Gabriel Roeder Smith & Company
Consultants & Actuaries

CITY OF COLUMBIA POLICE AND FIREMEN'S RETIREMENT FUND

5-YEAR EXPERIENCE STUDY

OCTOBER 1, 2010 THROUGH SEPTEMBER 30, 2015

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November 7, 2016

Retirement Boards
Police Retirement Fund
Firemen's Retirement Fund
Columbia, Missouri

Dear Board Members:

Presented in this report are the results of an actuarial investigation of experience of the City of Columbia Police and Firemen's Retirement fund. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing City of Columbia Police and Firemen's Retirement fund actuarial liabilities and establishing employer contribution rates.

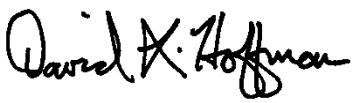
The investigation was based upon the statistical data furnished for annual actuarial valuations during the period October 1, 2010 to September 30, 2015.

The report presents specific recommendations with respect to non-economic assumptions and presents a range of potential choices for the economic assumptions. Non-economic activities (rates of turnover, retirement, etc.) tend to be generally stable and are subject to measurement by the actuary. Economic activities (inflation, investment return) tend to be unstable and are not really subject to direct measurement. We believe that the Board should select the economic assumptions from within ranges that the actuary deems reasonable.

The investigation was carried out using generally accepted actuarial principles and techniques in accordance with standards of practice prescribed by the Actuarial Standards Board. We believe that the recommended actuarial assumptions that are the result of this investigation form a reasonable basis for computing future contributions and measuring funding progress for the City of Columbia Police and Firemen's Retirement fund.

Mita Drazilov is a Member of the American Academy of Actuaries (MAAA) and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,



Mita D. Drazilov ASA, MAAA

David L. Hoffman

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5 – YEAR EXPERIENCE STUDY
OCTOBER 1, 2010 – SEPTEMBER 30, 2015

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SECTION A

BACKGROUND AND DESCRIPTION OF STUDY

BACKGROUND

The actuary calculates contribution requirements and actuarial present values for a retirement system by applying actuarial assumptions to the benefit provisions and people information of the system. The principal areas of risk which require assumptions about future experience are:

- Long-term rates of investment return to be generated by the assets of the system. The rate of return is generally considered to be composed of an underlying inflation rate, plus a real rate of return.
- Rates of pay increases to active members. The rates of pay increases are the combination of an underlying across-the-board increase, plus an age and/or service dependent merit and longevity scale of increases.
- Rates of mortality among active members, retirants, and beneficiaries.
- Rates of withdrawal of active members.
- Rates of disability among active members.
- The age patterns of retirements.

In making a valuation, the actuary calculates the monetary effect of each assumption for as long as a present covered person survives - - - a period of time which can be as long as a century.

The rates of inflation, real investment return, across-the-board pay increases and pay increases due to merit and longevity can be considered to be "economic assumptions." These rates are generally selected by policymakers from within a range of reasonable alternatives provided by the actuary.

The remaining risk areas are usually referred to as the "non-economic" assumptions. The actuary is responsible for reviewing past experience and recommending assumptions for adoption by policymakers. The general impact of these risk assumptions is described below:

- Rates of retirement. Higher rates of retirement with full benefits at earlier ages lead to higher projected benefits and higher costs.
- Rates of withdrawal. Higher rates (more turnover) lead to more benefit forfeitures or more deferred benefits, resulting in lower projected benefits and lower costs.
- Rates of disability. Higher rates lead to higher projected benefits and higher costs.
- Rates of mortality. Lower rates (longer lifetimes) lead to higher projected benefits and higher costs.

The present actuarial assumptions were adopted following an experience study covering the period September 30, 2002 through September 30, 2009, and first used in the September 30, 2010 actuarial valuation.

DESCRIPTION OF THE STUDY

Annual actuarial valuations are completed each year as of September 30. An important ingredient for the valuation is the census of current active members and benefit recipients. Key items of interest include:

Status
Date of birth
Date of departure (from active status)
Reason for departure
Credited service
Annual pay

Six years of active member and retiree data submissions were used for the experience study. From this data we determined which members left active service each year and the reason they left service (retirement, withdrawal, disability, etc.). The reported data is of sufficient quality and is adequate for this purpose.

The tables and charts in this report show the "rate" of employment termination due to some cause. As an example, consider 100 members age 55 and eligible for normal retirement. If 30 of the members actually retire, the "rate of retirement" is 0.30 (30 divided by 100).

“Exposure” means the number of members who can potentially terminate membership within a given year, due to a particular cause. For example, for retirement, the exposure is the number of members eligible to retire in a given year.

No mathematical credibility procedure was utilized in the selection of the proposed non-economic assumptions. When actual experience is different from projected experience, we generally propose new actuarial assumptions which are between the present assumptions and the actual experience. In some circumstances, more weight is given to the experience that occurred during the investigation period, especially if this experience is consistent with that observed during the previous investigation period (e.g., Fire withdrawal). There may be times when the actuary may propose new actuarial assumptions that are not reflective of recent past experience (e.g., if circumstances dictate that future experience is expected to deviate from the past experience due to a benefit change, economic or employment changes, etc.).

SECTION B

SUMMARY OF VALUATION RESULTS

ACTUARIAL VALUATION RESULTS
BASED ON PROPOSED DEMOGRAPHIC AND ECONOMIC ASSUMPTIONS
AS OF SEPTEMBER 30, 2015

Presented on the following page are actuarial valuation results as of September 30, 2015 based upon the proposed set of demographic assumptions as well as the following sets of economic assumptions (investment return and wage inflation):

	Investment Return	Wage Inflation	Price Inflation
Scenario A	7.00%	3.25%	2.50%
Scenario B	6.50%	3.25%	2.50%

In conjunction with the adoption of the new set of actuarial assumptions, we believe that it is reasonable to consider a lengthening of the amortization period to help mitigate the increase in the computed contribution rate. Given this, we have shown results on the following page using the Fund's current amortization period (i.e., 24 years) as well as an alternate amortization period.

ACTUARIAL VALUATION RESULTS
BASED ON PROPOSED DEMOGRAPHIC AND ECONOMIC ASSUMPTIONS
AS OF SEPTEMBER 30, 2015

Actuarial Valuation Results as of September 30, 2015. Actuarial valuation results, based upon the proposed set of demographic and economic assumptions, are shown below:

Police

	Current Assumptions			Proposed Decrement Assumptions and Indicated Investment Return and Wage Inflation Assumptions								
							Proposed Economic Assumptions					
	7.50%, 3.50%			Demographic Changes Only			7.0%, 3.25%			6.5%, 3.25%		
	Pre 10/1/2012	Post 10/1/2012	Police Total*	Pre 10/1/2012	Post 10/1/2012	Police Total*	Pre 10/1/2012	Post 10/1/2012	Police Total*	Pre 10/1/2012	Post 10/1/2012	Police Total*
Normal Cost	21.64%	13.63%	20.23%	22.35%	14.15%	20.92%	24.35%	15.37%	22.77%	27.27%	17.27%	25.52%
UAL%*	22.64%	22.64%	22.64%	25.03%	25.03%	25.03%	28.07%	28.07%	28.07%	30.53%	30.53%	30.53%
Total Rate	44.28%	36.27%	42.87%	47.38%	39.18%	45.95%	52.42%	43.44%	50.84%	57.80%	47.80%	56.05%
Member Rate	3.50%	4.50%	3.68%	3.50%	4.50%	3.68%	3.50%	4.50%	3.68%	3.50%	4.50%	3.68%
Employer Rate	40.78%	31.77%	39.19%	43.88%	34.68%	42.27%	48.92%	38.94%	47.16%	54.30%	43.30%	52.37%
Accrued Liability			$ 81,021,262			$ 84,249,979			$ 89,259,894			$ 94,971,765
Valuation Assets			$ 48,364,215			$ 48,364,215			$ 48,364,215			$ 48,364,215
Unfunded Liability			$ 32,657,047			$ 35,885,764			$ 40,895,679			$ 46,607,550
Funded Percent			59.7%			57.4%			54.2%			50.9%
FY 2017 Contribution			$ 3,662,151			$ 3,949,965			$ 4,385,652			$ 4,870,157
Alternate Amortization Period									30			30
UAL%									24.26%			26.07%
Employer Rate									43.35%			47.91%
FY 2017 Contribution									$ 4,031,341			$ 4,455,398

** Based upon a 24-year amortization period.*

ACTUARIAL VALUATION RESULTS
BASED ON PROPOSED DEMOGRAPHIC AND ECONOMIC ASSUMPTIONS
AS OF SEPTEMBER 30, 2015

Actuarial Valuation Results as of September 30, 2015. Actuarial valuation results, based upon the proposed set of demographic and economic assumptions, are shown below:

Fire

	Current Assumptions			Proposed Decrement Assumptions and Indicated Investment Return and Wage Inflation Assumptions								
							Proposed Economic Assumptions					
	7.50%, 3.50%			Demographic Changes Only			7.0%, 3.25%			6.5%, 3.25%		
	Pre 10/1/2012	Post 10/1/2012	Fire Total*	Pre 10/1/2012	Post 10/1/2012	Fire Total*	Pre 10/1/2012	Post 10/1/2012	Fire Total*	Pre 10/1/2012	Post 10/1/2012	Fire Total*
Normal Cost	38.07%	18.60%	35.04%	40.13%	19.62%	36.93%	43.92%	21.26%	40.39%	49.17%	23.67%	45.19%
UAL%*	35.88%	35.88%	35.88%	39.11%	39.11%	39.11%	44.25%	44.25%	44.25%	48.43%	48.43%	48.43%
Total Rate	73.95%	54.48%	70.92%	79.24%	58.73%	76.04%	88.17%	65.51%	84.64%	97.60%	72.10%	93.62%
Member Rate	16.32%	4.00%	14.46%	16.32%	4.00%	14.46%	16.32%	4.00%	14.46%	16.32%	4.00%	14.46%
Employer Rate	57.63%	50.48%	56.46%	62.92%	54.73%	61.58%	71.85%	61.51%	70.18%	81.28%	68.10%	79.16%
Accrued Liability			$120,598,202			$124,606,740			$ 132,336,488			$ 141,061,528
Valuation Assets			$ 72,876,702			$ 72,876,702			$ 72,876,702			$ 72,876,702
Unfunded Liability			$ 47,721,500			$ 51,730,038			$ 59,459,786			$ 68,184,826
Funded Percent			60.4%			58.5%			55.1%			51.7%
FY 2017 Contribution			$ 4,872,874			$ 5,314,764			$ 6,027,776			$ 6,799,070
Alternate Amortization Period									30			30
UAL%									38.19%			41.29%
Employer Rate									64.12%			72.02%
FY 2017 Contribution									$ 5,507,281			$ 6,185,814

** Based upon a 24-year amortization period*

SECTION C

ECONOMIC ASSUMPTIONS

ECONOMIC ASSUMPTIONS – INTRODUCTION

Economic assumptions include **long-term rates of investment return** (net of investment expenses based upon a passive investment strategy; sometimes net of administrative expenses), **price inflation**, **wage inflation** (the across-the-board portion of salary increases), pay increases due to **merit and seniority** and a **payroll growth assumption**. Unlike demographic activities, economic activities do not lend themselves to analysis solely on the basis of internal historical patterns because both salary increases and investment return are affected more by external forces; namely inflation (both wage and price), general productivity changes and the local economic environment which defy accurate long-term prediction. Estimates of economic activities are generally selected on the basis of the expectations in an inflation-free environment and then both long-term rates of investment return and wage inflation are increased by some provision for long-term price inflation.

If price inflation and/or productivity increases are lower than expected, it will probably result in both actual rates of salary increases and investment return below the assumed rates. Salaries increasing at rates less than expected produce lower liabilities. However, actual investment return below the assumed rate of investment return (whether due to manager performance, change in the mix of assets, or general market conditions) results in lower than expected asset amounts.

Sources considered in the analysis of the price inflation assumption included:

- 2015 Social Security Trustees Report
- Philadelphia Federal Reserve quarterly survey of Society of Professional Forecasters
- Congressional Budget Office's 2014 Long-Term Budget Outlook
- Comparison of Treasury yields and Treasury Inflation Protected Securities (TIPS)
- Future capital market expectations of eight investment consultants that GRS monitors

Sources considered in the analysis of the investment return assumption included:

- Future capital market expectations of eight investment consultants that GRS monitors

Sources considered in the analysis of the wage inflation, merit and seniority and payroll growth assumptions included:

- Actual experience over the last 5 years (i.e., merit and seniority pay increases)
- Historical observations of inflation statistics (both price and wage) nationally

ECONOMIC ASSUMPTIONS – INTRODUCTION (CONCLUDED)

Because GRS is a benefits consulting firm and does not develop or maintain its own capital market expectations, we monitor forward-looking expectations developed by several major investment consulting firms. The eight investment consultants that GRS monitored for this analysis were Towers Watson, PCA, RV Kuhns, BNY Mellon, JP Morgan, Aon, NEPC and Mercer.

Current economic assumptions for the System are as follows:

Investment Return	7.50%
Wage Inflation	3.50%
Price Inflation	3.00%
Spread Between Investment Return and Wage Inflation	4.00%
Spread Between Investment Return and Price Inflation	4.50%

Note that the investment return assumption of 7.50% is currently net of investment expenses based upon a passive investment strategy *but gross of administrative expenses*. A 0.35% of payroll load to the normal cost was first used in the September 30, 2015 actuarial valuation to reflect administrative expenses.

The remainder of this section addresses the economic assumptions other than pay increases due to merit and seniority. Pay increases due to merit and seniority are addressed in Section G.

ECONOMIC ASSUMPTIONS – ASOP NO. 27

Guidance regarding the selection of economic assumptions for measuring pension obligations is provided by Actuarial Standards of Practice (ASOP) No. 27. The standard requires that the selected economic assumptions be consistent with each other. That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions.

ASOP No. 27 has been revised since the last time an Experience Study was performed for the City of Columbia Police and Firemen's Retirement Fund. The adopted revision of ASOP No. 27 (applicable to valuation dates on or after September 30, 2014) defines a reasonable economic assumption as an assumption that 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 valuation 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 not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed under Section 3.5.1, or when alternative assumptions are used for the assessment of risk.

The revised ASOP No. 27 has significantly reduced the range of economic assumptions that can be deemed reasonable for actuarial valuation purposes.

ECONOMIC ASSUMPTIONS – PRICE INFLATION

Price inflation underlies both the wage inflation and investment return assumptions. Since price inflation underlies the wage inflation assumption and the investment return assumption, we recommend that a specific price inflation assumption be adopted in conjunction with this Experience Study. The table below shows the average price inflation over various periods, ending December 2015:

Periods Ending December 2015	Average Annual Increase in CPI-U
Last five (5) years	1.53%
Last ten (10) years	1.86
Last fifteen (15) years	2.07
Last twenty (20) years	2.18
Last twenty-five (25) years	2.30
Last thirty (30) years	2.61

As the table shows, recent experience, both short-term and long-term, has been below the current assumption of 3.0%.

The 2015 Social Security Trustees report uses 2.7% as the long-range intermediate price inflation assumption. For the Congressional Budget Office's 2014 Long-Term Budget Outlook (a 75-year projection), a CPI increase assumption of 2.5% was used.

The Philadelphia Federal Reserve conducts a quarterly survey of the Society of Professional Forecasters. Their recent forecast, from the second quarter of 2016, is for inflation over the following ten years to average 2.20%. This is a decrease from the survey results from the fourth quarter of 2011, which was for inflation over the following ten years to average 2.50%.

Another source of information about future price inflation is the market for US Treasury bonds. The December 31, 2015 yield for a 20-year inflation indexed Treasury bond (20-year TIPS) was 1.07% plus actual inflation. The yield for a non-indexed 20-year Treasury bond was 2.67%. The difference between these two yields, 1.60%, gives an approximate measure of the market's expectation of price inflation over the next 20 years.

ECONOMIC ASSUMPTIONS – PRICE INFLATION (CONCLUDED)

In the process of developing capital market expectations for asset classes, investment consultants use an underlying price inflation assumption. For the eight investment consultants that GRS monitors, the average of price inflation assumptions used in their capital market expectations was 2.27%. The highest price inflation assumption was 2.50% and the lowest was 2.11%.

Based upon the reviewed data, we recommended that the Board consider a price inflation assumption between 2.25% and 2.50%. Our preferred price inflation assumption is 2.50%.

ECONOMIC ASSUMPTIONS – INVESTMENT RETURN

The investment return assumption is the actuarial assumption that has the largest impact on actuarial valuation results. As more of the actuarial accrued liabilities are related to non-active members, the nominal (as opposed to real) investment return assumption becomes a more prominent factor. Since one of the City of Columbia Police and Firemen's Retirement Fund's fundamental financial objectives is the receipt of level contributions over time, the discount rate assumption is set equal to the investment return assumption (with perhaps an adjustment for conservatism).

Presented below is the target asset allocation used in our analysis. The target asset allocation was estimated based upon the asset allocation provided by the client and used in September 2015 for GASB Statement No. 67 reporting purposes.

Asset Allocation

Asset Class	Target Allocation	Long-Term Expected Real Rate of Return
Cash	0.00%	-0.10%
Domestic Equity - Large Cap	26.05%	5.47%
Domestic Equity - Small Cap	26.05%	6.28%
International Equity	11.16%	6.29%
Emerging Markets	11.16%	8.38%
Domestic Corporate Fixed Income	8.36%	1.05%
Domestic Government Fixed Income	11.36%	0.43%
Treasury Inflation Protected Securities	0.00%	0.87%
High Yield Bonds	5.86%	2.71%
Real Estate	0.00%	4.10%
Private Equity	0.00%	8.35%
Hedge Funds	0.00%	3.48%
Other Alternatives	0.00%	3.83%
Total	100.00%	

ECONOMIC ASSUMPTIONS – INVESTMENT RETURN (CONTINUED)

Based upon the asset allocation presented on the previous page, future return expectations of the investment consultants that GRS monitors were analyzed. The analysis was based upon the following:

(1) Since capital market expectations reported by the investment consultants are already net of passive investment expenses, no expense assumption was used. To the extent that the City of Columbia Police and Firemen's Retirement Fund incurs investment expenses for active management, it is assumed that the City of Columbia Police and Firemen's Retirement Fund will earn at least enough investment return to offset the investment expenses associated with active management.

(2) Results presented in the following tables are based upon a price inflation assumption of 2.50% (i.e., GRS' preferred price inflation assumption).

ECONOMIC ASSUMPTIONS – INVESTMENT RETURN (CONTINUED)

Presented below are the results of our investment return analysis:

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Plan Incurred Administrative Expenses	Expected Nominal Return Net of Expenses (6)-(7)		Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)
1	6.31%	2.12%	4.19%	2.50%	6.69%	0.00%	6.69%		14.30%
2	6.95%	2.50%	4.45%	2.50%	6.95%	0.00%	6.95%		15.20%
3	6.99%	2.50%	4.49%	2.50%	6.99%	0.00%	6.99%		13.40%
4	6.90%	2.25%	4.65%	2.50%	7.15%	0.00%	7.15%		14.40%
5	7.38%	2.11%	5.28%	2.50%	7.78%	0.00%	7.78%		15.40%
6	7.69%	2.26%	5.43%	2.50%	7.93%	0.00%	7.93%		14.00%
7	7.93%	2.20%	5.73%	2.50%	8.23%	0.00%	8.23%		14.40%
8	7.94%	2.20%	5.74%	2.50%	8.24%	0.00%	8.24%		14.90%
Average	**7.26%**	**2.27%**	**4.99%**	**2.50%**	**7.49%**	**0.00%**	**7.49%**		**14.50%**

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of exceeding 7.50%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.92%	5.72%	6.52%	28.8%
2	5.01%	5.86%	6.71%	31.4%
3	5.40%	6.15%	6.90%	32.5%
4	5.37%	6.17%	6.98%	33.9%
5	5.82%	6.67%	7.53%	40.4%
6	6.22%	7.01%	7.79%	43.7%
7	6.46%	7.27%	8.07%	47.1%
8	6.37%	7.20%	8.04%	46.4%
Average	**5.70%**	**6.51%**	**7.32%**	**38.0%**

ECONOMIC ASSUMPTIONS – INVESTMENT RETURN (CONCLUDED)

The preferred investment return assumption in the actuarial community is the forward-looking expected geometric return (i.e., 50th percentile). Based upon the average of each of the investment consultants' expectations, this would lead to an investment return assumption of 6.51%. A less preferred investment return assumption, but still reasonable assumption, is the forward-looking expected arithmetic return (i.e., expected nominal return). Based on the average of each of the investment consultants' expectations, this would lead to an investment return assumption of 7.49%.

Based upon the results of our analysis, our preferred investment return assumption would be 6.50%, based upon a price inflation assumption of 2.50%. However, given the current investment return assumption of 7.50%, we have also presented 7.00% as an investment return assumption for the Board's consideration. The higher the selected investment return assumption by the Board, the less margin that would exist for actuarial standards reasonability purposes in future years if capital market expectations are lowered from their current levels. In other words, if capital market assumptions are lowered from current levels and 7.00% is selected by the Board, it may become necessary to lower the investment return assumption yet further prior to the next experience study.

ECONOMIC ASSUMPTIONS – WAGE INFLATION AND PAYROLL GROWTH

Wage Inflation. Wage inflation consists of two components, 1) a portion due to pure price inflation (i.e., increases due to changes in the CPI), and 2) increases in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors). The table below shows the difference between the increase in National Average Earnings and price inflation over various periods, ending December 2015:

Periods Ending December 2015	Difference Between Increase in National Average Earnings and CPI
Last five (5) years	1.3%
Last ten (10) years	0.7
Last fifteen (15) years	0.6
Last twenty (20) years	1.2
Last twenty-five (25) years	1.0
Last thirty (30) years	0.9

We are generally comfortable with the wage inflation assumption exceeding the price inflation assumption by 0.50% to 1.00%. Given our preferred price inflation assumption of 2.50%, our preferred assumption is for the wage inflation assumption to exceed the price inflation assumption by 0.75%. **This would result in a wage inflation assumption of 3.25%.**

Payroll Growth. The table below shows the annual increase in payroll over various periods, ending September 30, 2015:

	Annual Increase in Payroll		
Periods Ending September 2015	Police	Fire	Total
Last five (5) years	0.4 %	2.1 %	1.2 %
Last ten (10) years	2.5	2.9	2.7
Last fifteen (15) years	3.6	3.1	3.3

The above shows that experience over the past 10 and 15 years has lagged or slightly lagged the current payroll growth assumption of 3.50%. However, if all actuarial assumptions are met, and both the number of active members and their age and service characteristics remain relatively constant, it is expected that payroll growth will be the same as wage inflation. **Therefore, we recommend a payroll growth assumption of 3.25%.**

SECTION D

RETIREMENT EXPERIENCE

RATES OF RETIREMENT

Pages D-2 compares the present retirement assumptions with the actual experience for both the Police and Fire groups.

Current retirement eligibility conditions allow a member to retire with an unreduced benefit after completing 20 years of credited service, or at age 65 with any years of credited service for both the Police and Fire groups. The current retirement assumptions are based on the member's service.

As can be seen, there were slightly more retirements than assumed for the Police group (there were substantially more in year one) and substantially fewer retirements than assumed for the Fire group. It appears that the Deferred Retirement Option Program (DROP) is having the desired affect of extending active membership careers for the Fire group. However, this appears not to be the case for the Police group. Experience pertaining to the DROP program is presented on page D-3. We are recommending increasing the first year rate of retirement for Police and a decrease in the rates of retirement for the Fire group to somewhat reflect the experience observed during the five year period.

Because there is no retirement experience for members hired on or after October 1, 2012, we propose similar changes to the retirement rates as those proposed for the pre October 1, 2012 benefit provisions.

The recommended changes will have an upward effect on computed liabilities and contributions for the Police group and will have a downward effect on computed liabilities and contributions for the Fire group.

SERVICE BASED RETIREMENT EXPERIENCE OF POLICE MEMBERS
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Service	Retirements	Exposure	Experience	Sample Rates		Expected Retirements	
				Present	Proposed	Present	Proposed
20	17	25	0.6800	0.3500	0.6500	9	16
21	4	14	0.2857	0.2500	0.2500	4	4
22	4	13	0.3077	0.2500	0.2500	3	3
23	1	7	0.1429	0.2500	0.2500	2	2
24	0	6	0.0000	0.2500	0.2500	2	2
25	2	5	0.4000	0.2500	0.2500	1	1
26	2	5	0.4000	0.2500	0.2500	1	1
27	0	2	0.0000	0.2500	0.2500	1	1
28	0	3	0.0000	0.2500	0.2500	1	1
29	1	3	0.3333	0.2500	0.2500	1	1
30	0	3	0.0000	1.0000	1.0000	3	3
31	1	2	0.5000	1.0000	1.0000	2	2
32	0	1	0.0000	1.0000	1.0000	1	1
33	2	2	1.0000	1.0000	1.0000	2	2
Totals	**34**	**91**	**0.3736**	**0.3626**	**0.4396**	**33**	**40**

SERVICE BASED RETIREMENT EXPERIENCE OF FIRE MEMBERS
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Service	Retirements	Exposure	Experience	Sample Rates		Expected Retirements	
				Present	Proposed	Present	Proposed
20	5	21	0.2381	0.4000	0.3000	8	6
21	2	14	0.1429	0.2500	0.2000	4	3
22	0	10	0.0000	0.2000	0.2000	2	2
23	2	10	0.2000	0.2000	0.2000	2	2
24	0	6	0.0000	0.2000	0.2000	1	1
25	1	4	0.2500	0.5000	0.3500	2	1
26	0	4	0.0000	0.5000	0.3500	2	1
27	1	5	0.2000	0.5000	0.3500	3	2
28	3	5	0.6000	0.5000	0.5000	3	3
29	1	2	0.5000	0.5000	0.5000	1	1
30	1	2	0.5000	1.0000	1.0000	2	2
31	0	2	0.0000	1.0000	1.0000	2	2
32	1	2	0.5000	1.0000	1.0000	2	2
33	0	1	0.0000	1.0000	1.0000	1	1
34	1	1	1.0000	1.0000	1.0000	1	1
35	0	0	N\A	1.0000	1.0000	0	0
36	0	1	0.0000	1.0000	1.0000	1	1
37	0	1	0.0000	1.0000	1.0000	1	1
38	1	1	1.0000	1.0000	1.0000	1	1
Totals	**19**	**92**	**0.2065**	**0.4239**	**0.3587**	**39**	**33**

SERVICE BASED RETIREMENT EXPERIENCE
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

	Police			Fire		
Calendar Year	Retired from Active Status	Retired from DROP	Total Retirements	Retired from Active Status	Retired from DROP	Total Retirements*
2011	(3)	(4)	**(7)**	(1)	(2)	**(3)**
2012	(4)	(2)	**(6)**	(2)	(2)	**(4)**
2013	(5)	(4)	**(9)**	0	(5)	**(5)**
2014	(5)	(6)	**(11)**	(3)	(1)	**(4)**
2015	(1)	0	**(1)**	(2)	(2)	**(4)**
Total	**(18)**	**(16)**	**(34)**	**(8)**	**(12)**	**(20)**

**Includes one age-based retirement.*

MEMBERS ENTERING THE DROP
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

	New DROP Members	
Calendar Year	Police	Fire
2011	3	4
2012	4	5
2013	2	1
2014	2	1
2015	2	1
Total	**13**	**12**

For the 16 Police members that retired from the DROP during the 5-year period, the average DROP participation period was 1.9 years. For these 16 members, 10 participated in the DROP for less than 2 years.

For the 12 Fire members that retired from the DROP during the 5-year period, the average DROP participation period was 3.6 years. For these 12 members, 2 participated in the DROP for less than 2 years.

SECTION E

WITHDRAWAL EXPERIENCE

RATES OF WITHDRAWAL
(EXCLUDING RETIREMENT, DISABILITY, OR DEATH)

Pages E-2 through E-3 compare the present withdrawal assumptions with the actual experience, separately for the Police and Fire groups. Proposed new assumptions are also shown.

Results are presented for members with less than 5 years of service (on a service based basis) and for members with 5 or more years of service (on an age based basis). This is the structure of the current set of assumptions and we recommend continuing this structure going forward. For the Police group, there were more withdrawals than assumed for members with less than five years of service and withdrawals for members with five or more years of service were as expected. For the Fire group, withdrawals were in line with the current assumptions.

The proposed new withdrawal rates are shown on pages E-2 through E-3. The proposed assumptions have a downward effect on computed liabilities and employer contributions for the Police group. We recommend no changes for the Fire group.

WITHDRAWAL EXPERIENCE OF POLICE MEMBERS WITH FIVE OR MORE YEARS OF SERVICE OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Age	Withdrawals	Exposure	Experience	Sample Rates*		Expected Withdrawals	
				Present	Proposed	Present	Proposed
20-24	1	4	0.2500	0.0470	0.0470	0	0
25-29	0	32	0.0000	0.0470	0.0470	1	1
30-34	2	60	0.0333	0.0340	0.0340	2	2
35-39	2	136	0.0147	0.0250	0.0250	3	3
40-44	2	173	0.0116	0.0160	0.0160	2	2
45-49	2	88	0.0227	0.0110	0.0110	1	1
50-54	0	38	0.0000	0.0090	0.0090	0	0
55-59	0	10	0.0000	0.0050	0.0050	0	0
60-64	0	2	0.0000	0.0001	0.0001	0	0
Totals	**9**	**543**	**0.0166**	**0.0166**	**0.0166**	**9**	**9**

** Sample rates are taken from midpoint of age group.*

WITHDRAWAL EXPERIENCE OF POLICE MEMBERS WITH LESS THAN FIVE YEARS OF SERVICE OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Service	Withdrawals	Exposure	Experience	Sample Rates		Expected Withdrawals	
				Present	Proposed	Present	Proposed
0	3	24	0.1250	0.1000	0.1200	2	3
1	6	52	0.1154	0.0900	0.1100	5	6
2	5	47	0.1064	0.0800	0.1000	4	5
3	4	41	0.0976	0.0700	0.0900	3	4
4	7	32	0.2188	0.0600	0.0700	2	2
Totals	**25**	**196**	**0.1276**	**0.0816**	**0.1020**	**16**	**20**

WITHDRAWAL EXPERIENCE OF FIRE MEMBERS
WITH FIVE OR MORE YEARS OF SERVICE
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Age	Withdrawals	Exposure	Experience	Sample Rates*		Expected Withdrawals	
				Present	Proposed	Present	Proposed
20-24	0	0	N\A	0.0250	0.0250	0.0	0.0
25-29	1	10	0.1000	0.0250	0.0250	0.2	0.2
30-34	1	60	0.0167	0.0160	0.0160	1.0	1.0
35-39	2	161	0.0124	0.0090	0.0090	1.4	1.4
40-44	0	130	0.0000	0.0040	0.0040	0.5	0.5
45-49	0	84	0.0000	0.0040	0.0040	0.3	0.3
50-54	1	61	0.0164	0.0040	0.0040	0.2	0.2
55-59	0	23	0.0000	0.0040	0.0040	0.1	0.1
60-64	0	6	0.0000	0.0040	0.0040	0.0	0.0
Totals	**5**	**535**	**0.0093**	**0.0069**	**0.0069**	**3.7**	**3.7**

** Sample rates are taken from midpoint of age group.*

WITHDRAWAL EXPERIENCE OF FIRE MEMBERS
WITH LESS THAN FIVE YEARS OF SERVICE
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Service	Withdrawals	Exposure	Experience	Sample Rates		Expected Withdrawals	
				Present	Proposed	Present	Proposed
0	1	14	0.0714	0.0400	0.0400	0.6	0.6
1	1	25	0.0400	0.0400	0.0400	1.0	1.0
2	1	22	0.0455	0.0300	0.0300	0.7	0.7
3	0	17	0.0000	0.0300	0.0300	0.5	0.5
4	1	25	0.0400	0.0300	0.0300	0.8	0.8
Totals	**4**	**103**	**0.0388**	**0.0350**	**0.0350**	**3.6**	**3.6**

SECTION F

DISABILITY EXPERIENCE

RATES OF DISABILITY

Page F-2 compares the present disability assumptions with actual experience. Proposed new assumptions are also shown.

As shown, the present assumptions reflected actual experience reasonably well for both the Police and Fire groups.

We propose that both the Police group and Fire group rates remain unchanged.

Other Assumptions: We have assumed that 75% of disability benefits are duty related and 25% are non-duty related for members of the Police group. This assumption is required given the different structure of duty and non-duty disability benefits for the Police group. Since the only difference between non-duty and duty disability benefits for Fire members hired before October 1, 2012 is the one year of continuous service requirement for non-duty disability benefits, we have assumed that 100% of disabilities are non-duty related. Given the different benefit structure of duty and non-duty disability benefits for Fire members hired on or after October 1, 2012, we have assumed that 50% of disabilities are non-duty related and 50% of disabilities are duty related.

We propose that these Police and Fire group's disability assumptions remain unchanged.

DISABILITY EXPERIENCE OF POLICE MEMBERS
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Age	Disabilities	Exposure	Experience	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
25-29	0	32	0.0000	0.0018	0.0018	0.0	0.0
30-34	0	60	0.0000	0.0023	0.0023	0.1	0.1
35-39	0	134	0.0000	0.0034	0.0034	0.4	0.4
40-44	0	146	0.0000	0.0050	0.0050	0.7	0.7
45-49	0	58	0.0000	0.0078	0.0078	0.4	0.4
50-54	0	20	0.0000	0.0130	0.0130	0.3	0.3
55-59	0	4	0.0000	0.0231	0.0231	0.1	0.1
60-64	0	2	0.0000	0.0330	0.0330	0.0	0.0
Totals	**0**	**456**	**0.0000**	**0.0044**	**0.0044**	**2.0**	**2.0**

* *Sample rates are taken from midpoint of age group.*

DISABILITY EXPERIENCE OF FIRE MEMBERS
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Age	Disabilities	Exposure	Experience	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
25-29	0	10	0.0000	0.0035	0.0035	0.0	0.0
30-34	0	60	0.0000	0.0046	0.0046	0.3	0.3
35-39	0	160	0.0000	0.0068	0.0068	1.1	1.1
40-44	1	119	0.0084	0.0100	0.0100	1.2	1.2
45-49	1	59	0.0169	0.0157	0.0157	0.9	0.9
50-54	1	36	0.0278	0.0260	0.0260	0.9	0.9
55-59	1	9	0.1111	0.0462	0.0462	0.4	0.4
60-64	0	1	0.0000	0.0660	0.0660	0.1	0.1
Totals	**4**	**454**	**0.0088**	**0.0108**	**0.0108**	**4.9**	**4.9**

* *Sample rates are taken from midpoint of age group.*

SECTION G

SALARY INCREASES

RATES OF MERIT AND LONGEVITY PAY INCREASES

Rates of merit and longevity pay increases for all members were analyzed for the period October 1, 2010 through September 30, 2015. Page G-2 compares the present pay increase assumption with the actual experience. Proposed new assumptions are also shown.

Actual total pay increases include a component for across-the-board pay increases, as well as the merit and longevity component which we are attempting to measure in this study. To complicate matters, the across-the-board component changes from year to year. We normalize each year's experience by subtracting the estimated rate of wage inflation over the 5-year period, or 2.0%.

Actual merit and longevity increases for the Fire group are generally somewhat higher than projected by the present assumptions. (Experience at the younger ages, when members generally have less service credit, may in some instances be influenced by other items such as pay annualization. Hence, less credibility is sometimes given to these experience rates.) The proposed rates for the Fire group give recognition to the higher experience rates observed during the period.

As shown, the present assumptions reflected actual experience reasonably well for the Police group. Hence, the proposed Police rates are unchanged.

The proposed Fire group assumptions have an upward effect on computed liabilities and contributions.

RATES OF MERIT AND LONGEVITY PAY INCREASES OF POLICE MEMBERS OCTOBER 1, 2010 - SEPTEMBER 30, 2015

	Merit/Seniority Portion of Annual Increase		
		Sample Rates*	
Age	Experience**	Present	Proposed
20-24	6.28%	5.23%	5.23%
25-29	2.15%	3.51%	3.51%
30-34	2.97%	2.17%	2.17%
35-39	3.32%	1.23%	1.23%
40-44	0.74%	0.68%	0.68%
45-49	0.13%	0.53%	0.53%
50-54	0.00%	0.38%	0.38%
55-59	0.00%	0.24%	0.24%
60-64	0.00%	0.09%	0.09%
65 and Older	0.00%	0.00%	0.00%

RATES OF MERIT AND LONGEVITY PAY INCREASES OF FIRE MEMBERS OCTOBER 1, 2010 - SEPTEMBER 30, 2015

	Merit/Seniority Portion of Annual Increase		
		Sample Rates*	
Age	Experience**	Present	Proposed
20-24	11.59%	7.90%	9.50%
25-29	6.83%	4.90%	6.70%
30-34	5.75%	2.66%	3.60%
35-39	2.52%	1.73%	2.60%
40-44	1.79%	1.06%	1.60%
45-49	1.84%	0.67%	1.00%
50-54	0.00%	0.41%	0.10%
55-59	0.00%	0.20%	0.00%
60-64	0.00%	0.00%	0.00%
65 and Older	0.00%	0.00%	0.00%

* *Sample rates are taken from midpoint of age group.*

** *The estimate of wage inflation for the experience period was 2.0% for both Police and Fire. The tables above show the raw data during the experience period adjusted by the estimated wage inflation assumption.*

SECTION H

MORTALITY EXPERIENCE

Findings

Post-retirement mortality is an important, but relatively stable ingredient in cost calculations. This assumption should be updated from time to time to reflect longevity improvements.

Another consideration is that Actuarial Standard of Practice (ASOP) No. 35 has recently been revised with regard to the Mortality assumption. ASOP No. 35 Disclosure Section 4.1.1 now states, "The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement." The current rates include such margin in the tables by assuming rates lower than those actually observed (referred to as a static improvement assumption).

The proposed rates take a different approach and assume that future mortality rates will continue to decline with each generation. For this "generational" approach, we remove any static margin from the base tables and apply a mortality improvement scale to project rates getting lower each year in the future. This means that next year's 65-year-old will have a slightly longer life expectancy than this year's, etc.

The approach we have taken is based on the RPEC_2014 model described by the Society of Actuaries (SOA). The base mortality tables we select from are the RP-2014 mortality tables. That is, our starting point was the RP-2014 tables adjusted for mortality improvement back to the observation period base year of 2006. The improvement scales we consider are the 2-dimensional MP-2015 mortality improvement scales. It is anticipated that the SOA will release new improvement scales annually. For purposes of the Columbia valuation, we recommend maintaining the MP-2015 improvement scales until the next experience study.

RATES OF MORTALITY

Healthy Retirees

Healthy mortality experience during the study period was not sufficient to be credible. We recommend adopting the mortality assumptions recently adopted by Missouri LAGERS, or the RP-2014 Healthy Annuitant mortality table for males, adjusted for mortality improvement back to the observation period base year of 2006, and then establish the base year as 2017.

Disabled Retirees

Disabled mortality experience during the study period was not sufficient to be credible. We recommend adopting the mortality assumptions recently adopted by Missouri LAGERS, or the RP-2014 disabled mortality tables, adjusted for mortality improvement back to the observation period base year of 2006, and then establish the base year for males as 2017.

Active Members

Active mortality experience during the study period was not sufficient to be credible. We recommend adopting the mortality assumptions recently adopted by Missouri LAGERS, or the RP-2014 Employees mortality tables, adjusted for mortality improvement back to the observation period base year of 2006, and then establish the base year for males as 2017.

Mortality Improvement

The Society of Actuaries' MP-2015 report recommends considering applying MP-2015 fully generational to the selected RP-2014 table adjusted to the base year of 2006. We have applied this adjustment as recommended.

Future Life Expectancy

The table below shows the future life expectancy of a Healthy Annuitant based on the current and proposed mortality tables.

Sample Attained Ages	Future Life Expectancy (years)			
	Present		Proposed*	
	Men	Women	Men	Women
50	30.80	33.59	33.13	37.52
55	26.18	28.91	28.46	32.60
60	21.74	24.38	23.92	27.81
65	17.61	20.12	19.58	23.18
70	13.88	16.23	15.54	18.78
75	10.57	12.74	11.92	14.72
80	7.75	9.68	8.77	11.09

** Applicable to calendar year 2015. Life expectancy in future years are determined by the MP-2015 projection scale.*

RATES OF POST-RETIREMENT MORTALITY MALES
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Age	Actual	Expected	Exposure	Crude Rate	Act/Exp	Sample Rates*	
						Present	Proposed
40-44	0	0	5	0.0000	0.0000	0.0012	0.0029
45-49	0	0	59	0.0000	0.0000	0.0017	0.0045
50-54	1	0	155	0.0065	2.5000	0.0027	0.0058
55-59	2	1	141	0.0142	2.8571	0.0047	0.0070
60-64	2	2	211	0.0095	1.0526	0.0088	0.0099
65-69	3	2	135	0.0222	1.4286	0.0161	0.0160
70-74	1	2	71	0.0141	0.5263	0.0273	0.0262
75-79	1	2	39	0.0256	0.5556	0.0469	0.0431
80-84	1	3	33	0.0303	0.3846	0.0805	0.0720
85-89	4	2	11	0.3636	2.5000	0.1360	0.1232
Totals	**15**	**13.1**	**860**	**0.0174**	**1.1439**	**0.0152**	**0.0159**

** Sample rates are taken from midpoint of age group.*

RATES OF POST-RETIREMENT MORTALITY FEMALES
OCTOBER 1, 2010 - SEPTEMBER 30, 2015

Age	Actual	Expected	Exposure	Crude Rate	Act/Exp	Sample Rates*	
						Present	Proposed
40-44	0	0.00	1	0.0000	0.0000	0.0017	0.0036
45-49	0	0.02	12	0.0000	0.0000	0.0027	0.0048
50-54	1	0.04	34	0.0294	25.0000	0.0040	0.0062
55-59	0	0.03	16	0.0000	0.0000	0.0070	0.0085
60-64	0	0.13	11	0.0000	0.0000	0.0133	0.0128
65-69	0	0.21	17	0.0000	0.0000	0.0243	0.0202
70-74	0	0.10	3	0.0000	0.0000	0.0413	0.0329
75-79	0	0.00	0	0.0000	0.0000	0.0682	0.0541
80-84	0	0.00	0	0.0000	0.0000	0.1126	0.0929
85-89	0	0.00	0	0.0000	0.0000	0.1927	0.1651
Totals	**1**	**0.5**	**94**	**0.0106**	**1.8960**	**0.0056**	**0.0105**

** Sample rates are taken from midpoint of age group.*

SECTION I

NEW ASSUMPTION LISTING

ACTUARIAL ASSUMPTIONS
BASED ON 2010-2015 EXPERIENCE STUDY

NORMAL RETIREMENT

Pre 10/1/2012 Hires

Normal Retirement Pre 10/1/2012		
	% Retiring	
Service	Police	Fire
20	65%	30%
21	25%	20%
22	25%	20%
23	25%	20%
24	25%	20%
25	25%	35%
26	25%	35%
27	25%	35%
28	25%	50%
29	25%	50%
30	100%	100%
Rx	235	2666
anchor	20	20

Post 10/1/2012 Hires

Normal Retirement Post 10/1/2012	
	% Retiring
Service	Police
25	65%
26	25%
27	25%
28	25%
29	25%
30	100%

Normal Retirement Post 10/1/2012	
	% Retiring
Age	Fire
55	30%
56	20%
57	20%
58	20%
59	20%
60	35%
61	35%
62	35%
63	50%
64	50%
65	100%

With Rule of 80 Post 10/1/2012	
	% Retiring
Age	Fire
50	30%
51	20%
52	20%
53	20%
54	20%
55	35%
56	35%
57	35%
58	50%
59	50%
60	100%

SELECT AND ULTIMATE WITHDRAWAL

Less than 5 Years of Service		
Service Index	Police	Fire
1	0.1200	0.0400
2	0.1100	0.0400
3	0.1000	0.0300
4	0.0900	0.0300
5	0.0700	0.0300
Sw	1047	142

5 or More Years of Service		
Age	Police	Fire
25	0.0470	0.0250
26	0.0470	0.0250
27	0.0470	0.0250
28	0.0426	0.0240
29	0.0402	0.0210
30	0.0378	0.0200
31	0.0354	0.0180
32	0.0340	0.0160
33	0.0322	0.0150
34	0.0304	0.0130
35	0.0286	0.0110
36	0.0268	0.0100
37	0.0250	0.0090
38	0.0232	0.0080
39	0.0214	0.0060
40	0.0196	0.0040
41	0.0178	0.0040
42	0.0160	0.0040
43	0.0150	0.0040
44	0.0140	0.0040
45	0.0130	0.0040
46	0.0120	0.0040
47	0.0110	0.0040
48	0.0106	0.0040
49	0.0102	0.0040
50	0.0098	0.0040
51	0.0094	0.0040
52	0.0090	0.0040
53	0.0082	0.0040
54	0.0074	0.0040
Wx	660	285
Wx Mult	100%	100%

DISABILITY RATES

	% Becoming Disabled	
Age	Police	Fire
20	0.15%	0.29%
21	0.15%	0.29%
22	0.15%	0.29%
23	0.18%	0.36%
24	0.19%	0.37%
25	0.18%	0.36%
26	0.18%	0.35%
27	0.18%	0.35%
28	0.18%	0.36%
29	0.19%	0.37%
30	0.20%	0.40%
31	0.21%	0.43%
32	0.23%	0.46%
33	0.25%	0.50%
34	0.27%	0.54%
35	0.28%	0.57%
36	0.32%	0.63%
37	0.34%	0.68%
38	0.36%	0.73%
39	0.39%	0.78%
40	0.42%	0.85%
41	0.46%	0.92%
42	0.50%	1.00%
43	0.54%	1.09%
44	0.59%	1.19%
45	0.65%	1.30%
46	0.71%	1.43%
47	0.78%	1.57%
48	0.91%	1.82%
49	0.95%	1.90%
50	1.05%	2.10%
51	1.17%	2.34%
52	1.30%	2.60%
53	1.46%	2.91%
54	1.63%	3.27%
55	1.84%	3.67%
56	2.06%	4.12%
57	2.31%	4.62%
58	2.57%	5.14%
59	2.83%	5.65%
60	3.06%	6.12%
Hx	18	18
Mult	50%	100%

AGE BASED SALARY SCALE

% Merit Increases in Salaries Next Year		
Age	**Police**	**Fire**
20	5.3%	9.5%
21	5.3%	9.5%
22	5.2%	9.5%
23	4.9%	9.5%
24	4.5%	9.5%
25	4.2%	8.5%
26	3.8%	7.6%
27	3.5%	6.7%
28	3.2%	5.9%
29	2.9%	5.1%
30	2.7%	4.3%
31	2.4%	3.9%
32	2.2%	3.6%
33	2.0%	3.4%
34	1.8%	3.2%
35	1.6%	3.0%
36	1.4%	2.8%
37	1.2%	2.6%
38	1.1%	2.4%
39	1.0%	2.2%
40	0.9%	2.0%
41	0.8%	1.8%
42	0.7%	1.6%
43	0.7%	1.4%
44	0.6%	1.3%
45	0.6%	1.2%
46	0.6%	1.1%
47	0.5%	1.0%
48	0.5%	0.8%
49	0.5%	0.7%
50	0.4%	0.5%
51	0.4%	0.3%
52	0.4%	0.1%
53	0.4%	0.0%
54	0.3%	0.0%
55	0.3%	0.0%
56	0.3%	0.0%
57	0.2%	0.0%
58	0.2%	0.0%
59	0.2%	0.0%
60	0.2%	0.0%
Ref	76	482

HEALTHY MORTALITY
PROPOSED RATES*

Age	% Dying Next Year	
	Male	Female
50	0.5046%	0.2688%
51	0.5329%	0.2847%
52	0.5599%	0.3025%
53	0.5826%	0.3224%
54	0.6049%	0.3445%
55	0.6289%	0.3687%
56	0.6564%	0.3954%
57	0.6892%	0.4245%
58	0.7286%	0.4566%
59	0.7757%	0.4922%
60	0.8324%	0.5314%
61	0.8992%	0.5752%
62	0.9770%	0.6240%
63	1.0669%	0.6784%
64	1.1695%	0.7395%
65	1.2850%	0.8081%
66	1.4142%	0.8856%
67	1.5576%	0.9727%
68	1.7164%	1.0707%
69	1.8927%	1.1800%
70	2.0870%	1.3018%
71	2.3010%	1.4367%
72	2.5384%	1.5861%
73	2.8007%	1.7512%
74	3.0916%	1.9350%
75	3.4129%	2.1400%
76	3.7704%	2.3683%
77	4.1682%	2.6261%
78	4.6119%	2.9171%
79	5.1075%	3.2463%
80	5.6630%	3.6195%

Age	% Dying Next Year	
	Male	Female
81	6.2847%	4.0455%
82	6.9837%	4.5262%
83	7.7679%	5.0733%
84	8.6499%	5.6928%
85	9.6359%	6.3897%
86	10.7365%	7.1728%
87	11.9648%	8.0465%
88	13.3292%	9.0167%
89	14.8391%	10.0861%
90	16.5059%	11.2708%
91	18.2602%	12.5533%
92	20.0512%	13.9159%
93	21.8524%	15.3473%
94	23.6490%	16.8334%
95	25.4251%	18.3814%
96	27.3075%	20.0841%
97	29.2199%	21.8631%
98	31.1746%	23.7173%
99	33.1559%	25.6439%
100	35.1605%	27.6222%
101	37.1594%	29.6405%
102	39.1066%	31.6762%
103	40.9965%	33.7151%
104	42.8014%	35.7256%
105	44.5068%	37.7120%
106	46.1239%	39.6516%
107	47.6080%	41.5097%
108	48.9704%	43.3020%
109	50.2233%	45.0018%
110	100.0000%	100.0000%
Ref	#2135sb0x1	#2136sb0x1

* *Applicable to calendar year 2015. Rates in future years are determined by the above rates and the MP-2015 projection scale.*

DISABLED MORTALITY
PROPOSED RATES*

Age	% Dying Next Year	
	Male	Female
50	2.5319%	1.1566%
51	2.5550%	1.2199%
52	2.5706%	1.2841%
53	2.5706%	1.3489%
54	2.5706%	1.4129%
55	2.5706%	1.4740%
56	2.5781%	1.5330%
57	2.6126%	1.5878%
58	2.6686%	1.6399%
59	2.7470%	1.6904%
60	2.8497%	1.7402%
61	2.9756%	1.7935%
62	3.1240%	1.8523%
63	3.2948%	1.9201%
64	3.4860%	2.0001%
65	3.6971%	2.0946%
66	3.9261%	2.2063%
67	4.1718%	2.3366%
68	4.4356%	2.4876%
69	4.7192%	2.6593%
70	5.0213%	2.8532%
71	5.3442%	3.0699%
72	5.6929%	3.3105%
73	6.0674%	3.5764%
74	6.4720%	3.8709%
75	6.9066%	4.1950%
76	7.3774%	4.5498%
77	7.8874%	4.9408%
78	8.4413%	5.3684%
79	9.0434%	5.8345%
80	9.7016%	6.3403%

Age	% Dying Next Year	
	Male	Female
81	10.4203%	6.8924%
82	11.2109%	7.4840%
83	12.0793%	8.1245%
84	13.0374%	8.8135%
85	14.0880%	9.5490%
86	15.2397%	10.3352%
87	16.5037%	11.1690%
88	17.8838%	12.0507%
89	19.3843%	12.9755%
90	21.0114%	13.9564%
91	22.6215%	15.0354%
92	24.2043%	16.2007%
93	25.7584%	17.4429%
94	27.2797%	18.7446%
95	28.7533%	20.1110%
96	30.3178%	21.6369%
97	31.8797%	23.2306%
98	33.4494%	24.8881%
99	35.0144%	26.6067%
100	36.5858%	28.3698%
101	38.1608%	30.1760%
102	39.7362%	32.0194%
103	41.3247%	33.8973%
104	42.9148%	35.7899%
105	44.5068%	37.7120%
106	46.1239%	39.6516%
107	47.6080%	41.5097%
108	48.9704%	43.3020%
109	50.2233%	45.0018%
110	100.0000%	100.0000%
Ref	#2137sb0x1	#2138sb0x1

** Applicable to calendar year 2015. Rates in future years are determined by the above rates and the MP-2015 projection scale.*

PRE-RETIREMENT MORTALITY
PROPOSED RATES*

Age	% Dying Next Year	
	Male	Female
50	0.2093%	0.1070%
51	0.2274%	0.1181%
52	0.2463%	0.1301%
53	0.2645%	0.1428%
54	0.2840%	0.1564%
55	0.3058%	0.1703%
56	0.3314%	0.1850%
57	0.3625%	0.2001%
58	0.4004%	0.2159%
59	0.4464%	0.2324%
60	0.5022%	0.2500%
61	0.5688%	0.2692%
62	0.6474%	0.2903%
63	0.7392%	0.3141%
64	0.8450%	0.3409%
65	0.9658%	0.3711%
66	1.0889%	0.4130%
67	1.2252%	0.4599%
68	1.3757%	0.5130%
69	1.5418%	0.5722%
70	1.7242%	0.6382%
71	1.9244%	0.7118%
72	2.1454%	0.7937%
73	2.3885%	0.8848%
74	2.6564%	0.9866%
75	2.9501%	1.1006%
76	3.2732%	1.2276%
77	3.6280%	1.3705%
78	4.0176%	1.5304%
79	4.4449%	1.7094%
80	4.9146%	1.9092%

Age	% Dying Next Year	
	Male	Female
81	5.5355%	2.2558%
82	6.3020%	2.7418%
83	7.2053%	3.3640%
84	8.2404%	4.1162%
85	9.3961%	4.9900%
86	10.6650%	5.9794%
87	12.0413%	7.0730%
88	13.5135%	8.2603%
89	15.0699%	9.5256%
90	16.6991%	10.8653%
91	18.3871%	12.2743%
92	20.1162%	13.7409%
93	21.8757%	15.2553%
94	23.6530%	16.8011%
95	25.4251%	18.3814%
96	27.3075%	20.0841%
97	29.2199%	21.8631%
98	31.1746%	23.7173%
99	33.1559%	25.6439%
100	35.1605%	27.6222%
101	37.1594%	29.6405%
102	39.1066%	31.6762%
103	40.9965%	33.7151%
104	42.8014%	35.7256%
105	44.5068%	37.7120%
106	46.1239%	39.6516%
107	47.6080%	41.5097%
108	48.9704%	43.3020%
109	50.2233%	45.0018%
110	100.0000%	100.0000%
Ref	#2133sb0x1	#2134sb0x1

** Applicable to calendar year 2015. Rates in future years are determined by the above rates and the MP-2015 projection scale.*