City of Royal Oak Retirement System

Review of System Experience

July 1, 2012 Through June 30, 2017

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September 28, 2018

Board of Trustees
City of Royal Oak Retirement System
Royal Oak, Michigan

Dear Board Members:

Presented in this report are the results of a review of Retirement System experience. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing the City of Royal Oak Retirement System (RORS) actuarial liabilities, assets and actuarially determined employer contribution rates.

The investigation was based upon the data furnished for the annual actuarial valuations during the period ***July 1, 2012 through June 30, 2017.***

We have shown the expected impact of the proposed changes on City contributions as of June 30, 2017. This information is shown in Section D of this report.

Mark Buis and James D. Anderson are Members of the American Academy of Actuaries (MAAA) and meet the qualification standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,

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James D. Anderson, FSA, EA, FCA, MAAA

MHB/JDA:ah

159

Index

Section	Page	
	1	Introduction
A		**Demographic Assumptions**
	2	Retirement
	3-4	Retirement Rates
	5	Turnover
	6	Turnover Rates
	7	Disability
	7	Disability Rates
	8	Mortality
	9	Summary of Life Expectancies
	10	Merit and Longevity Portion of Pay Increases
B		**Economic Assumptions**
	11-16	Investment Return and Wage Inflation
C	17-18	**Miscellaneous Assumptions and Methods**
D		**Contribution Rates Based on Proposed Changes**
	19	Summary of Current and Proposed Assumptions
	20	Effects of Recommended Changes in Actuarial Assumptions on Actuarial Liabilities and Pension Contribution Rates
E		**Complete Listing of Recommended Assumptions**
	21	Proposed Retirement Rates
	22	Proposed Turnover rates
	23	Proposed Disability Rates
	24	Proposed Merit and Longevity Portion of Pay Increases
	25-27	Proposed Mortality Rates

Introduction

Each year, as of June 30th, the actuarial liabilities of the City of Royal Oak Retirement System are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

- Rates of **termination** of active members
- Rates of **disability** among active members
- Rates of **retirement** among active members
- Rates of **mortality** among active members, retirants and beneficiaries
- Long-term rates of **investment return** to be generated by the assets of the System
- Patterns of **salary increases** to active members

Assumptions should be carefully chosen and continually monitored. Continued use of outdated assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or sharp increases in required contributions at some point in the future; or

- Overstated costs resulting in either benefit levels that are kept below the level that could be supported by the computed rate or an unnecessarily large burden on the current generation of members, employers and taxpayers.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things also changes. In recognition of this, assumptions used to value the liabilities of the Retirement System should be reviewed and adjusted periodically to recognize changes in experience trends, a changing economic environment (or changing perceptions of the economic environment) and to maintain consistency within the universe of public employee retirement systems. The results of this analysis are shown in Section A of this report.

A common practice among public employee retirement systems is that the actuary recommends a set of demographic assumptions and suggests a range of reasonable alternate economic assumptions. Following discussion involving the actuary, the plan governing body, and other professionals, the plan governing body makes a final choice from the various alternatives.

The scope of this report is limited to assumptions used in the pension actuarial valuation. Analysis of assumptions specific to the retiree health valuation is beyond the scope of this project.

SECTION A

DEMOGRAPHIC ASSUMPTIONS

Retirement

Discussion: Rates of retirement are used to measure the probabilities of an eligible member retiring from City employment during the next year. During the study period, actual rates of retirement for the City of Royal Oak Retirement System have been higher than expected for all Police and Fire groups.

Summary of Experience: The experience during the study period is summarized below:

Number of Retirements Among Eligible System Members					
Police & Fire and Police Service Aides		General		Total	
Actual	Expected	Actual	Expected	Actual	Expected
34	11.65	26	29.25	60	40.90

Proposal: We recommend a change in the retirement rates for the Police and Fire groups and Police Service Aides. The current and proposed retirement rates are shown on the following two pages. This change will put upward pressure on liabilities.

Retirement Rates

Current Rates of Retirement

Retirement Ages	Percents of Active Members Retiring within Next Year: General	Police Service Aides	Fire Hired Before 10/1/09 & All Police	Fire Hired After 10/1/09	Retirement Service	All Police, Police and Fire Department Heads, and Fire Hired Before 10/1/09
45-49						
50	20%	20%		40%	25	40%
51	15%	15%		40%	26	40%
52	15%	15%		40%	27	40%
53	15%	15%		25%	28	25%
54	15%	15%		25%	29	25%
55	15%	15%	25%	25%	30	25%
56	15%	15%	25%	25%	31	25%
57	15%	15%	25%	25%	32	25%
58	15%	15%	25%	25%	33	25%
59	15%	15%	25%	25%	34	25%
60	15%	15%	25%	25%	35	25%
61	15%	15%	25%	25%	36	25%
62	35%	35%	25%	25%	37	25%
63	20%	20%	25%	25%	38	25%
64	20%	20%	25%	25%	39	25%
65	55%	100%	100%	100%	40	100%
66	45%					
67	45%					
68	45%					
69	45%					
70	100%					
Ref.	2321	2322	2323	2323		2323

Proposed Rates of Retirement

Retirement Ages	Percents of Active Members Retiring within Next Year: General	Police Service Aides	Fire Hired Before 10/1/09 & All Police	Fire Hired After 10/1/09	Retirement Service	All Police, Police and Fire Department Heads, and Fire Hired Before 10/1/09
45-49						
50	20%	22.5%		50%	25	50%
51	15%	17.5%		50%	26	50%
52	15%	17.5%		50%	27	50%
53	15%	17.5%		30%	28	30%
54	15%	17.5%		30%	29	30%
55	15%	17.5%	30%	30%	30	30%
56	15%	17.5%	30%	30%	31	30%
57	15%	17.5%	30%	30%	32	30%
58	15%	17.5%	30%	30%	33	30%
59	15%	17.5%	30%	30%	34	30%
60	15%	17.5%	30%	30%	35	30%
61	15%	17.5%	30%	30%	36	30%
62	35%	37.5%	30%	30%	37	30%
63	20%	22.5%	30%	30%	38	30%
64	20%	22.5%	30%	30%	39	30%
65	55%	100%	100%	100%	40	100%
66	45%					
67	45%					
68	45%					
69	45%					
70	100%					
Ref.	2321	2549	2550	2550		2550

Additionally, all Police and Fire employees are assumed to retire with 100% probability upon attaining a maximum benefit.

Turnover

Discussion: During the study period, actual rates of termination for all employee groups have been less than expected at most ages. The actual turnover rates for General employees are only slightly less than expected, so no change is recommended in that case. However, the experience suggests a need to decrease the overall assumed rates of termination for the Police and Fire employees. The tables on the current and following pages summarize recent experience and the current and proposed rates of termination.

Summary of Experience: The experience during the study period is summarized below.

Number of General Employee Terminations from City Employment

Vested		Non-Vested		Total	
Actual	**Expected**	**Actual**	**Expected**	**Actual**	**Expected**
5	6.18	0	0.23	5	6.41

Number of Police and Fire and Police Service Aide Terminations from City Employment

Vested		Non-Vested		Total	
Actual	**Expected**	**Actual**	**Expected**	**Actual**	**Expected**
2	3.31	7	12.21	9	15.52

Proposal: We recommend a change in the turnover rates for the Police and Fire groups. The current and proposed turnover rates are shown on the following page. This change will put upward pressure on liabilities.

Turnover Rates

Current Rates of Turnover

Sample Ages	Years of Service	% of Active Members Separating within Next Year *	
		General & PSA	Police & Fire
ALL	0	12.00%	10.00%
	1	9.00%	7.00%
	2	7.00%	5.00%
	3	5.00%	4.00%
	4	4.50%	3.50%
25	5 & Over	4.50%	3.00%
30		4.00%	2.50%
35		3.50%	1.50%
40		2.50%	1.00%
45		2.00%	0.75%
50		1.50%	0.50%
55		1.00%	0.25%
60		1.00%	0.25%
65		1.00%	0.25%
Ref.		29	30
		1300	1301

Proposed Rates of Turnover

Sample Ages	Years of Service	% of Active Members Separating within Next Year *	
		General & PSA	Police & Fire
ALL	0	12.00%	10.00%
	1	9.00%	7.00%
	2	7.00%	5.00%
	3	5.00%	4.00%
	4	4.50%	3.50%
25	5 & Over	4.50%	2.50%
30		4.00%	2.00%
35		3.50%	1.25%
40		2.50%	0.75%
45		2.00%	0.50%
50		1.50%	0.25%
55		1.00%	0.25%
60		1.00%	0.25%
65		1.00%	0.25%
Ref.		29	30
		1300	1177

* *No separations are assumed for members eligible to retire.*

Disability

Discussion: The actual number of disability retirements was approximately equal to the number expected during the study period for all groups.

Number of Disability Retirements from City Employment					
Police and Fire and Police Service Aides		General		Total	
Actual	Expected	Actual	Expected	Actual	Expected
3	2.57	1	1.56	4	4.13

Proposal: We recommend no change to the current disability rates at this time. The current and proposed rates are shown below:

Disability Rates

Current and Proposed Rates of Disability

Sample Ages	% of Active Members Becoming Disabled within Next Year		
	General & PSA		
	Male	Female	Police & Fire
20	0.04%	0.02%	0.08%
25	0.05%	0.03%	0.11%
30	0.05%	0.04%	0.19%
35	0.07%	0.07%	0.23%
40	0.11%	0.10%	0.53%
45	0.16%	0.14%	0.60%
50	0.26%	0.23%	0.71%
55	0.46%	0.38%	0.83%
60	0.77%	0.55%	0.90%
Ref.	33	34	45
Multiplier:	50%	50%	75%

Mortality

Discussion: Mortality rates among retired public employees have been declining for years. Additionally, and perhaps consequently, the Actuarial Standards of Practice with regard to the mortality assumption has recently been revised. 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."*** In 2014, the Society of Actuaries released a new set of mortality tables (RP-2014) and recommended the use of a 'fully generational' (2-dimensional) projection scale (MP-2014). Recently, the Society of Actuaries issued a newer projection scale (MP-2017).

Proposal: We recommend updating the mortality assumption to use the following; this change will increase measured liabilities:

- **Healthy Pre-Retirement:** The RP-2014 Employee Generational Mortality Tables, with blue-collar adjustments and extended via cubic spline. This table is adjusted backwards to 2006 with the MP-2014 scale, resulting in a base year of 2006 with future mortality improvements assumed each year using scale MP-2017.

- **Healthy Post-Retirement:** The RP-2014 Healthy Annuitant Generational Mortality Tables, with blue-collar adjustments and extended via cubic spline. This table is adjusted backwards to 2006 with the MP-2014 scale, resulting in a base year of 2006 with future mortality improvements assumed each year using scale MP-2017.

- **Disability Retirement:** The RP-2014 Disabled Mortality Table, extended via cubic spline. This table is adjusted backwards to 2006 with the MP-2014 scale, resulting in a base year of 2006 with future mortality improvements assumed each year using scale MP-2017.

Mortality

Summary of Life Expectancies under the Current Tables

Sample Attained Ages	Healthy Post-Retirement Future Life Expectancy (Years)	
	Men	Women
55	27.27	29.03
60	22.72	24.49
65	18.47	20.24
70	14.58	16.34
75	11.01	12.82
80	7.93	9.66

For disabled retirees, mortality rates are based on the healthy life table above, but set forward ten years.

The Healthy Post-Retirement table shown above was used for active members with 100% of deaths assumed to be non-duty related.

Summary of Life Expectancies under the Proposed Tables

Sample Attained Ages	Healthy Pre-Retirement Future Life Expectancy (Years)*		Healthy Post-Retirement Future Life Expectancy (Years)*		Disabled Retirement Future Life Expectancy (Years)*	
	Men	Women	Men	Women	Men	Women
55	29.54	34.78	28.31	31.18	21.00	24.76
60	24.74	29.82	23.80	26.51	18.03	21.28
65	20.29	24.98	19.57	22.04	15.22	17.89
70	16.23	20.26	15.65	17.77	12.49	14.52
75	12.49	15.75	12.06	13.83	9.87	11.37
80	9.16	11.52	8.92	10.34	7.51	8.66

** Based on retirements in 2017. Retirements in future years will reflect improvements in life expectancy.*

Merit and Longevity Portion of Pay Increases

Discussion: Pay increases granted to individual active members consist in principle of two parts. The first part is an across-the-board economic type of increase related to inflation or cost-of-living changes. The second part, merit and/or longevity increases, relates to the performance of individual active members during a given year. Merit and longevity may include promotions and pay increases related to years of experience. Overall, merit and longevity pay increases were lower than expected during the experience period.

Proposal: Lower the rates of merit and longevity rate of salary increase for all groups. The current and proposed rates are shown below.

Current Rates

Sample Ages	Annual Rate of Salary Increase for Sample Age Merit & Longevity	
	General & PSA	Police-Fire
20	2.9%	2.3%
25	2.3%	2.3%
30	2.0%	2.3%
35	1.8%	1.6%
40	1.6%	0.6%
45	1.3%	0.2%
50	0.9%	0.1%
55	0.5%	0.0%
60	0.1%	0.0%
65	-	-
Ref	417	418

Proposed Rates

Sample Ages	Annual Rate of Salary Increase for Sample Age Merit & Longevity	
	General & PSA	Police-Fire
20	2.2%	1.7%
25	1.8%	1.7%
30	1.5%	1.7%
35	1.3%	1.2%
40	1.2%	0.4%
45	0.9%	0.1%
50	0.6%	0.1%
55	0.4%	0.0%
60	0.1%	0.0%
65	-	-
Ref	760	761

SECTION B

ECONOMIC ASSUMPTIONS

Economic Assumptions
Investment Return and Wage Inflation

Economic assumptions include **long-term rates of investment return** (investment expenses) and **wage inflation** (the across-the-board portion of salary increases). 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 inflation.

If 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 economic assumptions included:

- Actual Plan experience over the last 5 years (i.e., merit and seniority pay increases);
- **Future expectations of various investment consultants;**
- 2017 Social Security Trustees Report; and
- Historical observations of inflation statistics (both price and wage) and investment returns.

Current economic assumptions for the System are as follows:

Price Inflation	2.75%
Wage Inflation	3.00%
Investment Return	7.75%

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 on page 10.

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.

The recently 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.

Public Act 202. Under Public Act 202 of the State of Michigan, Michigan municipalities will be required to report liabilities under new uniform assumption guidelines. While the current guidelines are currently only for reporting purposes (and not funding), City governments will be encouraged to use these new assumptions for funding. The recommendations include the following:

- Investment return no higher than 7.0%
- Assumed wage inflation no lower than 3.5%
- Mortality assumption that uses a version of the RP-2014 table
- Amortization period no longer than 20 years for Pension Plans and 30 years for Retiree Health Plans

Price Inflation. While no specific price inflation assumption is necessary in order to perform the actuarial valuation, price inflation is a key component of the underlying wage inflation and interest rate assumptions. The chart on the following page shows historical averages of both price and wage inflation. While long-term historical averages approach 4.0%, short-term averages are generally between 2.0% and 2.5%. Most investment firms expect inflation to be between 2.0% and 2.5%, and the 2017 annual report of the Social Security Trustees uses 2.6% as the intermediate assumption. **Based upon the reviewed data, we suggest the Board adopt a price inflation assumption of 2.5%.**

Summary of Findings - Economic Assumptions (Continued)

Year	Annual Increase in Prices (CPI-U)	Wages (NAE)	Difference
3-Year Avg	1.6 %	2.6 %	1.0 %
5-Year Avg	1.5 %	2.8 %	1.3 %
10-Year Avg	1.9 %	2.6 %	0.7 %
20-Year Avg	2.2 %	3.4 %	1.2 %
30-Year Avg	2.6 %	3.5 %	0.9 %
50-Year Avg	4.1 %	4.8 %	0.7 %

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 long-term rate of increase in National Average Earnings over the last 50 years is higher than the current assumption, although shorter term averages are below it. It is expected that, in the long run, salary increases in all parts of the country will be close to the national averages. However, few economists are forecasting a repeat of the high inflation rates experienced in the 1970s. Given our recommendation for a 2.5% price inflation assumption, we believe a reasonable range for this assumption is from 3.0% to 3.5% a year. **We recommend no change to the current wage inflation assumption at this time.**

Summary of Findings - Economic Assumptions (Continued)

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 Retirement System'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 approximate target asset allocation for the City of Royal Oak Retirement System:

Pension Asset Class	Target Allocation
World Equity	19.00%
Core Fixed Income	13.00%
Opportunistic Income Fund	12.00%
Large Cap Index	20.00%
Dynamic Asset Allocation	8.00%
Small Cap	8.00%
Emerging Markets Debt	6.00%
Core Property	5.00%
Emerging Markets Equity	5.00%
High Yield	4.00%
Total	100.00%

Retiree Health Asset Class	Target Allocation
Domestic Fixed Income	15.00%
Domestic Equity	45.00%
International Equity	20.00%
Private Equity	10.00%
Real Estate	10.00%
Total	100.00%

Based upon the approximate target asset allocation, future expectations of various investment consultants were analyzed. The next few exhibits show the results of this analysis. Final expected nominal investment return results are based upon a 2.5% price inflation assumption. We used the actuarial assumption for price inflation rather than the consultant assumption, in order to be consistent with the calculation of liabilities. Investment results presented are net of expenses.

Summary of Findings - Economic Assumptions (Continued)

Investment Return Expectations of Various Investment Consultants

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	6.04%	2.20%	3.84%	2.50%	6.34%	0.06%	6.28%		14.39%
2	6.19%	2.21%	3.98%	2.50%	6.48%	0.06%	6.42%		14.68%
3	6.67%	2.50%	4.17%	2.50%	6.67%	0.06%	6.61%		14.65%
4	6.51%	2.26%	4.25%	2.50%	6.75%	0.06%	6.69%		12.41%
5	6.59%	2.25%	4.34%	2.50%	6.84%	0.06%	6.78%		14.05%
6	6.85%	2.50%	4.35%	2.50%	6.85%	0.06%	6.79%		14.54%
7	6.45%	2.00%	4.45%	2.50%	6.95%	0.06%	6.89%		13.48%
8	7.05%	2.31%	4.74%	2.50%	7.24%	0.06%	7.18%		14.55%
9	6.81%	2.00%	4.81%	2.50%	7.31%	0.06%	7.25%		12.81%
10	6.83%	1.95%	4.88%	2.50%	7.38%	0.06%	7.32%		13.48%
11	7.32%	2.26%	5.06%	2.50%	7.56%	0.06%	7.50%		15.07%
12	7.93%	2.00%	5.93%	2.50%	8.43%	0.06%	8.37%		13.99%
Average	**6.77%**	**2.20%**	**4.57%**	**2.50%**	**7.07%**	**0.06%**	**7.01%**		**14.01%**

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of Exceeding
	40th	50th	60th	7.75%
(1)	(2)	(3)	(4)	(5)
1	4.51%	5.31%	6.12%	22.41%
2	4.60%	5.42%	6.24%	23.83%
3	4.80%	5.62%	6.44%	25.67%
4	5.28%	5.97%	6.67%	26.08%
5	5.09%	5.87%	6.66%	27.40%
6	5.01%	5.82%	6.63%	27.52%
7	5.30%	6.05%	6.81%	28.61%
8	5.40%	6.21%	7.03%	31.69%
9	5.78%	6.49%	7.21%	32.95%
10	5.73%	6.48%	7.24%	33.62%
11	5.62%	6.46%	7.30%	34.94%
12	6.70%	7.48%	8.26%	46.51%
Average	**5.32%**	**6.10%**	**6.89%**	**30.10%**

Summary of Findings - Economic Assumptions (Concluded)

The current version of ASOP No. 27 (applicable to valuation dates on or after September 30, 2014) suggests that either the expected geometric return (i.e., 50th percentile) or the expected arithmetic return is suitable for use as a reasonable investment return assumption. Based on the average of each of the investment consultants' expectations, this would result in a range of 6.10% to 7.0%. The expected range for the Retiree Health Care Plan was approximately 50 basis points higher. Additionally, since the plan is partially closed to new hires, annual benefit payments as a percentage of trust fund assets will continue to grow which ultimately results in the need for more liquid investments. **We recommend the Board consider lowering the investment return assumption to 7.25% or 7.0%.**

We have illustrated the approximate impact on contribution requirements if the investment return assumption were changed to 7.25% or 7.0% on page 19.

SECTION C

MISCELLANEOUS ASSUMPTIONS AND METHODS

Miscellaneous Assumptions and Methods

Annuity Withdrawal Option

If elected, a member's contribution account balance is paid in a lump sum at retirement. The regular retirement benefit is then reduced so that total benefits paid (lump sum plus monthly pension) are actuarially equivalent to the regular retirement benefit. The interest rate used to establish equivalency is based on the PBGC rates in effect at the time of retirement. These rates have averaged just over 1% for the last 5 years. Since the interest rate used to value liabilities is greater than 1.0% (currently 7.75% assumed interest rate), members who elect this option receive a higher net benefit than if this offset was calculated using valuation assumptions. Liabilities for active members are currently increased by 3% to account for this subsidy. However, since PBGC rates are much lower now than they have been historically, we recommend increasing the 3% adjustment to 5%. Future studies should be conducted periodically to review the appropriateness of this assumption.

Load in FAC for Unused Sick and Vacation Time

Unused vacation and sick leave can be rolled into final average compensation at time of retirement. As a result, our valuation includes a percent load to account for this provision. We analyzed the final average compensation with and without the unused vacation and sick leave for all members who retired during the period 2012 to 2017. Based on the results of this analysis we recommend the following change:

Division	Actual	Current Assumption	Proposed Assumption
General and Police Service Aides	2.60%	3.00%	3.00%
Police and Fire	11.10	7.00	10.00

Amortization Policy

The current actuarial valuation report computes contribution amounts using a 26-year closed amortization period for Police and Fire and Police Service Aides and a 21-year closed amortization period for the General employees and Police Service Aides. Under Public Act 202, the maximum period allowed is under 20 years for Pension and 30 years for Retiree Health Care. Shorter amortization periods will increase the volatility of contribution rates from year to year.

Actuarial Cost Method

The actuarial cost method is the allocation method the actuary uses to develop the contribution. The City of Royal Oak Retirement System currently uses the entry age normal cost method. **We recommend no change to the actuarial cost method.**

Option Factors

Option factors are calculated using the current interest assumption and the assumed rates of mortality. If a retiring member elects an optional form of benefit, the assumed benefit is multiplied by the appropriate option factor to produce the benefit actually payable. As a matter of common practice, option factors are usually revised to correspond to the new interest and mortality assumptions adopted with an experience study. When mortality experience is improved (i.e., members live longer), option factors will generally increase. When interest rates are reduced, option factors will generally decrease. Examples of option factors calculated using the present mortality assumptions and interest rates and the proposed mortality assumptions and interest rates are shown below. **We recommend all option factors for benefit calculations be updated for new mortality and interest rate assumptions effective July 1, 2019 to allow time for administrative changes.**

Retiring Participants' Ages		50% Joint & Survivor			100% Joint & Survivor		
			Proposed	Proposed		Proposed	Proposed
Retiree	Beneficiary	Present	7.75%	7.25%	Present	7.75%	7.25%
50	45	0.96185	0.95344	0.95028	0.92651	0.91103	0.90526
55	50	0.94759	0.94081	0.93733	0.90040	0.88824	0.88205
60	55	0.92899	0.92514	0.92140	0.86739	0.86070	0.85425
65	60	0.90628	0.90595	0.90202	0.82862	0.82806	0.82152

Asset Valuation Method

The City of Royal Oak Retirement System currently uses a 4-year asset smoothing method with no corridor. The Funding Value of Assets recognizes assumed investment income fully each year. Differences between actual and assumed investment income are phased-in over closed 4-year periods. This is a very common method among public retirement systems. Most systems use an averaging period between 3 and 10 years with 5 being the most common. We do not recommend any changes at this time. If, however, the Board has concerns over the volatility of contributions, a smoothing period of 5 or 7 years could be considered. If the smoothing period was lengthened, we would recommend establishing a 'corridor', so that the Funding Value will not diverge too far from the actual Market Value. Systems which use a corridor will vary on the amount of the corridor, but it is typically between 10% and 30%.

SECTION D

CONTRIBUTION RATES BASED ON PROPOSED CHANGES

Summary of Current and Proposed Assumptions

	Economic Assumptions			Non-Economic Assumptions	
				Demographic	
Assumption Set	Net Rate of Investment Return	Rate of Inflation		Police and Fire	General and Police Service Aides
		Wage	Spread		
A. Base	7.75%	3.00%	4.75%	Current	Current
B. Proposed Demographic	7.75	3.00	4.75	Proposed	Proposed
C. Alternate I Economic	7.25	3.00	4.25	Proposed	Proposed
D. Alternate II Economic (PA 202)	7.00	3.50	3.50	Proposed	Proposed

Effects of Recommended Changes in Actuarial Assumptions on Actuarial Liabilities and Pension Contribution Rates
Results as of June 30, 2017

	GENERAL			
	A	B	C	D
	Baseline	New Decrements	New Decrements with 7.25% Interest	New Decrements with 7.00% Interest, 3.50% Wage Inflation, and 20-Year Amortization
Actuarial Value of Assets	$ 80,158,368	$ 80,158,368	$ 80,158,368	$ 80,158,368
Actuarial Accrued Liability	78,131,480	80,616,355	84,538,683	87,130,913
Unfunded Accrued Liability	$ (2,026,888)	$ 457,987	$ 4,380,315	$ 6,972,545
Funded Percent	102.6 %	99.4 %	94.8 %	92.0 %
Employer Normal Cost %	8.16 %	8.20 %	9.88 %	11.83 %
Employer Normal Cost $	$ 400,142	$ 402,103	$ 484,486	$ 585,753
Amortization Amount	(191,162)	43,194	398,144	636,140
Estimated Dollar Contribution	$ 208,980	$ 445,297	$ 882,630	$ 1,221,893

	POLICE-FIRE AND POLICE SERVICE AIDES			
	A	B	C	D
	Baseline	New Decrements	New Decrements with 7.25% Interest	New Decrements with 7.00% Interest, 3.50% Wage Inflation, and 20-Year Amortization
Actuarial Value of Assets	$ 78,618,480	$ 78,618,480	$ 78,618,480	$ 78,618,480
Actuarial Accrued Liability	139,861,826	145,592,110	153,272,035	158,184,832
Unfunded Accrued Liability	$ 61,243,346	$ 66,973,630	$ 74,653,555	$ 79,566,352
Funded Percent	56.2 %	54.0 %	51.3 %	49.7 %
Employer Normal Cost %	12.09 %	13.44 %	15.83 %	18.56 %
Amortization %	34.63 %	37.87 %	40.17 %	47.16 %
Computed Employer%	46.72 %	51.31 %	56.00 %	65.72 %
Estimated Dollar Contribution	$ 5,396,356	$ 5,926,521	$ 6,468,235	$ 7,590,936

SECTION E

COMPLETE LISTING OF RECOMMENDED ASSUMPTIONS

Proposed Retirement Rates

Retirement Ages	Percents of Active Members Retiring within Next Year: General	Police Service Aides	Fire Hired Before 10/1/09 & All Police	Fire Hired After 10/1/09	Retirement Service	All Police, Police and Fire Department Heads, and Fire Hired Before 10/1/09
45-49						
50	20%	22.5%		50%	25	50%
51	15%	17.5%		50%	26	50%
52	15%	17.5%		50%	27	50%
53	15%	17.5%		30%	28	30%
54	15%	17.5%		30%	29	30%
55	15%	17.5%	30%	30%	30	30%
56	15%	17.5%	30%	30%	31	30%
57	15%	17.5%	30%	30%	32	30%
58	15%	17.5%	30%	30%	33	30%
59	15%	17.5%	30%	30%	34	30%
60	15%	17.5%	30%	30%	35	30%
61	15%	17.5%	30%	30%	36	30%
62	35%	37.5%	30%	30%	37	30%
63	20%	22.5%	30%	30%	38	30%
64	20%	22.5%	30%	30%	39	30%
65	55%	100%	100%	100%	40	100%
66	45%					
67	45%					
68	45%					
69	45%					
70	100%					
Ref.	2321	2549	2550	2550		2550

Proposed Turnover Rates

Sample Ages	Years of Service	% of Active Members Separating within Next Year * General & PSA	Police & Fire
ALL	0	12.00%	10.00%
	1	9.00%	7.00%
	2	7.00%	5.00%
	3	5.00%	4.00%
	4	4.50%	3.50%
25	5 & Over	4.50%	2.50%
26		4.40%	2.40%
27		4.30%	2.30%
28		4.20%	2.20%
29		4.10%	2.10%
30		4.00%	2.00%
31		3.90%	1.85%
32		3.80%	1.70%
33		3.70%	1.55%
34		3.60%	1.40%
35		3.50%	1.25%
36		3.30%	1.15%
37		3.10%	1.05%
38		2.90%	0.95%
39		2.70%	0.85%
40		2.50%	0.75%
41		2.40%	0.70%
42		2.30%	0.65%
43		2.20%	0.60%
44		2.10%	0.55%
45		2.00%	0.50%
46		1.90%	0.45%
47		1.80%	0.40%
48		1.70%	0.35%
49		1.60%	0.30%
50		1.50%	0.25%
51		1.00%	0.25%
52		1.00%	0.25%
53		1.00%	0.25%
54		1.00%	0.25%
55		1.00%	0.25%
56		1.00%	0.25%
57		1.00%	0.25%
58		1.00%	0.25%
59		1.00%	0.25%
60		1.00%	0.25%
61		1.00%	0.25%
62		1.00%	0.25%
63		1.00%	0.25%
64		1.00%	0.25%
65		1.00%	0.25%
Ref.		29	30
		1300	1177

* *No separations are assumed for members eligible to retire.*

Proposed Disability Rates
(Same as Current Rates)

Sample Ages	% of Active Members Becoming Disabled within Next Year		
	General & PSA		
	Male	Female	Police & Fire
20	0.04%	0.02%	0.08%
21	0.05%	0.03%	0.08%
22	0.05%	0.03%	0.09%
23	0.05%	0.03%	0.10%
24	0.05%	0.03%	0.11%
25	0.05%	0.03%	0.11%
26	0.05%	0.04%	0.13%
27	0.05%	0.04%	0.14%
28	0.05%	0.04%	0.16%
29	0.05%	0.04%	0.17%
30	0.05%	0.04%	0.19%
31	0.07%	0.07%	0.20%
32	0.07%	0.07%	0.20%
33	0.07%	0.07%	0.21%
34	0.07%	0.07%	0.22%
35	0.07%	0.07%	0.23%
36	0.11%	0.10%	0.29%
37	0.11%	0.10%	0.35%
38	0.11%	0.10%	0.41%
39	0.11%	0.10%	0.47%
40	0.11%	0.10%	0.53%
41	0.16%	0.14%	0.54%
42	0.16%	0.14%	0.56%
43	0.16%	0.14%	0.57%
44	0.16%	0.14%	0.59%
45	0.16%	0.14%	0.60%
46	0.26%	0.23%	0.62%
47	0.26%	0.23%	0.65%
48	0.26%	0.23%	0.67%
49	0.26%	0.23%	0.69%
50	0.26%	0.23%	0.71%
51	0.46%	0.38%	0.72%
52	0.46%	0.38%	0.73%
53	0.46%	0.38%	0.74%
54	0.46%	0.38%	0.74%
55	0.46%	0.38%	0.83%
56	0.77%	0.55%	0.09%
57	0.77%	0.55%	0.11%
58	0.77%	0.55%	0.12%
59	0.77%	0.55%	0.14%
60	0.77%	0.55%	0.90%
Ref.	33	34	45
Multiplier:	50%	50%	75%

Proposed Merit and Longevity Portion of Pay Increases with 3.0% Wage Inflation

Sample Ages	Salary Increase Assumptions for an Individual Member				
	Merit and Seniority		Base (Economic)	Increase Next Year	
	General & PSA	P-F		General & PSA	P-F
20	2.16%	1.69%	3.00%	5.16%	4.69%
21	2.06	1.69	3.00	5.06	4.69
22	1.97	1.69	3.00	4.97	4.69
23	1.89	1.69	3.00	4.89	4.69
24	1.82	1.69	3.00	4.82	4.69
25	1.76	1.69	3.00	4.76	4.69
26	1.70	1.69	3.00	4.70	4.69
27	1.64	1.69	3.00	4.64	4.69
28	1.59	1.69	3.00	4.59	4.69
29	1.55	1.69	3.00	4.55	4.69
30	1.51	1.69	3.00	4.51	4.69
31	1.47	1.69	3.00	4.47	4.69
32	1.43	1.69	3.00	4.43	4.69
33	1.40	1.52	3.00	4.40	4.52
34	1.37	1.35	3.00	4.37	4.35
35	1.34	1.18	3.00	4.34	4.18
36	1.31	1.01	3.00	4.31	4.01
37	1.28	0.84	3.00	4.28	3.84
38	1.26	0.71	3.00	4.26	3.71
39	1.23	0.57	3.00	4.23	3.57
40	1.20	0.44	3.00	4.20	3.44
41	1.16	0.30	3.00	4.16	3.30
42	1.12	0.17	3.00	4.12	3.17
43	1.07	0.16	3.00	4.07	3.16
44	1.01	0.15	3.00	4.01	3.15
45	0.94	0.14	3.00	3.94	3.14
46	0.88	0.12	3.00	3.88	3.12
47	0.82	0.11	3.00	3.82	3.11
48	0.75	0.10	3.00	3.75	3.10
49	0.70	0.09	3.00	3.70	3.09
50	0.64	0.08	3.00	3.64	3.08
51	0.59	0.07	3.00	3.59	3.07
52	0.53	0.06	3.00	3.53	3.06
53	0.48	0.05	3.00	3.48	3.05
54	0.43	0.03	3.00	3.43	3.03
55	0.37	0.02	3.00	3.37	3.02
56	0.32	0.01	3.00	3.32	3.01
57	0.26	0.00	3.00	3.26	3.00
58	0.20	0.00	3.00	3.20	3.00
59	0.15	0.00	3.00	3.15	3.00
60	0.09	0.00	3.00	3.09	3.00
61	0.03	0.00	3.00	3.03	3.00
62	0.00	0.00	3.00	3.00	3.00
63	0.00	0.00	3.00	3.00	3.00
64	0.00	0.00	3.00	3.00	3.00
65	0.00	0.00	3.00	3.00	3.00
66	0.00	0.00	3.00	3.00	3.00
67	0.00	0.00	3.00	3.00	3.00
68	0.00	0.00	3.00	3.00	3.00
69	0.00	0.00	3.00	3.00	3.00
70	0.00	0.00	3.00	3.00	3.00
71	0.00	0.00	3.00	3.00	3.00
72	0.00	0.00	3.00	3.00	3.00
73	0.00	0.00	3.00	3.00	3.00
74	0.00	0.00	3.00	3.00	3.00
Ref.	760	761			

Proposed Healthy Post-Retirement Mortality Rates

Age	% Dying Next Year*	
	Male	Female
50	0.4106%	0.2809%
51	0.4447%	0.3052%
52	0.4831%	0.3322%
53	0.5262%	0.3617%
54	0.5697%	0.3939%
55	0.6141%	0.4284%
56	0.6606%	0.4652%
57	0.7105%	0.5040%
58	0.7645%	0.5448%
59	0.8241%	0.5882%
60	0.8903%	0.6338%
61	0.9637%	0.6826%
62	1.0452%	0.7348%
63	1.1351%	0.7913%
64	1.2332%	0.8534%
65	1.3400%	0.9227%
66	1.4558%	1.0007%
67	1.5817%	1.0896%
68	1.7205%	1.1911%
69	1.8747%	1.3067%
70	2.0465%	1.4381%
71	2.2390%	1.5868%
72	2.4558%	1.7545%
73	2.7000%	1.9435%
74	2.9752%	2.1540%
75	3.2831%	2.3899%
76	3.6292%	2.6529%
77	4.0174%	2.9485%
78	4.4516%	3.2800%
79	4.9359%	3.6539%
80	5.4767%	4.0754%
81	6.0801%	4.5518%
82	6.7489%	5.0881%
83	7.4974%	5.6923%
84	8.3355%	6.3711%
85	9.2620%	7.1304%

Age	% Dying Next Year*	
	Male	Female
86	10.2921%	7.9762%
87	11.4388%	8.9143%
88	12.7024%	9.9500%
89	14.0973%	11.0821%
90	15.6328%	12.3352%
91	17.2215%	13.6766%
92	18.8263%	15.0858%
93	20.4124%	16.5426%
94	21.9582%	18.0329%
95	23.4501%	19.5556%
96	25.1438%	21.1927%
97	26.8470%	22.8741%
98	28.5880%	24.7030%
99	30.3448%	26.6470%
100	32.2013%	28.6326%
101	34.2314%	30.6436%
102	36.2396%	32.6717%
103	38.2134%	34.6935%
104	40.1372%	36.6731%
105	41.9804%	38.6181%
106	43.7556%	40.5181%
107	45.4317%	42.3098%
108	47.0094%	44.0300%
109	48.4886%	45.6432%
110	49.8564%	47.1598%
111	50.3423%	48.5664%
112	50.2513%	49.8654%
113	50.1706%	50.3619%
114	50.0852%	50.1704%
115	50.0000%	50.0000%
116	50.0000%	50.0000%
117	50.0000%	50.0000%
118	50.0000%	50.0000%
119	50.0000%	50.0000%
120	100.0000%	100.0000%

Ref 100% x 2310 100% x 2311

** Based on retirements in 2017. Retirements in future years will reflect improvements in life expectancy.*

Proposed Disabled Post-Retirement Mortality Rates

Age	% Dying Next Year*	
	Male	Female
50	2.0606%	1.1852%
51	2.1319%	1.2479%
52	2.2069%	1.3165%
53	2.2690%	1.3890%
54	2.3299%	1.4647%
55	2.3922%	1.5413%
56	2.4590%	1.6169%
57	2.5334%	1.6891%
58	2.6151%	1.7568%
59	2.7044%	1.8202%
60	2.8009%	1.8786%
61	2.9031%	1.9355%
62	3.0107%	1.9930%
63	3.1236%	2.0547%
64	3.2410%	2.1245%
65	3.3657%	2.2060%
66	3.4987%	2.3027%
67	3.6434%	2.4182%
68	3.8057%	2.5557%
69	3.9885%	2.7170%
70	4.1940%	2.9042%
71	4.4254%	3.1177%
72	4.6857%	3.3597%
73	4.9763%	3.6323%
74	5.3002%	3.9346%
75	5.6568%	4.2704%
76	6.0523%	4.6399%
77	6.4898%	5.0482%
78	6.9725%	5.4950%
79	7.5040%	5.9846%
80	8.0912%	6.5177%
81	8.7402%	7.0987%
82	9.4522%	7.7259%
83	10.2434%	8.4039%
84	11.1234%	9.1341%
85	12.0857%	9.9173%

Age	% Dying Next Year*	
	Male	Female
86	13.1455%	10.7545%
87	14.3138%	11.6456%
88	15.5849%	12.5891%
89	16.9696%	13.5759%
90	18.4724%	14.6274%
91	19.9525%	15.7775%
92	21.4135%	17.0142%
93	22.8438%	18.3206%
94	24.2321%	19.6819%
95	25.5667%	21.0952%
96	27.1216%	22.6447%
97	28.6804%	24.2505%
98	30.2721%	25.9224%
99	31.8776%	27.6475%
100	33.5067%	29.4075%
101	35.1539%	31.1972%
102	36.8232%	33.0257%
103	38.5193%	34.8811%
104	40.2435%	36.7390%
105	41.9804%	38.6181%
106	43.7556%	40.5181%
107	45.4317%	42.3098%
108	47.0094%	44.0300%
109	48.4886%	45.6432%
110	49.8564%	47.1598%
111	50.3423%	48.5664%
112	50.2513%	49.8654%
113	50.1706%	50.3619%
114	50.0852%	50.1704%
115	50.0000%	50.0000%
116	50.0000%	50.0000%
117	50.0000%	50.0000%
118	50.0000%	50.0000%
119	50.0000%	50.0000%
120	100.0000%	100.0000%

Ref 100% x 2137 100% x 2138

** Based on retirements in 2017. Retirements in future years will reflect improvements in life expectancy.*

Proposed Pre-Retirement Mortality Rates

Age	% Dying Next Year*	
	Male	Female
20	0.0504%	0.0190%
21	0.0565%	0.0190%
22	0.0624%	0.0190%
23	0.0660%	0.0190%
24	0.0660%	0.0190%
25	0.0649%	0.0190%
26	0.0630%	0.0190%
27	0.0623%	0.0225%
28	0.0623%	0.0234%
29	0.0623%	0.0245%
30	0.0654%	0.0261%
31	0.0679%	0.0279%
32	0.0706%	0.0299%
33	0.0733%	0.0319%
34	0.0754%	0.0342%
35	0.0774%	0.0364%
36	0.0789%	0.0385%
37	0.0805%	0.0411%
38	0.0828%	0.0438%
39	0.0856%	0.0469%
40	0.0893%	0.0503%
41	0.0940%	0.0540%
42	0.1000%	0.0583%
43	0.1078%	0.0633%
44	0.1177%	0.0691%

Age	% Dying Next Year*	
	Male	Female
45	0.1292%	0.0757%
46	0.1433%	0.0832%
47	0.1591%	0.0918%
48	0.1773%	0.1012%
49	0.1978%	0.1115%
50	0.2204%	0.1230%
51	0.2456%	0.1356%
52	0.2737%	0.1496%
53	0.3026%	0.1651%
54	0.3343%	0.1817%
55	0.3693%	0.1997%
56	0.4090%	0.2188%
57	0.4548%	0.2388%
58	0.5077%	0.2594%
59	0.5688%	0.2806%
60	0.6388%	0.3027%
61	0.7181%	0.3258%
62	0.8073%	0.3503%
63	0.9069%	0.3770%
64	1.0166%	0.4061%
65	1.1377%	0.4383%
66	1.2465%	0.4820%
67	1.3643%	0.5310%
68	1.4939%	0.5861%
69	1.6374%	0.6482%

Ref 100% x 2308 100% x 2309

** Based on decrement in 2017. Decrements in future years will reflect improvements in life expectancy.*

GRS Retirement Consulting

800.521.0498 | P: 248.799.9000 | F: 248.799.9020 | www.grsconsulting.com

September 28, 2018

Ms. Julie Rudd
City of Royal Oak
211 Williams Street
Royal Oak, Michigan 48067

Dear Ms. Rudd:

Enclosed are 15 copies of our report of Retirement System experience. I look forward to meeting with the Board to discuss the results of our review. If you have any questions, please feel free to call me at (248) 799-9000.

Sincerely,

Mark Buis, FSA, EA, FCA, MAAA

MB:ah
Enclosures

One Towne Square | Suite 800 | Southfield, Michigan 48076-3723