City of Royal Oak Retirement System

Review of System Experience
July 1, 2017 Through June 30, 2022

GRS

October 24, 2023

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

Re: City of Royal Oak Retirement System Review of System Experience as of June 30, 2022
     Actuarial Disclosures

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 actuarial liabilities, assets, and actuarially determined employer contribution amounts.

The investigation was based upon the data furnished for the annual actuarial valuations during the period *July 1, 2017 through June 30, 2022* and was carried out using generally accepted actuarial principles and techniques. We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided.

We have shown the expected impact of the proposed changes on City contributions as of June 30,2022. This information is shown in Section D of this report.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the City of Royal Oak Retirement System.

This report should not be relied on for any purpose other than that described above. It was prepared at the request of the Board and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than the System only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. We certify that, to the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

This report was prepared using our proprietary valuation model and related software which, in our professional judgment, has the capability to provide results that are consistent with the purposes of the valuation and has no material limitations or known weaknesses. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.
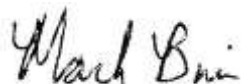
Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law.

Mark Buis and Michael D. Kosciuk 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.

The signing actuaries are independent of the plan sponsor.

Gabriel, Roeder, Smith & Company will be pleased to review this experience study and report with the Board of Trustees and to answer any questions pertaining to the experience study.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

Mark Buis, FSA, EA, FCA, MAAA

Michael D. Kosciuk, FSA, EA, FCA, MAAA

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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; and
- 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 the Police and Fire groups and lower than expected for the General group.

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	22.90	28	38.70	62	61.60

Proposal: We recommend a change for the Police and Fire groups and for the General employees. The current and proposed retirement rates are shown on the following pages. This change will put upward pressure on liabilities for Police and Fire and downward pressure on liabilities for the General group.

Retirement Rates

Current Rates of Retirement

Percents of Active Members
Retiring within Next Year

Retirement Ages	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

Retirement Rates

Proposed Rates of Retirement

Percents of Active Members
Retiring within Next Year

Retirement Ages	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	15%	32.5%		60%	25	60%
51	10%	27.5%		60%	26	60%
52	10%	27.5%		60%	27	60%
53	10%	27.5%		40%	28	40%
54	10%	27.5%		40%	29	40%
55	10%	27.5%	40%	40%	30	40%
56	10%	27.5%	40%	40%	31	40%
57	10%	27.5%	40%	40%	32	40%
58	10%	27.5%	40%	40%	33	40%
59	10%	27.5%	40%	40%	34	40%
60	10%	27.5%	40%	40%	35	40%
61	10%	27.5%	40%	40%	36	40%
62	30%	47.5%	40%	40%	37	40%
63	15%	32.5%	40%	40%	38	40%
64	15%	32.5%	40%	40%	39	40%
65	50%	100%	100%	100%	40	100%
66	40%					
67	40%					
68	40%					
69	40%					
70	100%					
Ref.	625	3412	3411	3411		3411

Turnover

Discussion: During the study period, actual rates of termination for both the General group and the Police and Fire groups have been close to expected. The tables on the current page 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
2	3.10	0	0.00	2	3.10

Number of Police and Fire and Police Service Aide Terminations from City Employment					
Vested		Non-Vested		Total	
Actual	Expected	Actual	Expected	Actual	Expected
3	1.80	18	15.40	21	17.20

Proposal: We recommend no change in the turnover rates. This will result in no impact on computed liabilities and contributions.

Current and 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 less than expected during the study period. However, experience in this area is limited for a group of this size and a 5-year period is too short a period over which to develop a plan-specific table.

Number of Disability Retirements from City Employment					
Police and Fire and Police Service Aides		General		Total	
Actual	Expected	Actual	Expected	Actual	Expected
1	2.10	0	0.60	1	2.70

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

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: The mortality assumption is used to measure the probabilities of members dying before retirement and the probability of each benefit payment being made after retirement. 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."* The current mortality assumption is the RP-2014 Employee Generational Mortality Tables, with blue collar adjustments and extended via cubic spline. These tables are 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.

Newer tables (Pub-2010 mortality tables) have been developed since the last experience study by the Society of Actuaries that include mortality rates based on analysis of experience of public plan populations specifically for General and separately, Safety, employees.

During the study period, the COVID-19 pandemic influenced mortality experience. The impact of the COVID-19 pandemic varies considerably by occupation, income, geography, etc. We considered some recognition of the impact COVID had on the mortality assumption; however, the impact would have been minimal at this time, so no adjustment has been made. Actual experience will continue to be reflected in each future valuation as experience emerges.

Mortality

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

General

- **Healthy Pre-Retirement:** Pub-2010 General Employee Mortality Tables, amount-weighted, and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.

- **Healthy Post-Retirement:** Pub-2010 General Healthy Retiree Mortality Tables, amount-weighted, and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.

- **Disability Retirement:** Pub-2010 Non-Safety Disabled Retiree Mortality Tables, amount-weighted, and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.

Police and Fire

- **Healthy Pre-Retirement:** Pub-2010 Safety Employee Mortality Tables, amount-weighted, and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.

- **Healthy Post-Retirement:** Pub-2010 Safety Healthy Retiree Mortality Tables, amount-weighted, and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.

- **Disability Retirement:** Pub-2010 Safety Disabled Retiree Mortality Tables, amount-weighted, and projected with mortality improvements using the fully generational MP-2021 projection scale from a base year of 2010.

Mortality

Summary of Life Expectancies under the Current 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	30.01	35.16	28.80	31.64	21.58	25.31
60	25.16	30.17	24.23	26.92	18.50	21.72
65	20.66	25.30	19.94	22.41	15.59	18.27
70	16.55	20.58	15.98	18.13	12.81	14.89
75	12.80	16.05	12.37	14.16	10.17	11.71
80	9.42	11.78	9.19	10.62	7.77	8.94

* Based on attained ages in 2022. Future years will reflect improvements in life expectancy.

Summary of Life Expectancies under the Proposed Tables

General

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	34.07	36.14	30.55	33.40	22.68	25.51
60	29.17	31.12	25.83	28.53	19.51	22.21
65	24.42	26.19	21.35	23.82	16.61	18.96
70	19.78	21.36	17.10	19.29	13.82	15.60
75	15.24	16.65	13.18	15.04	11.07	12.31
80	10.83	12.10	9.71	11.23	8.49	9.38

Police and Fire

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	33.37	35.80	30.43	32.41	29.22	31.36
60	28.37	30.76	25.55	27.51	24.54	26.74
65	23.51	25.78	20.95	22.87	20.19	22.41
70	18.81	20.86	16.68	18.48	16.17	18.28
75	14.34	16.13	12.78	14.41	12.45	14.38
80	10.16	11.68	9.36	10.81	9.23	10.81

* Based on attained ages in 2022. 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 close to expected rates and the overall wage inflation was also close to expected during the experience period.

Proposal: We recommend no change to the merit and longevity portion of the pay increase assumption. This will result in no impact on computed liabilities and contributions. We recommend increasing the base wage inflation rate of 3.00% to 3.25% (this is discussed further in Section B of this report). This change will increase measured liabilities.

Current and Proposed Merit and Longevity 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 price inflation assumptions included:

- Congressional Budget Office's expectations;
- Expectations from the Federal Reserve Banks of Philadelphia, Cleveland, and St. Louis;
- Comparisons of Treasury yields and Treasury Inflation Protected Securities (TIPS);
- Social Security Trustees report; and
- Future expectations for various investment consultants that GRS monitors.

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

- Future expectations of various investment consultants that GRS monitors.

Sources considered in the wage inflation and merit and longevity pay increases included:

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

Current economic assumptions for the System are as follows:

Price Inflation	2.50%
Wage Inflation	3.00%
Investment Return	7.25%

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 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.

ASOP No. 27 acknowledges that for any given economic assumption, there is a reasonable range of opinions on that assumption.

Public Act 202. Under Public Act 202 of the State of Michigan, Michigan municipalities are 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 (for fiscal year 2023 reporting):

   •   Investment return no higher than 6.85%;
   •   Assumed wage inflation no lower than 3.25%*;
   •   Mortality assumption that uses a version of the Pub-2010 table with future mortality improvement projected generationally using Scale MP-2021*; and
   •   Amortization period no longer than 16 years for Pension Plans and 26 years for Retiree Health Plans.

   * Or based on an actuarial experience study conducted within the last five years.

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. For the actuarial valuation, a 2.50% price inflation assumption is currently used and is compatible with the wage inflation and investment return assumptions. The table on the following page shows forward-looking price inflation forecasts.

Forward-Looking Price Inflation Forecasts[a]	
Congressional Budget Office[b]	
5-Year Annual Average	3.23%
10-Year Annual Average	2.81%
Federal Reserve Bank of Philadelphia[c]	
5-Year Annual Average	3.75%
10-Year Annual Average	2.95%
Federal Reserve Bank of Cleveland[d]	
10-Year Expectation	2.22%
20-Year Expectation	2.29%
30-Year Expectation	2.37%
Federal Reserve Bank of St. Louis[e]	
10-Year Breakeven Inflation	2.26%
20-Year Breakeven Inflation	2.50%
30-Year Breakeven Inflation	2.26%
U.S. Department of the Treasury[f]	
10-Year Breakeven Inflation	2.07%
20-Year Breakeven Inflation	2.40%
30-Year Breakeven Inflation	2.21%
50-Year Breakeven Inflation	2.34%
100-Year Breakeven Inflation	2.44%
Social Security Trustees[g]	
Ultimate Intermediate Assumption	2.40%

[a]End of the Fourth Quarter, 2022. Version 2023-02-09 by Gabriel, Roeder, Smith & Company.

[b]*The Budget and Economic Outlook: 2022 to 2032*, Release Date: May 2022, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2022 - 2026), 10-Year Annual Average (2022 - 2031).
[c]*Fourth Quarter 2022 Survey of Professional Forecasters*, Release Date: November 14, 2022, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2022 - 2026), 10-Year Annual Average (2022 - 2031).
[d]Inflation Expectations, Model output date: December 1, 2022.
[e]The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: December, 2022.
[f]The Treasury Breakeven Inflation (TBI) Curve, Monthly Average Rates, December, 2022.
[g]*The 2022 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds*, June 2, 2022, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2026 and later.

The previous table shows forward-looking price inflation forecasts at various time horizons. The Congressional Budget Office and Federal Reserve Bank of Philadelphia's 5-year annual average inflation assumptions are 3.23% and 3.75% respectively, while their 10-year annual average assumptions are 2.81% and 2.95% respectively. This suggests that price inflation is expected to decrease and stabilize in years 6 through 10.

For the firms included in the 2022 version of the GRS CMAM, the average price inflation assumption used in the forward-looking capital market expectations was 2.52% over the next 10 years (with a range of 2.26% to 2.90%) and 2.49% over the next 20 to 30 years.

While the very current CPI rates are well above 2.50% and future expectations for inflation have been rising, the current assumption is in line with inflation forecasters' and investment firms' forward-looking expectations. **Therefore, we recommend no change to the current price inflation assumption of 2.50%.**

Summary of Findings – Economic Assumptions

| Year | Annual Increase in | | |
	Prices (CPI-U)	Wages (NAE)	Difference
3-Year Avg	5.0 %	2.6 %	(2.4)%
5-Year Avg	3.9 %	2.8 %	(1.1)%
10-Year Avg	2.6 %	2.6 %	0.0 %
20-Year Avg	2.5 %	3.4 %	0.9 %
30-Year Avg	2.5 %	3.5 %	1.0 %
50-Year Avg	4.0 %	4.8 %	0.8 %

Payroll growth (wage inflation) represents the expected growth in total payroll for a stable population. Increases or decreases in covered population that lead to a change in total payroll are not reflected in this assumption which 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 current payroll growth assumption is 3.0%, which is comprised of a 2.5% price inflation assumption, plus a real wage growth assumption of 0.50%. Average salaries in the City of Royal Oak Employees Retirement System have risen at approximately 3.8% annually over the last 5 years and 2.4% over the last 20 years.

We are generally comfortable with the wage inflation assumption exceeding the price inflation assumption by 0.50% to 1.00%. Given our recommendation for a 2.50% price inflation assumption, we believe a reasonable range for this assumption is 3.0% to 3.5% per year. **Based on these statistics, we recommend increasing the wage growth assumption from 3.0% to 3.25%.**

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 <u>nominal</u> (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
S&P 500 Index	25.00%
US Small/Mid Cap Equity Index	8.00%
World Equity ex-US	23.00%
Emerging Markets Equity	4.00%
U.S. High Yield	2.00%
Emerging Markets Debt	3.00%
Core Fixed Income	17.00%
Private Real Estate	8.00%
Structured Credit	5.00%
Global Private Assets	5.00%
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

GRS 2023 CMAM									
Capital Market Assumption Set (CMA)	CMA Expected Nominal Return	CMA Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Investment 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	6.89%	2.50%	4.39%	2.50%	6.89%	0.10%	6.79%		13.18%
2	7.29%	2.90%	4.39%	2.50%	6.89%	0.10%	6.79%		12.84%
3	7.68%	2.51%	5.17%	2.50%	7.67%	0.10%	7.57%		13.44%
4	7.67%	2.31%	5.36%	2.50%	7.86%	0.10%	7.76%		13.44%
5	7.68%	2.26%	5.42%	2.50%	7.92%	0.10%	7.82%		13.05%
6	7.88%	2.41%	5.47%	2.50%	7.97%	0.10%	7.87%		12.89%
7	8.05%	2.50%	5.55%	2.50%	8.05%	0.10%	7.95%		13.16%
8	8.56%	2.90%	5.66%	2.50%	8.16%	0.10%	8.06%		13.24%
9	8.11%	2.28%	5.84%	2.50%	8.34%	0.10%	8.24%		13.20%
10	8.77%	2.62%	6.15%	2.50%	8.65%	0.10%	8.55%		12.44%
11	8.92%	2.54%	6.38%	2.50%	8.88%	0.10%	8.78%		13.68%
Average	**7.96%**	**2.52%**	**5.44%**	**2.50%**	**7.94%**	**0.10%**	**7.84%**		**13.14%**
					Average from last 3 CMAMs		**6.86%**		**12.98%**

GRS 2023 CMAM				
Capital Market Assumption Set (CMA)	**Distribution of 10-Year Average Geometric Net Nominal Return**			**Probability of exceeding**
	40th	**50th**	**60th**	**7.25%**
(1)	(2)	(3)	(4)	(5)
1	4.95%	5.99%	7.03%	38.01%
2	5.02%	6.03%	7.05%	38.12%
3	5.68%	6.74%	7.81%	45.17%
4	5.87%	6.93%	8.00%	47.00%
5	6.01%	7.04%	8.08%	47.95%
6	6.09%	7.10%	8.13%	48.56%
7	6.12%	7.16%	8.20%	49.09%
8	6.22%	7.26%	8.31%	50.09%
9	6.40%	7.44%	8.49%	51.87%
10	6.86%	7.85%	8.84%	56.09%
11	6.86%	7.93%	9.02%	56.38%
Average	**6.01%**	**7.04%**	**8.09%**	**48.03%**
Average from last 3 CMAMs over 10-year horizon	**6.08%**			
Current CMAM average over 20- to 30-year horizon	**7.18%**			

The table below summarizes the average geometric and arithmetic returns based upon the System's target funding policy for 2021, 2022, and 2023 CMAMs. Due to the volatility in forecasted returns, the table also provides a 3-year average of results.

	Average Returns	
CMAM Scenarios	**Geometric**	**Arithmetic**
2021 CMAM	5.71%	6.49%
2022 CMAM	5.46%	6.24%
2023 CMAM	7.05%	7.84%
3-Year Average	6.08%	6.86%

Based upon the results of our analysis, and given the variation of future expectations, we recommend no change to the current investment return assumption to 7.25% at this time.

Nothing in this report should be construed as GRS giving investment advice.

We have illustrated the approximate impact on contribution requirements based on the current 7.25% investment return assumption along with 6.85% on page 21.

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. Although this index is no longer published, the PBGC replacement rate methodology, agreed upon by the City, is being used and is the rate established on July 1 preceding the date of retirement (1.75% effective for retirements 7/1/2022 through 6/30/2023; 2.25% effective for retirements 7/1/2023 through 6/30/2024). Since the interest rate used to value liabilities is greater than 2.25% (currently 7.25% assumed interest rate), members who elect this option receive a higher net benefit than if this offset was calculated using valuation assumptions. Service retirement liabilities for active members are currently increased by 5% to account for this subsidy. However, since the current interest rates are much lower now than they have been historically, **we recommend increasing the 5% adjustment to 7%.** 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 2017 to 2022. 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	13.20	10.00	13.00

Amortization Policy

The current actuarial valuation report computes contribution amounts using a 20-year closed amortization period for Police and Fire and a 15-year closed amortization period for the General employees. **We recommend continuing the current amortization policy until the amortization period for the Police and Fire division reaches 15 years and the General division reaches 10 years. At that time, we recommend incorporating layered amortization. Under a layered amortization approach, once the period reaches 15 years (10 years for General), the initial Unfunded Actuarial Accrued Liability (UAAL) would wind down until it is fully amortized. For each subsequent valuation, any new UAAL created by gains/losses, assumption changes and/or plan changes for that valuation will be amortized over a new, closed 15-year period (10 years for General). This change will have no impact on current employer contributions, but would aid in stabilizing future employer contributions. This is also considered a best practice under the Conference of Consulting Actuaries (CCA) Public Plans Community white paper on amortization methods.**

Miscellaneous Assumptions and Methods
(Concluded)

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, 2024 to allow time for administrative changes.**

Retiring Participants' Ages		50% Joint & Survivor			100% Joint & Survivor		
			Proposed	Proposed		Proposed	Proposed
Retiree	Beneficiary	Present	7.25%	6.85%	Present	7.25%	6.85%
50	45	0.95028	0.95742	0.95485	0.90526	0.91832	0.91360
55	50	0.93733	0.94585	0.94302	0.88205	0.89726	0.89218
60	55	0.92140	0.93120	0.92813	0.85425	0.87125	0.86589
65	60	0.90202	0.91286	0.90960	0.82152	0.83969	0.83419

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. **Due to the high volatility we have seen in investment markets over the last 10 years, we recommend consideration be given to increasing the asset smoothing method from 4 years to 5 years. If adopted, this change would be recognized prospectively and have no immediate impact on employer contributions, but would aid in stabilizing future employer contributions.**

Funding Policy

We have reviewed the Funding Policy for the City of Royal Oak Employees Retirement System and confirmed that all of the proposed recommendations comply with the framework set within the policy. Once the final recommendations have been approved, we will work with staff to ensure any updates are included.

SECTION D

CONTRIBUTION RATES BASED ON PROPOSED CHANGES

Summary of Current and Proposed Assumptions

	Economic Assumptions			Non-Economic Assumptions	
	Net Rate of Investment Return	Rate of Inflation		Demographic	
				Police and	General and
Assumption Set		Wage	Spread	Fire	Police Service Aides
A. Base	7.25%	3.00%	4.25	Current	Current
B. Proposed Demographic	7.25	3.25	4.00	Proposed	Proposed
C. Alternate I Economic	6.85	3.25	3.60	Proposed	Proposed

Effects of Recommended Changes in Actuarial Assumptions on Actuarial Liabilities and Pension Contribution Rates Results as of June 30, 2022

	GENERAL		
	A	**B**	**C**
	Baseline	**New Decrements with 7.25% Interest**	**New Decrements with 6.85% Interest**
Actuarial Value of Assets	$ 80,813,892	$ 80,813,892	$ 80,813,892
Actuarial Accrued Liability	86,079,242	88,297,616	91,656,247
Unfunded Accrued Liability	$ 5,265,350	$ 7,483,724	$ 10,842,355
Funded Percent	93.9 %	91.5 %	88.2 %
Employer Normal Cost %	9.37 %	9.79 %	11.42 %
Employer Normal Cost $	$ 303,325	$ 335,587	$ 391,462
Amortization Amount	547,043	777,520	1,099,128
Estimated Dollar Contribution	$ 850,368	$ 1,113,107	$ 1,490,590

	POLICE-FIRE AND POLICE SERVICE AIDES		
	A	**B**	**C**
	Baseline	**New Decrements with 7.25% Interest**	**New Decrements with 6.85% Interest**
Actuarial Value of Assets	$ 81,867,242	$ 81,867,242	$ 81,867,242
Actuarial Accrued Liability	172,932,304	178,954,568	186,753,137
Unfunded Accrued Liability	$ 91,065,062	$ 97,087,326	$ 104,885,895
Funded Percent	47.3 %	45.7 %	43.8 %
Employer Normal Cost %	15.40 %	17.66 %	20.01 %
Amortization %	55.52 %	57.76 %	60.30 %
Computed Employer%	70.92 %	75.42 %	80.31 %
Estimated Dollar Contribution	$ 8,219,946	$ 8,762,734	$ 9,330,882

SECTION E

COMPLETE LISTING OF RECOMMENDED ASSUMPTIONS

Proposed Retirement Rates

<div align="center">Percents of Active Members
Retiring within Next Year</div>

Retirement Ages	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	15%	32.5%		60%	25	60%
51	10%	27.5%		60%	26	60%
52	10%	27.5%		60%	27	60%
53	10%	27.5%		40%	28	40%
54	10%	27.5%		40%	29	40%
55	10%	27.5%	40%	40%	30	40%
56	10%	27.5%	40%	40%	31	40%
57	10%	27.5%	40%	40%	32	40%
58	10%	27.5%	40%	40%	33	40%
59	10%	27.5%	40%	40%	34	40%
60	10%	27.5%	40%	40%	35	40%
61	10%	27.5%	40%	40%	36	40%
62	30%	47.5%	40%	40%	37	40%
63	15%	32.5%	40%	40%	38	40%
64	15%	32.5%	40%	40%	39	40%
65	50%	100%	100%	100%	40	100%
66	40%					
67	40%					
68	40%					
69	40%					
70	100%					
Ref.	625	3412	3411	3411		3411

Proposed Turnover Rates
(Same as Current 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		Police & Fire
	Male	Female	
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 3.25% 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%	3.25%	5.41%	4.94%
21	2.06	1.69	3.25	5.31	4.94
22	1.97	1.69	3.25	5.22	4.94
23	1.89	1.69	3.25	5.14	4.94
24	1.82	1.69	3.25	5.07	4.94
25	1.76	1.69	3.25	5.01	4.94
26	1.70	1.69	3.25	4.95	4.94
27	1.64	1.69	3.25	4.89	4.94
28	1.59	1.69	3.25	4.84	4.94
29	1.55	1.69	3.25	4.80	4.94
30	1.51	1.69	3.25	4.76	4.94
31	1.47	1.69	3.25	4.72	4.94
32	1.43	1.69	3.25	4.68	4.94
33	1.40	1.52	3.25	4.65	4.77
34	1.37	1.35	3.25	4.62	4.60
35	1.34	1.18	3.25	4.59	4.43
36	1.31	1.01	3.25	4.56	4.26
37	1.28	0.84	3.25	4.53	4.09
38	1.26	0.71	3.25	4.51	3.96
39	1.23	0.57	3.25	4.48	3.82
40	1.20	0.44	3.25	4.45	3.69
41	1.16	0.30	3.25	4.41	3.55
42	1.12	0.17	3.25	4.37	3.42
43	1.07	0.16	3.25	4.32	3.41
44	1.01	0.15	3.25	4.26	3.40
45	0.94	0.14	3.25	4.19	3.39
46	0.88	0.12	3.25	4.13	3.37
47	0.82	0.11	3.25	4.07	3.36
48	0.75	0.10	3.25	4.00	3.35
49	0.70	0.09	3.25	3.95	3.34
50	0.64	0.08	3.25	3.89	3.33
51	0.59	0.07	3.25	3.84	3.32
52	0.53	0.06	3.25	3.78	3.31
53	0.48	0.05	3.25	3.73	3.30
54	0.43	0.03	3.25	3.68	3.28
55	0.37	0.02	3.25	3.62	3.27
56	0.32	0.01	3.25	3.57	3.26
57	0.26	0.00	3.25	3.51	3.25
58	0.20	0.00	3.25	3.45	3.25
59	0.15	0.00	3.25	3.40	3.25
60	0.09	0.00	3.25	3.34	3.25
61	0.03	0.00	3.25	3.28	3.25
62	0.00	0.00	3.25	3.25	3.25
63	0.00	0.00	3.25	3.25	3.25
64	0.00	0.00	3.25	3.25	3.25
65	0.00	0.00	3.25	3.25	3.25
66	0.00	0.00	3.25	3.25	3.25
67	0.00	0.00	3.25	3.25	3.25
68	0.00	0.00	3.25	3.25	3.25
69	0.00	0.00	3.25	3.25	3.25
70	0.00	0.00	3.25	3.25	3.25
71	0.00	0.00	3.25	3.25	3.25
72	0.00	0.00	3.25	3.25	3.25
73	0.00	0.00	3.25	3.25	3.25
74	0.00	0.00	3.25	3.25	3.25

Ref. 760 761

Proposed Healthy Post-Retirement Mortality Rates

General

	% Dying Next Year*			% Dying Next Year*	
Age	Male	Female	Age	Male	Female
50	0.2803%	0.2033%	86	8.8839%	6.6693%
51	0.2998%	0.2154%	87	9.9589%	7.5897%
52	0.3228%	0.2306%	88	11.1300%	8.6202%
53	0.3486%	0.2473%	89	12.3993%	9.7546%
54	0.3793%	0.2650%	90	13.7583%	10.9792%
55	0.4130%	0.2844%	91	15.1982%	12.2756%
56	0.4506%	0.3050%	92	16.7004%	13.6206%
57	0.4918%	0.3271%	93	18.2560%	15.0125%
58	0.5361%	0.3492%	94	19.8606%	16.4435%
59	0.5843%	0.3737%	95	21.4933%	17.9300%
60	0.6338%	0.4000%	96	23.2778%	19.5596%
61	0.6852%	0.4296%	97	25.1219%	21.2850%
62	0.7396%	0.4621%	98	27.0284%	23.1125%
63	0.7950%	0.4994%	99	28.9978%	25.0420%
64	0.8550%	0.5393%	100	31.0091%	27.0702%
65	0.9214%	0.5853%	101	33.0427%	29.1668%
66	0.9958%	0.6364%	102	35.0634%	31.2854%
67	1.0807%	0.6946%	103	37.0692%	33.4128%
68	1.1769%	0.7626%	104	39.0303%	35.5234%
69	1.2876%	0.8418%	105	40.9301%	37.6137%
70	1.4139%	0.9334%	106	42.7733%	39.6410%
71	1.5569%	1.0403%	107	44.5515%	41.6137%
72	1.7216%	1.1643%	108	46.2304%	43.5145%
73	1.9096%	1.3076%	109	47.8367%	45.3262%
74	2.1272%	1.4724%	110	49.1369%	47.0407%
75	2.3763%	1.6613%	111	49.2946%	48.6616%
76	2.6624%	1.8755%	112	49.4528%	49.5717%
77	2.9905%	2.1202%	113	49.6164%	49.7058%
78	3.3664%	2.3994%	114	49.7854%	49.8303%
79	3.7956%	2.7168%	115	49.9450%	49.9600%
80	4.2861%	3.0803%	116	49.9700%	49.9800%
81	4.8462%	3.4970%	117	49.9850%	49.9900%
82	5.4841%	3.9744%	118	50.0000%	50.0000%
83	6.2006%	4.5189%	119	50.0000%	50.0000%
84	7.0044%	5.1435%	120	100.0000%	100.0000%
85	7.8995%	5.8562%			

Ref   100%   x   2705   100%   x   2706

Based on attained ages in 2022. Future years will reflect improvements in life expectancy.

Proposed Healthy Post-Retirement Mortality Rates

Police and Fire

	% Dying Next Year*				% Dying Next Year*	
Age	Male	Female	Age	Male	Female	
50	0.1806%	0.1365%	86	9.4493%	7.2291%	
51	0.1971%	0.1544%	87	10.6093%	8.0895%	
52	0.2155%	0.1744%	88	11.8939%	9.0490%	
53	0.2371%	0.1976%	89	13.3138%	10.1137%	
54	0.2630%	0.2251%	90	14.8724%	11.2928%	
55	0.2932%	0.2566%	91	16.4680%	12.5530%	
56	0.3280%	0.2918%	92	18.0312%	13.8645%	
57	0.3681%	0.3302%	93	19.5363%	15.2200%	
58	0.4144%	0.3721%	94	20.9888%	16.6105%	
59	0.4660%	0.4165%	95	22.3948%	18.0557%	
60	0.5235%	0.4646%	96	23.9235%	19.6454%	
61	0.5867%	0.5132%	97	25.5171%	21.3357%	
62	0.6545%	0.5639%	98	27.2193%	23.1364%	
63	0.7269%	0.6173%	99	29.0538%	25.0487%	
64	0.8049%	0.6741%	100	31.0091%	27.0702%	
65	0.8891%	0.7352%	101	33.0427%	29.1668%	
66	0.9799%	0.8006%	102	35.0634%	31.2854%	
67	1.0797%	0.8747%	103	37.0692%	33.4128%	
68	1.1894%	0.9593%	104	39.0303%	35.5234%	
69	1.3130%	1.0553%	105	40.9301%	37.6137%	
70	1.4528%	1.1670%	106	42.7733%	39.6410%	
71	1.6126%	1.2945%	107	44.5515%	41.6137%	
72	1.7940%	1.4417%	108	46.2304%	43.5145%	
73	2.0020%	1.6107%	109	47.8367%	45.3262%	
74	2.2414%	1.8039%	110	49.1369%	47.0407%	
75	2.5142%	2.0248%	111	49.2946%	48.6616%	
76	2.8269%	2.2744%	112	49.4528%	49.5717%	
77	3.1836%	2.5563%	113	49.6164%	49.7058%	
78	3.5911%	2.8752%	114	49.7854%	49.8303%	
79	4.0550%	3.2318%	115	49.9450%	49.9600%	
80	4.5815%	3.6322%	116	49.9700%	49.9800%	
81	5.1790%	4.0815%	117	49.9850%	49.9900%	
82	5.8539%	4.5823%	118	50.0000%	50.0000%	
83	6.6084%	5.1406%	119	50.0000%	50.0000%	
84	7.4554%	5.7637%	120	100.0000%	100.0000%	
85	8.3997%	6.4574%				

Ref   100%   x   2703   100%   x   2704

* *Based on attained ages in 2022. Future years will reflect improvements in life expectancy.*

Proposed Disabled Post-Retirement Mortality Rates

General

Age	% Dying Next Year* Male	% Dying Next Year* Female	Age	% Dying Next Year* Male	% Dying Next Year* Female
50	1.5097%	1.3584%	86	10.7900%	9.6265%
51	1.5990%	1.4188%	87	11.6958%	10.4661%
52	1.6961%	1.4878%	88	12.6728%	11.3189%
53	1.8003%	1.5659%	89	13.8964%	12.1809%
54	1.9109%	1.6485%	90	15.2409%	13.0610%
55	2.0256%	1.7324%	91	16.6184%	13.9821%
56	2.1420%	1.8128%	92	18.0001%	14.9559%
57	2.2560%	1.8856%	93	19.3819%	16.0049%
58	2.3685%	1.9478%	94	20.7743%	17.1374%
59	2.4758%	1.9981%	95	22.1778%	18.3805%
60	2.5794%	2.0377%	96	23.7437%	19.8257%
61	2.6786%	2.0654%	97	25.3955%	21.4436%
62	2.7767%	2.0876%	98	27.1551%	23.1881%
63	2.8755%	2.1077%	99	29.0339%	25.0631%
64	2.9742%	2.1278%	100	31.0091%	27.0702%
65	3.0719%	2.1539%	101	33.0427%	29.1668%
66	3.1701%	2.1891%	102	35.0634%	31.2854%
67	3.2705%	2.2393%	103	37.0692%	33.4128%
68	3.3747%	2.3075%	104	39.0303%	35.5234%
69	3.4883%	2.3977%	105	40.9301%	37.6137%
70	3.6143%	2.5130%	106	42.7733%	39.6410%
71	3.7601%	2.6545%	107	44.5515%	41.6137%
72	3.9279%	2.8249%	108	46.2304%	43.5145%
73	4.1251%	3.0257%	109	47.8367%	45.3262%
74	4.3543%	3.2604%	110	49.1369%	47.0407%
75	4.6192%	3.5317%	111	49.2946%	48.6616%
76	4.9222%	3.8398%	112	49.4528%	49.5717%
77	5.2683%	4.1886%	113	49.6164%	49.7058%
78	5.6599%	4.5813%	114	49.7854%	49.8303%
79	6.1026%	5.0196%	115	49.9450%	49.9600%
80	6.5970%	5.5069%	116	49.9700%	49.9800%
81	7.1503%	6.0484%	117	49.9850%	49.9900%
82	7.7613%	6.6458%	118	50.0000%	50.0000%
83	8.4292%	7.3019%	119	50.0000%	50.0000%
84	9.1580%	8.0206%	120	100.0000%	100.0000%
85	9.9444%	8.8065%			

Ref   100%   x   2711   100%   x   2712

* Based on attained ages in 2022. Future years will reflect improvements in life expectancy.

Proposed Disabled Post-Retirement Mortality Rates

Police and Fire

	% Dying Next Year*			% Dying Next Year*	
Age	Male	Female	Age	Male	Female
50	0.3320%	0.2785%	86	9.4493%	7.2291%
51	0.3484%	0.3050%	87	10.6093%	8.0895%
52	0.3685%	0.3365%	88	11.8939%	9.0490%
53	0.3936%	0.3724%	89	13.3138%	10.1137%
54	0.4238%	0.4131%	90	14.8724%	11.2928%
55	0.4599%	0.4585%	91	16.4680%	12.5530%
56	0.5031%	0.5077%	92	18.0312%	13.8645%
57	0.5551%	0.5596%	93	19.5363%	15.2200%
58	0.6155%	0.6153%	94	20.9888%	16.6105%
59	0.6832%	0.6712%	95	22.3948%	18.0557%
60	0.7574%	0.7282%	96	23.9235%	19.6454%
61	0.8386%	0.7848%	97	25.5171%	21.3357%
62	0.9232%	0.8407%	98	27.2193%	23.1364%
63	1.0119%	0.8970%	99	29.0538%	25.0487%
64	1.1025%	0.9535%	100	31.0091%	27.0702%
65	1.1969%	1.0130%	101	33.0427%	29.1668%
66	1.2947%	1.0759%	102	35.0634%	31.2854%
67	1.3987%	1.1462%	103	37.0692%	33.4128%
68	1.5092%	1.2243%	104	39.0303%	35.5234%
69	1.6302%	1.3123%	105	40.9301%	37.6137%
70	1.7669%	1.4137%	106	42.7733%	39.6410%
71	1.9226%	1.5286%	107	44.5515%	41.6137%
72	2.1059%	1.6588%	108	46.2304%	43.5145%
73	2.3231%	1.8064%	109	47.8367%	45.3262%
74	2.5814%	1.9714%	110	49.1369%	47.0407%
75	2.8834%	2.1554%	111	49.2946%	48.6616%
76	3.2305%	2.3615%	112	49.4528%	49.5717%
77	3.6231%	2.5930%	113	49.6164%	49.7058%
78	4.0557%	2.8752%	114	49.7854%	49.8303%
79	4.5237%	3.2318%	115	49.9450%	49.9600%
80	5.0259%	3.6322%	116	49.9700%	49.9800%
81	5.5722%	4.0815%	117	49.9850%	49.9900%
82	6.1737%	4.5823%	118	50.0000%	50.0000%
83	6.8424%	5.1406%	119	50.0000%	50.0000%
84	7.6009%	5.7637%	120	100.0000%	100.0000%
85	8.4714%	6.4574%			

Ref   100%   x   2709   100%   x   2710

* Based on attained ages in 2022. Future years will reflect improvements in life expectancy.

Proposed Pre-Retirement Mortality Rates

General

| | % Dying Next Year* | | | % Dying Next Year* | |
Age	Male	Female	Age	Male	Female
20	0.0382%	0.0141%	45	0.1051%	0.0543%
21	0.0378%	0.0133%	46	0.1106%	0.0577%
22	0.0354%	0.0125%	47	0.1160%	0.0612%
23	0.0341%	0.0116%	48	0.1236%	0.0651%
24	0.0330%	0.0107%	49	0.1316%	0.0703%
25	0.0329%	0.0110%	50	0.1402%	0.0760%
26	0.0366%	0.0126%	51	0.1513%	0.0832%
27	0.0393%	0.0142%	52	0.1633%	0.0909%
28	0.0433%	0.0158%	53	0.1771%	0.1003%
29	0.0461%	0.0176%	54	0.1920%	0.1101%
30	0.0503%	0.0206%	55	0.2098%	0.1223%
31	0.0545%	0.0224%	56	0.2297%	0.1348%
32	0.0585%	0.0254%	57	0.2523%	0.1481%
33	0.0624%	0.0269%	58	0.2766%	0.1621%
34	0.0658%	0.0295%	59	0.3018%	0.1775%
35	0.0704%	0.0319%	60	0.3287%	0.1938%
36	0.0743%	0.0340%	61	0.3566%	0.2096%
37	0.0775%	0.0371%	62	0.3848%	0.2260%
38	0.0814%	0.0384%	63	0.4140%	0.2437%
39	0.0845%	0.0406%	64	0.4429%	0.2628%
40	0.0881%	0.0425%	65	0.4723%	0.2826%
41	0.0909%	0.0452%	66	0.5024%	0.3051%
42	0.0943%	0.0465%	67	0.5345%	0.3309%
43	0.0971%	0.0488%	68	0.5688%	0.3593%
44	0.1007%	0.0510%	69	0.6080%	0.3916%

Ref   100%   x   2723   100%   x   2724

* Based on attained ages in 2022. Future years will reflect improvements in life expectancy.

Proposed Pre-Retirement Mortality Rates

Police and Fire

Age	% Dying Next Year* Male	% Dying Next Year* Female	Age	% Dying Next Year* Male	% Dying Next Year* Female
20	0.0423%	0.0174%	45	0.0880%	0.0650%
21	0.0430%	0.0188%	46	0.0909%	0.0671%
22	0.0429%	0.0193%	47	0.0950%	0.0705%
23	0.0429%	0.0209%	48	0.0993%	0.0734%
24	0.0429%	0.0226%	49	0.1059%	0.0776%
25	0.0429%	0.0245%	50	0.1129%	0.0834%
26	0.0464%	0.0264%	51	0.1205%	0.0897%
27	0.0494%	0.0283%	52	0.1306%	0.0966%
28	0.0525%	0.0317%	53	0.1415%	0.1041%
29	0.0556%	0.0338%	54	0.1532%	0.1130%
30	0.0573%	0.0372%	55	0.1677%	0.1223%
31	0.0602%	0.0391%	56	0.1849%	0.1327%
32	0.0629%	0.0423%	57	0.2028%	0.1440%
33	0.0653%	0.0452%	58	0.2243%	0.1538%
34	0.0673%	0.0478%	59	0.2478%	0.1649%
35	0.0704%	0.0500%	60	0.2721%	0.1750%
36	0.0728%	0.0517%	61	0.2985%	0.1838%
37	0.0731%	0.0543%	62	0.3267%	0.1934%
38	0.0757%	0.0550%	63	0.3552%	0.2018%
39	0.0776%	0.0566%	64	0.3835%	0.2100%
40	0.0788%	0.0578%	65	0.4138%	0.2177%
41	0.0794%	0.0587%	66	0.4617%	0.2445%
42	0.0821%	0.0606%	67	0.5131%	0.2742%
43	0.0831%	0.0613%	68	0.5717%	0.3099%
44	0.0851%	0.0631%	69	0.6363%	0.3509%

Ref   100%   x   2721   100%   x   2722

Based on attained ages in 2022. Future years will reflect improvements in life expectancy.