Houston Firefighters' Relief and Retirement Fund

Actuarial Experience Study – Final

November 2, 2020

BUCK

Disclosures

The information contained herein is developed for the Board of Trustees and Staff of Houston Firefighters' Relief and Retirement Fund by Buck Global, LLC using generally accepted actuarial principles and techniques in accordance with all applicable Actuarial Standards of Practice (ASOPs). The presentation contains key results of the June 30, 2019 five-year experience study. All recommendations contained in this report are consistent with each other, as appropriate. Interested parties should refer to the July 1, 2019 Actuary's Report, which was published November 15, 2019, for a detailed explanation regarding data, assumptions, methods, and plan provisions that underlie the results.

The purpose of this presentation is to provide information to assist the Board in adopting assumptions to be used in the actuarial valuation of the Fund. Any cost information provided is estimated and should not be used to determine the actual contributions needed for funding purposes.

No third-party recipient of Buck's work product should rely upon Buck's work product absent involvement of Buck or without our approval.

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this valuation.

I am a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. I am available to answer any questions on the material contained herein, or to provide explanations or further details as may be appropriate.

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Principal, Consulting Actuary

Agenda

Purpose and scope of the study

Assumptions

- Demographic
- Economic

Impact of Proposed Changes

Takeaways and Next Steps

Purpose and Scope of the Study

Senate Bill 2190* (SB2190)

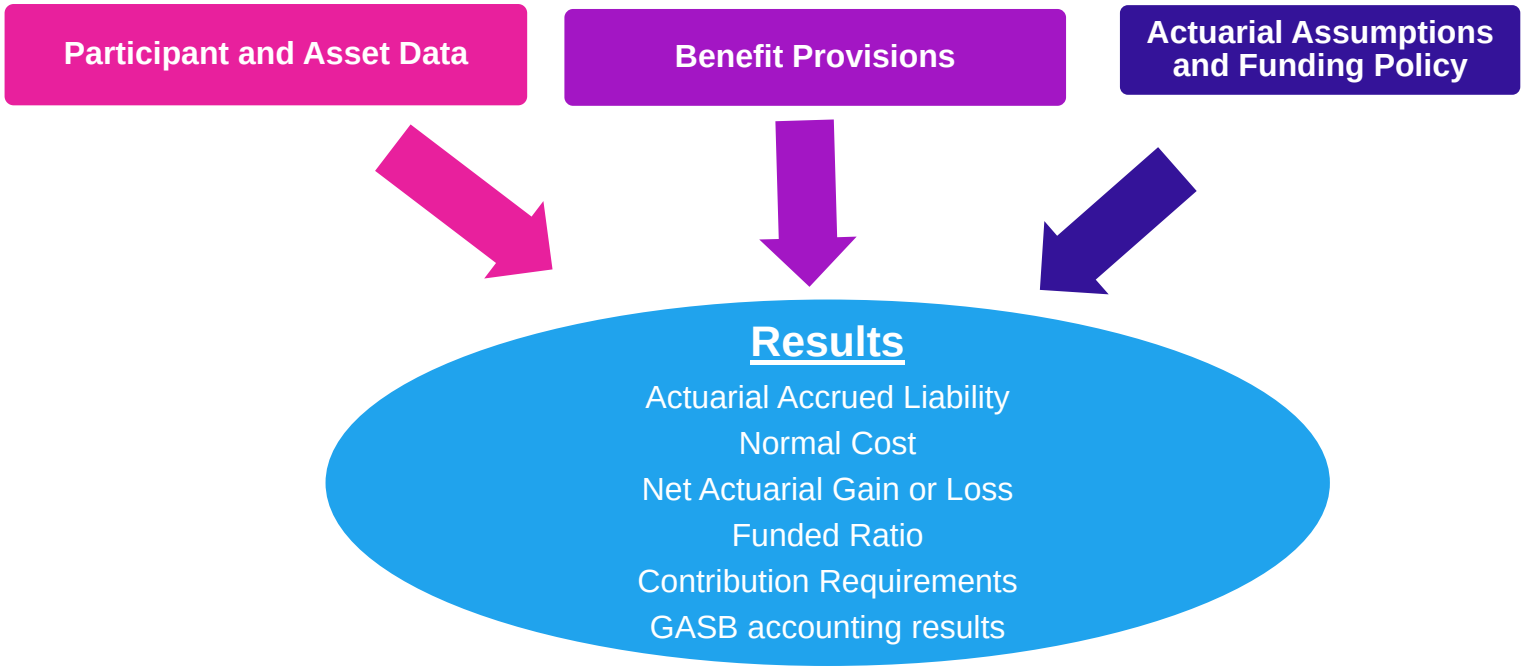
- SB2190 reformed the funding and benefit provisions of the Houston Firefighters' Relief and Retirement Fund (Fund)
- Funding reforms
  - Perform an annual Risk Sharing Valuation Study (RSVS)
  - Requires an experience study at least once every four years
- Benefit reforms effective July 1, 2017
  - Pensionable pay for benefit accruals after June 30, 2017 includes base pay
  - Increase member contributions to 10.5% of pay
  - Revised the calculation to determine COLA
  - Members hired prior to July 1, 2017 (legacy members)
    - Change service retirement benefit accrual formula for service after June 30, 2017
    - Reduced the DROP credits
  - Members hired after June 30, 2017
    - Lower benefit accrual formula than legacy member, maximum 80% of pay
    - Service retirement eligibility at age which the sum of the member's age and service equals 70
    - Not eligible to participate in DROP

* This analysis is provided without waiving the Fund's right to litigate the constitutionality of SB2190

Risk Sharing Valuation Study Process

- SB2190 sets forth requirements for an annual RSVS of the Fund
  - The actuary determines the amount of contributions to be made to the Fund according to prescribed contribution policy
  - The contribution is determined through the RSVS, which is summarized in the annual actuarial RSVS report
  - In addition, the RSVS:
    - Determines the funded ratio
    - Satisfies regulatory and accounting requirements
    - Explores why the results of the current RSVS differ from the results of the RSVS of the previous year

Risk Sharing Valuation Study Process



- The actuarial assumptions and funding policy are typically reviewed as part of an experience study
- This experience study is conducted to determine the assumptions that will serve as the basis for the RSVS from 2020 – 2023
- The funding policy and certain assumptions are prescribed by SB2190

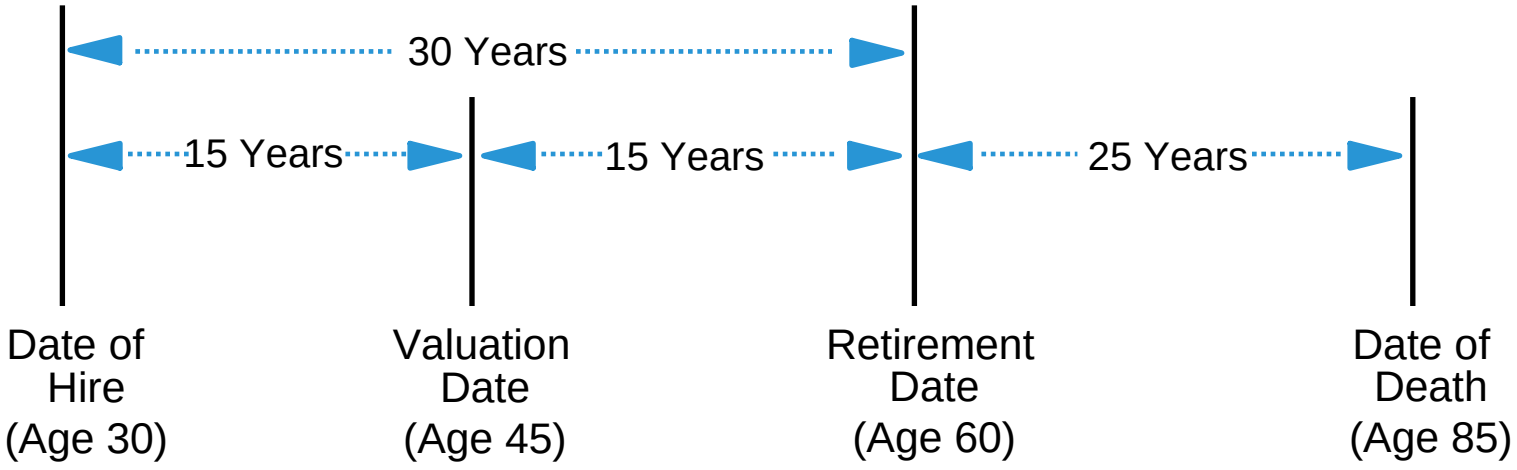
Experience Study

- Determine how actual experience or frequency of events (such as retirement, terminations, etc.) differs from expectations using current assumptions
  - This experience study covers the period from Fiscal Year Ending June 30, 2015 through Fiscal Year Ending June 30, 2019 (FYE2015 – FYE2019)
  - There is not enough data accumulated to examine emerging trends for demographic assumptions applicable to members hired after June 30, 2017, which may be different from legacy membership to warrant an alternative set of demographic assumptions. These will be reviewed when the next scheduled study is prepared as of June 30, 2023 and proposed changes, if warranted, will be recommended at that time.
    - The base assumptions, however, are adjusted for differing Fund provisions (e.g. eligibility)
- Develop recommendations for changes in those actuarial assumptions, if necessary
  - When selecting assumptions, it is important to account for a plan sponsor's expectations for future years that may differ from past experience
- Assess impact of changes on the RSVS
- Improve accuracy of results and forecasts

Things That Happen to Members (Demographics Assumptions)

- **KNOWN at valuation date:**
  1. Age
  2. Gender
  3. Service to date
  4. Occupation

- **ASSUMED at valuation date:**
  1. Retirement rate(s)
  2. Death rates before and after retirement
  3. Disability rates
  4. Termination rates
  5. Payment form



Things That Happen to Members – Salary Increases (Economic Assumptions)

- KNOWN at valuation date:

Salary History	
Age 43	$ 48,857
Age 44	51,422
Age 45	54,019
Total	$154,298

Current 78 pay period average

$154,298/3 = $51,433

- ASSUMED at valuation date:

at Retirement	
Age 57	$ 80,138
Age 58	82,542
Age 59	85,018
Total	$247,698

Projected 78 pay period average

$247,698/3 = $82,566

Things That Happen to Money (Economic Assumptions)

- KNOWN at valuation date:
  1. Market value of Fund assets
  2. Composition of Fund assets
     - Stocks
     - Bonds
     - Short term
     - Long term
     - International
     - Real estate
     - Alternative investments

- ASSUMED at valuation date:
  1. Future rates of investment return
  2. Future rates of inflation
  3. No change in composition of Fund assets

Selection of Actuarial Assumptions

What Assumption	Who Decides
➢ Economic:	
• Investment return	• Agreement between Municipality and Board with input from Actuary and Investment Consultant, as limited by SB2190
• Inflation	
• Payroll growth	
• Individual salary increases	• Mostly Actuary
➢ Demographic:	
• Retirement	• Mostly Actuary
• Disability	
• Withdrawal	
• Mortality	
• Other misc.	
➢ Actuarial cost method:	
• Cost method	• Prescribed by SB2190
• Actuarial asset valuation method	
• Amortization method	
• Administration expense load	

Actuarial Assumptions - Demographic

- Withdrawal
  - Non-Vested with less than 10 years of service
  - Vested with at least 10 years but not yet retirement eligible
    a. Less than 20 years of service for members hired prior to July 1, 2017, or
    b. Before age at which the sum of the member's age and service equals 70 for members hired after June 30, 2017
  - Pension commencement age

- Retirement
  - Members hired prior to July 1, 2017 – 20 years of service
    - DROP participation rate
    - DROP duration upon participation
    - Payment of DROP balances
  - Members hired after June 30, 2017 - age at which the sum of the member's age and service equals 70

- Marriage
  - Married percentage of retiring members
  - Age difference between member and spouse

Actuarial Assumptions - Demographic

- Disability
  - Non Service-Connected
  - Service-Connected
    - Capable of performing any substantial gainful activity
    - Not capable of performing any substantial gainful activity
- Death After Retirement
  - Healthy retired members
  - Disabled retired members
  - Beneficiary in receipt
- Death in Active Service
  - Non Service-Connected
  - Service-Connected

Demographic Assumptions

Setting Demographic Assumptions

- Based on 5-year Experience Review
- Full review covers July 1, 2014 - June 30, 2019
- Compare past experience (“actual”) with assumptions (“expected”)
- Determine trends
- Make judgments about future

Setting Demographic Assumptions

➢ Mortality

- Mortality has continually been improving over the last decade and is expected to improve in the future
  - ASOP No. 35 states that the actuary should “include an assumption as to expected mortality improvement after the measurement date.”

- Mortality trends among the plan population groups are examined through the relationship of liability that was expected to be released due to deaths versus the actual amount released due to actual deaths.
  - The expected release of liability based on the mortality table being examined (expected)
  - The actual liability released based on the mortality table being examined (actual)
  - If the ratio of actual to expected is 100%, the table has exactly predicted what actually occurred. If the ratio of actual to expected is greater than 100%, then the table has underestimated actual experience. If the ratio is less than 100%, then the table has overestimated actual experience
  - The ideal adjustment to the current mortality related rates is to find a mortality table basis that produces an expected liability released that is close to the liability actually released

Setting Demographic Assumptions

- Non-Mortality

  - The expected number of separations from service on account of withdrawal, retirement and disability is calculated by multiplying the rates of separation used as a basis for the active service tables by the number of those exposed to risk

  - The actual number of those who had separated from service is then compared with the expected number

  - If the ratio of actual to expected is 100%, the table has exactly predicted what actually occurred. If the ratio of actual to expected is greater than 100%, then the table has underestimated actual experience. If the ratio is less than 100%, then the table has overestimated actual experience

  - The ideal adjustment to the current non-mortality related rates is to produce an expected number that falls between the current expected number predicted by the assumption and the actual number of separations

Mortality

Mortality Table

- In January 2015 the Society of Actuaries (SOA) and the Retirement Plans Experience Committee (RPEC or “the Committee”) initiated a mortality study of public pension plans
  - The primary focus of this study was a comprehensive review of recent mortality experience of public retirement plans in the United States
- In January 2019 the SOA published the Pub-2010 Public Retirement Plans Mortality Tables Report with the results of the study
  - The analysis included several versions of the table based on job types (Public Safety, Teachers and General) and income levels (above and below median)
- Recommend selecting from the SOA Pub-2010 tables for Public Safety workers unless there is credible experience to support another assumption

Mortality Improvement Scale

- In general, the rates of mortality observed in America decline over time; each generation lives longer than preceding generations
- Actuarial professional standards of practice recommend projecting these mortality improvements into the future
- Theoretically will not have to update mortality (as much) in future experience reviews
- For purposes of our analysis we have used the MP-2019 Improvement Scale, the most recent one published by the SOA.

Experience Credibility

- The decision on what table to use and whether to adjust for actual plan experience is based on the “exposures” and expected number of deaths
- Generally, retiree mortality will have more credibility because you will have sufficient plan experience
- Actives and Disabled generally have less credibility due to the limited plan experience of active deaths and participants who go on disability
- Credibility factor is a measurement of the reliability of the plan experience as compared to the broader experience reflected in standard tables

Mortality Rates - Male Service Retirees

$millions	Actual Liability Released	Expected Liability Released	Ratio of Actual to Expected
Current Assumption: RP2014 Blue Collar-Male, generationally projected with scale MP2018	$112.0	$133.4	84.0%
SOA Public Safety Mortality (Below Median) Amount Weighted-Male, generationally projected with scale MP2019	$112.4	$121.3	92.6%
SOA Public Safety Mortality (Below Median) Amount Weighted-Male, 97.2% adjusted, generationally projected with scale MP2019	$112.8	$118.3	95.3%

- We recommend the SOA Public Mortality Safety (Below Median) Amount Weighted Male Table, with a 97.2% adjustment, generationally projected with scale MP2019

  — The credibility factor is 37.99%. During FYE2015 – FYE2019, there were 201 deaths
  — The 97.2% adjustment = .3799 x .926 + .6201 x 1

Mortality Rates - Female Beneficiaries

$millions	Actual Liability Released	Expected Liability Released	Ratio of Actual to Expected
Current Assumption: RP2014 Blue Collar-Female, generationally projected with scale MP2018	$33.0	$25.1	131.2%
SOA Public Cont. Surv. Mortality (Below Median) Amount Weighted-Female, generationally projected with scale MP2019	$33.2	$27.1	122.7%
SOA Public Cont. Surv. Mortality (Below Median) Amount Weighted-Female,106.0% adjusted, generationally projected with scale MP2019	$32.4	$28.0	115.8%

- We recommend the SOA Public Contingent Survivor Mortality (Below Median) Amount Weighted Female Table, with a 106.0% adjustment, scale MP2019
  - The credibility factor is 26.27%. During FYE2015 – FYE2019, there were 121 deaths
  - The 106.0% adjustment = .2627 x 1.227 + .7373 x 1

Mortality Rates - Groups with No Experience Credibility

- For all other groups, which have no experience credibility, we are recommending the following SOA Public Mortality Tables be used without any adjustments

Group	# Deaths during Study Period	Mortality basis recommendation
Female Service Retirees	0	SOA Public Safety Mortality (Below Median) Amount Weighted Female Table, projected generationally with scale MP2019
Male Beneficiaries	1	SOA Public Contingent Survivor Mortality (Below Median) Amount Weighted Male Table, projected generationally with scale MP2019
Male Disableds	42	SOA Public Safety Disability Mortality Amount Weighted Male Table, projected generationally with scale MP2019
Female Disableds	0	SOA Public Safety Disability Mortality Amount Weighted Female Table, projected generationally with scale MP2019
Male Actives	16	SOA Public Safety Mortality (Below Median) Amount Weighted Male Table, projected generationally with scale MP2019
Female Actives	1	SOA Public Safety Mortality (Below Median) Amount Weighted Female Table, projected generationally with scale MP2019

Mortality Recommendation

- The SOA 2010 Public Mortality Amount Weighted tables provides the best fit based on the makeup of the plan participants, therefore recommend using these tables:
  - Service retirees
    - Males - Public Safety (Below-Median) Amount Weighted Male Table with a 97.2% adjustment for credibility
    - Females - Public Safety (Below-Median) Amount Weighted Female Table
  - Survivor beneficiaries
    - Males - Contingent Survivor (Below-Median Male) Amount Weighted Male Table
    - Females - Contingent Survivor (Below-Median) Amount Weighted Female Table with a 106.0% adjustment for credibility
  - Disabled retirees – Sex-distinct Public Safety Disabled Retiree Amount Weighted Tables
  - All others, including actives and vested terminated participants
    - Pre-commencement of benefits: Sex-distinct Public Safety (Below-Median) Amount Weighted Tables
    - Post-commencement of benefits: Use applicable table above

- These base mortality tables will then be generationally projected using the Mortality Improvement Scale MP-2019 from 2010

Mortality - Percentage of Active Service-Connected Deaths

- The pre-retirement death benefit formula is based on whether the death was service-connected or non-service connected
  - Current assumption varies death type by age
  - Experience

Group	# Observed	Actual Rate
Service-Connected Deaths	7	0.54
Non-Service-Connected Deaths	6	0.46

  - Assumption modifications as follows

Age	Current	Proposed
25	100.0%	80%
35	100.0%	80%
45	42.0%	40%
55	20.0%	20%

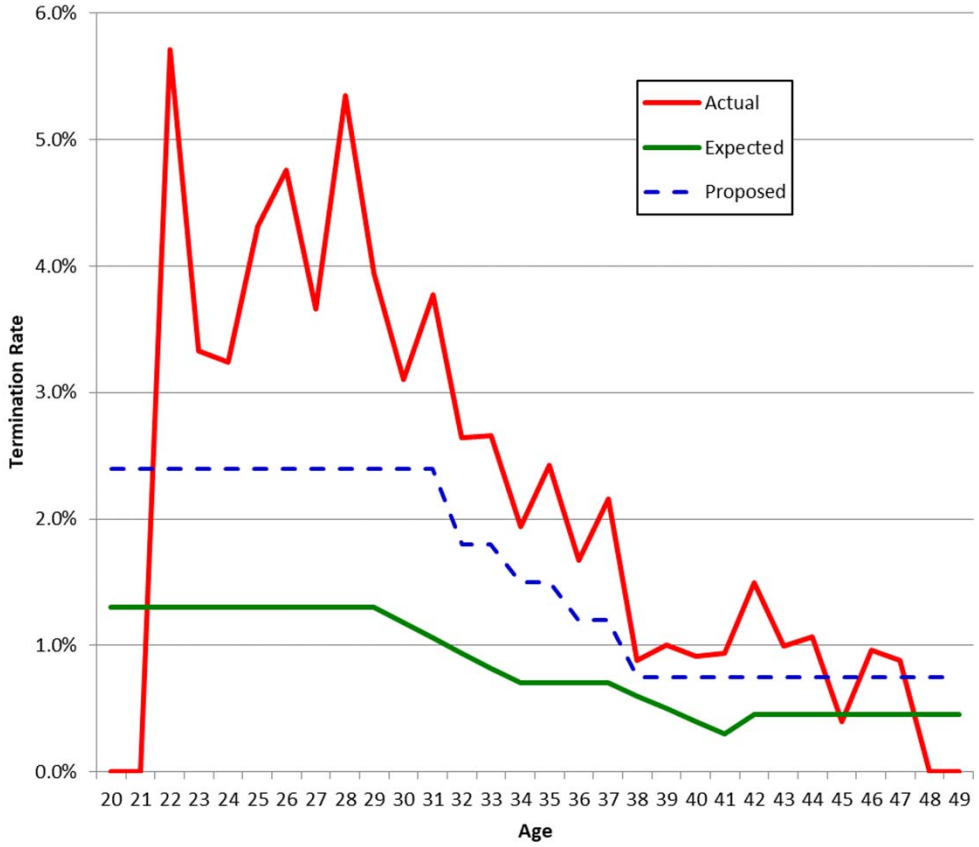
Termination

Termination - Termination Rates Prior to Service Retirement Eligibility

Central Age Group	Exposed	Actual	Expected		Actual/Expected	
			Current	Proposed	Current	Proposed
20	109	4	1.4	2.6	2.8	1.5
25	1,333	53	17.3	32.0	3.1	1.7
30	2,995	110	34.2	67.8	3.2	1.6
35	3,745	81	27.1	53.6	3.0	1.5
40	3,772	39	17.1	28.3	2.3	1.4
45	2,422	21	10.9	18.2	1.9	1.2
50	877	5	2.1	3.6	2.3	1.4
Total	15,253	313	110.1	206.0	2.8	1.5

Recommendation: Increase the rates since the total incidence of actual terminations is more than expected.

Termination - Termination Rates Prior to Service Retirement Eligibility



Age	Actual Rate	Expected Rate	Proposed Rate
20	0.0000	0.0130	0.0240
21	0.0000	0.0130	0.0240
22	0.0571	0.0130	0.0240
23	0.0333	0.0130	0.0240
24	0.0324	0.0130	0.0240
25	0.0431	0.0130	0.0240
26	0.0476	0.0130	0.0240
27	0.0366	0.0130	0.0240
28	0.0535	0.0130	0.0240
29	0.0395	0.0130	0.0240
30	0.0310	0.0118	0.0240
31	0.0377	0.0106	0.0240
32	0.0264	0.0094	0.0180
33	0.0266	0.0082	0.0180
34	0.0194	0.0070	0.0150
35	0.0242	0.0070	0.0150
36	0.0167	0.0070	0.0120
37	0.0216	0.0070	0.0120
38	0.0088	0.0060	0.0075
39	0.0100	0.0050	0.0075
40	0.0092	0.0040	0.0075
41	0.0094	0.0030	0.0075
42	0.0149	0.0045	0.0075
43	0.0100	0.0045	0.0075
44	0.0107	0.0045	0.0075
45	0.0040	0.0045	0.0075
46	0.0096	0.0045	0.0075
47	0.0088	0.0045	0.0075
48	0.0000	0.0045	0.0075
49	0.0000	0.0045	0.0075

Termination - Pension Commencement Age

- Prior to eligibility for service retirement, a vested pension is available to participants who terminate with at least 10 years of service
  - Current assumption for members hired prior to July 1, 2017: 50% of those eligible for a vested pension will elect an immediate refund of contributions, while 50% will elect a deferred monthly pension benefit payable at age 50
  - Experience and proposed assumption modifications for members hired prior to July 1, 2017, as follows*

Commencement	# Exposed	Actual	Expected Rate	Actual Rate	Proposed Rate
Immediate Contribution Refund	84	69	0.50	0.82	0.80
Deferred Pension Benefit	84	15	0.50	0.18	0.20

*No change proposed for members hired after June 30, 2017 – assume 100% will elect a deferred monthly pension benefit payable at service retirement eligibility (age and service equals 70)

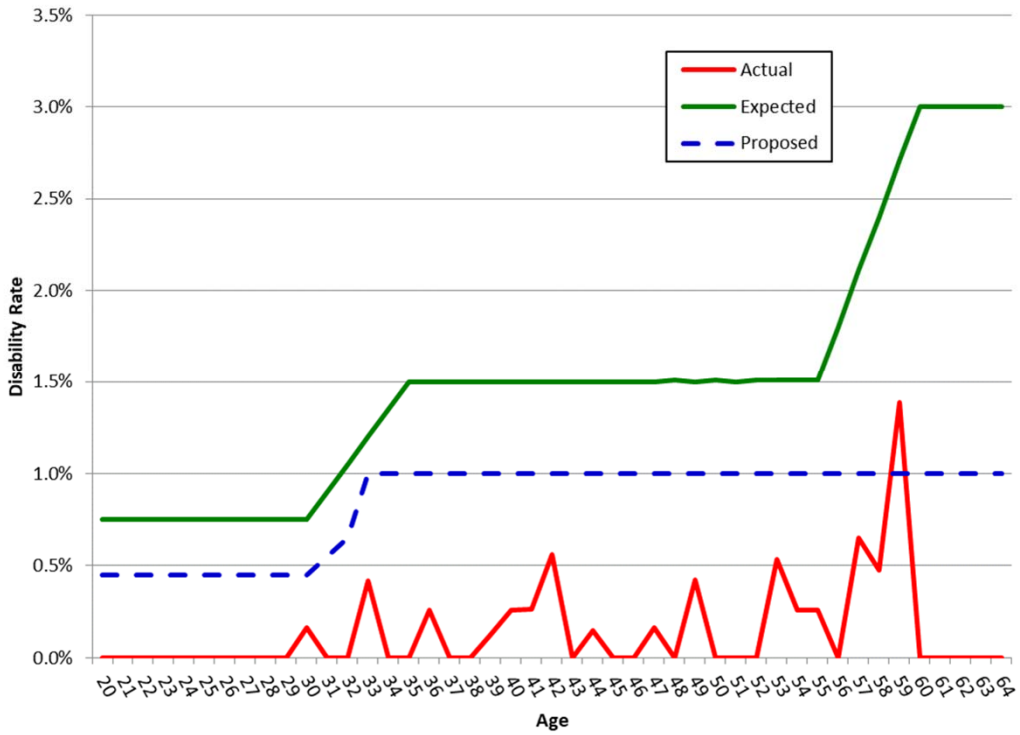
Disability

Disability – Combined Rates for Service-Connected and Non Service-Connected Disability Retirements

Central Age Group	Exposed	Actual	Expected		Actual/Expected	
			Current	Proposed	Current	Proposed
20	109	0	0.8	0.5	0.0	0.0
25	1,333	0	10.0	6.0	0.0	0.0
30	2,995	1	25.5	15.5	0.0	0.1
35	3,745	5	52.9	37.5	0.1	0.1
40	3,829	9	57.4	38.3	0.2	0.2
45	3,314	2	49.7	33.1	0.0	0.1
50	2,212	2	33.3	22.1	0.1	0.1
55	1,821	6	30.4	18.2	0.2	0.3
> 57	566	3	14.8	5.5	0.2	0.5
Total	19,924	28	274.8	176.7	0.1	0.2

Recommendation: Decrease the rates since the total incidence of actual disabilities is less than expected.

Disability – Combined Rates for Service-Connected and Non Service-Connected Disability Retirements



Age	Actual Rate	Expected Rate	Proposed Rate
<30	0.0000	0.0075	0.0045
30	0.0016	0.0075	0.0045
31	0.0000	0.0090	0.0055
32	0.0000	0.0105	0.0065
33	0.0042	0.0120	0.0100
34	0.0000	0.0135	0.0100
35	0.0000	0.0150	0.0100
36	0.0026	0.0150	0.0100
37	0.0000	0.0150	0.0100
38	0.0000	0.0150	0.0100
39	0.0013	0.0150	0.0100
40	0.0026	0.0150	0.0100
41	0.0026	0.0150	0.0100
42	0.0056	0.0150	0.0100
43	0.0000	0.0150	0.0100
44	0.0015	0.0150	0.0100
45	0.0000	0.0150	0.0100
46	0.0000	0.0150	0.0100
47	0.0016	0.0150	0.0100
48	0.0000	0.0151	0.0100
49	0.0042	0.0150	0.0100
50	0.0000	0.0151	0.0100
51	0.0000	0.0150	0.0100
52	0.0000	0.0151	0.0100
53	0.0053	0.0151	0.0100
54	0.0026	0.0151	0.0100
55	0.0026	0.0151	0.0100
56	0.0000	0.0180	0.0100
57	0.0065	0.0211	0.0100
58	0.0048	0.0240	0.0100
59	0.0139	0.0271	0.0100
59 - 64	0.0000	0.0300	0.0100
> 64	0.0000	0.0000	0.0000

Disability - Percentage of Service-Connected Disabilities

- The disability benefit formula is based on whether the incident was service-connected or non-service connected. If it is service-connected, the benefit is based on whether member is capable of performing any substantial gainful activity (SGA)
  - Current assumption varies disability type by age and provides that 1% of service-connected disabilities cannot perform SGA
  - The available data used for the analysis does not provide a clear basis for varying rates by age
  - Experience and proposed assumption modifications as follows:

Disability Type	# Observed	Expected Rate	Actual Rate	Proposed Rate
Service-Connected Disabilities	23	Varies by age	0.82	0.80
Non Service-Connected Disabilities	5	Varies by age	0.18	0.20

Service-Connected Disabilities	# Observed	Expected Rate	Actual Rate	Proposed Rate
Not Able to Perform SGA	12	.01	0.52	0.50
Able to Perform SGA	11	.99	0.48	0.50

The proposed rates are uniform rates at all ages for each category

Retirement

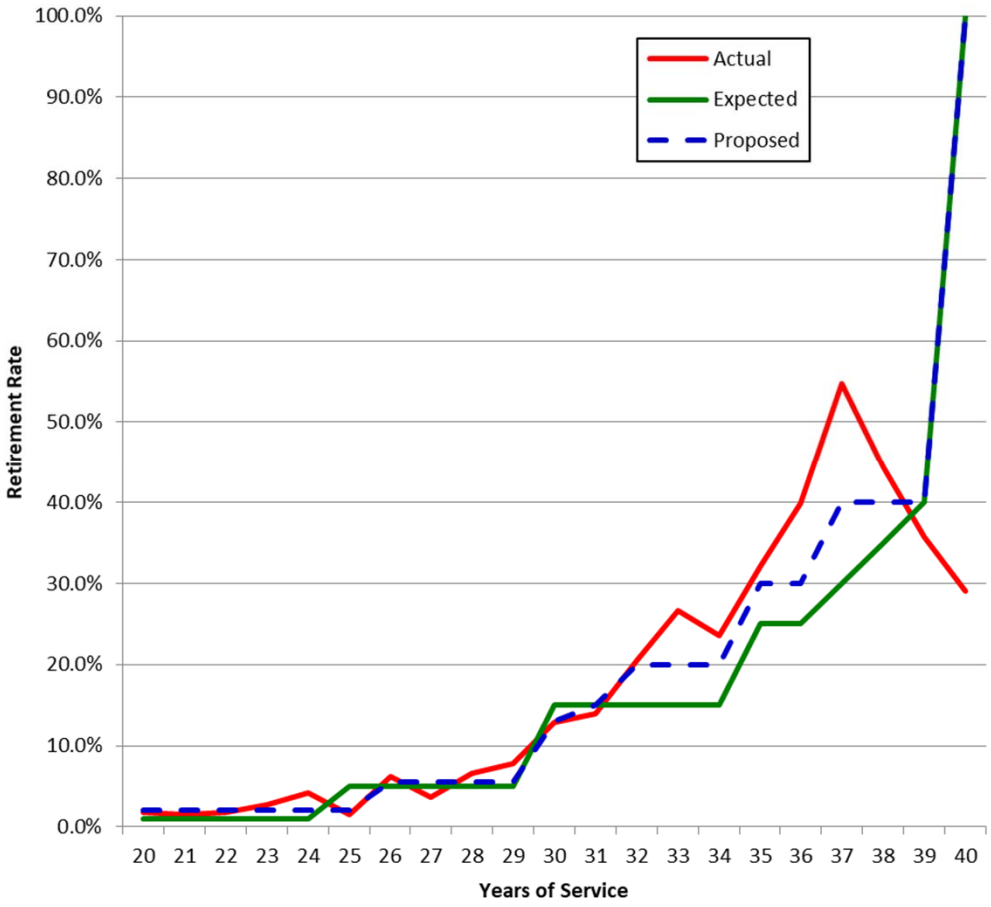
Retirement

Years of Service	Exposed	Actual	Expected*		Actual/Expected	
			Current	Proposed	Current	Proposed
20	105	2	1.1	2.1	1.90	0.95
21	294	7	2.9	5.9	2.38	1.19
22	316	7	3.2	6.3	2.22	1.11
23	358	11	3.6	7.2	3.07	1.54
24	334	14	3.3	6.7	4.19	2.10
25	258	4	12.9	5.2	0.31	0.78
26	211	13	10.6	11.6	1.23	1.12
27	194	7	9.7	10.7	0.72	0.66
28	258	17	12.9	14.2	1.32	1.20
29	140	11	7.0	7.7	1.57	1.43
30	178	23	26.7	23.1	0.86	0.99
31	216	30	32.4	32.4	0.93	0.93
32	264	54	39.6	52.8	1.36	1.02
33	225	60	33.8	45.0	1.78	1.33
34	221	52	33.2	44.2	1.57	1.18
35	174	56	43.5	52.2	1.29	1.07
36	133	53	33.3	39.9	1.59	1.33
37	64	35	19.2	25.6	1.82	1.37
38	27	12	9.5	10.8	1.27	1.11
39	14	5	5.6	5.6	0.89	0.89
40	31	9	31.0	31.0	0.29	0.29
Total	4,671	489	375.0	440.2	1.28	1.08

Recommendation: Decrease the rates at service years 25 and 30. No change to the rates at service years 31, 39 and 40. Increase the rates at all other service years.

* Without regard to the effect of DROP duration

Retirement



Years of Service	Actual Rate	Expected Rate	Proposed Rate
20	0.0190	0.0100	0.0200
21	0.0238	0.0100	0.0200
22	0.0222	0.0100	0.0200
23	0.0307	0.0100	0.0200
24	0.0419	0.0100	0.0200
25	0.0155	0.0500	0.0200
26	0.0616	0.0500	0.0550
27	0.0361	0.0500	0.0550
28	0.0659	0.0500	0.0550
29	0.0786	0.0500	0.0550
30	0.1292	0.1500	0.1300
31	0.1389	0.1500	0.1500
32	0.2045	0.1500	0.2000
33	0.2667	0.1500	0.2000
34	0.2353	0.1500	0.2000
35	0.3218	0.2500	0.3000
36	0.3985	0.2500	0.3000
37	0.5469	0.3000	0.4000
38	0.4444	0.3500	0.4000
39	0.3571	0.4000	0.4000
40	0.2903	1.0000	1.0000

Rates are without regard to the effect of DROP duration

Marriage Assumptions

- Currently, 90% of retiring active participants are assumed to be married
  - Actual experience over study period and proposed rates, are as follows:

Retiree Gender	Over study period	Current Assumption	Proposed Assumption
% of Males married at retirement	82.2%	90.0%	82.0%
% of Females married at retirement	84.6%	90.0%	85.0%

- Currently, husbands are assumed to be three years older than wives
  - Actual experience over study period and proposed age differences, are as follows:

Retiree Gender	Average over study period	Current Assumption	Proposed Assumption
Males	+2.11	+3	+2
Females	-6.56	-3	-6

DROP Participation Rate

- Currently, 100% of active participants who are projected to have at least 25 years of service at age 55 and eligible to participate in the DROP are assumed to participate in the DROP
  - Actual experience over study period and proposed rates, are as follows:

Years of Service	A = Actives who Bypassed DROP and Retired	B = Actives who Entered DROP	C = Exposures = A + B	D = B/C = DROP Take Rate
Total	14	463	477	97.1%

  - The 97.1% total DROP participation rate supports the current assumption that a member eligible to retire will elect to participate in DROP
- Some members who are projected to have less than 25 years of service at age 55 are assumed to retire and not enter DROP

DROP Duration

- As all legacy active members of the Fund are assumed to participate in the DROP, “duration” is the assumption of how long the member remain in DROP until he/she retires. The current method assume probabilities at central duration years of 5, 8 and 10
- The five-year experience suggests a significant number of members remain in the DROP through the 13th year (as the Fund allows)
- We recommend extending the central duration years through the 13th year and reflect the weighted retirement rates experienced through the central duration year
  - Experience and proposed assumption modifications*:

Years in DROP/Duration	Probability of Retirement	Current Assumption	Proposed Assumption
5	12.0%	5.00%	10.00%
8	31.9%	30.00%	20.00%
10	53.3%	65.00%	45.00%
13	94.5%		25.00%

* See Appendix for a complete development.

Payment of DROP Balances – Active members

- Current assumption - DROP balances will be distributed over 15 years from pension commencement date
- Data to analyze the experience during the covered period is not provided for the annual RSVS
  - As discussed with the Fund's staff, payment information provided for the Fund's "415-limit" testing was used
  - Available data estimates - it will take an average of 15.5 years to fully distribute a DROP balance assuming the DROP balance is paid in equal annual payments
- The 15-year installment of a DROP balance assumption is supported by Fund's experience and we recommend no change in the assumption

Payment of DROP/PROP Balances – Inactive members

- Current assumption - The liability for DROP/PROP balances of members who have left active service is assumed to be equal to the total of all of the DROP/PROP balances
- SB2190 - Effective July 1, 2017, investment earnings will be contributed to a member's DROP account at the rate of 65% of the Retirement Fund's earnings/losses averaged over a five-year period
  - DROP/PROP balance allocation among members who have left active service is not included in the RSVS data
  - DROP balances for active participants projected to participate in the DROP is assumed to be distributed over 15 years from pension commencement date
  - On average, members currently receiving a retirement benefit for 15 years or less have been in pay status for 7.5 years
- We recommend assuming a 7.5-year level installment of the Retirement Fund's remaining DROP/PROP balance, applied based on the difference between the assumed investment rate of return and the assumed DROP interest crediting rate (defined to be 65% of the assumed investment rate of return)

Economic Assumptions

Setting Economic Assumptions

- Review Past Experience
- Review General Practice
- Develop component parts of each assumption
  - Maintain linkage with investments
  - Maintain internal consistency
- Make Judgment About Future
  - Make use of forward looking models
- Apply Statutory provisions

Investment Return & Inflation

Investment Return

- SB2190 requires the annual RSVS assumed rate of return to be not less than 7.0% per annum (net of investment expenses)
- Current actuarial standards of practice allow for the investment return assumption to be based on the expected returns of the underlying portfolio
- Current asset allocation:

Investment	Allocation
Domestic equity	17.00%
International equity	17.00%
Fixed income	30.00%
Cash	1.00%
Hedge Funds	8.00%
Real Estate	7.00%
Private Equity	20.00%

Investment Return

- Unadjusted GEMS* Model (gross benchmark returns)

Expected Annualized Compound Returns Over Period Geometric Returns					
	1 Year	5 Year	10 Year	20 Year	30 Year
25th Percentile	-0.95%	3.34%	4.83%	5.92%	7.00%
40th Percentile	3.41%	5.57%	6.39%	7.30%	8.12%
50th Percentile	6.20%	6.82%	7.44%	8.00%	8.71%
60th Percentile	9.16%	8.27%	8.22%	8.71%	9.34%
75th Percentile	14.62%	10.51%	9.65%	9.92%	10.32%

- Based on an unadjusted model that begins in the current economic environment
- Tends to be mean-reverting (I.e., equity returns, inflation rates and interest rates will tend, over the very long term, to center around the historical averages for these items)

* See Appendix

Investment Return

- Based on the current economic environment and growing downward pressure on even mid-to-longer term forecasts, some Retirement Funds opt instead to use a model that is not mean-reverting but in fact recognizes the “new normal”

- GEMS* “New Normal” model reflects that emerging demographic trends (aging workforce, increasing longevity, globalization of economy, technological innovation transforming the workforce) will contribute to a low GDP, low inflation, and low asset return environment, and will persist well beyond the current business cycle

- GEMS* “New Normal” Model (gross benchmark returns) are as follows:

Expected Annualized Compound Returns Over Period Geometric Returns					
	1 Year	5 Year	10 Year	20 Year	30 Year
25th Percentile	-2.93%	1.94%	3.24%	4.65%	5.23%
40th Percentile	2.02%	3.99%	4.71%	5.90%	6.38%
50th Percentile	4.98%	5.42%	5.82%	6.72%	7.01%
60th Percentile	7.90%	6.72%	6.76%	7.38%	7.59%
75th Percentile	13.29%	8.98%	8.57%	8.62%	8.46%

* See Appendix

Investment Return

- Future consideration of the “New Normal” may be warranted
- Considerations based on the unadjusted GEMS model
  - Maintaining 7.00% return assumption is acceptable
  - NASRA survey indicates median rate used by public plans is 7.25%
  - The 7.00% return assumption can be maintained for the Fund

Inflation

- Current assumption – 3.0% per annum
- As prescribed by SB2190, the assumption should be based on
  - *"the most recent headline consumer price index 10-year forecast published in the Federal Reserve Bank of Philadelphia Survey of Professional Forecasters"* or, if not available, another standard agreed to by the Municipality and the Fund's board
  - Further, "*the price inflation assumption as of the most recent actuarial experience study…may be reset by the board by plus or minus 50 basis points based on that actuarial experience study*"
- The published "*headline consumer price index 10-year forecast*" (Long-Term Annual Average for 2019-2028) is currently 2.20% per annum
- Update the inflation assumption to 2.50% per annum based on the 50 basis limitation above

Future Cost-of-Living Adjustments (COLAs)

- Current assumption – Assumed to be equal to 2.25% (the assumed asset return of 7% less 4.75%
- Proposed clarification – Assumed to be equal to the assumed asset return less 4.75% (current 7% less 4.75% equal 2.25%)

Salary Increase

Salary Increase

- When selecting assumptions, it is important to account for the Fund sponsor's expectations for future years that may differ from past experience

- Discussions with the Fund's staff: the last five years may not be a good proxy for the future:
  - Lack of reporting consistency of payroll used in study due to the SB2190 change in payroll definition
  - Lack of contract settlements during the examination period
    - Expectation of new contracts in the near future - may have increases to include prior years
  - Legal uncertainty over Proposition B, which may grant a one-time substantial payroll increase

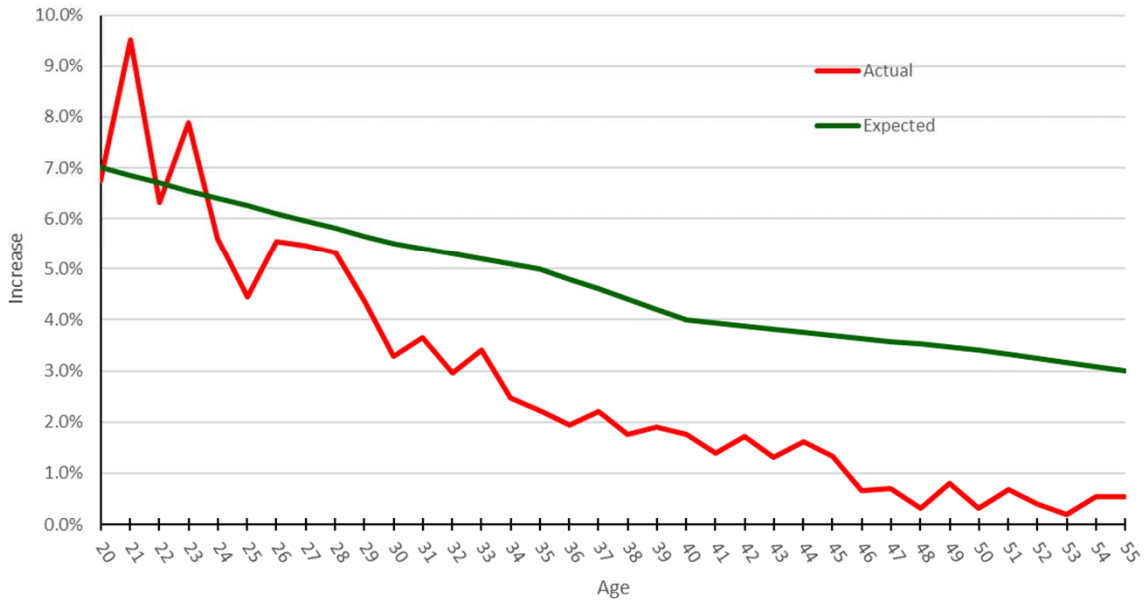
- No change is recommended at this time
  - This will be reviewed when the next scheduled study is prepared as of June 30, 2023 and proposed changes, if warranted, will be recommended at that time.

Salary Increase

Central Age Group	Exposed *	Prior Year Salary	Current Year Salary	Expected Salary	Current Year/Expected
20	48	2,363,005	2,543,374	2,522,928	1.0081
25	928	48,089,819	50,732,814	51,047,632	0.9938
30	2,506	142,376,080	147,734,035	150,199,408	0.9836
35	3,590	223,432,251	228,824,664	234,428,471	0.9761
40	3,667	243,817,929	247,989,106	253,789,214	0.9771
45	3,157	226,876,638	229,465,153	235,281,160	0.9753
50	1,953	145,138,838	145,858,423	150,069,945	0.9719
55	985	75,589,643	75,903,490	77,920,713	0.9741
Total	16,834	1,107,684,203	1,129,051,059	1,155,259,471	0.9773

* Member records with partial year salary information were excluded from the study.

Salary Increase



Age	Actual Rate	Expected Rate
20	0.0675	0.0700
21	0.0950	0.0685
22	0.0633	0.0670
23	0.0788	0.0655
24	0.0560	0.0640
25	0.0444	0.0625
26	0.0555	0.0610
27	0.0546	0.0595
28	0.0533	0.0580
29	0.0437	0.0565
30	0.0329	0.0550
31	0.0364	0.0540
32	0.0296	0.0530
33	0.0341	0.0520
34	0.0248	0.0510
35	0.0223	0.0500
36	0.0194	0.0480
37	0.0220	0.0460
38	0.0176	0.0440
39	0.0191	0.0420
40	0.0175	0.0400
41	0.0140	0.0394
42	0.0171	0.0388
43	0.0131	0.0382
44	0.0162	0.0376
45	0.0132	0.0370
46	0.0066	0.0364
47	0.0070	0.0358
48	0.0031	0.0352
49	0.0080	0.0346
50	0.0031	0.0340
51	0.0068	0.0332
52	0.0039	0.0324
53	0.0020	0.0316
54	0.0053	0.0308
55	0.0053	0.0300

Payroll Growth

- The amortization of the Fund's unfunded accrued liability uses a level percentage of payroll method which produces a payment stream that is designed to increase based on the expected growth in payroll
- The current assumption is 3%
- The last five years is not a good proxy for payroll expectations in the future
- No change is recommended at this time
  - This will be reviewed when the next scheduled study is prepared as of June 30, 2023 and proposed changes, if warranted, will be recommended at that time.

Adjustment to Reflect Definition of Average Monthly Salary for Members Hired Prior to July 1, 2017

- Currently, active liabilities are increased 5% to account for differences between the Fund's definition of average monthly salary, the average of the highest 78 pay periods and the compensation data available for the RSVS
  - Prior to SB2190, the highest 78 pay periods may include future pays above those anticipated by the RSVS
- SB2190 prescribed pensionable pay for benefit accruals after June 30, 2017 to include base pay only
  - The highest 78 pay periods will most likely be based on pensionable pays received prior to the effective date of SB2190 (July 1, 2017), which includes base pay and overtime, before reduction for pre-tax employee contributions and salary deferrals
  - The historical highest 78-pay periods is provided in the RSVS data
- We recommend discontinued use of the current estimate and directly determine the effect of this Fund provision

Impact of Proposed Changes

Actuarial Impact of Recommended Changes: July 1, 2019 RSVS[1]

($000)	Current Assumptions	Proposed Assumptions	Change
Present Value of Future Benefits	$5,843,854	$5,703,350	($140,504)
Actuarial Accrued Liability	$5,057,759	$4,932,944	($124,815)
Actuarial Value of Assets (AVA)	$4,190,934	$4,190,934	$ 0
Unfunded Accrued Liability	$ 866,825	$ 742,010	($124,815)
AVA - Funded Ratio	82.9%	85.0%	2.1%
City Normal Cost Rate[2]	17.15%	15.59%	-1.56%
City Accrued Liability Rate	19.10%	16.17%	-2.93%
Total City Contribution Rate[3]	36.25%	31.76%	-4.49%
Estimated City Contribution for following Fiscal Year	$ 99,496	$ 87,172	($ 12,324)
Employee Contribution Rate	10.50%	10.50%	0.00%

1. This analysis is provided without waiving the Fund's right to litigate the constitutionality of SB2190
2. Contains an allowance for administrative expenses equal to 1.25% of payroll
3. As a percentage of pensionable compensation

Takeaways and Next Steps

Takeaways

- The proposed assumption changes result in a decrease in overall costs of the pension plan
- Setting assumptions closer to expected future experience will minimize gains and losses and make costs more predictable

Next Steps

- On October 20, 2020, the Board adopted the assumptions proposed in this Actuarial Experience Study

- Fund actuary to incorporate such assumptions changes into the Proposed Risk Sharing Valuation Study for the Fund as of July 1, 2020, to be provided to City actuary no later than November 27, 2020

Questions?

THANK YOU

Appendix

Analysis for Duration Modifications

Analysis for Duration Modifications

- Experience and proposed assumption modifications:

Years in DROP	Exposed	Count who Retired	Rate of Retirement	Probability of Continuing in DROP (a)	Probability of Retirement = 1 – (a)	Current Assumption	Proposed Assumption
0	282	6	2.13%	100.00%			
1	538	7	1.30%	97.9%			
2	438	15	3.42%	96.6%			
3	370	11	2.97%	93.3%			
4	326	9	2.76%	90.5%			
5	283	17	6.01%	88.0%	12.0%	5.00%	10.00%
6	269	22	8.18%	82.7%			
7	288	30	10.42%	76.0%			
8	302	42	13.91%	68.1%	31.9%	30.00%	20.00%
9	282	57	20.21%	58.6%			
10	247	85	34.41%	46.7%	53.3%	65.00%	45.00%
11	173	61	35.26%	30.7%			
12	115	83	72.17%	19.8%			
13	31	28	90.32%	5.5%	94.5%		25.00%
14	6	3	50.00%	0.5%			
15	4	3	75.00%	0.3%			
16	1	0	0.00%	0.1%			
17	2	0	0.00%	0.1%			
18	4	1	25.00%	0.1%			
19	3	1	33.33%	0.1%			
20	0	0	0.00%	0.0%			

a. At year 0, 100% are participating in the DROP. Each succeeding year, the probability of continuing in the DROP is the prior year's amount and the prior year's probability of continuing (i.e. 1 minus the rate of retirement)

ASOP 51

ASOP 51 Disclosures

New Actuarial Standard of Practice on Risk Assessment

The Actuarial Standards Board approved a new Actuarial Standard of Practice No. 51 (ASOP 51 or Standard) regarding risk assessment when performing an examination of Methods, Assumptions or Plan Provisions which impact funding calculations for a pension plan.

ASOP 51 requires actuaries to identify risks that "may reasonably be anticipated to significantly affect the plan's future financial condition". Investment risk, asset/liability mismatch risk, interest rate risk, longevity and other demographic risks and contribution risk are cited as examples in ASOP 51. The Standard does not require the actuary to evaluate the likelihood of contributing entities to make contributions when due, nor does it require the actuary to assess the likelihood or consequences of future changes in applicable law.

The actuary's assessment can be qualitative or quantitative (e.g., based on numerical demonstrations). The actuary may use non-numerical methods for assessing risks that might take the form of commentary about potential adverse experience and the likely effect on future results. While the Standard does not require that every valuation include a quantitative risk assessment, the actuary may recommend that a more detailed risk assessment be performed. When making that decision, the actuary will take into account such factors as the Plan's design, maturity, size, funded status, asset allocation, cash flow, possible insolvency and current market conditions.

The Standard also requires disclosure of plan maturity measures and other historical information that are significant to understanding the risks associated with the plan.

ASOP 51 Disclosures

Investment Risk - One type of investment risk is that assets materially underperform expected return.

- Lower assets mean higher unfunded liability and larger required contributions.
- Example: In the 2019 RSVS, if returns on assets at market value were an additional 1% less than expected, this would reduce the actuarial value of assets by approximately $8,172,000, which would increase the estimated City Contribution for Fiscal Year 2020 contribution by $522,000.
- The five year smoothing method used for the actuarial value of assets defers a portion of investment gain/loss in each of the previous 5 years. If the assumed return on assets consistently overestimates the actual return on assets, the actuarial value of assets will be consistently higher than the true market value. Consistent underestimation of the unfunded liability can prevent the Fund from achieving anticipated funding goals even when all minimum required contributions are made timely.

Asset growth does not keep pace with liability increases over time - Another type of investment risk is that asset returns do not keep pace with liability growth over time. Fund liabilities are based on the discounted present value of anticipated future benefit payments. That present value grows at the discount rate as time passes and the future payouts move closer. If investment returns are lower than the rates used to discount liabilities, Fund liabilities will increase more rapidly than Fund assets. Over extended periods of time, such as those involved in pension obligations, these discrepancies can accumulate to significant shortfalls.

ASOP 51 Disclosures

Market shocks or regime changes - Invested assets are subject to significant disruptions from market shocks, such as the financial crisis of 2008/2009, or as a result of systemic regime changes that persist for years, such as historically low interest rates over the recent decade. These shocks or changes will increase the risk that investments will underperform the expected return. They may also lead to a need to lower the long-term return on assets assumption. Since the long-term return on asset assumption is also used for discounting liabilities a lower assumption will increase liabilities and recommended contributions. Currently the investment return assumption used for funding is set by SB2190.

Salary increases - Fund costs are sensitive to salary increases, with higher rates leading to higher obligations. This is because benefits at retirement are pay related, meaning that higher pay generates higher benefit levels at retirement. Compensation increases greater than assumed lead to actuarial losses since projected benefits are higher than predicted by assumed rates.

Declining active workforce - since the City's contributions are based on a percentage of participant's salaries, a declining active workforce will have the impact of the Fund potentially receiving lower contributions. In addition, if the required dollar amount of contributions remain level or increase, a declining active workforce will result in higher contribution rates in order to meet required contribution levels.

ASOP 51 Disclosures

DROP - The Fund provides certain eligible members to enter the Deferred Retirement Option Program (DROP). It allows members who elect DROP the option to continue to work beyond their standard or alternative service eligibility date and convert part of their retirement benefit into a lump sum.

- A DROP presents a risk due to large lump sums paid, particularly during economic downturns. Another investment consideration is the need for liquid assets to pay DROP lump sums as employees and retirees may elect to receive their DROP account at any time creating either the necessity to maintain larger allocations of cash to pay these large lump sum benefits or force the Fund to sell securities or other illiquid investments at inopportune times. These payments are less predictable than monthly retirement benefits and may cause some losses.

- The DROP provided by the Fund also presents risk due to investment return provided to the DROP account. The Fund provides DROP investment return at the rate of 65% of the Fund's earnings/losses averaged over a five-year period. When the average is a loss, the DROP account is only decreased by 65% of the loss rate and the Fund has to absorb the remaining 35%. However, this risk is also mitigated by the 65% factor - when the average is an earning, the Fund gets to keep the extra 35% earnings.

ASOP 51 Disclosures

Contribution risk – risk of not contributing an actuarially determined contribution. Based on the statutory requirements of SB 2190 it is our understanding that the actual City contribution rate may be established as an average of the contribution rates shown in this report and those shown in the RSVS prepared by the City's actuary. If future contributions are established in this manner at levels below those determined by the RSVS, the Fund may not be expected to achieve a fully funded position over the 30-year time horizon as contemplated in the statute based on the data, assumptions and methods.

Longevity and other demographic risks - Potential that mortality or other demographic experience (retirement, turnover, disability) may be different than expected. As the Fund matures and the majority of participants reach (or have reached) retirement eligibility, risks associated when participants retire can become significant. The Fund provides for unreduced early retirement benefits after meeting certain age and service conditions. These benefits are highly subsidized and thus can be significantly more valuable than normal retirement benefits and regular early retirement benefits. The demographic assumptions used to determine the actuarial valuation attempt to account for unreduced early retirement based on historical plan experience. However, due to the unpredictable nature of such benefits, future experience could differ significantly from past experience.

In addition to the risk that participants will not retire as expected, the Fund is subject to longevity risk - the risk that participants will live longer (or shorter) than expected. Cost of living adjustments (COLA) provided by the Fund increase longevity risk because if a participant lives longer than expected more COLA will be provided.

ASOP 51 Disclosures

Ultimate Entry Age Normal Cost Method (Ultimate EANC) - The Ultimate EANC method is a variation of EANC, where the normal cost is calculated for each active member based on the Fund provisions applicable to new members of the Fund. As the Fund has a lower annual cost for new members hired after June 30, 2017, use of the Ultimate EANC method lowers the normal cost and increases the actuarial accrued liability, as compared to EANC.

Historical Results – The RSVS actuary's report, published November 19, 2020, provides selected historical values of key valuation measures. These items illustrate how actual volatility has impacted the Fund in recent years and gives additional context to the risks described above. Interested parties should refer to the actuary's report.

GEMS Capital Market Model

Buck's Capital Market Model

- Buck's capital market assumptions are derived from the General Economy and Market Simulator ("GEMS") developed by Conning & Company.
  - Buck determines a set of capital market assumptions based on the GEMS modeling of the key economic variables and the asset class returns that result from a factor model that forecasts future values for all asset classes in the model
- GEMS Model
  - Incorporates historical data to develop the factor model
  - Calibrates to current economic and market conditions,
  - Models the general economy and capital markets
  - Asset class means, volatilities, and correlations are determined dynamically to reflect the change over time
  - Asset class return distributions will vary depending on the time horizon modeled
- Returns modeled are benchmark returns and results don't include reductions for fees and/or expenses.