Based on our experience, we believe that further declines in this assumption have occurred for many systems in the last two years.

***Conclusion***

The current inflation assumption is 3.0%. While actuarial standards caution against assigning too much weight to recent events, multiple factors lead us to believe that the current assumption should be reduced. The lower inflation for the last three decades, coupled with the low future inflation anticipated by the bond markets and the Social Security actuary, suggests that there may have been a fundamental change away from the longer-term historical norms. While some of these sources are influenced by the short-term outlook, we remain focused on the longer term. Based on the information presented above**, we recommend a reduction in the inflation assumption to 2.75%.**

| Consumer Price Inflation | |
|---|---|
| Current Assumption | 3.00% |
| Recommended Assumption | 2.75% |

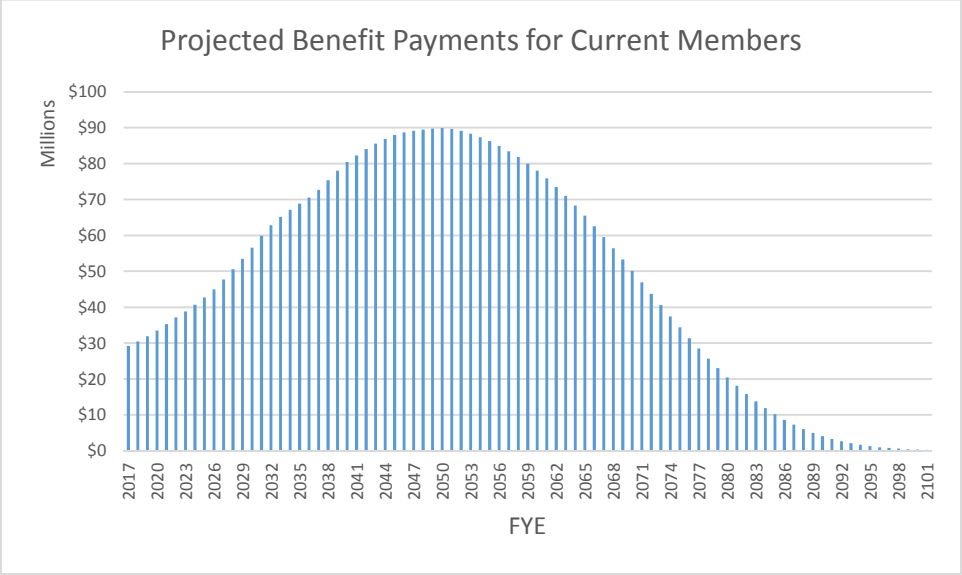
*INVESTMENT RETURN*

**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 System's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. This assumption has a direct and powerful impact on the calculation of liabilities, normal costs and actuarial contribution rates. 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 price inflation rate, and investment expenses. However, the selection of an investment return assumption is also impacted by the dynamics of the system along with the risk tolerance and preferences of the Board.

The current investment return assumption is 8.00%, net of both investment-related expenses and administrative expenses. This is referred to as the nominal 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. Based on the current set of assumptions, the real rate of return is 5.00% (the nominal return of 8.0% less 3.00% inflation).

**Long Term Perspective**

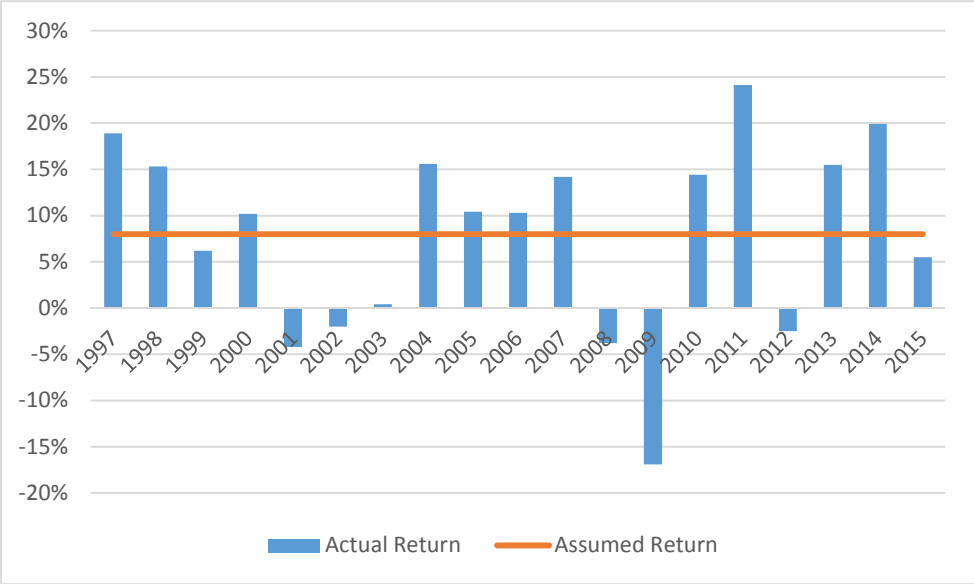
Because the economy is constantly changing, assumptions about what may occur in the near term are volatile. Asset managers and investment consultants usually focus on this near-term horizon in order to make prudent choices regarding how to invest the trust funds, i.e. asset allocation. For actuarial calculations, we typically consider very long periods of time as some current employees will still be receiving benefit payments more than 80 years from now. For example, a newly-hired officer who is 25 years old may work for 30 years, to age 55, and live another 30 years, to age 85. The retirement system would receive contributions for the first 30 years and then pay out benefits for the next 30 years. During the entire 60-year period, the system is investing assets on behalf of the member. For such a typical career employee, more than one-half of the investment income earned on assets accumulated to pay benefits is received after the employee retires. In addition, in an open ongoing plan like POR, the stream of benefit payments is continually increasing as new hires replace current members who leave covered employment due to death, termination of employment, and retirement. This difference in the time horizon used by actuaries and investment consultants is frequently a source of debate and confusion when setting economic assumptions. The following graph illustrates the long duration of the expected benefit payments for current members on July 1, 2015.




**POR Historical Perspective**

One of the inherent problems with analyzing historical data is that the results can look significantly different depending on the timeframe used, especially if the year-to-year results vary widely. In addition, the asset allocation can also impact the investment returns so comparing actual results over long periods when different asset allocations were in place may not be meaningful.

The following graph shows the actual fiscal year (June 30) net returns for the POR portfolio for the last 19 years. Despite significant volatility in the results from year to year the actual geometric (compound) return over this period was 7.5%.



**Forward Looking Analysis**

We believe the most appropriate analysis to consider in setting the investment return assumption is to model the expected returns using the system's target asset allocation and forward-looking capital market assumptions. However, we are trained as actuaries and not as investment professionals. As such, we rely heavily on professional investment consultants, such as New England Pension Consultants, to provide investment expertise including capital market assumptions.

In performing our analysis, we use the building block approach which allows for the real rate of return of the portfolio to be modeled based on the target asset allocation. The expected return is then added to the price inflation assumption. Therefore, our analysis focuses on the real rate of return while the analysis of the investment consultants more typically focuses on the nominal return in their asset allocation consulting.

POR's assets are invested by the Iowa State Treasurer's office with the guidance of their investment consultant, New England Pension Consultants (NEPC). Since ASOP 27 provides that the actuary may rely on outside experts, it seems appropriate to heavily weight the market outlook and expectations provided by NEPC. As part of their duties, NEPC performed an Asset/Liability Study in December, 2015. This report was provided to us, along with the 2016 capital market assumptions.

NEPC's 30-year inflation assumption is 2.75% which is consistent with our recommended assumption. Consequently, we were able to use NEPC's nominal assumptions in our analysis of expected returns. Our analysis is based on the POR target asset allocation as shown below:

| Asset Class | Target Allocation | Expected Return | Standard Deviation |
|---|---|---|---|
| Large Cap Equities | 25.00% | 8.83% | 17.5% |
| Small Cap Equities | 15.00% | 9.64% | 21.0% |
| International Equities | 18.75% | 9.89% | 21.0% |
| Fixed Income | 25.00% | 3.95% | 5.95% |
| Real Estate | 10.00% | 7.50% | 15.00% |
| Emerging Equities | 6.25% | 12.50% | 27.00% |

Using projection results, an expected range of rates of return is produced over a 50-year time horizon. Looking at one year's results produces an expected return of 7.30%, but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the average return does not change much, but the volatility declines significantly. The table below provides a summary of results.

| Time Span In Years | Mean Return | Standard Deviation | Real Returns by Percentile | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5th | 25th | 50th | 75th | 95th |
| 1 | 8.03% | 12.61% | -11.39% | -0.80% | 7.30% | 16.06% | 29.93% |
| 5 | 7.43 | 5.59 | -1.50 | 3.60 | 7.30 | 11.13 | 16.89 |
| 10 | 7.36 | 3.95 | 1.00 | 4.67 | 7.30 | 9.99 | 13.99 |
| 20 | 7.32 | 2.79 | 2.80 | 5.43 | 7.30 | 9.20 | 11.99 |
| 30 | 7.31 | 2.28 | 3.61 | 5.77 | 7.30 | 8.85 | 11.11 |
| 50 | 7.30 | 1.77 | 4.43 | 6.11 | 7.30 | 8.50 | 10.24 |

The percentile results are the percentage of random returns over the time span shown that are expected to be less than the amount indicated. Thus for the 10-year time span, 5% of the real rates of return will be below 1.00% and 95% will be above that. As the time span increases, the results begin to converge. Over a 50-year time span, the results indicate a 25% chance that returns will be below 6.11% and a 25% chance they will be above 8.50%. There is a 50% chance the returns will be 7.30% or above and a 50% chance the returns will be below 7.30%.

For a broader view of expected returns in the investment consultant community, we modeled the median capital market assumptions of the 12 investment consultants included in the 2015 Horizon Actuarial Survey who provided 20-year assumptions and compared the results to those of NEPC. As actuaries, our focus is on the timeframe of the expected benefit payments in the valuation so a longer term view of 30 to 50 years is appropriate. Using the median of the expected return and standard deviation for each asset class from the 2015 Horizon Survey and POR's target asset allocation, the expected real rate of return and distribution of returns were modeled. It is important to note that the capital market assumptions used in modeling expected returns are generally based on indexed returns and do not reflect any additional returns that may be earned due to active asset managers outperforming the market ("alpha"), net of investment expenses.

The projection results produce an expected range of real rates of return over a 30 year time horizon as shown in the following table, along with a comparison to NEPC's 30-year assumptions. The capital market assumptions in the 2015 Horizon Survey produce higher expected returns.

***LONG-TERM CAPITAL MARKET ASSUMPTIONS***

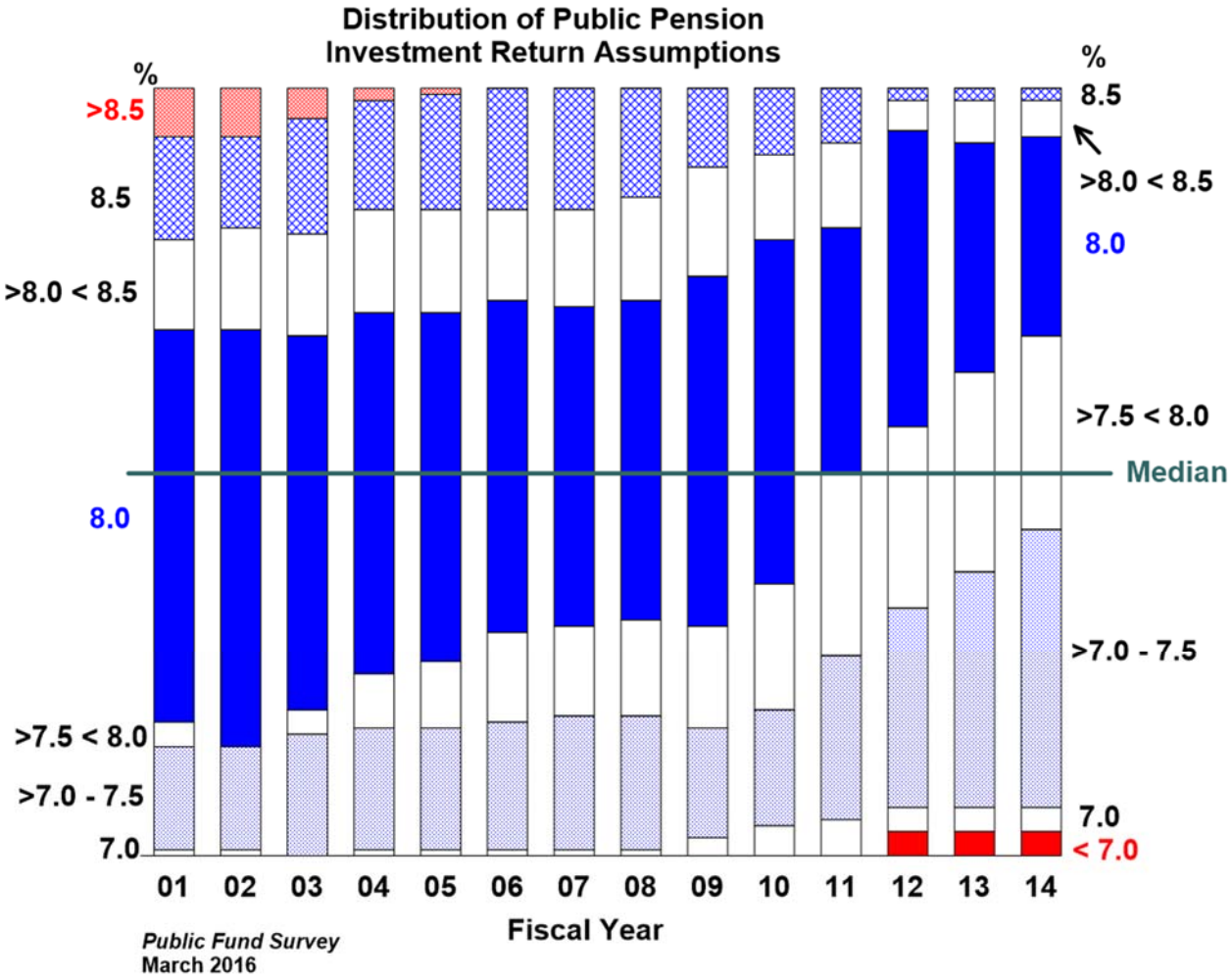
| Percentile | Real Returns by Percentile | |
|---|---|---|
| | NEPC | Horizon |
| 95th | 7.49% | 8.25% |
| 75th | 6.10% | 6.48% |
| **50th** | **4.55%** | **5.27%** |
| 25th | 3.36% | 4.07% |
| 5th | 1.68% | 2.37% |

We find some value in considering the pooled result of many different investment firms, including many major investment consultants in the public plan arena. Consequently, we believe there is value in considering both NEPC's and the Horizon capital market assumptions in our analysis although we recognize that survey information has its limitations and that NEPC has more insight and specific knowledge about the POR portfolio.

**Peer System Comparison**

While we believe there is some value in assessing the movement in the assumed rate of return for other systems, this is not an appropriate basis for setting this assumption in our opinion. For example, different plans have different plan dynamics which will impact their choice of the investment return assumption. This peer group information merely provides another set of relevant data to consider as long as the difference in asset allocation from system to system is recognized.

The following graph shows the change in the distribution of the investment return assumption from fiscal year 2001 through 2014 for the 120+ large public retirement systems included in the National Association of State Retirement Administrators (NASRA) Public Fund Survey. It is worth noting that the median investment return assumption in fiscal year 2012 dropped from 8.00% to 7.75%.




This survey has been updated since the economic assumptions were studied in May, 2016. The most current results indicate that the median investment return assumption is now 7.50%. We continue to see large public retirement systems reduce their assumed rate of return so the median return may continue to be lowered.

**Recommendation:**

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 the short-term expectations impact our judgment regarding the appropriateness of the current assumption over the long term.

This is a challenging time to develop a recommendation for the investment return assumption. We need to recognize that there is no right answer to the question as no one knows what the future holds. After

reviewing all of the available information, **we recommend a 7.50% investment return assumption**, based on the 2.75% inflation assumption and a real rate of return of 4.75%.

| Investment Return | |
|---|---|
| Current Assumption | 8.00% |
| Recommended Assumption | 7.50% |

***ADMINISTRATIVE EXPENSES***

There is some variance of actuarial practice on how administrative expenses are handled in the valuation process. The different practices are as follows:

- A fixed dollar amount.
- A percentage of the actuarial liabilities or normal cost.
- An offset to the assumed rate of return.

For POR, the past practice has been to set the investment return assumption as the net return after payment of administrative expenses. Using this methodology, the investment return assumption in the last experience was lowered by 0.05% to reflect the impact of paying administrative expenses from investment income.

The new GASB accounting standards require administrative expenses to be separately accounted for in disclosure, and more importantly, in the projection of plan assets in future years to determine the discount rate used to calculate the Net Pension Liability. Therefore, technically, the expected long-term rate of return for GASB purposes is net only of investment expenses. If this guidance was followed, as written, the discount rate used to calculate the GASB pension liability would be higher than the assumed rate of return used in the funding valuation. This could lead to some confusion or misunderstanding as to why a rate other than the assumed rate of return is being used.

In addition, the inclusion of administrative expenses as a separate component of the actuarial contribution rate provides much more transparency which we believe is a positive result.

**To be consistent with the GASB standards, avoid related complexities, and enhance transparency, we are recommending a change in the way administrative expenses are reflected in the funding valuation, i.e. an explicit administrative expense charge be added to the normal cost rate as part of the actuarial required contribution rate.** For this purpose, the actual administrative expense for the prior year will be used to approximate the expense in the current valuation year.

Although this change is not required for funding purposes, it is more explicit than the current approach and provides more transparency. In addition, it permits the discount rate in the GASB accounting valuation to be developed on a consistent basis with the funding valuation (assuming assets are not projected to be depleted in the GASB projection of fiduciary net position).

### *GENERAL WAGE INCREASE (WAGE INFLATION)*

***Background:*** General wage increase/growth, 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/real wage growth. The excess of wage growth over price inflation represents the increase in the standard of living, also called productivity growth.

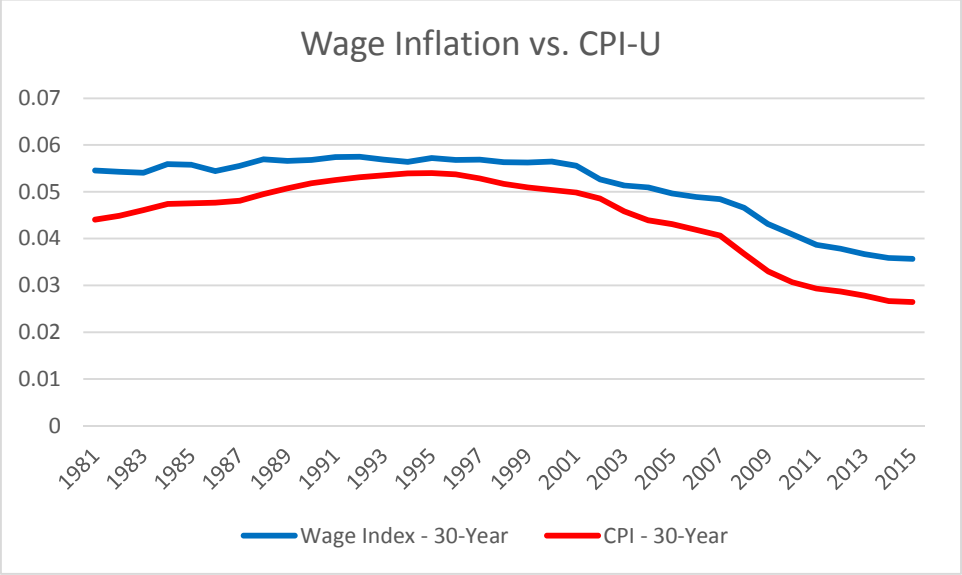
In constructing the individual salary increase assumption used to project future salary increases, the general wage increase assumption is further combined with an assumption for service-based salary increases (called a merit scale). The merit scale salary increase assumption is discussed later in this report. Given the current price inflation assumption of 3.00%, the current general wage increase of 3.75% implies assumed real wage growth of 0.75%.

***Historical Perspective***: For this analysis, we have used statistics from the Social Security System on the National Average Wage back to 1951. Because the National Average Wage is based on all wage earners in the country who are covered by Social Security, 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). Further, if compensation is shifted between wages and benefits, the wage index would not accurately reflect increases in total compensation. POR's membership is a homogeneous group composed exclusively of state patrol members living in Iowa. 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 POR members, but the dynamic is different than applies to general state employees. As a result, the wage growth of POR membership and the nation may be less directly correlated.

The excess of wage growth over price inflation represents the real wage growth rate. The following table shows the US compounded wage growth over various periods, along with the comparable price inflation rate for the same period. The differences represent the real wage growth rate.

| Years | General Wage Inflation | CPI Increase | Real Wage Inflation |
|---|---|---|---|
| Last 10 Years | 2.7% | 2.3% | 0.4% |
| Last 20 Years | 3.4% | 2.4% | 1.0% |
| Last 30 Years | 3.6% | 2.8% | 0.8% |
| Last 40 Years | 4.5% | 4.0% | 0.5% |
| Last 50 Years | 4.8% | 4.2% | 0.6% |

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




Over the past 30 years, the real wage growth, as measured by the Social Security Administration, has been 0.8% per year, on average. A somewhat similar, but slightly different set of data is available from the Bureau of Labor Statistics, which reports the median weekly wage for full-time employees. Over the last 30 years, this amount (adjusted for inflation) has had an average increase of 0.2% per year. Part of the difference in these results arises from the difference between using an average and a median. There are also technical differences arising from the group included in each measure.

**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 June, 2015 Trustees Report, the annual increase in the National Average Wage Index under the intermediate cost assumption (best estimate) was 3.9%, 1.2% higher than the Social Security Administration's intermediate inflation assumption of 2.7% per year. The range of the assumed real wage growth in the 2015 Trustees report was 0.6% to 1.8% per year.

**Analysis and Conclusion:** Over the last 30 years, the actual experience on a national basis has been close to the current assumption. However, this is based on SSA data, which uses the average wages of all U.S. workers. As mentioned earlier, the median real wage increase has been significantly lower. We believe that wages will continue to grow at a greater rate than prices over the long term, although not at the level projected by Social Security. We also expect wage growth for governmental employees to be lower than the national average, at least in the short term, due to budget challenges still being experienced by both state and local governmental employers.

Based on the available data and our professional judgment, **we recommend that the long-term assumed real wage growth remain 0.75%. When coupled with the reduction in the price inflation assumption to 2.75%, the resulting general wage increase assumption decreases from 3.75% to 3.50%.**

## PAYROLL GROWTH ASSUMPTION

Amortization payments on the unfunded actuarial liability are currently determined as a level percent of payroll. Therefore, the valuation requires an assumption regarding future annual increases in covered payroll. The payroll growth assumption is the combined impact of an assumption regarding the size of the active membership and the general increase in wages over time (previously discussed and recommended at 3.50%).

Size of Active Membership: We propose continuing the assumption that no future growth in membership will occur. With no assumed growth in membership, future covered payroll growth is due only to general wage increases. If increases should occur not only because of wage increases, but also because of additional members, there will be a larger pool of salaries over which to spread the unfunded actuarial liability, which would result in lower UAAL payments as a percent of payroll. The uncertainties in light of current conditions in public employment and the national economy argue against anticipating any increase in membership for funding purposes.

General Wage Increases: This assumption was previously discussed and our recommendation was to reduce the assumption from 3.75% to 3.50%. Given the assumed constant size of the active membership, we typically see the general wage increase assumption used as the payroll growth assumption. However, a review of the actual payroll increase for the POR system over the last six years indicates an average payroll growth of 1.3% due to a decline in the size of the active membership of 11% (see table below). The average salary increased 3.25% over the study period. In addition, payroll growth from 1999 through 2015 was 2.7%, with a decrease in the active population of 8%.

| Year End June 30 | Covered Payroll ($M) | Active Count | Average Salary ($) | Change in Average Salary |
|---|---|---|---|---|
| **2009** | 41.862 | 662 | 63,236 | |
| **2010** | 41.955 | 643 | 65,248 | 3.2% |
| **2011** | 43.494 | 644 | 67,537 | 3.5% |
| **2012** | 43.902 | 618 | 71,040 | 5.2% |
| **2013** | 43.985 | 599 | 73,430 | 3.4% |
| **2014** | 43.070 | 578 | 74,516 | 1.5% |
| **2015** | 45.129 | 589 | 76,619 | 2.8% |

Given the past experience and continuing pressure on the state's budget, we believe it is prudent to build some conservatism into this assumption by using a total payroll growth assumption that is less than the general wage growth assumption of 3.50%. **Therefore, we recommend the total payroll growth assumption for amortizing the UAAL be set at 3.00%.**

There are several demographic assumptions used in the actuarial valuation performed for the Peace Officers' Retirement, Accident and Disability System. They include:

- Mortality
- Service Retirement
- Disability Retirement
- Termination of Employment (Withdrawal)
- Salary Increase for Merit and Promotions

***ASOP 35 General Considerations and Application***

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 selects 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.

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 our opinion, the demographic assumptions recommended in this report have been developed in accordance with *ASOP 35*.

***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 (fiscal years ending in 2012 through 2016) with what was expected to happen based on the actuarial assumptions. A single five-year period is still a relatively short observation period. In addition, the System's size limits the full credibility of the findings. Therefore, we have considered the results of the prior Experience Study when practical to do so, but a considerable amount or professional judgment was used to develop the recommendations in this study.

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 member behavior, including a determination of the amount of weight to assign to the most recent experience.

As in the past, we have continued the concept of analyzing 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 active decrements. The exposure and actual occurrences are then multiplied by the benefit level to provide the liability-weighted experience. For retiree mortality experience, the member's benefit is used to weight the experience. 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 on the actual experience.

## MORTALITY

Because benefits are usually paid over a retiree's lifetime, it is important to appropriately model a typical lifetime of the members. Therefore, one of the most important demographic assumptions used in the valuation process is the mortality assumption because it predicts when retirement payments will stop. In addition, deaths before retirement may also result in the payout of benefits to a spouse or survivor. For valuation purposes, mortality assumptions must be set for retirees, beneficiaries, disabled retirees and active members.

ASOP 35 states that the actuary should consider the effect of mortality improvement both prior to and subsequent to the valuation date. This implies the need to make a specific assumption with respect to future improvements in mortality, even if the assumption is that there will be no future improvement. Over the last few generations, rates of mortality have been declining, meaning people are generally living longer. We believe that trend will continue in the future, although the rate at which future improvements will unfold is a source of debate. However, we believe it is appropriate for a retirement system to reflect some future mortality improvements in the mortality assumption. For the POR valuation, this is accomplished by the use of a generational mortality assumption where the probability of death at a given age is projected to be slightly lower each year in the future.

**Retiree Mortality:** The post-retirement mortality rates used in the valuation project the percentage of retirees who are expected to die in a given future year. This assumption typically has the most significant impact on liability projections of any demographic assumption.

The POR valuation currently uses separate mortality assumptions for male and female members. The RP-2000 Healthy Annuitant Mortality Table for Males and Females, with generational mortality using Projection Scale AA, is used to predict the probability of death for members receiving benefits.

In examining the results of the Experience Study, if the A/E Ratio is greater than 100% the assumptions have predicted fewer deaths than actually occurred and with an A/E Ratio less than 100% the assumptions have predicted more deaths than have actually occurred. Sometimes a mortality table is selected with the explicit purpose of anticipating fewer deaths so there is room for mortality improvements in the future (called "margin"). Using generational mortality, we expect the A/E Ratio to be around 100% as mortality improvements in future years are directly reflected in the valuation by projecting lower mortality rates for future years, i.e., no margin in the current rates is needed.

The observed A/E Ratios for male retirees during the study period are shown in the following table. We studied mortality experience on both a count basis and a benefit-weighted basis (a better indicator of liability experience). There is an insufficient number of female retirees to provide any reasonable analysis for the group so that information is not shown. Due to the lower number of exposure at the younger ages combined with a low probability of death, our goal was to find a standard table, with age adjustments, that was a reasonable fit at ages 65 to 95.

| Fiscal Year | Exposure | Actual | Expected | A/E Ratio Count | A/E Ratio Weighted |
|---|---|---|---|---|---|
| **Total** | **1,713** | **37** | **45** | **82%** | **80%** |

Actual deaths for healthy male retirees age 65 and older were lower than the number expected (37 compared to 45 over the five year study period) based on the current assumption with a resulting A/E ratio of 82%. The A/E ratio in the prior experience study, using the RP 2000 Healthy Annuitant Mortality Table, was 91% (48 actual versus 53 expected). Although the amount of data is limited, the results in both study periods was consistent.

When experience is weighted based on the benefit amounts, the A/E ratio is even further below 100% (A/E ratio is 80% at ages 65 and older and 71% at ages 55 and older). This indicates that the amount of liability actually being released in the valuation as a result of retiree deaths is not being accurately anticipated. One cause of this discrepancy can be differences in mortality patterns between retirees with lower monthly benefits and those with higher monthly benefits, which we have observed in other systems.

Based on the findings of the last two studies, we believe some adjustment should be made to the mortality assumption at this time. If a change is to be made, it makes sense to move to the most recently published mortality table that was developed for use in pension plan valuations, the RP-2014 Mortality Table. **We recommend the postretirement mortality assumption be set to the RP-2014 Mortality Table with a one-year age setback for males and no age adjustment for females, with generational mortality improvements anticipated by Scale MP-2016.** Using the recommended assumption, the A/E Ratio is 103% on a count basis and 99% on a benefit-weighted basis for ages 65 and above. Note that our recommendation is that this projection scale continue to be used until the next experience study is completed and a new recommendation for future mortality improvements is made at that time.

**Beneficiaries:** The retirement benefits under POR are paid for both the life of the member and the spouse. This group is very small, but we did consider the actual experience. The actual mortality of this group over the study period indicated that there were fewer deaths than anticipated by the current assumption. The A/E Ratio on a count basis was 80% and on a benefit-weighted basis was 81%. The recommended assumption for healthy retirees is also a reasonable fit for beneficiaries with a resulting A/E Ratio of 103% on a weighted basis. **Therefore, we recommend that the same mortality assumption that is used for retirees (RP-2014 Mortality Table with a one-year age setback for males and no age adjustment for females, with MP-2016 Scale) also be used for valuing the benefits payable to beneficiaries.**

**Disabled Members:** The valuation currently assumes that disabled members, in general, will not live as long as retired members who met the regular service retirement eligibility by applying a five-year age set forward for disabled members. However, there is a very small number of disabled retirees so the results are not statistically reliable. The experience observed in the study period indicated that actual deaths were much higher than expected using the current assumption (11 actual versus 8 expected). On a benefit-weighted basis, the A/E ratio was 134%. Therefore, **we recommend the RP-2014 Healthy Annuitant Mortality Tables (generational with Scale MP-2016) with a four year age set-forward be used to value the disabled annuitants. The revised A/E ratio using the recommended assumption is 92% on a count basis and 96% on a benefit-weighted basis.**

**Active Members:** This assumption predicts eligibility for death benefits prior to retirement, rather than the expected lifetime for pension payments. In smaller groups, the mortality rates for active members are often set based on the same assumption as is used for healthy retirees. Given the low probability of death while active and the relatively low exposure at each age, the results are not credible on their own. We prefer to keep the mortality assumption for active and retired members on a consistent basis. **Therefore, we recommend the active member mortality also be changed to the RP-2014 Mortality Table with a one-year age setback for males and no age adjustment for females, using Scale MP-2016 to anticipate mortality improvements in future years.**

The valuation also uses a specific assumption for accidental death while an active member, currently .00085 (8.5 deaths per 10,000 exposed). There is insufficient data to perform any analysis so this assumption is set based on professional judgment. **The current assumption is reasonable and we recommend it be retained.**

## SERVICE RETIREMENT

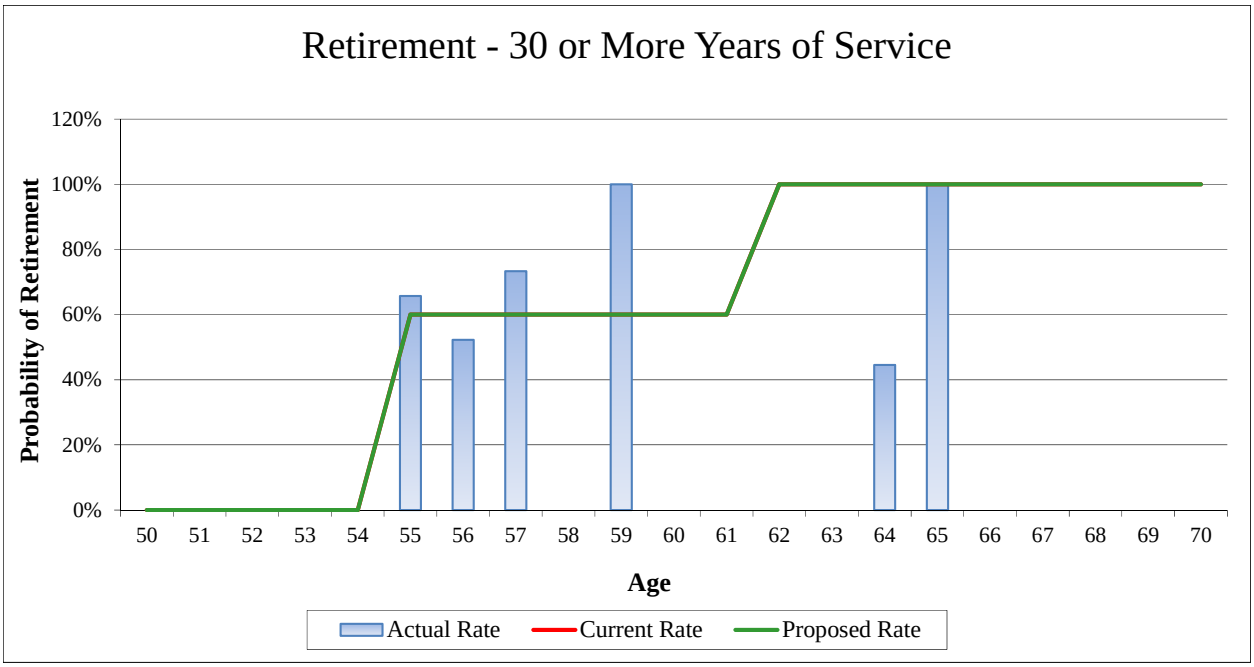
Service retirement measures the change in status from active membership directly to retirement. This assumption does not include the retirement patterns of members who terminated from active membership years prior to their retirement. A separate assumption addresses that situation.

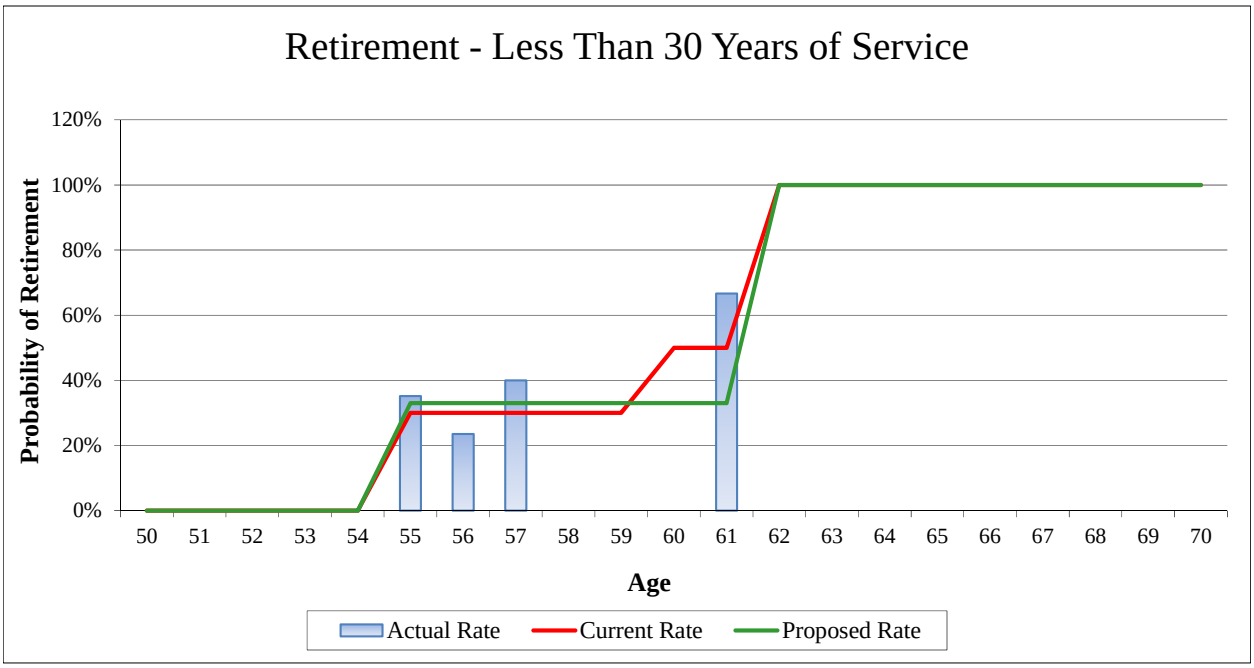
The POR plan provisions for service retirement require that a member be age 55 with 22 years of service. Early retirement (with reduced benefits) is available age 50 with 22 years of service. Benefit accruals cease after 32 years of service so there is little incentive for members to remain in covered employment after reaching that benchmark. Actual retirement behavior confirms this expectation.

In the last experiences study, the retirement assumption was modified from a single age-based assumption to an age-based assumption that varies by whether or not the member has 30 or more years of service, reflecting higher rates of retirement for those with 30 or more years of service. The actual and expected retirement experience for the period is summarized in the following table:

| | Actual | Expected | AE Ratio (Count Basis) | AE Ratio (Liability-Weighted) |
|---|---|---|---|---|
| Less Than 30 Years of Service | 25 | 27 | 93% | 102% |
| 30 or More Years of Service | 34 | 37 | 92% | 93% |

The pattern of retirements under the two current assumptions, on a liability-weighted basis, is shown below:






These assumptions are relatively new, having been implemented as a result of the last experience study. In aggregate, the A/E ratios are well within acceptable ranges. However, we are recommending a minor modification to the retirement rates applicable for those with less than 30 years of service to improve the fit of the assumption to the observed experience. The revised A/E ratio, using the recommended assumption, is 89% on a count basis and 98% on a liability-weighted basis.

**Inactive Vested Members:** We currently assume inactive vested members retire at age 55. There are very few such members so no reliable data is available. **We recommend keeping the current assumption that benefits will commencement at the earliest retirement age as it is a reasonable assumption and provides a conservative estimate of the liability for inactive vested members.**

**Miscellaneous Assumptions:** There are several miscellaneous assumptions that are set largely on the basis of professional judgment. These include the percentage of members married at retirement (currently 90%) and the age difference between male and female spouses (currently the female is assumed to be 4 years younger). Both of these assumptions are reasonable and we recommend they be retained.

Different benefit amounts are paid depending on whether a disability is ordinary or accidental (in the line of duty). Therefore, separate disability rates are currently used to model accidental and ordinary disability. Currently, the accidental disability rates are 150% of the ordinary disability rates, reflecting a higher incidence of accidental disability.

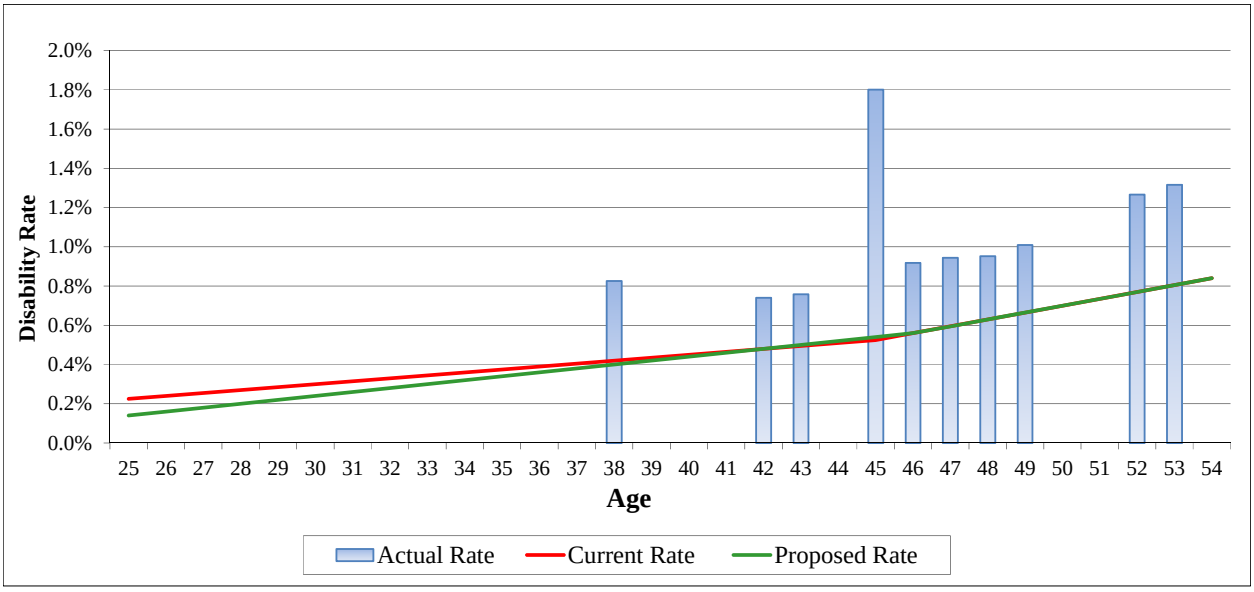
The size of the System, coupled with the small probability of disablement at most ages, does not permit credible derivation of disability rates based solely on the System's experience. Nonetheless, the actual to expected ratio was calculated for disabilities as one factor to consider in evaluating the current assumption.

The table below indicates the number of actual and expected disabilities for the current and the two prior study periods along with the resulting A/E Ratios. In general, ratios below 100% indicate fewer disabilities than expected which would typically result in lower actuarial liabilities.

| | Observations | | A/E Ratio |
|---|---|---|---|
| Disabilities | Actual | Expected | Current |
| 2001 - 2006 | 14 | 12 | 117% |
| 2006 - 2011 | 3 | 13 | 23% |
| 2011 - 2016 | 11 | 14 | 79% |
| 2001 - 2016 | 28 | 39 | 72% |

Disability experience has been extremely volatile over the last three study periods. However, it does appear that the 2006-2011 period was an anomaly and that experience should be heavily discounted in evaluating the assumption. Given the size of the active membership and the relatively low probability of disability, we expect to observe volatility in the actual number of disabilities in different periods. However, there is typically a higher probability of disability as the member ages. While the current assumption reflects that general trend, the actual experience is even more pronounced.

On the basis of this analysis and our professional judgment, **we are recommending the current disability rates be lowered at the younger ages (see graph below).**



Using the proposed assumption, the A/E ratio increases from 79% to 85%.

In this study period, there were a total of 11 disabilities, none of which were ordinary disabilities. In the prior study, there were 3 disabilities of which one was an ordinary disability. In the 2007 Experience Study, there were a total of 14 disabilities of which two were ordinary. Based on the aggregate ordinary disability experience from the past, about 12% of all disabilities were ordinary disability and 82% were accidental disabilities. **It appears that the current assumption that 30% of all disabilities are ordinary is too high and we recommend the assumption be changed to assume that 20% of all disabilities are ordinary.**

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 can vary by both age and years of service. In general, rates of termination tend to be highest at younger ages and in the early years of employment. The current termination of employment assumption is based only on years of service. The current rates are low, grading down from 5% in the first year to 0% for members with 20 or more years of service.

The number of withdrawals includes all members reported to have terminated employment - whether voluntarily or not. The number of terminations of employment in this study period was very different than that observed in the last study period, as shown in the table below.

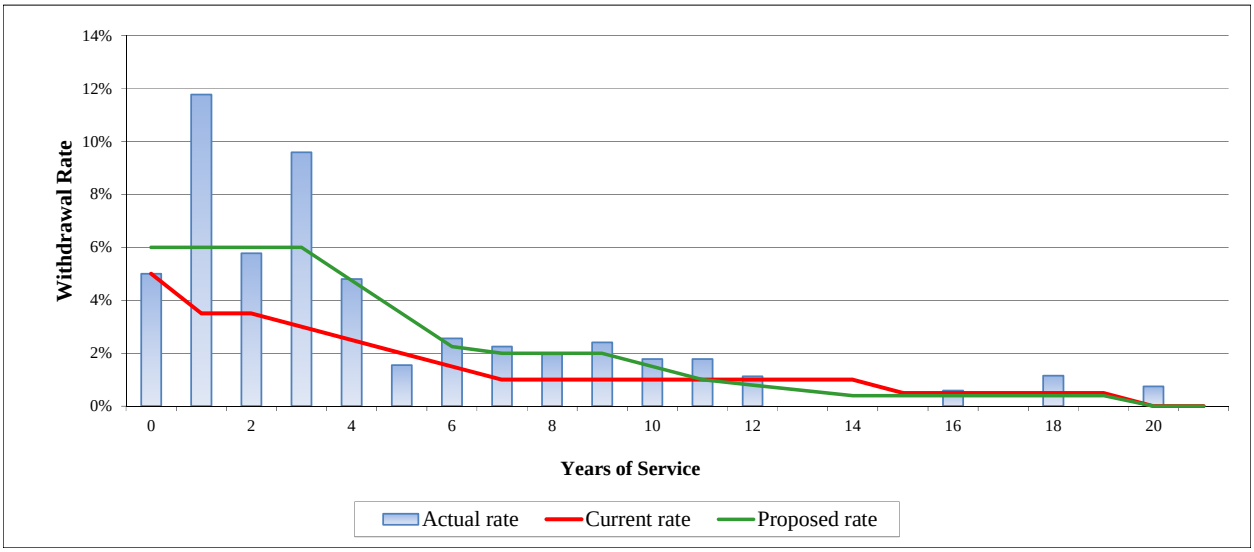
| Termination of Employment | Observations | | | |
|---|---|---|---|---|
| Study Period | Actual | Expected | A/E Ratio (Count) | A/E Ratio (Weighted) |
| Prior (2006 - 2011) | 29 | 42 | 69% | 67% |
| Current (2011 – 2016) | 42 | 27 | 154% | 151% |

We further analyzed the termination of employment experience for each year in the five-year study period to see if there were any anomalies in the observed experience that should be considered. Our findings, by year, are shown below:

| Termination of Employment | Observations | | |
|---|---|---|---|
| | Actual | | A/E Ratio Expected |
| **FY 2012** | 16 | 8 | 212% |
| **FY 2013** | 10 | 6 | 172% |
| **FY 2014** | 8 | 5 | 163% |
| **FY 2015** | 0 | 4 | 0% |
| **FY 2016** | 8 | 5 | 172% |

Although there were no terminations in FY 2015, the actual terminations in the other years were consistently much higher than anticipated by the current assumption. Based on the experience in the current study period, we believe some adjustment to the assumption is needed to more closely model the termination experience of the system.

The following graph shows both the actual terminations along with those expected based on the current and recommended assumptions:




The A/E ratio, using the recommended assumption, is 108% on a count basis and 115% on a liability-weighted basis, reflecting a partial movement toward the observed experience.

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

1. Increases in each individual's salary due to promotion or longevity (often called merit scale), and

2. Increases in the general wage level of the membership, which are directly related to price and wage inflation.

Earlier in this report, we recommended that the second of these rates, general wage growth be reduced from 3.75% to 3.50% (2.75% price inflation and 0.75% real wage growth).

Although future salary increases are the result of two components, it is difficult, if not impossible, to distinguish the true salary adjustments due to inflation, productivity and merit. Therefore, the experience study reviews total salary increases for the study period. Typically, the percentage attributable to general wage growth is eliminated in an attempt to isolate the merit scale. The general wage growth for the period is usually identified by reviewing actual salary increases by duration (years of service). Those members with a high number of years of service are assumed to have no merit scale applied. Therefore, all of their salary increase is assumed attributable to increases in the general wage level. This approach did not prove to be particularly insightful in identifying the general wage level for this period.

Another approach was used to try to isolate merit versus general wage or across the board increases. The System provided us with historical "across the board increases" for the current study period. This history is summarized below:

| **SPOC** | | **Non-Contract** | |
|---|---|---|---|
| July 1, 2011 | 2.00% | July 1, 2011 | 2.00% |
| January 1, 2012 | 1.00% | January 1, 2012 | 1.00% |
| July 1, 2012 | 2.00% | July 1, 2012 | 2.00% |
| January 1, 2013 | 1.00% | January 1, 2013 | 1.00% |
| July 1, 2013 | 1.00%* | July 1, 2013 | 1.00%* |
| January 1, 2014 | 2.00%* | January 1, 2014 | 2.00%* |
| July 1, 2014 | 1.00%* | July 1, 2014 | 1.00%* |
| January 1, 2015 | 2.00%* | January 1, 2015 | 2.00%* |
| July 1, 2015 | 2.85% | July 1, 2015 | 2.50% |
| July 1, 2016 | 2.00% | July 1, 2016 | 2.25% |
| *Additional non-cumulative | | | |
| 5 year period ending 6/30/2017 | 1.77% | 5 year period ending 6/30/2017 | 2.20% |

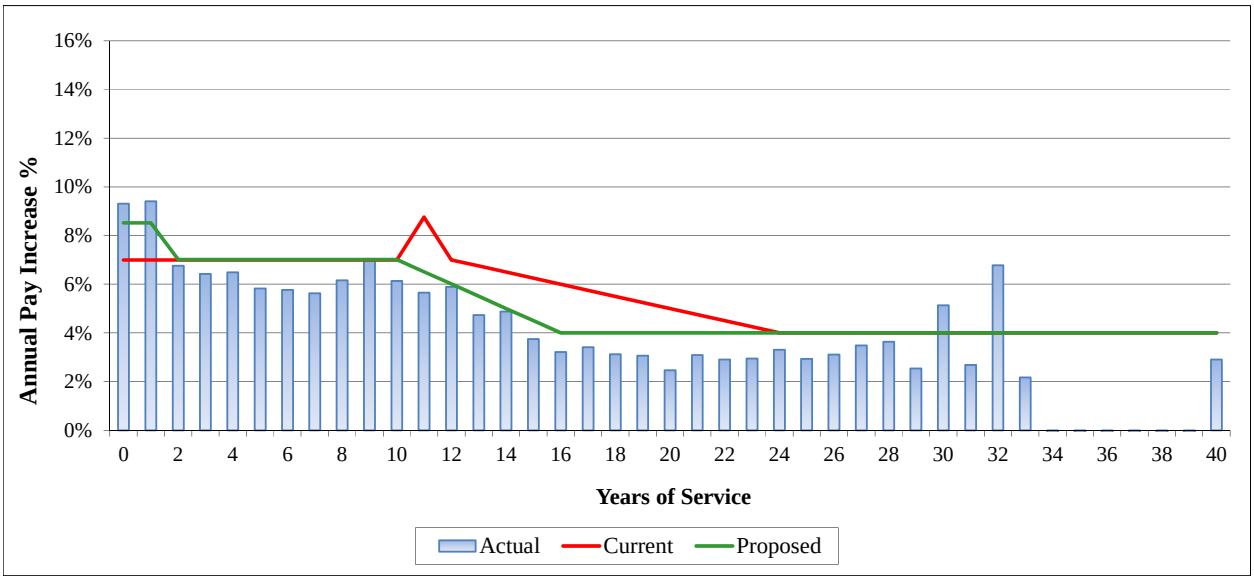
During this period (July 1, 2011 through June 30, 2016), the "across the board salary increases" were somewhat higher than actual price inflation (about 1.4%), but below the actual wage inflation in the national economy, which was about 3.0%. However, during this period many governmental employers have struggled with reduced revenue so it is possible that salary increases have been lower as a result of budget constraints.

We also compared the individual salary increases for all members who were active in any two consecutive periods (e.g. 2006 and 2007, 2007 and 2008, etc.). The overall results for the years in the current study period are shown below:

| Fiscal Year End | Actual | Expected | Difference |
|---|---|---|---|
| 2012 | 5.13% | 5.97% | (0.84%) |
| 2013 | 3.95% | 5.86% | (1.91%) |
| 2014 | 2.99% | 5.80% | (2.81%) |
| 2015 | 4.77% | 5.66% | (0.89%) |
| 2016 | 4.30% | 5.60% | (1.30%) |
| 2012 - 2016 | 4.23% | 5.78% | (1.55%) |

The actual salary increases during the five-year study period averaged 4.23% and the expected increases were 5.78%, a difference of 1.55%. During this period, the actual wage inflation was 3% compared to the assumption of 4% so we would have expected actual salary increases to be about 1% lower than assumed.

The current merit scale, developed in the last experience study, is based on years of service and we recommend that approach be maintained. However, we believe some modifications would improve the fit of the assumption to actual increases observed. The graph below reflects the proposed salary increase assumption (total salary increase including general wage growth assumption of 3.50%), as well as the actual pay experience and the current salary increase assumption. Note that because the general wage growth assumption of 3.50% is higher than actual wage growth during the study period, the recommended salary increase assumption generates an overall salary increase (5.02%) which is higher than the actual salary increase (4.23%).



**Actuarial Cost Method**

Liabilities and contributions shown in this report are computed using the Individual Entry Age method of funding.

Sometimes called "funding method," this is a particular technique used by actuaries for establishing the amount of the annual actuarial cost of pension System benefits, or normal cost, and the related unfunded actuarial accrued liability. Ordinarily the annual contribution to the System is comprised of (1) the normal cost and (2) an amortization payment on the unfunded actuarial accrued liability.

Under the Entry Age Actuarial Cost Method, the **Normal Cost** is computed as the level percentage of pay which, if paid from the earliest time each member would have been eligible to join the System if it then existed (thus, entry age) until his retirement or termination, would accumulate with interest at the rate assumed in the valuation to a fund sufficient to pay all benefits under the System.

The **Actuarial Accrued Liability** under this method at any point in time is the theoretical amount of the fund that would have accumulated had annual contributions equal to the normal cost been made in prior years (it does not represent the liability for benefits accrued to the valuation date). The **Unfunded Actuarial Accrued Liability (UAAL)** is the excess of the actuarial accrued liability over the actuarial value of System assets on the valuation date.

Under this method experience gains or losses, i.e. decreases or increases in accrued liabilities attributable to deviations in experience from the actuarial assumptions, adjust the unfunded actuarial accrued liability.

**UAAL Amortization Method**

The Board has elected to amortize the unfunded actuarial accrued liability, as a level percent of payroll, over a closed 30-year period beginning July 1, 2008.

**Asset Valuation Method**

The System uses an asset valuation method to smooth the effects of market fluctuations. The actuarial value of assets spreads the difference between the actual return and the expected return (based on the actuarial assumption of 7.5%, effective July 1, 2016) evenly over four years.

## Actuarial Assumptions

***Investment Return:*** 8.00% per year.

***Price Inflation:*** 3.00% per year.

***Payroll Growth:*** 3.75% per year, including price inflation.

***Active Members:***

1. Ordinary death rate — RP-2000 Mortality Table for Employees with Generational Projection, using Scale AA.

2. Accidental death rate — 8.5 deaths per 10,000 exposed for one year.

3. Disability rates

| Age | Accidental Disability | Ordinary Disability |
|---|---|---|
| 22 | 0.16% | 0.07% |
| 27 | 0.18% | 0.08% |
| 32 | 0.23% | 0.10% |
| 37 | 0.28% | 0.12% |
| 42 | 0.34% | 0.14% |
| 47 | 0.42% | 0.18% |
| 52 | 0.54% | 0.23% |

4. Withdrawal rate — The following table is used:

| Service | Rate |
|---|---|
| 0 | 5.0% |
| 1-2 | 3.5% |
| 3 | 3.0% |
| 4 | 2.5% |
| 5 | 2.0% |
| 6 | 1.5% |
| 7-14 | 1.0% |
| 15-19 | 0.5% |
| 20 | 0.0% |

5. Retirement age

**30 or More Years of Service**

| Age | Probability of Retirement |
|---|---|
| 55-61 | 60% |
| 62 | 100% |

**Less than 30 Years of Service**

| Age | Probability of Retirement |
|---|---|
| 55-59 | 30% |
| 60-61 | 50% |
| 62 | 100% |

Inactive vested members are assumed to begin receiving benefits at age 55.

6. Salary scale

| Year | Increase |
|---|---|
| 1 | 7.25% |
| 5 | 7.25% |
| 10 | 7.25% |
| 15 | 6.50% |
| 20 | 5.25% |
| 25+ | 4.25% |

7. Post-retirement adjustments — Same as for retired members.

***Retired Members and Other Beneficiaries:***

1. Mortality rate - Service retirees — Service retirements and beneficiaries: RP-2000 Mortality Table for Healthy Annuitants with Generational Projection using Scale AA - Male and Female.

2. Mortality rate - Disabled retirees — Disability retirements: RP-2000 Mortality Table for Healthy Annuitants with Generational Projection, using Scale AA, and a 5-year age set forward.

3. Annual readjustment of pensions — Wages for the same rank are assumed to increase 3.75%.

***Dependency Ratios:***

| | | |
|---|---|---|
| 1. | Ordinary death benefit | Alternate benefits payable to widow and minor children in 90% of cases. |
| 2. | Pension to spouse and children of deceased pensioned member | In 90% of cases, with 1 child per member. |

***Interest Credited to Member Contributions:*** 4.00% per year.

***Marriage Assumption:*** 90% married, with males 4 years older than females.

***Administrative Expenses:*** Based on actual amount for the prior year increased with inflation.

**Actuarial Cost Method**

Liabilities and contributions shown in this report are computed using the Individual Entry Age method of funding.

Sometimes called "funding method," this is a particular technique used by actuaries for establishing the amount of the annual actuarial cost of pension System benefits, or normal cost, and the related unfunded actuarial accrued liability. Ordinarily the annual contribution to the System is comprised of (1) the normal cost and (2) an amortization payment on the unfunded actuarial accrued liability.

Under the Entry Age Actuarial Cost Method, the **Normal Cost** is computed as the level percentage of pay which, if paid from the earliest time each member would have been eligible to join the System if it then existed (thus, entry age) until his retirement or termination, would accumulate with interest at the rate assumed in the valuation to a fund sufficient to pay all benefits under the System.

The **Actuarial Accrued Liability** under this method at any point in time is the theoretical amount of the fund that would have accumulated had annual contributions equal to the normal cost been made in prior years (it does not represent the liability for benefits accrued to the valuation date). The **Unfunded Actuarial Accrued Liability (UAAL)** is the excess of the actuarial accrued liability over the actuarial value of System assets on the valuation date.

Under this method experience gains or losses, i.e. decreases or increases in accrued liabilities attributable to deviations in experience from the actuarial assumptions, adjust the unfunded actuarial accrued liability.

**UAAL Amortization Method**

The recommendation is to continue to amortize the legacy unfunded actuarial accrued liability as of July 1, 2017, as a level percent of payroll, over a closed 30-year period beginning July 1, 2008. New layers of unfunded actuarial accrued liability will be created on each actuarial valuation date and will be amortized, as a level percent of payroll, over a new 20-year period. Changes in the unfunded actuarial accrued liability that are created by a change in assumptions or changes in benefit structure will be amortized over a reasonable time period as selected by the Board after consultation with their actuary.

**Asset Valuation Method**

The System uses an asset valuation method to smooth the effects of market fluctuations. The actuarial value of assets spreads the difference between the actual return and the expected return (based on the actuarial assumption of 7.5%, effective July 1, 2016) evenly over four years.

## Actuarial Assumptions

***Investment Return:*** 7.50% per year.

***Price Inflation:*** 2.75% per year.

***Payroll Growth:*** 3.00% per year, including price inflation.

***Active Members:***

1. Ordinary death rate — RP-2014 Total Dataset Mortality Table with a one-year set-back for males and Generational Projection, using MP-2016.

2. Accidental death rate — 8.5 deaths per 10,000 exposed for one year.

3. Disability rates

| Age | Accidental Disability | Ordinary Disability |
|---|---|---|
| 22 | 0.06% | 0.02% |
| 27 | 0.14% | 0.04% |
| 32 | 0.22% | 0.06% |
| 37 | 0.30% | 0.08% |
| 42 | 0.38% | 0.10% |
| 47 | 0.48% | 0.12% |
| 52 | 0.62% | 0.15% |

4. Withdrawal rate — The following table is used:

| Service | Rate |
|---|---|
| 0-3 | 6.00% |
| 4 | 4.75% |
| 5 | 3.50% |
| 6 | 2.25% |
| 7-9 | 2.00% |
| 10 | 1.50% |
| 11 | 1.00% |
| 12 | 0.80% |
| 13 | 0.60% |
| 14-19 | 0.40% |
| 20 | 0.00% |

5. Retirement age

**30 or More Years of Service**

| Age | Probability of Retirement |
|---|---|
| 55-61 | 60% |
| 62 | 100% |

**Less than 30 Years of Service**

| Age | Probability of Retirement |
|---|---|
| 55-61 | 33% |
| 62 | 100% |

Inactive vested members are assumed to begin receiving benefits at age 55.

6. Salary scale

| Year | Increase |
|---|---|
| 1 | 8.50% |
| 5 | 7.00% |
| 10 | 7.00% |
| 15 | 4.50% |
| 20+ | 4.00% |

7. Post-retirement adjustments — Same as for retired members.

***Retired Members and Other Beneficiaries:***

1. Mortality rate - Service retirees — Service retirements and beneficiaries: RP-2014 Total Dataset Mortality Table with a one-year set-back for males and Generational Projection, using MP-2016.

2. Mortality rate - Disabled retirees — Disability retirements: RP-2014 Total Dataset Mortality Table with a four-year set-forward for males and Generational Projection, using MP-2016.

3. Annual readjustment of pensions — Wages for the same rank are assumed to increase 3.50%.

***Dependency Ratios:***

| | | |
|---|---|---|
| 1. | Ordinary death benefit | Alternate benefits payable to widow and minor children in 90% of cases. |
| 2. | Pension to spouse and children of deceased pensioned member | In 90% of cases, with 1 child per member. |

***Interest Credited to Member Contributions:*** 4.00% per year.

***Marriage Assumption:*** 90% married, with males 4 years older than females.

***Administrative Expenses:*** Based on actual amount for the prior year increased with inflation.