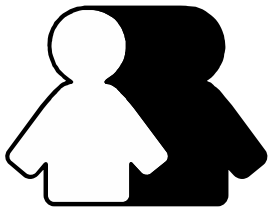

New York State and Local
Employees' Retirement System
Police and Fire Retirement System
Public Employees' Group Life Insurance Plan

Thomas P. DiNapoli, Comptroller

ANNUAL REPORT TO THE COMPTROLLER ON ACTUARIAL ASSUMPTIONS

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Retirement Systems Actuary

August 2021

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I. Executive Summary

Fiscal year 2021 (FY 2021) was the first in the current five-year experience study cycle. The August 2020 report based on experience studies for the period April 1, 2015 through March 31, 2020 recommended changes in virtually all demographic assumptions and recommended that changes to the economic assumptions be postponed one year due to the March 2020 bear market. This year's report displays the FY 2021 experience and recommends changes to several economic assumptions.

Summary of Assumptions and Methods

Assumption or Method	Recommendation
Inflation / COLA	**2.7% / 1.4%** (from 2.5 % / 1.3%)
Investment Return	**5.9%** (from 6.8 %)
ERS Salary Scale	4.4% average (using FY 2021 data) Indexed by Service
PFRS Salary Scale	**6.2%** average (using FY 2021 data) Indexed by Service
Asset Valuation Method	**Market Restart** (from 5-year level smoothing of gains or losses above or below the assumed return applied to all assets and cash flows)
Pensioner Mortality	Gender/Collar specific tables based upon FY 2016-2020 experience with Society of Actuaries' Scale **MP-2020** loading for mortality improvement (from MP-2019).
Active Member Decrements	Based upon FY 2016-2020 experience

This recommendation has been shared with the Systems' Actuarial Advisory Committee (AAC) for their review and comment. This Committee is composed of current or retired senior actuaries from major insurance companies or pension plans.

In addition to oversight provided by the AAC, the work of the Systems' actuaries is periodically reviewed by a number of organizations, including the Systems' financial statement auditors, internal auditors of the Office of the State Comptroller, examiners from the New York State Department of Financial Services (DFS), and a quinquennial review by an independent actuarial firm. The most recent review by an independent actuarial firm was completed in July 2018 by Grant Thornton, LLP.

The reviewed and finalized actuarial assumptions will be presented to Comptroller Thomas P. DiNapoli for certification for the purpose of developing employer contribution rates, payable on 2/1/2023, for the many different plans covered by the Employees' Retirement System (ERS) and the Police and Fire Retirement System (PFRS).

It is customary to avoid assumption changes between quinquennial experience studies (conducted in years divisible by five), where the five most recent years of system experience are combined and used as a basis for new assumptions. Annual tinkering with assumptions belies the long-term nature of pension funding.

Thus, we changed all the demographic assumptions last year, and these assumptions will be left alone, except for the mortality improvement table, where I recommend adopting the most recent version, MP-2020. However, last year's valuation date was in a bear market and I recommended that we wait until this year before changing the economic assumptions.

Lo and behold the Common Retirement Fund (CRF) enjoyed the best fiscal year return in its history (33.5%). This provides an opportunity to recommend a significant drop in the assumed rate of return to put it in alignment with the sole trustee's risk appetite as expressed by Pension Investment and Cash Management's (PICM's) most recent Asset Allocation Review (AAR, written in October 2019 and adopted in January 2020). This AAR set forth a policy portfolio with the expectation of a 6.07% geometric return (net of fees) in the ensuing 10-year period.

That 6.07% is a forecast. We are all familiar with weather forecasts. Sometimes they are spot on, and sometimes they are not close. Such is the nature of forecasting. Even so, there is no better forecast for CRF performance than that provided by the AAR, which involves the combined efforts of PICM and an investment consultant over many months, and then is vetted until approved by the Investment Advisory Committee (IAC), and ultimately the sole trustee. That approval establishes the sole trustee's risk appetite, which is the foundation of the assumed rate of return.

The previously approved AAR (early 2015) had a geometric return expectation of 6.58%, and we were headed in that direction with the 2019 assumed return reduction from 7.00% to 6.80%. AARs have the liberty to move more dramatically than the assumed return for a mature system (i.e. one in which payee liabilities are higher than the liabilities for the active workforce), which is made "sticky" by high asset leverage ratios (see page 21). But a record rate of return provides a door of opportunity to align the assumed return with the sole trustee's risk appetite. That door is opened by recommending a restart to the actuarial smoothing method, where we set the actuarial value of assets equal to the market value of assets (thus the phrase, "market restart"), and use the resulting valuation gains to "pay for" the valuation losses that accompany a reduction in the assumed return (see page 17).

I recommend that we take advantage of the stellar FY 2021 CRF performance and implement a market restart while reducing the assumed return from 6.8% to 5.9%. Other economic recommendations with smaller valuation gains and losses include increasing the CPI-U assumption from 2.5% to 2.7% and updating the PFRS salary scale table. Further discussion on these recommendations can be found in the respective sections of this report.

Finally, there will be some expectation of a discussion of the impact of COVID on the valuation. The valuation impact is much less than the societal impact (and is expected to be a one-year phenomenon), but the following fiscal year 2021 experience patterns are probably rooted in COVID and the societal response:

1) there were fewer new hires,
2) there were more withdrawals at lower service levels,
3) there were more deaths than expected among ERS payees (but not so in PFRS),
4) there were more deaths than expected among the active workforce, and
5) there was significant salary restraint with salary growth falling short of expectations.

A thorough and more quantitative analysis, beyond the data provided in the demographic sections of this report, is not available at this time.

II. Economic Assumptions

A. Inflation (CPI-U) and the Cost of Living Adjustment (COLA)

The table below displays the applicable CPI-U data:

	CPI-U	Increase	COLA
3/31/2021	264.877	2.62%	1.4%
3/31/2020	258.115		

The COLA is ½ of the percent increase in CPI, raised to the next tenth. As a result, a COLA of 1.4% will be applied in September of 2021, which is 0.1% more than the current assumption. (Note that COLA applies to the first $18,000 of the pensioner's single-life pension. Spousal beneficiaries are entitled to one-half of the pensioner's COLA.)

I recommend increasing the CPI-U assumption from the current 2.5% (resulting in valuation COLAs of 1.3%) to 2.7% (resulting in valuation COLAs of 1.4%).

This is not primarily a response to the FY 2021 experience, but there is a growing rumbling among economists that is less sanguine about inflation expectations than in the previous two decades. I will cite one article to demonstrate: (https://www.wsj.com/articles/higher-inflation-is-here-to-stay-for-years-economists-forecast-11626008400).

Articles can be found on both optimistic and pessimistic inflation expectations. Once again, forecasts are never certain. However, the NYSLRS COLA can vary in the range from 1.0% to 3.0%. Inflation expectations have been so benign that for a time we strongly favored the lower end of this range. I think that the current inflation conversations warrant us taking a small step back toward the middle of the COLA range.

B. Investment Rate of Return (Discount Rate)

The FY 2021 investment rate of return, as reported by the PICM is 33.55%. The 3, 5, 10, and 20-year returns are 11.00%, 11.17%, 9.19%, and 7.65% respectively.

The data below is taken from the National Association of State Retirement Administrators (NASRA) website and represents the investment return assumption distribution for public systems in their database. NYSLRS is in the group in bold. Funds continue to lower their return. The next shift from 7.25 and above to below 7.25 will lower the median.

	Number of Public Systems			
i	February 2021	July 2020	May 2015	March 2010
< 6.50	2	2	4	0
6.50	7	5		0
6.51-6.99	**18**	**17**		0
7.00	34	32	4	1
7.01-7.49	37	38	**43**	21
7.50	23	26		
7.51-7.99	6	7	36	16
8.00	3	3	34	**51**
8.01-8.49	0	0	3	16
8.50	0	0	2	19
Median	7.25	7.25	7.75	7.97

In January 2020, PICM reduced its geometric return expectation from 6.58% to 6.07%, a significant drop.

A pension fund has 3 sources of income:

1) investment income, 2) employer contributions, and 3) employee contributions.

Employee contributions are set by statute and do not vary based on investment expectations.
Thus, as investment income expectations decrease, employer contribution expectations must increase.

The actuarial rate of return assumption determines the TIMING of the employer contribution increase.
The investment performance determines the ultimate (i.e. over many years) AMOUNT of the increase.
An optimistic actuarial assumption (i.e. one above the geometric return expectation) is to say,

"we will defer some of the employer contributions we expect to be necessary to fund benefits".

A pessimistic actuarial assumption (i.e. one below the geometric return expectation) is to say,

"we will fast forward some of the employer contributions we expect to be necessary to fund benefits".

The actuary is primarily concerned with employer contribution rate SUFFICIENCY and SMOOTHNESS.

Before this 4/1/2021 valuation, a reduction of the assumed return to a point nearby PICM's 6.07% geometric expectation would have led to a spiking of employer contribution rates that would violate the goal of smoothness.

The record return in FY 2021 provides an opportunity to align the funding assumption with PICM's expectations (i.e. achieve expected sufficiency) without sacrificing smoothness.

However, to align the funding assumption with PICM's expectations (which is optimal), we must immediately recognize all previous asset gains/losses (primarily gains) by way of a market restart (i.e. a one-year suspension of asset smoothing).

The gains from a market restart are sufficient to both reduce the assumed rate of return to 5.90% and provide $1.5b in employer contribution relief (primarily in ERS).

Last year, I recommended maintaining the assumed rate of return at 6.8% and revisiting the assumption this year.

I now recommend reducing the assumed rate of return to 5.9%.

In so doing, the fund will have a better than 50% expectation of exceeding the assumed rate of return for the first time in over a decade, which is a significant funding development (see page 20).

C. Salary Scales

The salary scale is the assumed annual rate of salary increase. It is used to project an individual's final average salary and benefit. The current assumptions are indexed by system and age. The ERS regular plan assumptions are based upon ERS regular plan experience. The PFRS and ERS special plan assumptions are based upon all PFRS experience. The current assumptions are in the table below.

Srv	ERS	PFRS
0	8.80%	29.70%
1	8.80	29.70
2	7.70	14.85
3	6.60	12.65
4	5.50	10.45

Srv	ERS	PFRS
5	4.95%	8.25%
6	4.62	5.83
7	4.51	4.84
8	4.40	4.73
9	4.29	4.62

Srv	ERS	PFRS
10	4.18%	4.51%
11	4.07	4.40
12	3.96	4.29
13	3.85	4.18
14	3.74	4.07

Srv	ERS	PFRS
15	3.63%	3.96%
16	3.52	3.85
17	3.41	3.74
18+	3.30	3.63

The current assumptions were adopted in 2018 using the pattern of increase in the 2011-2015 experience study while increasing the magnitude by 10% and resulted in a total overall salary scale (for the April 1, 2018 cohort) of 4.3% in ERS and 5.2% in PFRS. The salary scales increased with the ensuing cohorts, particularly in PFRS, due to shifting demographics (i.e. a higher percentage of employees at the lower service levels where the higher salary scale rates are applied).

The table below provides a history of the assumption since fiscal year 1980 (the first year for which a total overall salary scale was computed). Distinctions between systems began in 1997.

FY		FY		FY	ERS	PFRS	FY	ERS	PFRS	FY	ERS	PFRS
80	5.0%	89	7.0%	97	6.0%	6.5%	02	5.9%	6.9%	11	4.9%	6.0%
81	5.0	90	7.0	98	6.0	6.5	03	5.9	6.9	12	4.9	5.7*
82	8.5	91	7.0	99	6.0	6.5	04	5.9	6.9	13	4.8*	5.4*
83	8.5	92	7.0	00	6.0	6.5	05	5.4	6.9	14	4.8	5.4
84	8.5	93	7.0	01	5.5	6.0	06	5.4	6.9	15	4.8	5.4
85	8.5	94	7.0				07	5.4	6.8	16	3.8	4.7
86	8.5	95	7.0				08	5.4	6.8	17	3.9*	4.7
87	7.3	96	7.0				09	5.4	6.8	18	4.3	5.2
88	7.3						10	5.4	6.8	19	4.4*	5.6*
										20	4.5*	5.7*
										21	*4.5*	*6.2*

*change due to shifts in cohort, not service indexed assumptions

NYSLRS has a track record of adjusting the salary scale assumption only slightly more frequently than the assumed investment return assumption (11 times in 40 years).

In 2020, the quinquennial experience study showed unusually large retroactive salary increases for PFRS members resulting from the settlement of long-standing employment contract negotiations. There was

concern that the 5-year experience would not be predictive of future salary growth in PFRS, so the decision to revise the salary scale in PFRS was deferred to this year. The ERS salary scale was considered sufficient and no revisions were recommended.

To address the prevalence of retroactive salary increases in PFRS, the typical 5-year experience period was extended to a 10-year lookback. The longer lookback period smooths the retroactive salary increases over a longer period, allocating the retroactive salary increases to prior years, as if employment contracts were settled in a timely manner. The resulting salary scale for PFRS was:

Service	0	1	2	3	4	5	6	7	8-25	26+
PFRS	28%	28%	17%	13%	10%	8%	6%	5%	4%	3%

Therefore, I recommend maintaining the current salary scale in ERS (first used in 2018 with a value of 4.4% for the FYE 2021 cohort) **and revising the PFRS assumption based on a 10-year experience period** (with a value of 6.2% for the FYE 2021 cohort).

The table to the right displays the actual and expected salary increases for full-time employees, under the assumptions set in 2018. Three observations:

1) The aggregate expectation in 2015 of 4.2% in ERS and 5.0% in PFRS differs from the expectation in subsequent years because changes in member demographics results in different weighting of each service-indexed salary scale factor.
2) The spike in PFRS salary in 2016 and 2020 (with A/E of 1.40 and 2.18, respectively) highlights the impact of retroactive pay increases. But A/E ratios are less than 1.00 in 2017, 2018, 2019, and 2021. A longer lookback period for the PFRS salary scale helps to balance the highs and lows.
3) The extremely low A/E ratios in 2021 are likely a result of government responses to the COVID state of emergency (pay freezes, hiring freezes, and furloughs) in addition to high member withdrawal rates and accelerated retirement.

Fiscal Year		Actual	Expected	A/E
2016	ERS	3.7%	4.2%	0.87
	PFRS	7.2%	5.2%	1.40
	Combined	4.2%	4.4%	0.96
2017	ERS	4.8%	4.3%	1.13
	PFRS	5.1%	5.2%	0.98
	Combined	4.9%	4.4%	1.10
2018	ERS	4.3%	4.3%	1.00
	PFRS	4.7%	5.2%	0.90
	Combined	4.4%	4.5%	0.99
2019	ERS	4.9%	4.4%	1.12
	PFRS	5.3%	5.6%	0.95
	Combined	5.0%	4.6%	1.09
2020	ERS	4.7%	4.5%	1.06
	PFRS	12.4%	5.7%	**2.18**
	Combined	5.8%	4.6%	1.25
2021	ERS	2.3%	4.5%	**0.51**
	PFRS	4.0%	6.0%	**0.67**
	Combined	2.6%	4.7%	**0.54**
2016-2021	ERS	4.1%	4.4%	0.94
	PFRS	6.5%	5.5%	1.18
	Combined	4.5%	4.5%	0.98

III. Asset Valuation Method

Pension fund trustee(s) could direct all assets to be invested in a fixed income portfolio. While this would greatly reduce investment income volatility, it would also increase the expected employer contribution rates.

In general, one expects to profit more as an owner (i.e. an investor in equities) than as a lender (i.e. an investor in bonds), especially if the equity ownership can be diversified and held. Thus, pension funds typically invest in equities. Unfortunately, this introduces volatility in investment income.

The basic equation governing pension funding is: **C + I = B + E**

Contributions (both employer and employee) + **I**nvestment Income = **B**enefits + **E**xpenses*

** In NYSLRS, administrative expenses are funded independently of the benefits.*

The equation shows that volatility in investment income translates into volatility in employer contributions.

Asset valuation methods "smooth" the investment income volatility by phasing in "unexpected" gains and losses, where the amount of "unexpected" and the period of smoothing are defined by the method.

The NYSLRS asset valuation method was revised in 2013 and has the following features:

1) expect a gain of the assumed rate of return on the plan net position and fiscal year cash flows,
2) recognize (smooth) the unexpected gain (= actual gain – expected gain)
   over 5 years in equal annual portions, beginning immediately
3) do not apply a market value corridor.

If we were to apply this smoothing method in the 4/1/2021 valuation, the actuarial value of assets would be $227.8b with a market value of assets of $260.1b. That leaves $32.3b in assets "on the sidelines". If our assumed rate of return (6.80%) were "in the neighborhood" of the expected geometric return (6.07%), then I would probably recommend that we maintain the current asset valuation method. But an assumption that is 73 basis points higher than the expectation is a significant funding weakness. The $32.3b in "latent" asset gains can be put to immediate use to reduce the assumed return assumption to be "in the neighborhood" of the expected geometric return. In so doing, the probability of exceeding the new assumed rate of return (5.90%) is 54.3%, a significant improvement over the previous value of 37.9% (under the 6.80% assumed return assumption – see page 20).

A second advantage of the recommendation to restart the asset smoothing and to drop the assumed return to 5.9% is that it allows us to recast the denominator in the GASB ratio. The numerator of the ratio is the market value of assets. The denominator is the total projected liability of the promised benefits.

	Using the 2020 rollforward (including 6.8% assumed return)	Recast 2020 rollforward using recommended 2021 assumptions
Market Value Assets	$ 260.1b	$ 260.1b
Total Projected Liability*	$ 237.9b	$ 261.9b
GASB Ratio	109.3%	99.3%

** The total projected liability of benefits must be rolled forward from the previous year's valuations as the auditors insist on being given months to audit the valuation data. It is, however, permissible to change the valuation assumptions used with the audited data to project a liability applicable one year later.*

Using an assumed return of 6.8%, the GASB ratio would be 109.3%, which would imply that we are "overfunded", when in truth the high GASB ratio would be owing to an optimistic assumed return assumption. By recasting the denominator of the GASB ratio, the ratio becomes 99.3%, which implies nearly 100% funding. The recast ratio provides a valid inference when the assumed return is "in the neighborhood" of the expected geometric return.

Therefore, I recommend that we suspend asset smoothing for the 4/1/2021 valuation and restart it with the 4/1/2022 valuation.

Now the reader may wonder why I recommend 5.90% instead of 6.07% on the nose. The 6.07% was set forth in January 2020. I think that some of the gains anticipated at that time have been "fast forwarded" by the investment recovery and that a similar study set forth in April 2021 would have a lower geometric return expectation. Even if I am mistaken, an investment return assumption 17 basis points lower than the geometric expectation is much closer and preferred to one 73 basis points over.

The reader may also note that by restarting the asset smoothing we are "consuming a cushion" against future asset losses. This is true, but from an actuarial funding perspective, an assumed return "in the neighborhood" of the geometric expectation is greatly preferred to a smoothing method cushion. Further, the following will help mitigate any future market setbacks: 1) the 5.90% is an easier target than 6.80%, 2) the smoothing method will be restarted with the 4/1/2022 valuation, and 3) the contribution stabilization program is still operating in the background providing an option to employers if contribution rates were to spike even after asset smoothing (see page 21).

The market and actuarial value of assets (MVA & AVA) , along with the entry age normal accrued liability (AL_{EAN}), the entry age normal unfunded accrued liability (UAL_{EAN}), and the ratio of the plan net position (MVA) to the entry age normal total pension liability (TPL_{EAN}) since FY 2000 are given on the following page (dollar amounts in billions).

Market Value (MVA) v. Actuarial Value of Assets (AVA)

FY	MVA[a]	AVA	AL_{EAN}	UAL_{EAN}	TPL_{EAN}	GASB 67 Ratio
2000	$128.9	$110.6	$90.6	$-20.0	Use AL_{EAN} as a proxy	**142.3**%
2001	114.0	119.4	98.0	-21.4		116.3
2002	112.7	125.1	103.9	-21.2		108.5
2003	97.3	106.6	107.3	0.6		90.7
2004[b]	120.8	117.4	116.2	-1.2		104.0
2005	128.0	123.7	120.0	-3.7		106.7
2006	142.6	132.0	126.6	-5.4		112.6
2007	156.5	142.5	134.6	-7.9		116.3
2008	155.8	151.7	141.3	-10.4		110.3
2009	110.9	148.9	146.7	-2.1		**75.6**
2010	134.2	147.7	156.6	8.9		85.7
2011	149.5	148.6	164.3	15.7		91.0
2012	153.3	147.8	169.3	21.5		90.5
2013	164.1	155.3	175.1	19.8		93.7
2014	181.2	171.6	186.1	14.6		97.4
2015	189.3	184.2	196.5	12.4	$193.1	98.0
2016	183.5	190.6	203.0	12.4	202.7	90.6
2017	197.5	198.0	210.1	12.1	209.1	94.5
2018	212.0	206.7	217.6	10.9	216.3	98.0
2019	215.2	212.8	224.0	11.2	223.9	96.1
2020	198.1	214.1	231.9	17.8	229.9	86.2
2021[c]	260.1	260.1	260.4	0.3	~~237.9~~ 261.9	99.3
2022					265.2	

a) Financial Statement Plan Net Position (i.e. Invested Assets + Receivables)
[both the MVA & AVA exclude funds for group term life insurance]

b) The equity smoothing was 'restarted'; MVA > AVA
as the market value of the fixed income portfolio exceeded the amortized cost.

c) The smoothing was 'restarted' and the TPL_{EAN} was recomputed under new assumptions.

IV. Demographic Assumptions

A. Pensioner Mortality Experience (annual option 0 in millions)

System	Retirement	Retiree	FY 2021		
			Actual	Expected	A/E
ERS	Service	Male Clerk*	114.736	89.802	1.278
		Male Laborer*	40.088	48.596	0.825
		Female Clerk*	91.099	80.701	1.129
		Female Laborer*	10.718	10.158	1.055
	Disability	Male	8.681	8.002	1.085
		Female	4.983	4.869	1.023
PFRS	Service	All	23.051	23.719	0.972
	Disability	All	4.038	4.552	0.887
ERS & PFRS	Beneficiary**	Male	2.912	2.791	1.043
		Female	18.646	18.524	1.007
All Pensioner Mortality			318.953	291.713	1.093
* Clerk refers to White Collar while Laborer refers to Blue Collar ** Beneficiary dollars reflect actual pension received					

B. Mortality Improvement

I recommend that NYSLRS actuarial valuations update Society of Actuaries' Mortality Improvement Scale MP-2019 to MP-2020, the most recently available.

C. Active Member Decrement Experience

Decrement	FY 2021			
	Exposures	Actual	Expected	A/E
ERS Withdrawals 0 ≤ Srv < 2 Age 55 Plan	39,314	20,797	6,665	3.120
ERS Withdrawals 2 ≤ Srv < 3 "	37,555	3,781	3,784	0.999
ERS Withdrawals 3 ≤ Srv < 4 "	27,593	2,346	2,161	1.086
ERS Withdrawals 4 ≤ Srv < 5 "	23,757	1,602	1,581	1.013
ERS Withdrawals 5 ≤ Srv < 10 "	68,832	3,274	2,947	1.111
ERS Withdrawals 10 ≤ Service "	112,940	2,367	1,872	1.264
PFRS Withdrawals	23,427	616	263	2.342
All Withdrawals	**333,417**	**34,783**	**19,274**	**1.805**
ERS T-1 Reg Plan Srv Ret 0 ≤ Srv < 20	103	23	20	1.151
ERS T-1 Reg Plan Srv Ret 20 ≤ Srv < 30	87	21	25	0.824
ERS T-1 Reg Plan Srv Ret 30 ≤ Service	143	40	32	1.261
ERS T-2,3,4,5,6 Reg Plan Srv Ret 0 ≤ Srv < 20	53,462	5,022	4,254	1.181
ERS T-2,3,4,5,6 Reg Plan Srv Ret 20 ≤ Srv <30	35,208	5,759	4,941	1.166
ERS T-2,3,4,5,6 Reg Plan Srv Ret 30 ≤ Srv	18,470	7,012	4,441	1.579
ERS State T-1,2 Correction Officer Srv Ret	0	0	0	N/A
ERS State T-3,5,6 Correction Officer Srv Ret	2,179	631	525	1.201
ERS County Correction Officer Srv Ret	1,018	285	254	1.124
All ERS Service Retirements	**110,667**	**18,793**	**14,492**	**1.297**
PFRS 20 Year Plan Srv Ret	1,794	422	265	1.595
PFRS 20 Year Plan w add'l 60ths Srv Ret	4,304	783	542	1.444
PFRS State Police 20 Year Plan Srv Ret	1,045	246	151	1.625
All PFRS Service Retirements	**7,143**	**1,451**	**958**	**1.514**
ERS Accidental Disability	200,983	0	5	0.000
ERS Ordinary Disability	109,819	24	207	0.116
PFRS Accidental Disability	30,792	36	51	0.705
PFRS Ordinary Disability	10,767	5	3	1.936
PFRS IPOD Disability	30,792	18	51	0.352
ERS Accidental Deaths Age 55 Plan	417,461	6	5	1.293
ERS Ordinary Deaths Age 55 Plan	417,461	798	595	1.342
PFRS Accidental Deaths	30,792	0	1	0.000
PFRS Ordinary Deaths	30,792	19	14	1.373

* reflects quotient of unrounded Actual and Expected counts

V. Effect on Contributions

The table below summarizes the projected average employer contribution rates for the most recent valuations.

Valuation 4/1	Local Employer Billing Date 2/1	ERS (reg plan GLIP)	PFRS (GLIP)	Total Employer Contributions/ FY Benefits (billions)	Contribution Stabilization Program (CSP) Mitigated Rates (does not apply to GLIP, ~~strikethrough~~ => no amortizing)				CSP Balance (billions)
2005	2007	10.7%	17.0%	$2.7 / 6.4	ERS		PFRS		
2006	2008	9.6	16.6	2.6 / 6.8					
2007	2009	8.5	15.8	2.5 / 7.2					
2008	2010	7.3	15.1	2.3 / 7.7	Original		Original		
2009	2011	11.9 (0.4)	18.2 (0.1)	3.6 / 8.5	9.5%		17.5%		
2010	2012	16.3 (0.4)	21.6 (0.0)	4.9 / 8.9	10.5		18.5		
2011	2013	18.9 (0.4)	25.8 (0.1)	5.5 / 9.5	11.5	Alternate	19.5	Alternate	$0.3
2012	2014	20.9 (0.4)	28.9 (0.0)	6.2 / 10.0	12.5	12.0%	20.5	20.0%	1.1
2013	2015	20.1 (0.4)	27.6 (0.1)	6.1 / 10.5	13.5	12.0	21.5	20.0	2.1
2014	2016	18.2 (0.5)	24.7 (0.0)	5.5 / 11.1	14.5	12.5	22.5	20.5	3.3
2015	2017	15.5 (0.4)	24.3 (0.0)	4.8 / 11.5	~~15.1~~	13.0	23.5	21.0	4.1
2016	2018	15.3 (0.4)	24.4 (0.1)	4.9 / 12.1	~~14.9~~	13.5	~~24.3~~	21.5	4.2
2017	2019	14.9 (0.5)	23.5 (0.0)	4.9 / 12.8	~~14.4~~	14.0	~~23.5~~	22.0	3.8
2018	2020	14.6 (0.4)	23.5 (0.0)	4.9 / 13.4	~~14.2~~	~~14.2~~	~~23.5~~	22.5	3.3
2019	2021	14.6 (0.5)	24.4 (0.0)	5.1 / 14.0	~~14.1~~	~~14.1~~	~~24.4~~	23.0	2.9
2020	2022	16.2 (0.4)	28.3 (0.0)	5.9 / 14.7	15.1	14.6	25.4	23.5	2.3
2021	**2023**	**11.6 (0.2)**	**27.0 (0.0)**	**4.4 / 15.4**	**~~14.1~~**	**~~14.1~~**	**26.4**	**24.0**	**0.82**

The new entrant rate:

for the ERS tier 6 A15 plan is 9.1% (9.9% including GLIP and administrative expenses).

for the PFRS tier 6 384D plan is 18.0% (18.7% including GLIP and administrative expenses).

for the tier 6 valuation cohort is 10.6% in ERS and 19.0% in PFRS (inc. GLIP and administrative expenses).

The 3/31/2021 CSP amortization balance is $0.82b, $0.69b held by local employers and $0.13b held by the state.

On 2/1/2023, ERS employers that have elected to participate in the CSP will be billed at the mitigated rate of 14.1% (plus GLIP and amortization payments) even though the employer's plan rates may average 11.6%. The contributions above 11.6% will be applied to outstanding amortizations. If there are no outstanding amortizations, the additional contributions will be set aside in an account for the ERS employer and made available if employer contribution rates should rise above the mitigated rate by more than 1% (original program) or 0.5% (alternate program).

VI. Gain/Loss Analysis

	ERS		PFRS	
2021 Estimated Contributions (2/1/22 Payment)	16.2%		28.3%	
Changes Due to Gains/Losses In:				
Assumed return reduction from 6.8% to 5.9%	10.7%		14.4%	
FYs 2017–2021 Investment Return (after restart)	-13.9%		-16.0%	
FY 2017 Investment Performance (11.5% v 7.0%)		*-0.52%*		*-0.59%*
FY 2018 Investment Performance (11.4% v 7.0%)		*-0.53%*		*-0.60%*
FY 2019 Investment Performance (5.2% v 7.0%)		*0.25%*		*0.28%*
FY 2020 Investment Performance (-2.7% v 6.8%)		*1.54%*		*1.76%*
FY 2021 Investment Performance (33.6% v 6.8%)		*-3.86%*		*-4.41%*
Market Restart (immediate recognition of remaining FY 2018 – 2021 Investment Performance)		*-10.82%*		*-12.40%*
CPI-U increase from 2.5% to 2.7%	0.4%		0.3%	
Mortality Improvement Scale MP-2019 to MP-2020	-0.5%		-0.4%	
PFRS Salary Scale			-0.2%	
PFRS Tiers 5&6 Overtime Limit Adjustment			1.7%	
FY 2021 Experience	-0.9%		-1.0%	
Tier 6 New Entrant	-0.1%		-0.3%	
GLIP, Administrative Contributions	-0.2%		0.3%	
Miscellaneous	-0.1%		-0.1%	
Net Change	-4.6%		-1.3%	
2022 Estimated Contributions (2/1/23 Payment)	11.6%		27.0%	

In a nutshell, the assumed return reduction and market restart dominate the funding gains and losses. Further, an examination of the PFRS valuation found that the overtime limitations were applied to the final average earnings, but not to the compensation subject to employee and employer contributions. The correction added 1.7% to the PFRS employer contribution rate as the same contributions need to be collected over a compensation that does not exceed the overtime limits.

VII. Summary of Recommendations

I recommend that the investment return assumption be decreased from 6.8% to 5.9%, the asset smoothing method be restarted, the CPI-U assumption be increased from 2.5% to 2.7%, the mortality improvement assumption be updated from Scale MP-2019 to MP-2020, and the PFRS salary scale assumption be updated based on the 10 years of experience ending on 3/31/21. I recommend all other assumptions be maintained. I am a Member of the American Academy of Actuaries and meet the Academy's Qualification Standards to issue this Statement of Actuarial Opinion.

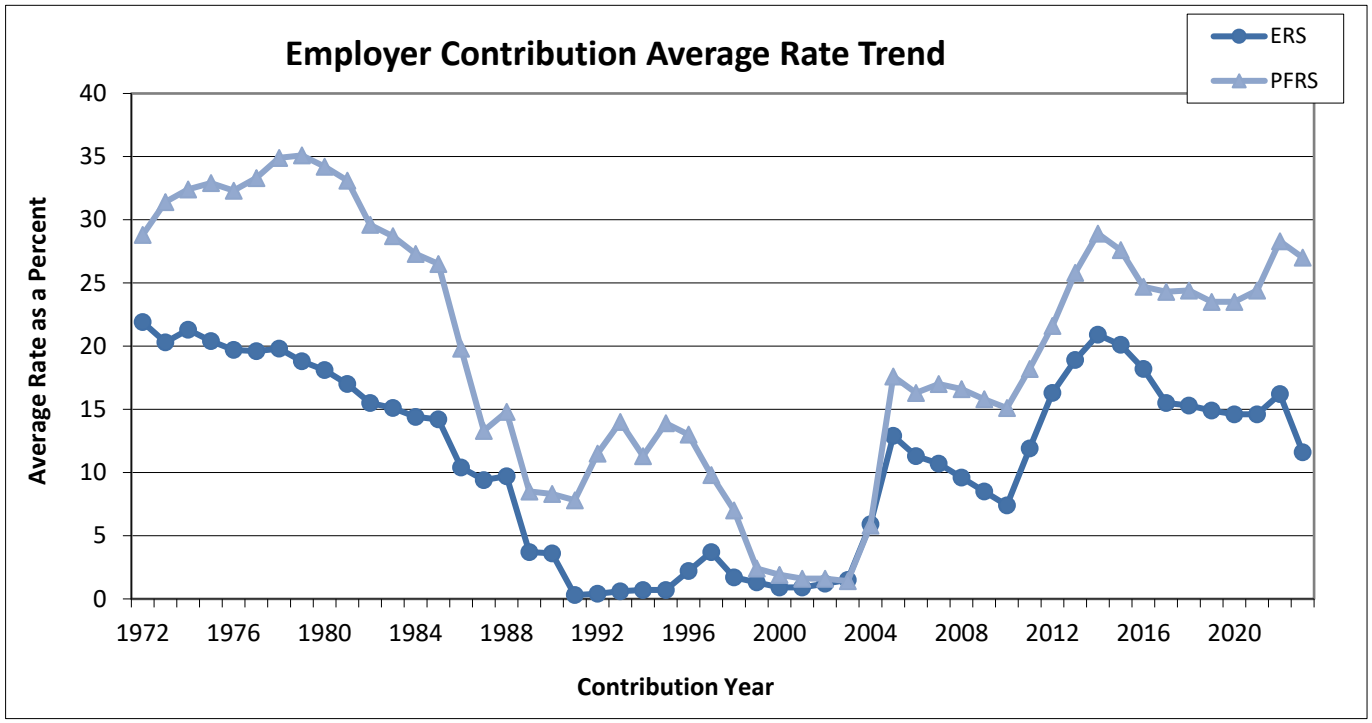
This recommendation was reviewed by the Actuarial Advisory Committee (AAC) in a meeting on August 4, 2021.

VIII. Historical Employer Contribution Average Rate

Average Rate		
Year	**ERS**	**PFRS**
1972	21.9	28.8
1973	20.3	31.4
1974	21.3	32.4
1975	20.4	32.9
1976	19.7	32.3
1977	19.6	33.3
1978	19.8	34.9
1979	18.8	35.1
1980	18.1	34.2
1981	17.0	33.1
1982	15.5	29.6
1983	15.1	28.7
1984	14.4	27.3
1985	14.2	26.5
1986	10.4	19.8
1987	9.4	13.3
1988	9.7	14.8
1989	3.7	8.5
1990	3.6	8.3

Average Rate		
Year	**ERS**	**PFRS**
1991	0.3	7.8
1992	0.4	11.5
1993	0.6	14.0
1994	0.7	11.3
1995	0.7	13.9
1996	2.2	13.0
1997	3.7	9.8
1998	1.7	7.0
1999	1.3	2.4
2000	0.9	1.9
2001	0.9	1.6
2002	1.2	1.6
2003	1.5	1.4
2004	5.9	5.8
2005	12.9	17.6
2006	11.3	16.3
2007	10.7	17.0
2008	9.6	16.6
2009	8.5	15.8

Average Rate		
Year	**ERS**	**PFRS**
2010	7.4	15.1
2011	11.9	18.2
2012	16.3	21.6
2013	18.9	25.8
2014	20.9	28.9
2015	20.1	27.6
2016	18.2	24.7
2017	15.5	24.3
2018	15.3	24.4
2019	14.9	23.5
2020	14.6	23.5
2021	14.6	24.4
2022	16.2	28.3
2023	11.6	27.0



IX. Risk Disclosures

Why should a governmental entity take on defined benefit (DB) pension risk? DB plans are an economically efficient means of attracting and retaining employees. For example, in the matter of public safety, special plans that offer half-pay at 20 or 25 years of service guarantee income in later middle age when physicality may wane while tasks remain grueling. During the career, disability and death benefits provide income protection to those who risk their lives in service to the public.

Optimizing the economic efficiencies of a DB plan requires prefunding the benefit promises, ideally by way of smooth employer contribution rates. Actuarial Standard of Practice No. 51 (ASOP 51 "Assessment and Disclosure of Risk Associated with measuring Pension Obligations and Determining Pension Plan Contributions") requires assessment and disclosure of risks inherent in the funding of DB plans. The two primary forms of risk are (1) insufficient employer contributions to fund the benefits, and (2) intolerable volatility in the employer contribution rate.

Employer Contribution Sufficiency Risk

Contribution Fulfillment Risk

In New York State, employers are required to pay the actuarially determined contribution. Employers who are delinquent are pursued and interest is charged on any late payments. Thus, there is very little risk that employer contributions will not be paid. This is the most significant component of a well-funded DB plan. Poorly funded DB plans invariably have a stretch of time when employer contributions are neglected.

Actuarial Assumptions

Actuarial assumptions and methods determine the allocation of benefit costs over time; they do not, however, determine the ultimate benefit costs. The ultimate cost of benefits is based on the lucrativeness of the promises and the performance of the assets.

The expected long-term employer contribution rate is the rate that would be charged if all assumptions were met annually. As experience deviates from what was assumed, the employer contribution rates deviate from the expected long-term rate. When billing rates are greater than the expected long-term rates, the current taxpayer is funding benefits earned in prior years. When billing rates are less than the expected long-term rates, the current taxpayer is benefiting from contributions collected in prior years. The more conservative a set of assumptions, the more quickly contributions are collected, possibly levying too great a cost to current taxpayers. The less conservative a set of assumptions, the more likely contributions will increase, possibly levying too great a cost to future taxpayers. The best assumptions decrease the likelihood of deviations in one direction persisting over long periods. In so doing, governmental services are compensated by the taxpayers benefitting from those services (that is, there is intergenerational equity).

New York State Retirement and Social Security Law (NYS RSSL) requires a review of all assumptions at least once every five years. To comply, the New York State and Local Retirement System (NYSLRS) undertakes a quinquennial comprehensive experience study and update of assumptions with a reasonableness review every year. Any emerging trends that are believed to continue in the future may warrant an assumption adjustment between quinquennial studies. Assumptions are reviewed annually by the Comptroller's Actuarial Advisory Committee and quinquennially by a consulting firm. The annual online publishing of the actuarial assumptions provides transparency to interested parties.

Assumed Investment Return Expectation Risk

Employer contribution rates are most sensitive to the assumed investment return. This report recommends decreasing this assumption from 6.8% to 5.9% for the 4-1-2021 actuarial valuation. The following table shows the FY 2023 system average billing rates and tier 6 expected long-term billing rate (known as the new entrant rate) for various assumed investment returns using the 4-1-2021 valuation cohort. The exceedance column shows the probability of exceeding the assumed return over a 30 year period using the capital market assumptions and policy asset allocation approved by Pension and Investment Cash Management (PICM) in 2020, the year of the most recently provided comprehensive asset/liability analysis.

	Employees' Retirement System		Police and Fire Retirement System		
Assumed Rate	FY 2022 System Average Billing Rate	Tier 6 New Entrant Rate	FY 2022 System Average Billing Rate	Tier 6 New Entrant Rate	Probability of Assumed Rate Exceedance
5.00%	24.4%	13.8%	44.5%	24.1%	69.8%
5.25%	20.7%	12.8%	39.5%	22.6%	65.9%
5.50%	17.2%	11.9%	34.6%	21.2%	61.5%
5.80%	13.0%	10.9%	28.9%	19.5%	56.1%
5.90%	**11.6%**	**10.6%**	**27.0%**	**19.0%**	**54.3%**
6.00%	10.2%	10.3%	25.2%	18.5%	52.5%
6.80%	0.8%	8.0%	10.8%	15.0%	37.9%

Inflation and Salary Scale Expectation Risk

The inflation assumption is used to compute COLA (cost of living adjustment) payments to retirees and beneficiaries. The COLA program provides payments equal to one half of the inflation rate based on the first $18,000 of the single life allowance. There is a floor of 1% and a cap of 3% so there is little risk of significant gains or losses in this valuation component.

The salary scale assumption is used to project future increases in a member's salary to estimate the final average salary at retirement as well as determine billable salary over a member's career. If members receive greater salary increases than assumed, greater benefits will be paid out in the future than expected, requiring an increase in employer contributions to make up for the shortfall. Salary increases vary within a relatively narrow range, so there is minor risk of significant gains or losses in this valuation component.

Demographic Expectation Risks

Demographic assumptions estimate member behavior regarding decrements (i.e. change in status) such as retiring, withdrawing or dying. Since NYSLRS is large (over 1.1 million participants), these assumptions are developed with a high degree of credibility using NYSLRS own experience. Actual/Expected (A/E) ratios are displayed on pages 14 and 15 earlier in this report to show how actual pensioner mortality and active member decrements track expectations. Decrements vary within a relatively narrow range, so there is minor risk of significant gains or losses in this valuation component.

NYSLRS is not large enough to develop in-house mortality improvement assumptions and thus relies on mortality improvement scales based on nationwide experience derived from data collected from the Social Security Administration by the Society of Actuaries (SOA). This report recommends using scale MP-2020 for the 4-1-2021 valuation. Over the past several years, updated tables vary within a relatively narrow range so there is minor risk of significant gains or losses in this valuation component.

Employer Contribution Volatility Risk

Investment Volatility Risk

Employer contribution rate smoothness is most sensitive to the investment return experience. We can evaluate exposure to investment volatility risk using the following Asset Leverage Ratio:

$$Asset\ Leverage\ Ratio = \frac{Market\ Value\ of\ Assets\ (MVA)}{Present\ Value\ of\ Valuation\ Cohort\ Billable\ Salary\ (PVBS)}$$

The following table displays the ratio and its components in the middle of the last four decades and for the most recent year (dollar amounts in billions).

	FYE	1985	1995	2005	2015	2021
ERS	MVA	$22.8	$53.3	$108.7	$161.2	$220.7
	PVBS	$102.0	$158.2	$176.1	$203.1	$266.0
	Ratio	22%	34%	62%	79%	83%
PFRS	MVA	$4.1	$9.8	$19.3	$28.2	$39.4
	PVBS	$11.9	$16.5	$27.0	$30.9	$41.4
	Ratio	35%	60%	71%	91%	95%

The ratio is zero at plan inception but increases as assets accumulate. Poor investment performance in a new plan is not problematic as there was not much to lose and plenty of billable salary to collect contributions and accumulate assets before benefits become due. In a more mature fund with a high asset leverage ratio, investment volatility has a greater impact on the employer contribution rate. NYSLRS is now a mature plan with the associated significant exposure to investment volatility risk.

Mitigating Employer Contribution Volatility Risk

NYSLRS currently employs two methods to reduce employer contribution rate volatility. An industry and GASB standard level five-year asset smoothing method is used to dampen annual investment return volatility. Any deviations from the current expected return of 5.9% are recognized in equal increments over a period of five years. This smoothing is suspended for this year to take advantage of the extraordinary asset performance and align the rate of return assumption with the trustee's risk appetite.

The Contribution Stabilization Program (CSP signed into law in 2010 - the Alternate Program was signed in 2014 and had a one-year opt-in window) provides an optional additional layer of employer contribution rate smoothing. Under the CSP, on the billing date, a participating employer is required to remit a graded rate contribution and permitted to amortize over a 10 year period the balance between the actuarial contribution and the graded contribution (12 year period for the Alternate Program). The graded rate increases or decreases up to 1% each year (0.5% for the Alternate Program) in the direction of the system average contribution rate. During "ordinary" investment periods, the actuarial and graded rates converge. Large deviations may occur when there is extraordinary asset performance, such as after the Global Financial Crisis of 2008.