

**THE POLICE AND FIRE RETIREMENT SYSTEM OF
THE CITY OF DETROIT**

**5-YEAR RETIRED MORTALITY EXPERIENCE STUDY
JULY 1, 2008 THROUGH JUNE 30, 2013**

ACTUARIAL INVESTIGATION REPORT 2008-2013

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February 13, 2015

The Board of Trustees
The Police and Fire Retirement System of the City of Detroit

Dear Board Members:

Article II, Section 15 of the Police and Fire Retirement System Plan (pre-bankruptcy) states that:

“At least once in each five year period, the Board of Trustees shall cause an actuarial investigation to be made into the mortality, service and compensation experience of the members and beneficiaries of the Retirement System...”

The results of this investigation as it relates to the mortality portion of the study are contained herein. This is also referred to as the “5-year actuarial experience study for retired mortality” or “post-retirement mortality study.”

The investigation was based upon the statistical data furnished for annual actuarial valuations concerning members who were retired at any time during the last 5 years.

The investigation covered the 5-year period from *July 1, 2008 to June 30, 2013*, and was carried out using generally accepted actuarial principles and techniques.

In past 5-year studies, we have studied all of the actuarial assumptions together based on the actuarial standard of practice requirement that all actuarial assumptions **must be reasonable and consistent with other actuarial assumptions**. Such a comprehensive study was started prior to the City filing for bankruptcy and was put on hold due to the pending changes resulting from the bankruptcy. The plan changes that were implemented in the bankruptcy may require changes in the other assumptions (such as rates of pay increases, investment return, retirement, termination, disability, etc.), for valuations that reflect all of the new provisions. As such, we will recommend changes to the assumptions as needed, and will perform a comprehensive study once sufficient post-bankruptcy experience emerges.

David T. Kausch and Judith A. Kermans are Members of the American Academy of Actuaries (M.A.A.A.), and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

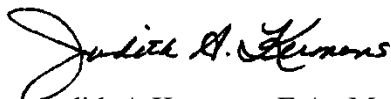
Respectfully submitted,



David T. Kausch, F.S.A., E.A., M.A.A.A.



Kenneth G. Alberts



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SECTION A
OVERVIEW

INTRODUCTION

Each year as of June 30, the actuarial liabilities of the System are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to many risk areas. Assumptions should be carefully chosen and continually monitored. An unrealistic set of assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or increases in required contributions as time progresses;
- Overstated costs resulting in an unnecessarily large burden on the current generation of employers and taxpayers and decreasing required contributions as time progresses.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. A package of assumptions should be adjusted to reflect basic experience trends -- but not random year to year fluctuations.

No single 5-year experience period should be given full credibility in the setting of actuarial valuation assumptions. When we see significant differences between what is expected from our assumptions and actual experience, our strategy in recommending a change in assumptions is usually to select rates that would produce results somewhere between the actual and expected experience. In this way, with each experience study the actuarial assumptions become better and better representations of actual experience. Consequently, temporary conditions that might influence a particular experience study period will not unduly influence the choice of long-term assumptions.

The purpose of this study is to review the retired mortality assumption only and we are recommending changes to those mortality assumptions. The assumption changes and their impact on the required contribution are described on the following pages.

BACKGROUND

Commonly accepted convention is that a study group should have several hundred thousand lives in the study period to establish a mortality table based on the groups own experience. In addition, a study group should include at least approximately 1,000 deaths in the study period to be considered credible for use in a mortality study. The System does not meet the first criteria and, therefore, we recommend using a standard published mortality table. The System is very close to meeting the second criteria for males (with over 900 deaths in the study period), but does not meet the second criteria for females (with less than 50 deaths in the study period). We are therefore able to assign some credibility to the System's experience for male members and little or no credibility to the System's experience for female members. Post-disabled deaths were very low, and therefore have little or no credibility. Therefore, our process was to use published tables where male mortality expectations reasonably matched the System's male mortality experience.

In October 2014, the Society of Actuaries published the RP-2014 Mortality Tables. These tables are the most current, publicly available pension mortality tables. As with the RP-2000 Mortality Tables (currently being used by the Retirement System), the RP-2014 Mortality Tables include Total tables for general use as well as Blue Collar and White Collar tables. Moreover, the RP-2014 Tables include separate tables for Annuitants and Employees. Assumed rates of mortality improvement called MP-2014 were also published with these tables.

There are two common but different methodologies for anticipating future mortality improvement. The current (prior) mortality assumption was selected with mortality rates below actual experience in the prior experience study period. Setting the assumption below the actual experience in this way created a margin for future improvement in mortality rates. This is referred to as a static mortality table.

The second way is known as fully generational mortality. Under this method, the Actuary uses a base table (with base rates for all ages) that is associated with a particular "base year" and then applies rates of mortality improvement to each age in each subsequent year. For example, assume that the base table contained the following rates of mortality: age 110: 50%; age 111: 60%; age 112: 70% and assumed mortality improvement is 1% per year. Then a member who is 110 in the base year will have the following assumed mortality rates: 110: 50%; 111: 59.4%; 112: 68.6%. It is important to note that with fully generational tables, the base table should match the experience as closely as possible (with no margin). Converting from a static table with a margin to a base table without a margin often results in an increase in the base table mortality rates (lower initial life expectancy).

SUMMARY OF FINDINGS

Average actual rates of mortality were close to assumed rates for males and above assumed rates for females for ages with the most exposure (ages 55 to 94), indicating that the average rates of mortality for the group do not need significant adjustment. Looking at specific age grouping for males, however, results indicate that a different curvature to the table might be a better fit, particularly at the younger ages (age 55 through 64). We compared actual plan experience to the newly published RP-2014 tables and determined that the Blue Collar tables are the best fit for the System's male experience. As discussed in the background section, we based our recommendations on the male experience due to the better credibility of results. Results of our comparisons are shown in Section C.

RECOMMENDATIONS

Based on the analysis above, we recommend the sex distinct RP-2014 Blue Collar Annuitant Tables for the retired base mortality tables. For consistency, we recommend the sex distinct RP-2014 Blue Collar Employee Tables for pre-retirement mortality. We recommend using fully generational tables based on the 2-dimensional, sex distinct mortality improvement scale MP-2014 (which was published and intended to be used with RP-2014). We recommend the same tables for post-disabled mortality.

An illustration of the financial effect of the proposed changes is shown in Section B.

SECTION B

SUMMARY OF THE VALUATION RESULTS

2008-2013 EXPERIENCE STUDY
ILLUSTRATIVE UNFUNDED ACTUARIAL ACCRUED LIABILITY AS OF JUNE 30, 2013

	Current Assumptions	Proposed Alternate Mortality Assumptions	Increase/ (Decrease)
	Static RP2000	Generational RP2014 Blue Collar	
Actuarial Accrued Liabilities	\$ 3,890,143,341	\$ 4,065,561,032	4.51%

The illustration above is based on the plan provisions, assumptions and methods used in the June 30, 2013 valuation. Actual results will be different based on the plan provisions, methods and assumptions mandated in the bankruptcy. However, since we have not published any baseline results reflecting the bankruptcy changes, we are showing results based on the most recently published valuation (June 30, 2013).

SECTION C

MORTALITY EXPERIENCE

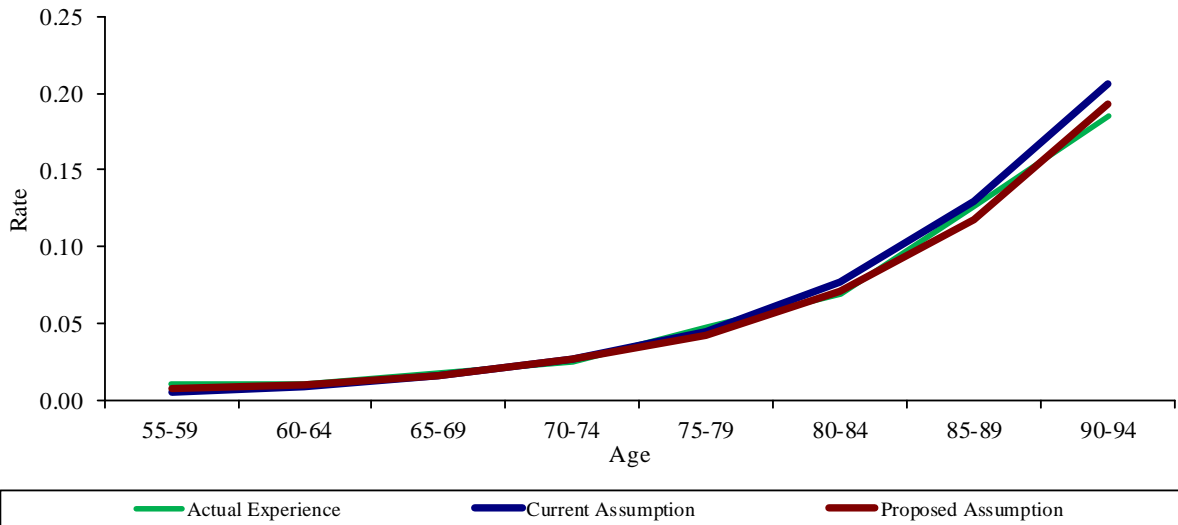
MALE RETIRED-LIFE MORTALITY EXPERIENCE (NORMAL RETIREMENT, ORIGINAL ANNUITANTS ONLY)

There were 881 member deaths reported for the 5-year period and 26,105 life years of exposure included in the male retired-life mortality investigation.

Age	Deaths	Exposure	Crude Rates	Sample Rates*		Expected Deaths**		Actual/Expected	
				Old	New	Old	New	Old	New
55-59	32	3,126	0.010237	0.004458	0.007076	15	24	213%	133%
60-64	75	7,059	0.010625	0.008319	0.010147	60	76	125%	99%
65-69	99	5,864	0.016883	0.015271	0.016117	89	98	111%	101%
70-74	76	3,102	0.024500	0.025917	0.025967	79	83	96%	92%
75-79	93	1,957	0.047522	0.044561	0.042420	89	89	104%	104%
80-84	189	2,727	0.069307	0.076462	0.070290	219	206	86%	92%
85-89	224	1,768	0.126697	0.129241	0.117315	229	211	98%	106%
90-94	93	502	0.185259	0.205775	0.192755	102	96	91%	97%
Totals	881	26,105	0.033748	0.033787	0.033825	882	883	100%	100%

* Sample rates are taken from midpoint of age group.

** "Expected Deaths – New" is calculated as the sum of rates applied to exposure at individual ages. "Expected Deaths – Old" is the sum of actual probabilities applied in the valuation.



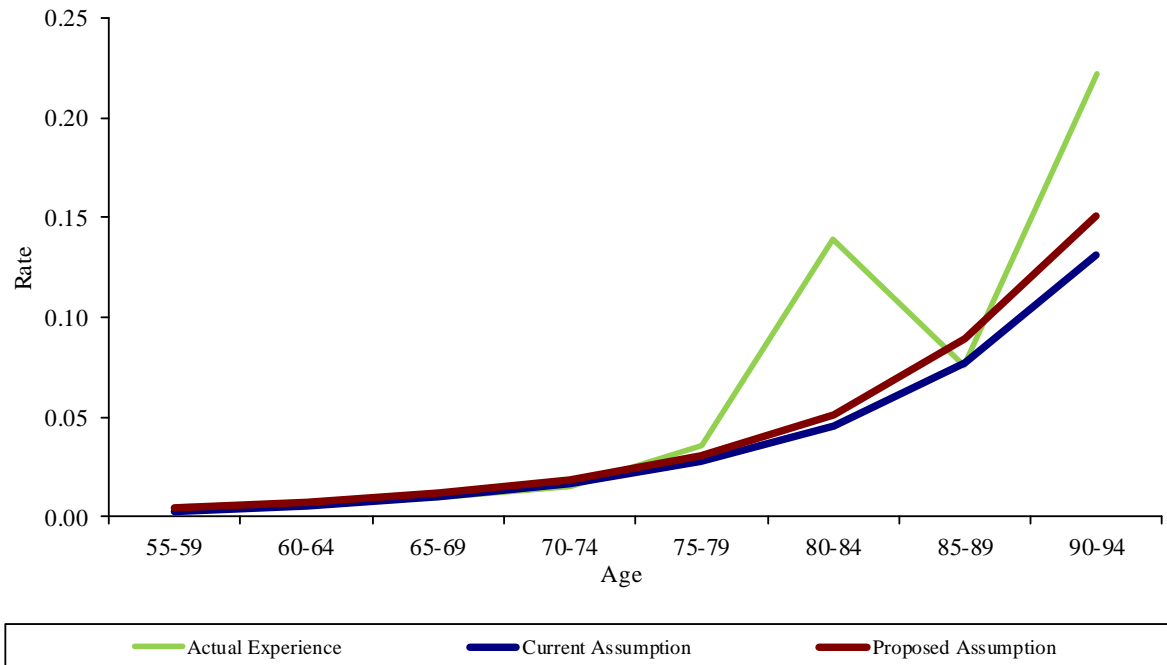
FEMALE RETIRED-LIFE MORTALITY EXPERIENCE (NORMAL RETIREMENT, ORIGINAL ANNUITANTS ONLY)

There were 43 member deaths reported for the 5-year period and 3,789 life years of exposure included in the female retired-life mortality investigation.

Age	Deaths	Exposure	Crude Rates	Sample Rates*		Expected Deaths**		Actual/Expected	
				Old	New	Old	New	Old	New
55-59	7	1,328	0.005271	0.002717	0.004735	4	7	175%	100%
60-64	10	1,423	0.007027	0.005055	0.007260	7	11	143%	91%
65-69	6	656	0.009146	0.009706	0.011526	6	8	100%	75%
70-74	3	199	0.015075	0.016742	0.018709	3	4	100%	75%
75-79	2	56	0.035714	0.028106	0.030691	2	2	100%	100%
80-84	6	43	0.139535	0.045879	0.051511	2	2	300%	300%
85-89	5	66	0.075758	0.077446	0.088925	5	6	100%	83%
90-94	4	18	0.222222	0.131682	0.150895	2	3	200%	133%
Totals	43	3,789	0.011349	0.008182	0.011349	31	43	139%	100%

* Sample rates are taken from midpoint of age group.

** "Expected Deaths – New" is calculated as the sum of rates applied to exposure at individual ages. "Expected Deaths – Old" is the sum of actual probabilities applied in the valuation.



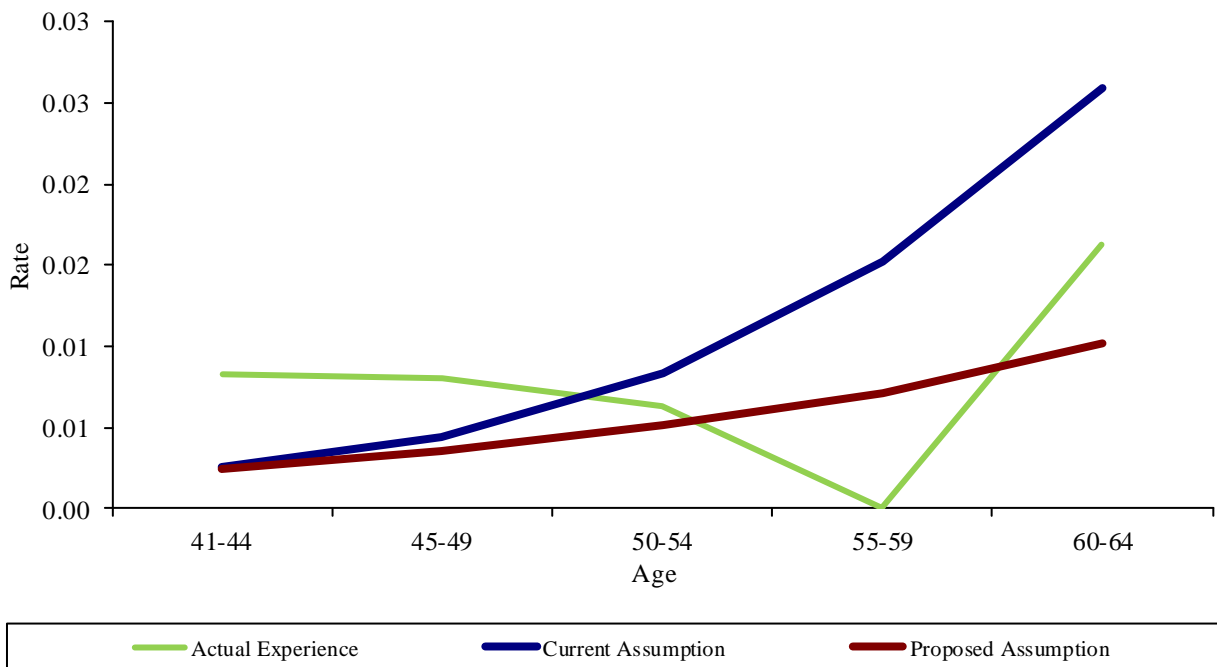
MALE DISABLED RETIRED-LIFE MORTALITY EXPERIENCE (DISABILITY RETIREMENT, ORIGINAL ANNUITANTS ONLY)

There were 34 member deaths reported for the 5-year period and 1,949 life years of exposure included in the male disabled retired-life mortality investigation.

Age	Deaths	Exposure	Crude Rates	Sample Rates*		Expected Deaths**		Actual/Expected	
				Old	New	Old	New	Old	New
41-44	2	242	0.008264	0.002534	0.002417	1	1	200%	200%
45-49	3	376	0.007979	0.004458	0.003600	2	1	150%	300%
50-54	2	318	0.006289	0.008319	0.005138	3	2	67%	100%
55-59	-	228	0.000000	0.015271	0.007076	3	2	0%	0%
60-64	3	184	0.016304	0.025917	0.010147	5	2	60%	150%
65+ & Other	24	601	0.039933	0.044561	0.016117	53	23	45%	104%
Totals	34	1,949	0.017445	0.034377	0.015906	67	31	51%	110%

* Sample rates are taken from midpoint of age group.

** "Expected Deaths – New" is calculated as the sum of rates applied to exposure at individual ages. "Expected Deaths – Old" is the sum of actual probabilities applied in the valuation.



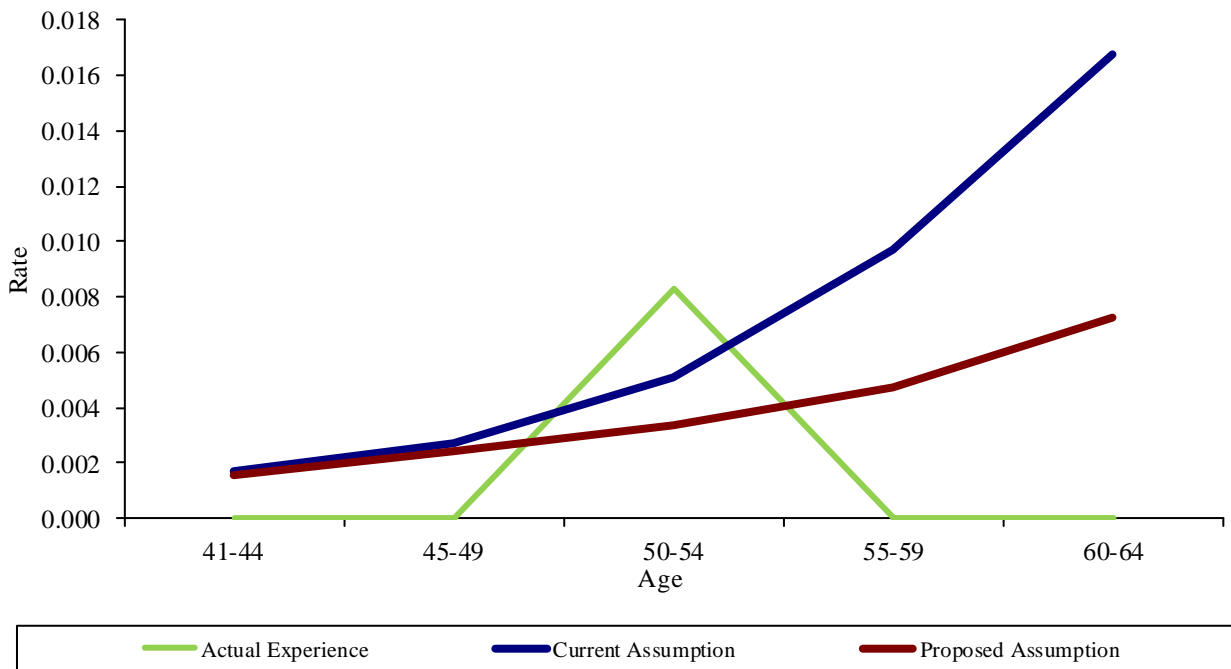
FEMALE DISABLED RETIRED-LIFE MORTALITY EXPERIENCE (DISABILITY RETIREMENT, ORIGINAL ANNUITANTS ONLY)

There was 1 member death reported for the 5-year period and 673 life years of exposure included in the female disabled retired-life mortality investigation.

Age	Deaths	Exposure	Crude Rates	Sample Rates*		Expected Deaths**		Actual/Expected	
				Old	New	Old	New	Old	New
41-44	-	50	0.000000	0.001676	0.001581	-	-	0%	0%
45-49	-	138	0.000000	0.002717	0.002389	-	-	0%	0%
50-54	1	121	0.008264	0.005055	0.003341	1	-	100%	0%
55-59	-	165	0.000000	0.009706	0.004735	2	1	0%	0%
60-64	-	58	0.000000	0.016742	0.007260	1	-	0%	0%
65+ & Other	-	141	0.000000	0.028106	0.011526	1	-	0%	0%
Totals	1	673	0.001486	0.007429	0.001486	5	1	20%	100%

* Sample rates are taken from midpoint of age group.

** "Expected Deaths – New" is calculated as the sum of rates applied to exposure at individual ages. "Expected Deaths – Old" is the sum of actual probabilities applied in the valuation.



COMPARISON OF LIFE EXPECTANCY

PRESENT ASSUMPTIONS
(BASED ON RP-2000 COMBINED)
(95% OF MALE RATES SET-BACK 0 YEARS)
(100% OF FEMALE RATES SET-BACK 2 YEARS)

Sample Attained Ages	Future Life Expectancy (years)	
	Men	Women
45	35.97	40.28
50	31.24	35.49
55	26.61	30.77
60	22.16	26.17
65	18.00	21.78
70	14.23	17.75
75	10.88	14.08
80	8.02	10.85

PROPOSED ASSUMPTIONS
(BASED ON RP-2014 BLUE COLLAR)

Sample Attained Ages in 2014	Future Life Expectancy (years)	
	Men	Women
45	39.15	42.53
50	34.17	37.47
55	29.40	32.57
60	24.86	27.80
65	20.53	23.20
70	16.49	18.83
75	12.79	14.82
80	9.53	11.24

SECTION D

NEW ASSUMPTION LISTING

**ACTUARIAL ASSUMPTIONS
BASED ON 2008-2013 EXPERIENCE STUDY**

**POST RETIREMENT MORTALITY RATES
2014 BASE YEAR**

Age	% Dying Next Year		Age	% Dying Next Year	
	Male	Female		Male	Female
50	0.4064%	0.2822%	81	5.7434%	4.2368%
51	0.4384%	0.3045%	82	6.3644%	4.7092%
52	0.4733%	0.3275%	83	7.0561%	5.2397%
53	0.5151%	0.3514%	84	7.8261%	5.8348%
54	0.5573%	0.3763%	85	8.6831%	6.5011%
55	0.5999%	0.4025%	86	9.6365%	7.2457%
56	0.6435%	0.4304%	87	10.6965%	8.0765%
57	0.6887%	0.4607%	88	11.8750%	9.0030%
58	0.7364%	0.4941%	89	13.1850%	10.0356%
59	0.7882%	0.5315%	90	14.6410%	11.1865%
60	0.8456%	0.5735%	91	16.1805%	12.4323%
61	0.9101%	0.6208%	92	17.7682%	13.7597%
62	0.9829%	0.6737%	93	19.3835%	15.1596%
63	1.0653%	0.7328%	94	21.0178%	16.6269%
64	1.1580%	0.7987%	95	22.6707%	18.1584%
65	1.2615%	0.8725%	96	24.3460%	19.7517%
66	1.3765%	0.9550%	97	26.0487%	21.4044%
67	1.5035%	1.0476%	98	27.7810%	23.1991%
68	1.6435%	1.1512%	99	29.5399%	25.1123%
69	1.7980%	1.2671%	100	31.3988%	27.0858%
70	1.9687%	1.3966%	101	33.4365%	29.1040%
71	2.1577%	1.5411%	102	35.4599%	31.1444%
72	2.3674%	1.7020%	103	37.4524%	33.1900%
73	2.6008%	1.8806%	104	39.3982%	35.2232%
74	2.8608%	2.0783%	105	41.2831%	37.2273%
75	3.1507%	2.2971%	106	43.0946%	39.1860%
76	3.4740%	2.5393%	107	44.8227%	41.0849%
77	3.8346%	2.8081%	108	46.4592%	42.9112%
78	4.2369%	3.1074%	109	47.9987%	44.6544%
79	4.6856%	3.4418%	110	100.0000%	100.0000%
80	5.1859%	3.8164%	Ref	#1310sb0x1	#1311sb0x1

Sample RP-2014 Blue Collar rates shown in section C have been adjusted for mortality improvement from 2011 to 2014 using MP-2014 in order to compare actual experience with the central year (2011) of expected mortality rates. For purposes of the valuation, published rates have been extended below age 50 using a cubic spline methodology.

**ACTUARIAL ASSUMPTIONS
BASED ON 2008-2013 EXPERIENCE STUDY**

**POST RETIREMENT DISABLED MORTALITY RATES
2014 BASE YEAR**

Age	% Dying Next Year		Age	% Dying Next Year	
	Male	Female		Male	Female
50	0.4064%	0.2822%	81	5.7434%	4.2368%
51	0.4384%	0.3045%	82	6.3644%	4.7092%
52	0.4733%	0.3275%	83	7.0561%	5.2397%
53	0.5151%	0.3514%	84	7.8261%	5.8348%
54	0.5573%	0.3763%	85	8.6831%	6.5011%
55	0.5999%	0.4025%	86	9.6365%	7.2457%
56	0.6435%	0.4304%	87	10.6965%	8.0765%
57	0.6887%	0.4607%	88	11.8750%	9.0030%
58	0.7364%	0.4941%	89	13.1850%	10.0356%
59	0.7882%	0.5315%	90	14.6410%	11.1865%
60	0.8456%	0.5735%	91	16.1805%	12.4323%
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67	1.5035%	1.0476%	98	27.7810%	23.1991%
68	1.6435%	1.1512%	99	29.5399%	25.1123%
69	1.7980%	1.2671%	100	31.3988%	27.0858%
70	1.9687%	1.3966%	101	33.4365%	29.1040%
71	2.1577%	1.5411%	102	35.4599%	31.1444%
72	2.3674%	1.7020%	103	37.4524%	33.1900%
73	2.6008%	1.8806%	104	39.3982%	35.2232%
74	2.8608%	2.0783%	105	41.2831%	37.2273%
75	3.1507%	2.2971%	106	43.0946%	39.1860%
76	3.4740%	2.5393%	107	44.8227%	41.0849%
77	3.8346%	2.8081%	108	46.4592%	42.9112%
78	4.2369%	3.1074%	109	47.9987%	44.6544%
79	4.6856%	3.4418%	110	100.0000%	100.0000%
80	5.1859%	3.8164%	Ref	#1310sb0x1	#1311sb0x1

Sample RP-2014 Blue Collar rates shown in section C have been adjusted for mortality improvement from 2011 to 2014 using MP-2014 in order to compare actual experience with the central year (2011) of expected mortality rates. For purposes of the valuation, published rates have been extended below age 50 using a cubic spline methodology.

**ACTUARIAL ASSUMPTIONS
BASED ON 2008-2013 EXPERIENCE STUDY**

MORTALITY IMPROVEMENT SCALE MP-2014

Males Aged	% Rate of Improvement Next Year				Females Aged	% Rate of Improvement Next Year			
	2015	2020	2025	2030		2015	2020	2025	2030
50	2.33%	1.70%	1.09%	1.00%	50	1.33%	1.34%	1.01%	1.00%
55	1.45%	1.40%	1.06%	1.00%	55	0.61%	1.05%	1.04%	1.00%
60	0.82%	1.15%	1.06%	1.00%	60	1.13%	1.07%	1.07%	1.00%
65	1.05%	1.12%	1.08%	1.00%	65	1.88%	1.32%	1.05%	1.00%
70	1.74%	1.20%	1.05%	1.00%	70	2.17%	1.58%	1.07%	1.00%
75	2.12%	1.55%	1.06%	1.00%	75	2.08%	1.66%	1.11%	1.00%
80	2.20%	1.63%	1.10%	1.00%	80	2.03%	1.61%	1.12%	1.00%
85	2.15%	1.63%	1.09%	1.00%	85	2.13%	1.65%	1.11%	1.00%
90	2.00%	1.54%	1.03%	0.93%	90	2.16%	1.60%	1.04%	0.93%
95	1.68%	1.33%	0.90%	0.85%	95	1.99%	1.47%	0.92%	0.85%
100	1.26%	1.00%	0.68%	0.64%	100	1.49%	1.11%	0.69%	0.64%

SECTION E
GLOSSARY

GLOSSARY

The following glossary is intended to provide definitions of a number of terms which are used throughout this report and which are somewhat unique to the discussion of an Experience Study.

Actual. The actual number of deaths which occurred during the study. This number is a straight tabulation of the actual number of occurrences of the particular decrement in question. Normally, the actual number of deaths will be subdivided by age and sex, and possibly by service.

Crude Rate. The rate of mortality determined by dividing the actual number of deaths for that age and sex by the corresponding exposure for that age and sex. The rate is described as a crude rate because no smoothing or elimination of statistical fluctuations has been made. It is indicative of the underlying true rate of the decrement and is the basis used in graduation to obtain the graduated or tabular rate.

Exposure. The number of lives exposed to a given risk of decrement for a particular age and sex. It represents the number of members who could have potentially died at that particular age and for that particular sex. This term will also be described as “the number exposed to a given risk.”

Base Year. The calendar year for which the published table of mortality rates applies. A mortality rate from the table in the base year is the probability of death for an individual of the particular age and sex in the table. Mortality rates for individuals of the same age and sex in future years may be adjusted by a mortality improvement scale.

Mortality Improvement Scale. The rates of decrease of mortality rates for each age, sex, and calendar year. For example, if a mortality rate for a 50-year-old male retiree in 2014 is 0.4064% and the 2015 mortality improvement rate for 50-year-old male is 2.33%, the mortality rate for a 50-year-old male retiree in 2015 is 0.3969% ($0.3969\% = 0.4064\% \times (1 - 2.33\%)$).

February 13, 2015

Ms. Cynthia Thomas, Executive Director
The Police and Fire Retirement System of the City of Detroit
500 Woodward Avenue, Suite 3000
Detroit, Michigan 48226

Re: 2008-2013 Experience Study

Dear Cynthia:

Enclosed are 20 copies of the report of the 2008-2013 Mortality Experience Study of the Police and Fire Retirement System of the City of Detroit.

Please call if you have any questions.

Sincerely,



Judith A. Kermans

DTK:rmg:bd
Enclosures