

Cincinnati Retirement System



Experience Review January 1, 2017 through December 31, 2021

March 2, 2023



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- Purpose of the Study
- Demographic Assumptions Review
- Economic Assumptions Review
- Financial Impact
- Projections
- Revised ASOP 4

Purpose of the Study



- An experience study is performed to compare actual System experience against the assumptions used to value the System. Such studies are generally performed every 5 years.
 - Last experience study covered the period January 1, 2012 through December 31, 2016
 - ASOPs 27 and 35 provide guidance for selecting reasonable assumptions
- Actuarial assumptions are intended to be long term in nature and should be reasonable both individually and in the aggregate
- Frequent or significant changes in the actuarial assumptions are not normally recommended nor desirable

Purpose of the Study



- Generally, propose changes in assumptions when the current assumption is not reflecting the actual experience or expected future trends
- When making adjustments they should:
 - Reflect future expectations that can differ from historical experience
 - Account for prior experience in part but not necessarily fully because there could be factors that temporarily influenced past participant behavior
- Actuary must disclose if the assumption significantly conflicts with what the actuary would determine is reasonable

2017 - 2021 Experience



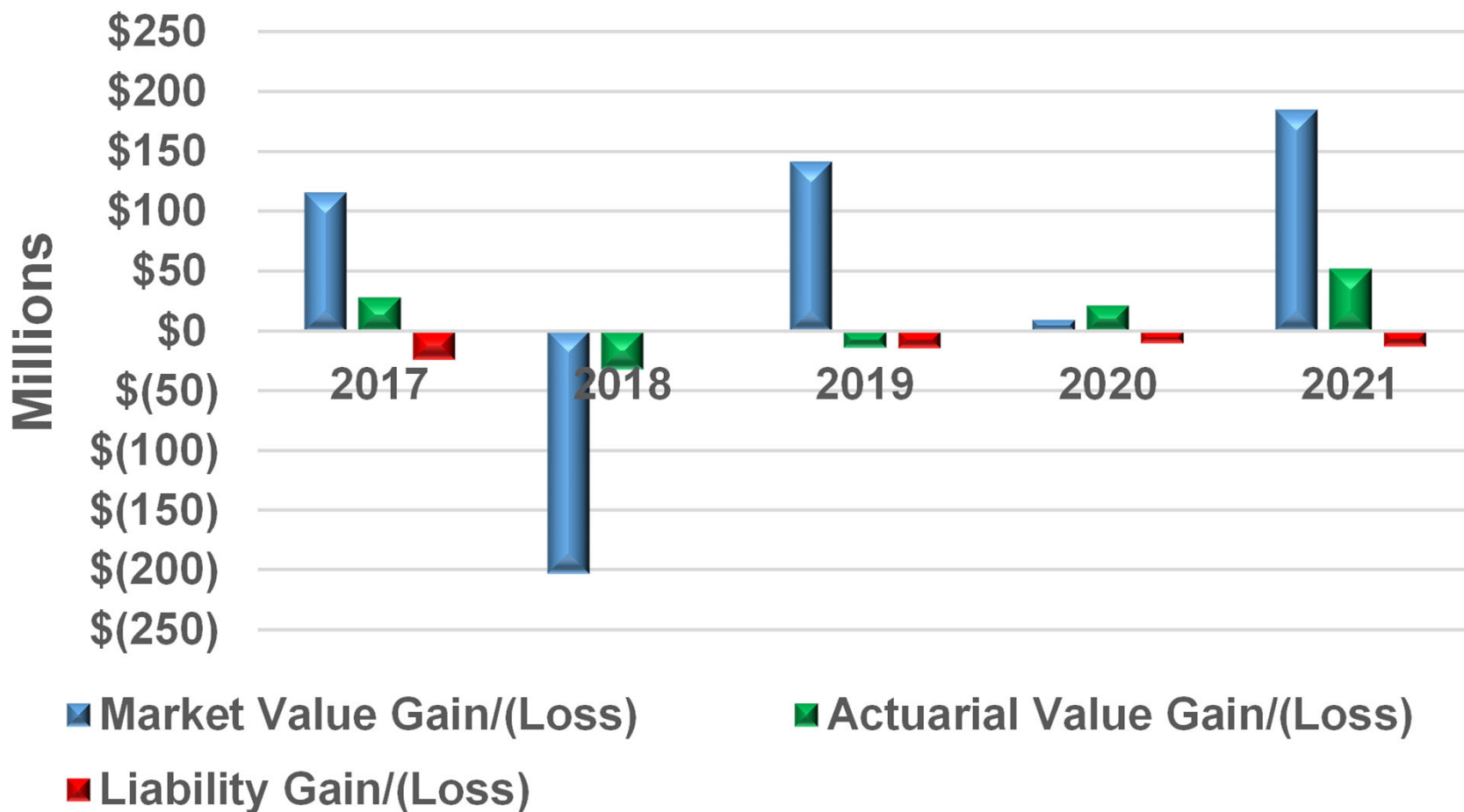
\$ in millions		Amount
(a) (Unfunded) Actuarial Liability - December 31, 2016	\$	(520.8)
(b) Expected Change*		(90.8)
(c) Investment Gain / (Loss) on AVA		56.6
(d) Liability Gain / (Loss)		(61.1)
(e) Assumption Changes		(48.3)
(f) Plan Changes		(24.7)
(g) Miscellaneous		(39.2)
(h) (Unfunded) Actuarial Liability - December 31, 2021	\$	(728.3)

* *Expected change includes benefit accruals, contributions and interest.*

2017 - 2021 Experience



Historical Gains / (Losses)





Demographic Assumptions

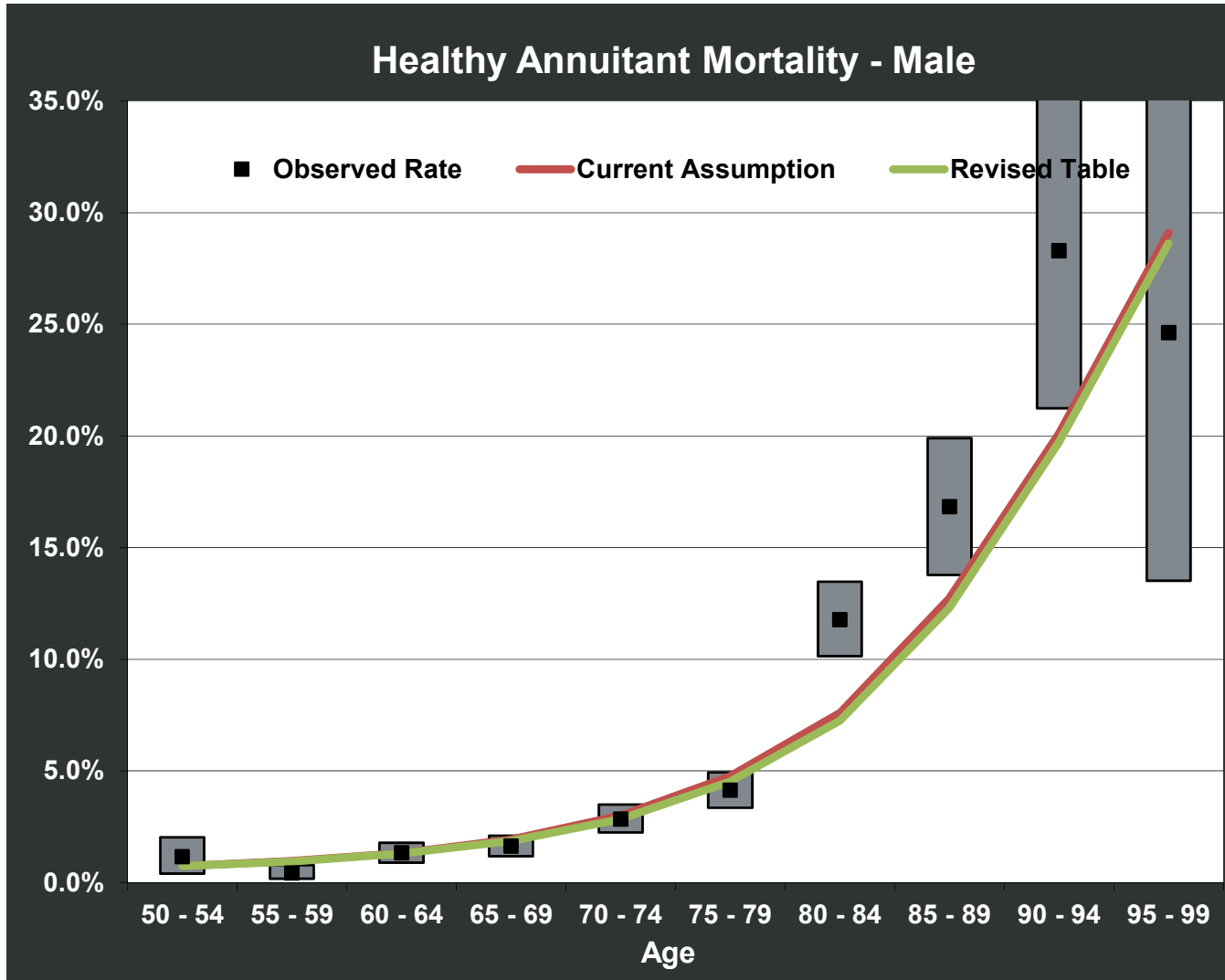
Retirement Rates
Termination Rates
Disability Rates
Mortality Rates
Salary Rates
Family Composition

Demographic Assumptions



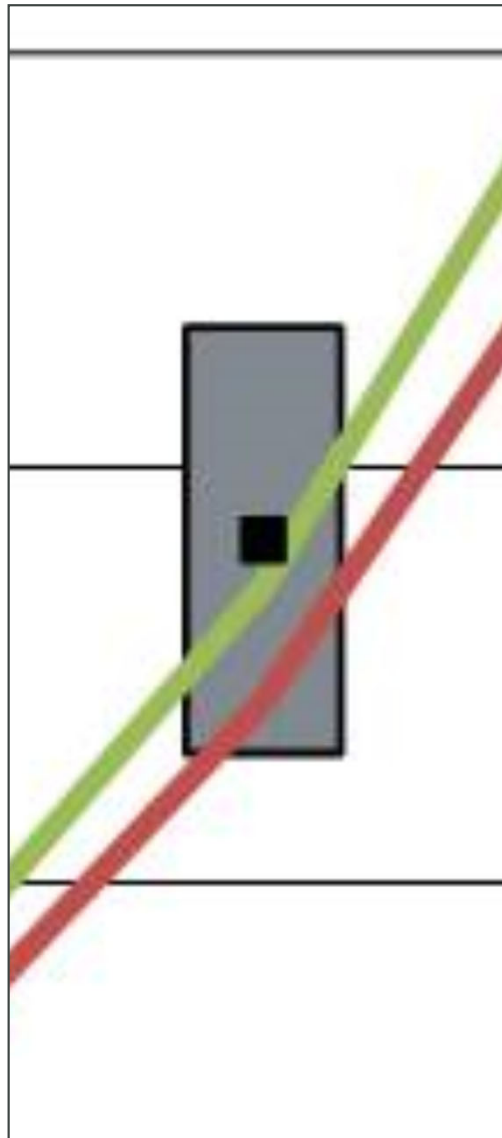
- Compare actual occurrences of each decrement (i.e., mortality, retirement, termination, disability) to what the assumption predicted would happen
 - Actual-to-Expected Ratio (A/E Ratio) – The ratio of the actual number of decrements to the expected number based on the assumption
- Examine any external influences on each assumption
 - Economic downturn, pandemic
- Consider potential future trends (e.g., mortality improvement)
- Recommend adjustments to each of the demographic assumptions

Demographic Assumptions



In looking at the actual versus expected experience, we use charts that compare actual to expected rates and then graph the proposed or revised assumed rates

Demographic Assumptions



- Square marker represents actual rate
- Box represents 90% confidence interval; smaller box means we had a lot of data (more credible); larger box means we only had a few data points (less credible)
- Red line represents current assumption
- Green line represents proposed assumption

Demographic Assumptions



- Instead of asking when a particular person will retire, we ask, out of 1,000 age 55 year olds, how many will retire next year?
- Instead of asking when a particular person will die, we ask, out of 1,000 age 80 year old males, how many are expected to be around next year?

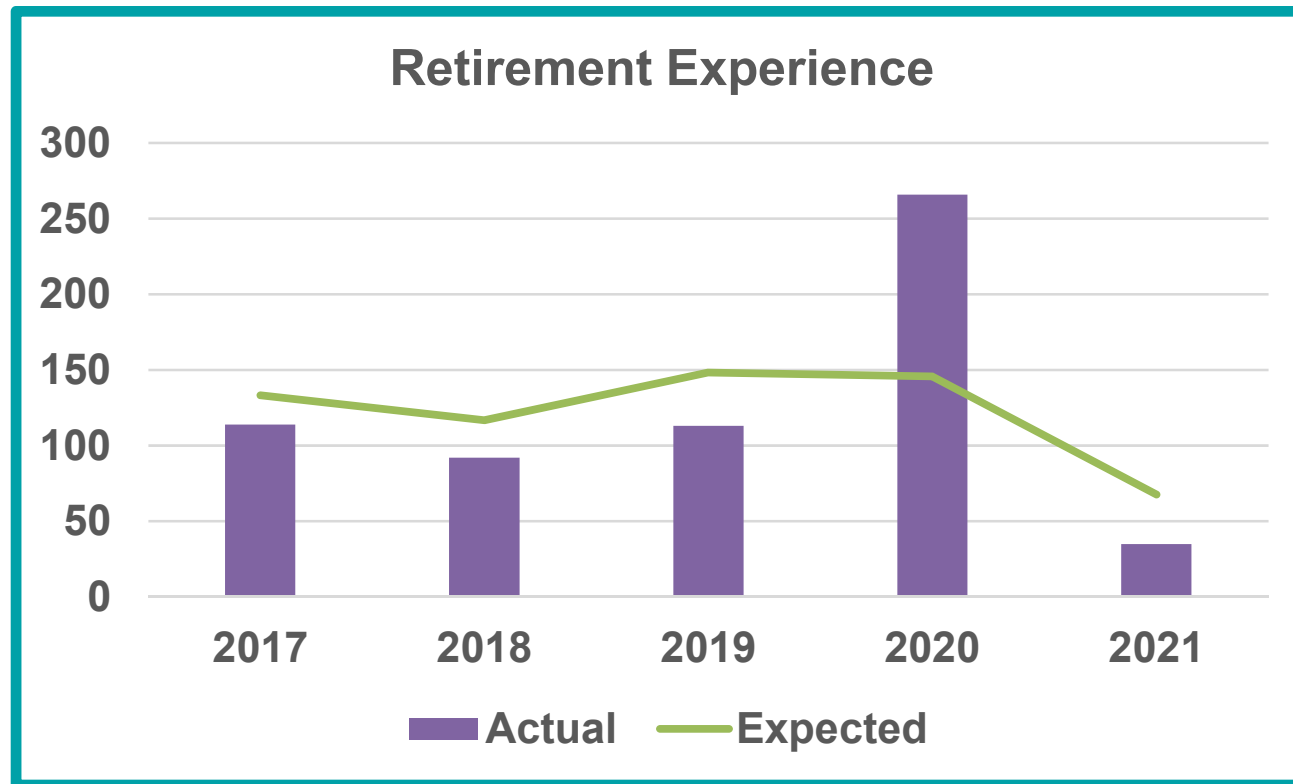


- When will participants retire?
- **Actives:** Current assumption based on age, service and Group, with higher probability of retirement for those who are eligible for unreduced benefits (30 years of service or Normal Retirement)
- **Terminated Vested:** Current assumption assumes all participants will retire at Normal Retirement Date

Retirement – Actives

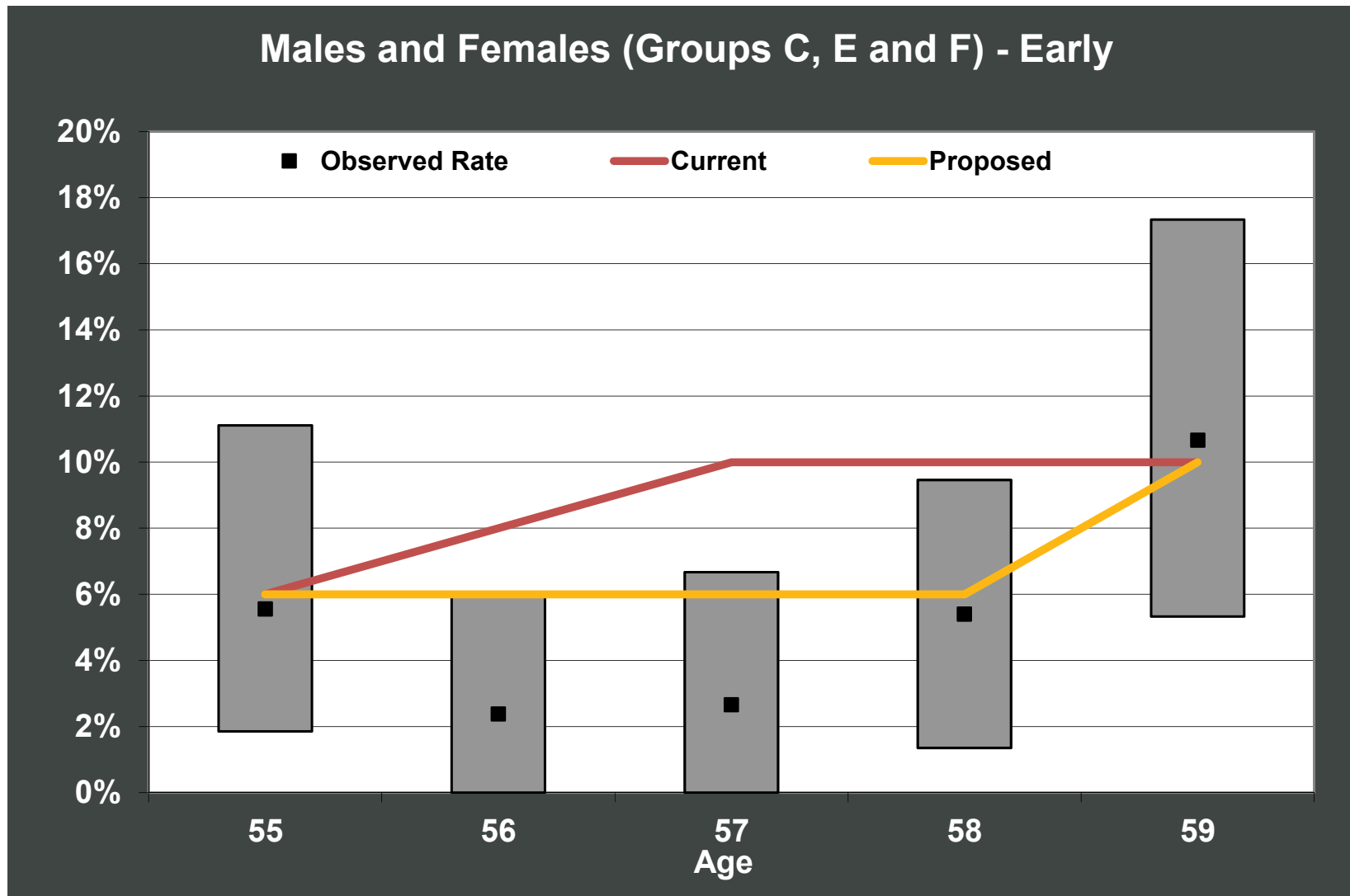


- Fewer actives retired than expected from 2017 to 2019
- 2020 and 2021 experience influenced by ERIP
- Proposed based on Groups C, E and F from 2017 to 2019; variation of these rates used for Group G

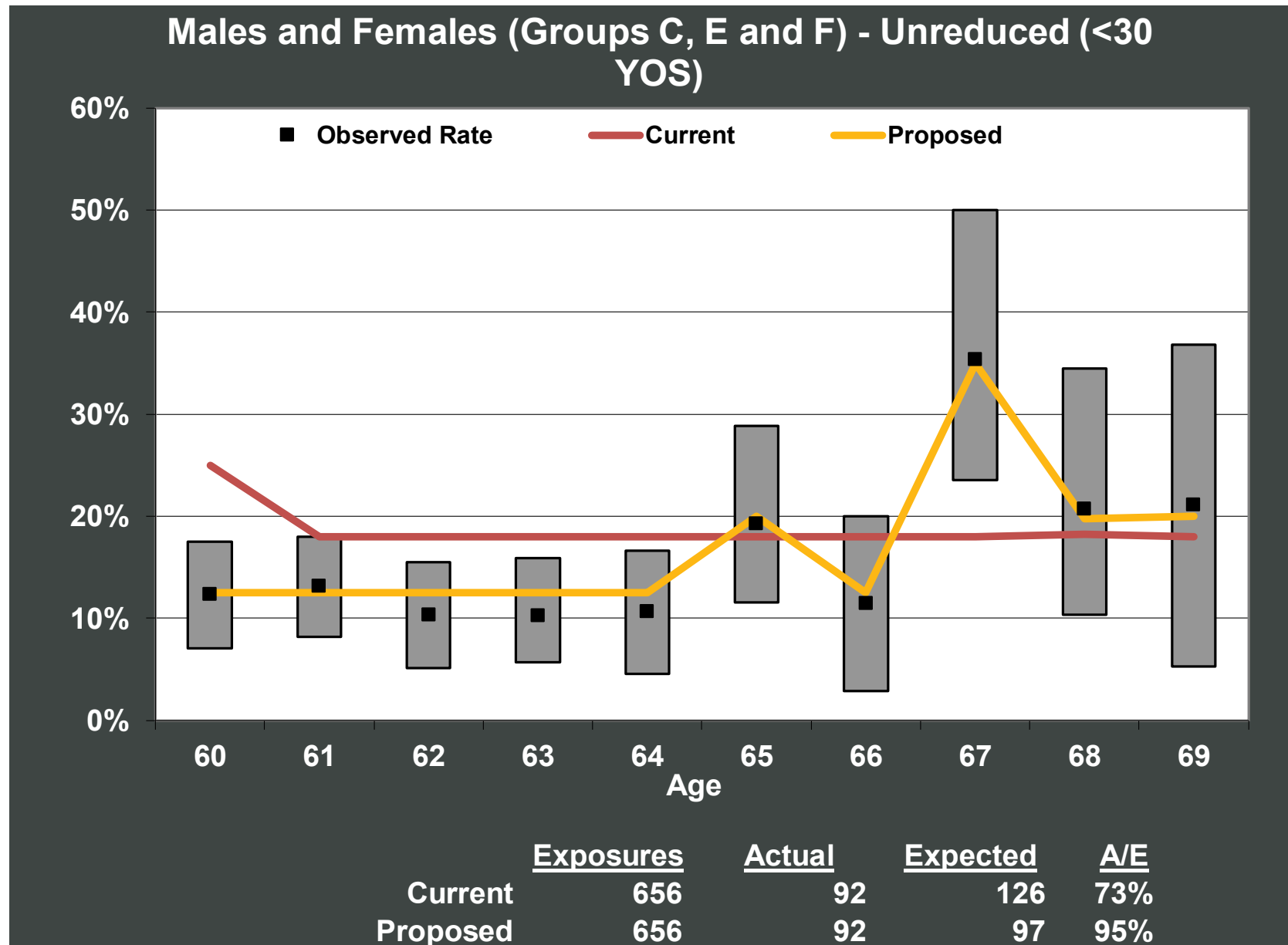


Only those deemed eligible to retire at beginning of each year are counted.

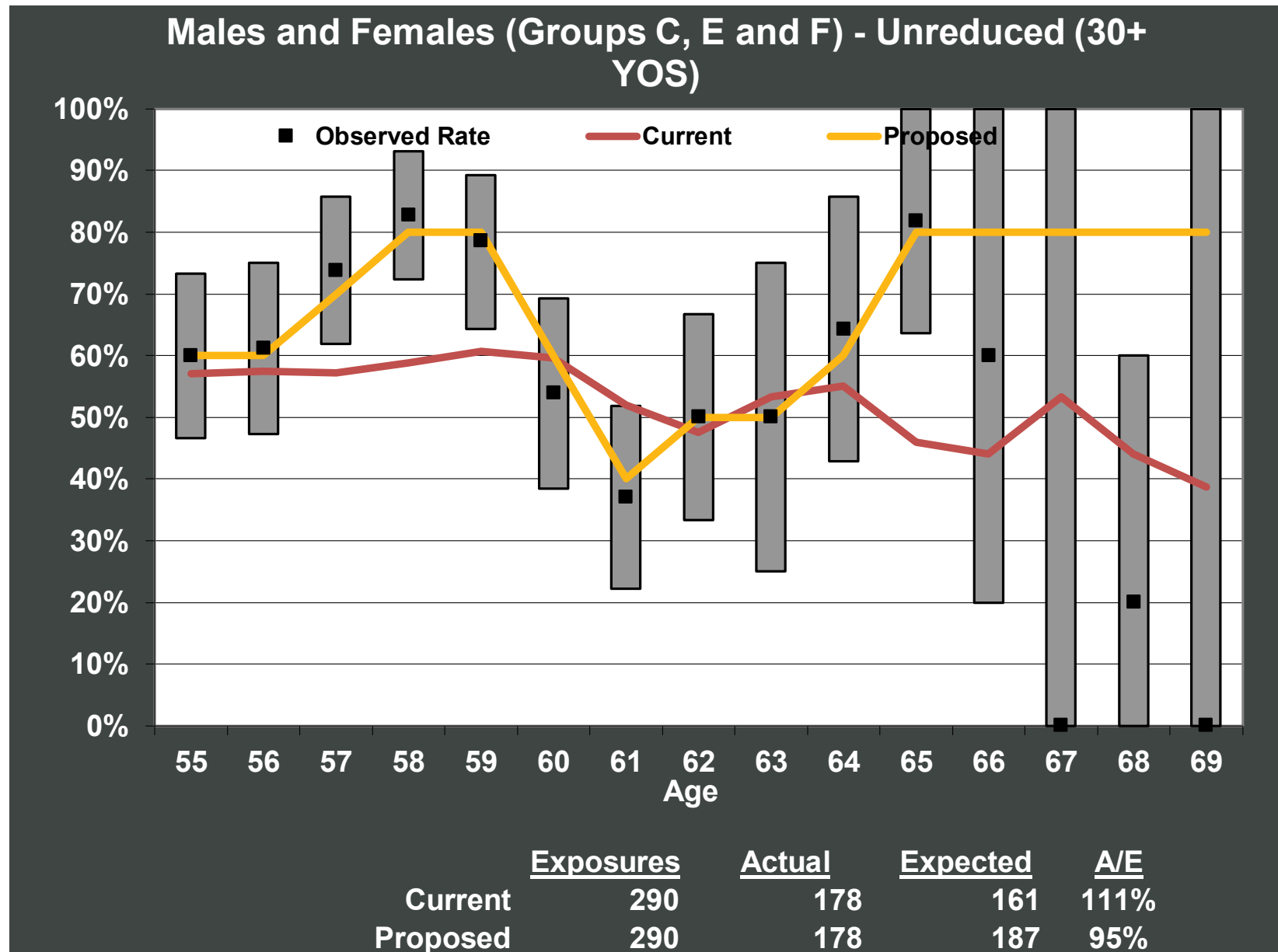
Retirement – Early



Retirement – Unreduced (< 30 YOS)



Retirement – Unreduced (30+ YOS)



Retirement – DROP Election



- Currently assume 40% eligible elect DROP
- From 2017 to 2019, about 70% of those eligible to participate in DROP elected to do so in lieu of commencing benefits immediately
- Propose increasing assumption from 40% to 70% to better reflect actual experience

Retirement – Terminated Vesteds



- As of December 31, 2021, only 247 terminated vesteds accounting for less than 1% of liabilities

Retirement Age	Terminated Vested Retired in..				
	2017	2018	2019	2020	2021
<60	0	0	2	0	0
60	5	8	8	10	16
>60	<u>1</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>3</u>
	6	10	11	10	19
% at 60	83%	80%	73%	100%	84%

- Propose to continue assumption that terminated vesteds commence their benefits at Normal Retirement Age

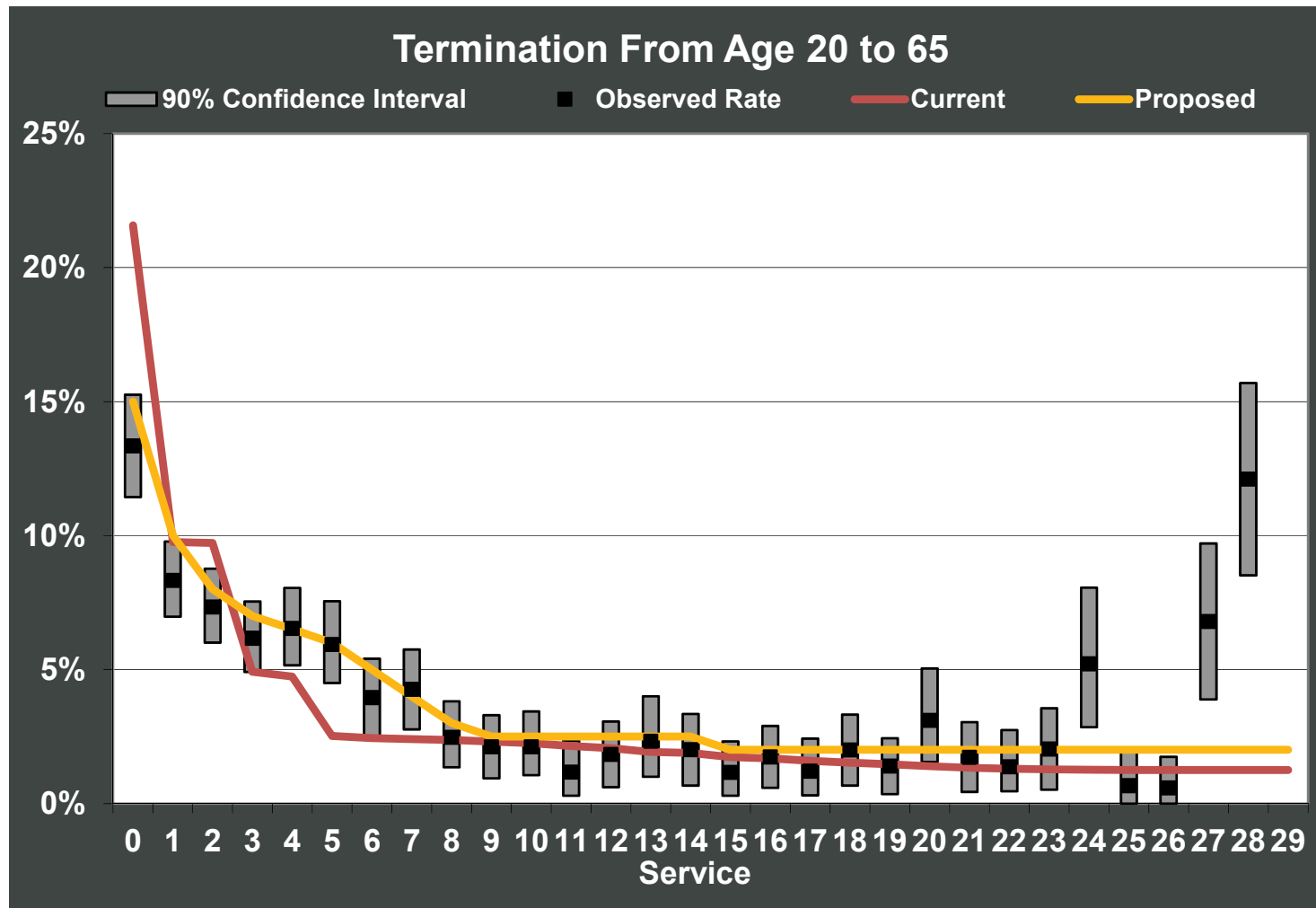
Termination



- Current assumption based on age and service with higher rates for first 4 years of service
- More terminations than expected, especially in most recent 3 years

Year	Exposures	Actual	Expect	A/E
2017	2,282	89	88.9	100%
2018	2,549	144	140.7	102%
2019	2,533	163	127.8	128%
2020	2,511	180	129.8	139%
2021	2,386	148	115.2	128%
Total	12,261	724	602.4	120%

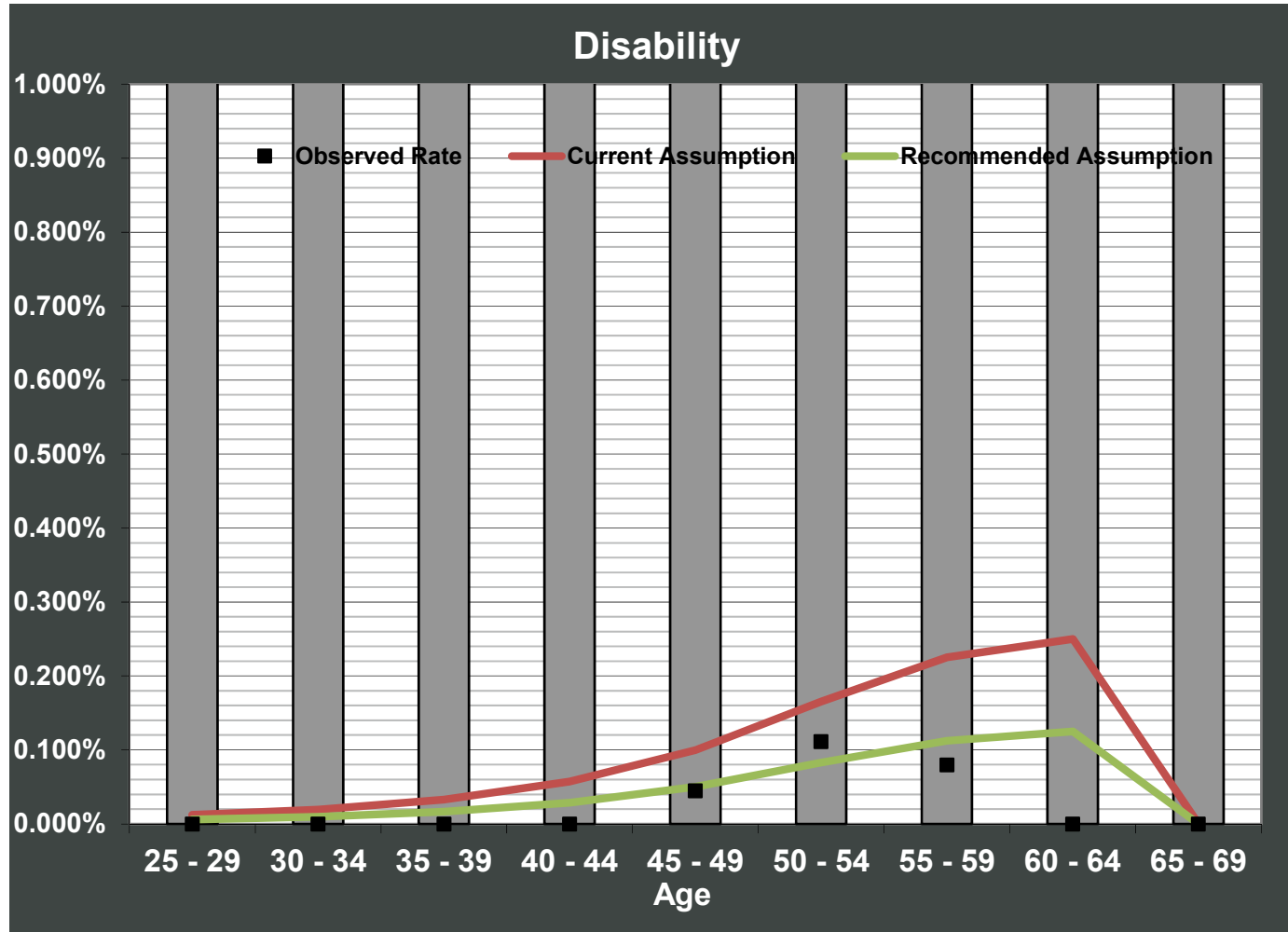
Termination



- Propose service-based termination rates given pattern above. A/E would be 113% under proposed.



- What are the chances that an active participant becomes disabled?
- Current assumption is based on age with higher rates at later ages
- Very few new disabilities reported in past 5 years; low credibility



- Propose reducing rates by 50% to move expectations toward past experience



- How long will participants receive a pension check?
- Current assumption based on RP-2014 with generational improvements using MP-2017
 - RP-2014 did not include any public plan data
- In February 2019, SOA published Pub-2010 mortality tables using public retirement plan experience

Mortality – Healthy Retirees

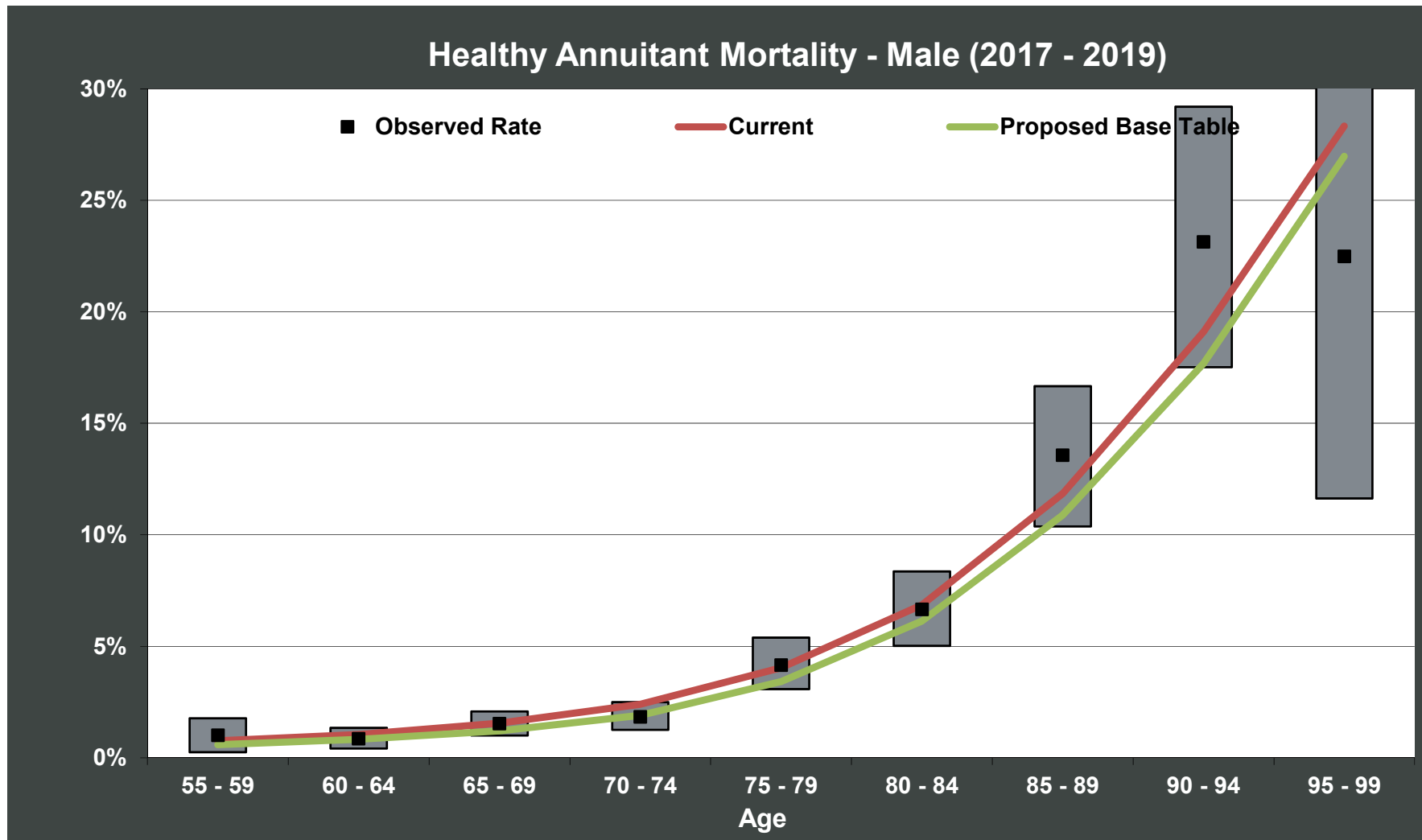


- In total, more healthy annuitants died than expected, especially at older ages
- More in most recent two years!

Headcounts						
	1/1/2017 – 12/31/2019			1/1/2020 – 12/31/2021		
	Actual	Expected	A/E	Actual	Expected	A/E
Males	238	218.0	109%	184	146.4	126%
Females	316	270.9	117%	234	170.0	138%

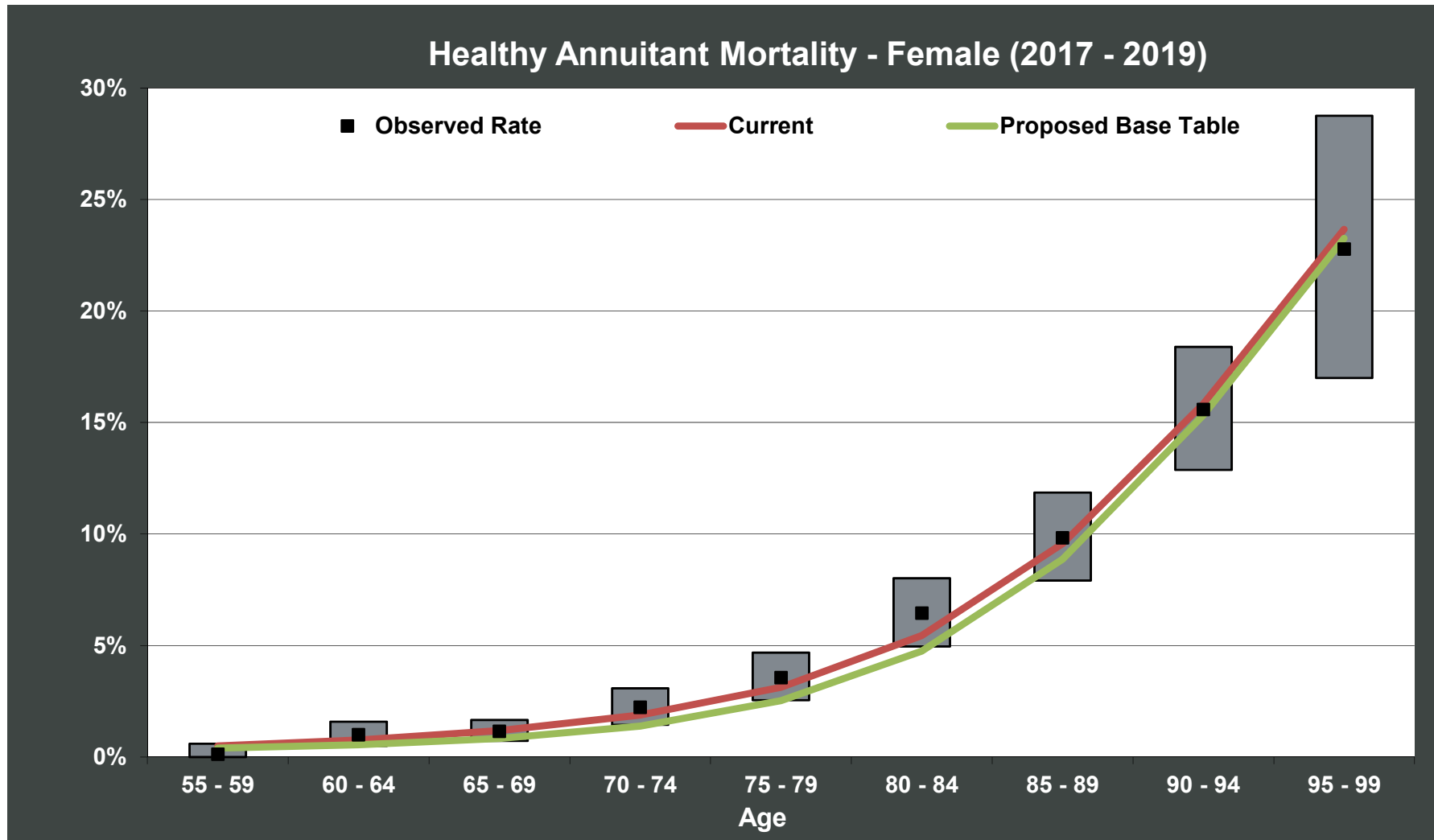
Amounts-Weighted (\$ in millions)						
	1/1/2017 – 12/31/2019			1/1/2020 – 12/31/2021		
	Actual	Expected	A/E	Actual	Expected	A/E
Males	\$ 9.10	\$ 9.13	100%	\$ 7.75	\$ 6.61	117%
Females	7.67	7.17	107%	6.55	5.15	127%

Mortality – Healthy Retirees - Male



Excludes 2020 and 2021 experience

Mortality – Healthy Retirees - Female



Excludes 2020 and 2021 experience



- Proposed best estimate tables are:
 - Pub-2010 General Table for Healthy Annuitants, Employees and Disabled Participants
 - Loading factors
 - 110% for healthy retired male participants
 - 115% for healthy retired female participants
 - 100% for actives and disabled participants
- Propose reflecting generational improvements based on MP-2021
 - Someone who is 50 years old in 2023 will have a higher mortality rate than a 50 year old in 2045



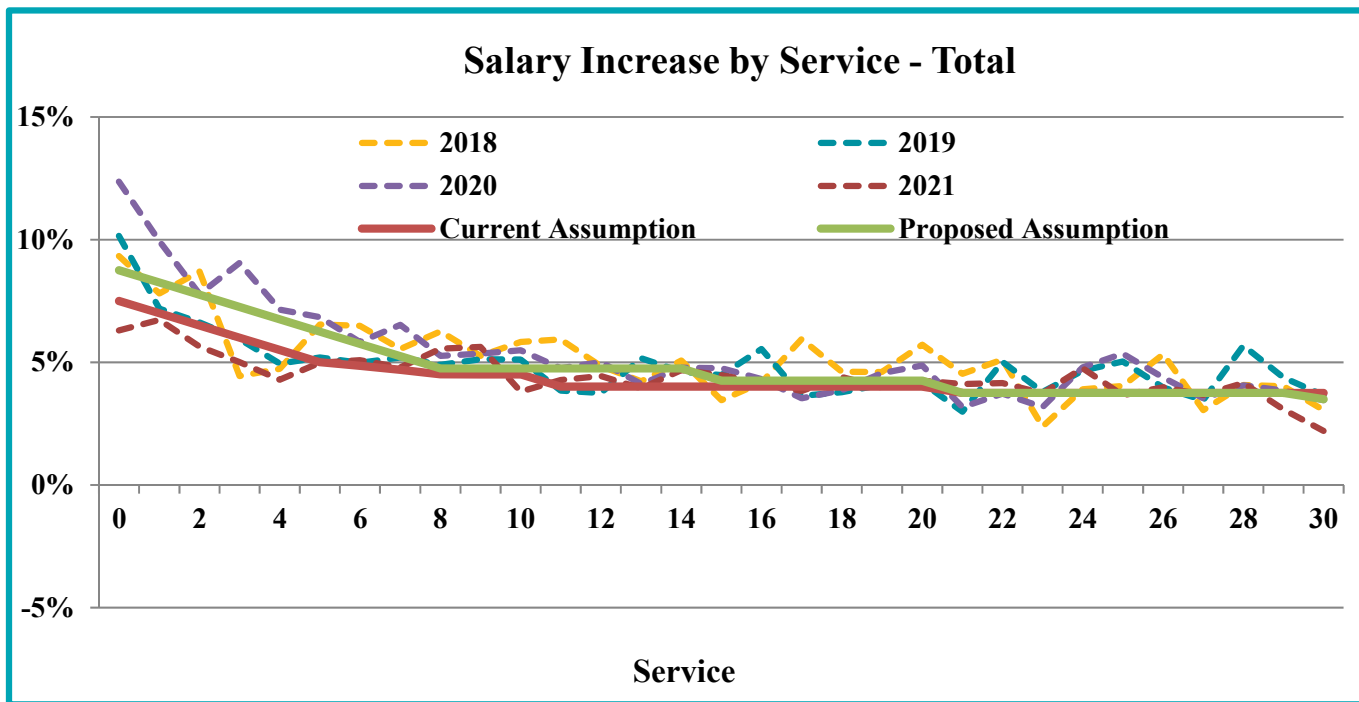
- How would proposed tables compare?

Amounts-Weighted (\$ in millions) 1/1/2017 – 12/31/2019						
	Current			Proposed		
	Actual	Expected	A/E	Actual	Expected	A/E
Males	\$ 9.10	\$ 9.13	100%	\$ 9.10	\$ 7.85	116%
Females	7.67	7.17	107%	7.67	6.29	122%

Salary Increases



- Current assumption based on service
- Small liability losses seen in past 4 years suggesting salaries greater than expected



	A/E Ratio	
	Current	Proposed
2018	100.7%	100.1%
2019	100.4%	99.8%
2020	101.2%	100.6%
2021	99.8%	99.2%
2018-2021	100.5%	99.9%

- Propose slight increases to rates to better align with recent experience



- Percent Married
 - Currently assume 80% are married at retirement/death
 - 36% of retirees have a Spouse Date of Birth on file regardless of form elected
 - Propose lowering assumption to 60% and continue to monitor
- Difference in Spousal Age
 - Currently assume female spouses are 3 years younger
 - Male participant had spouses who were 2.7 years younger
 - Propose maintaining current assumption

Summary of Demographic Assumptions



Demographic Assumption	Current	Proposed
Retirement (Active)	Based on age, service and Group	Based on age, service and Group, but simplify and update to better reflect experience
Retirement (TV)	Assumed to commence benefit at Normal Retirement Age	Same
DROP Election	40% of those retiring elect to participate in DROP	Increase election percentage to 70%
Termination	Based on age and service for first 4 years and then age thereafter	Change to only service-based rates
Disability	Based on age	Reduce to 50% of current assumption; low credibility
Mortality	RP-2014 Mortality projected with generational mortality improvements using MP-2017	Base on Pub-2010G tables adjusted for experience. Use MP-2021 for mortality improvement.
Salary	Based on service	Maintain service-based but increase rates

March 2, 2023

Impact of Demographic Assumptions



Demographic Assumptions	December 31, 2021 Actuarial Liability (\$mil)	December 31, 2021 Funded Status (AVA)	Gross Normal Cost (% of Pay)	City's Actuarially Determined Contribution Rate
Current	\$ 2,560.3	71.6%	12.10%	32.86%
Proposed	\$ 2,595.2	70.6%	12.51%	34.46%



- Current Assumptions
 - Discount Rate is 7.50% (required by CSA)
 - Administrative Expenses: 0.8% of payroll
- Factors to Typically Consider
 - Historical Experience
 - Future Expectations
 - Industry Trends
 - Regulatory / professional standards
 - Plan dynamics
 - Board's risk tolerance / preference
 - Purpose of measurement

Economic Assumptions



Market Value		Market Value	
<u>Plan Year</u>	<u>Return</u>	<u>Plan Year</u>	<u>Return</u>
2005	6.79%	2015	(0.11%)
2006	14.19%	2016	9.24%
2007	7.50%	2017	14.51%
2008	(27.45%)	2018	(3.93%)
2009	18.93%	2019	16.40%
2010	13.11%	2020	8.03%
2011	0.88%	2021	18.06%
2012	12.06%		
2013	16.99%		
2014	6.46%		
Last 5 Years (2017 - 2021)		10.31%	
Last 10 Years (2012 - 2021)		8.58%	
Last 15 Years (2007 - 2021)		6.04%	
Since 2005		6.55%	

Economic Assumptions – Risk Expectations



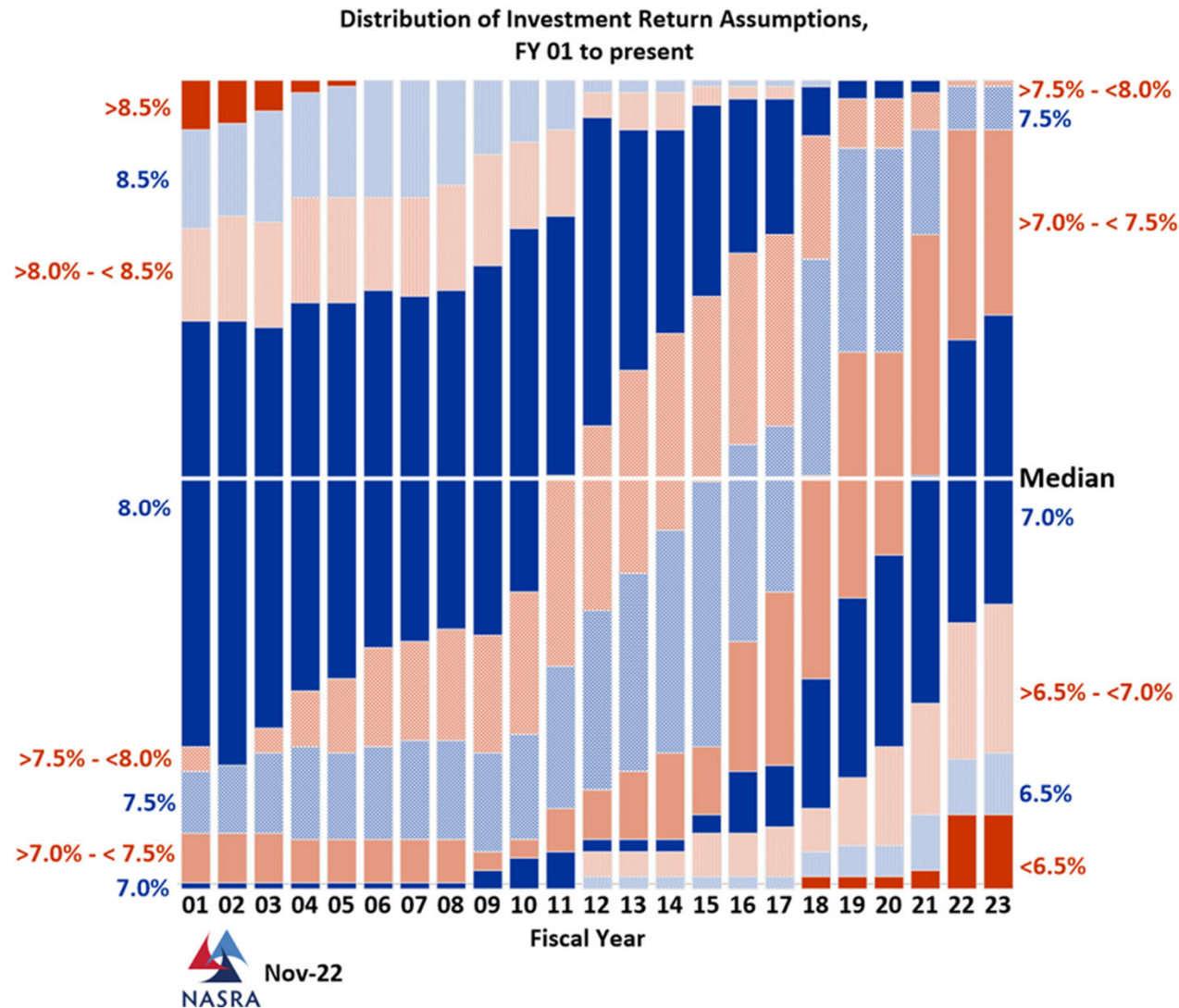
Investment Firm	Expected Geometric Return (10-Year)	Expected Geometric Return (20-Year)	Inflation
Marquette	8.04%	N/A	2.25%
Horizon 2022 Survey	5.21%	5.79%	2.44% (20-Yr)
Callan 2023	6.72%	N/A	2.50% (10-Yr)
Meketa 2023	7.92%	8.49%	2.6% (20-Yr)

Based on the allocations for the Approved portfolio shown by Marquette in its asset allocation study report dated January 25, 2023. We did our best to pair these asset classes with those in each of the other investment firm's capital market assumption reports.

Investment Return – NASRA Average



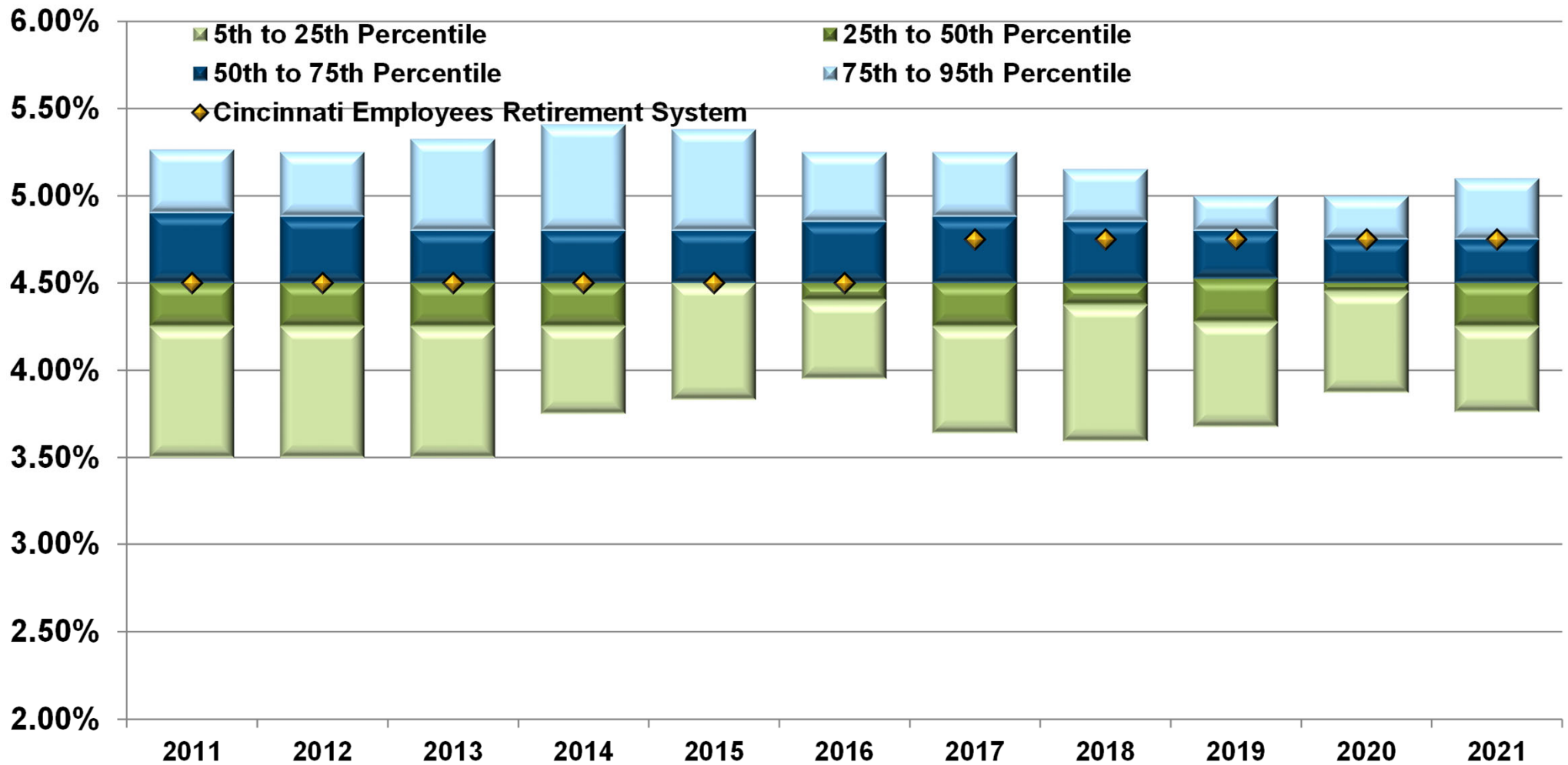
- Since 2009, many plans have reduced their investment return assumption
- The median assumption is now 7.00%
- The number of plans assuming 7.00% or lower has increased significantly



Economic Assumptions – Real Rate

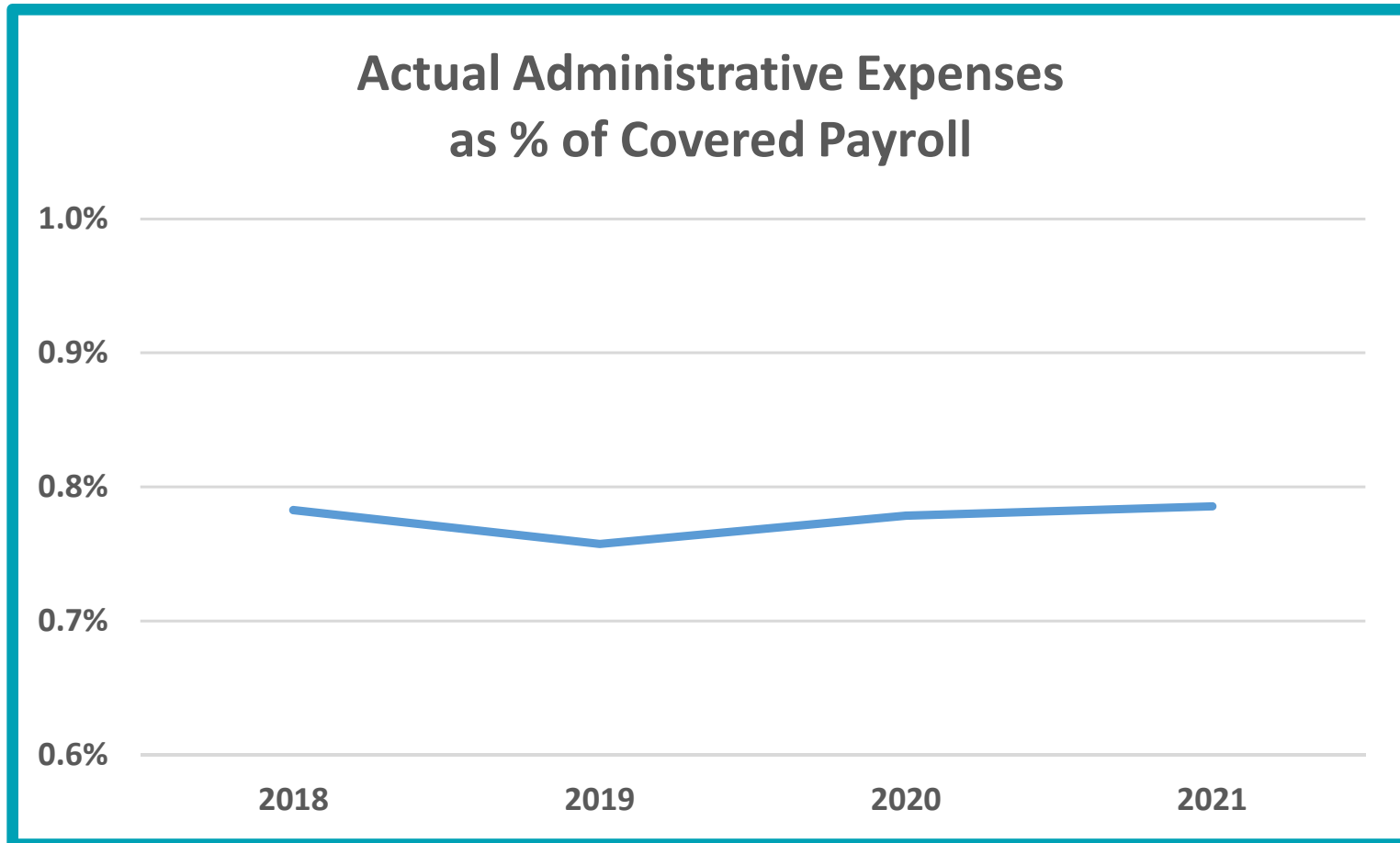


Real Return



Survey Data from Public Plans Data as of 4/15/2022

Administrative Expenses



- Current assumption is 0.80% of covered full time payroll
- Propose no change to assumption

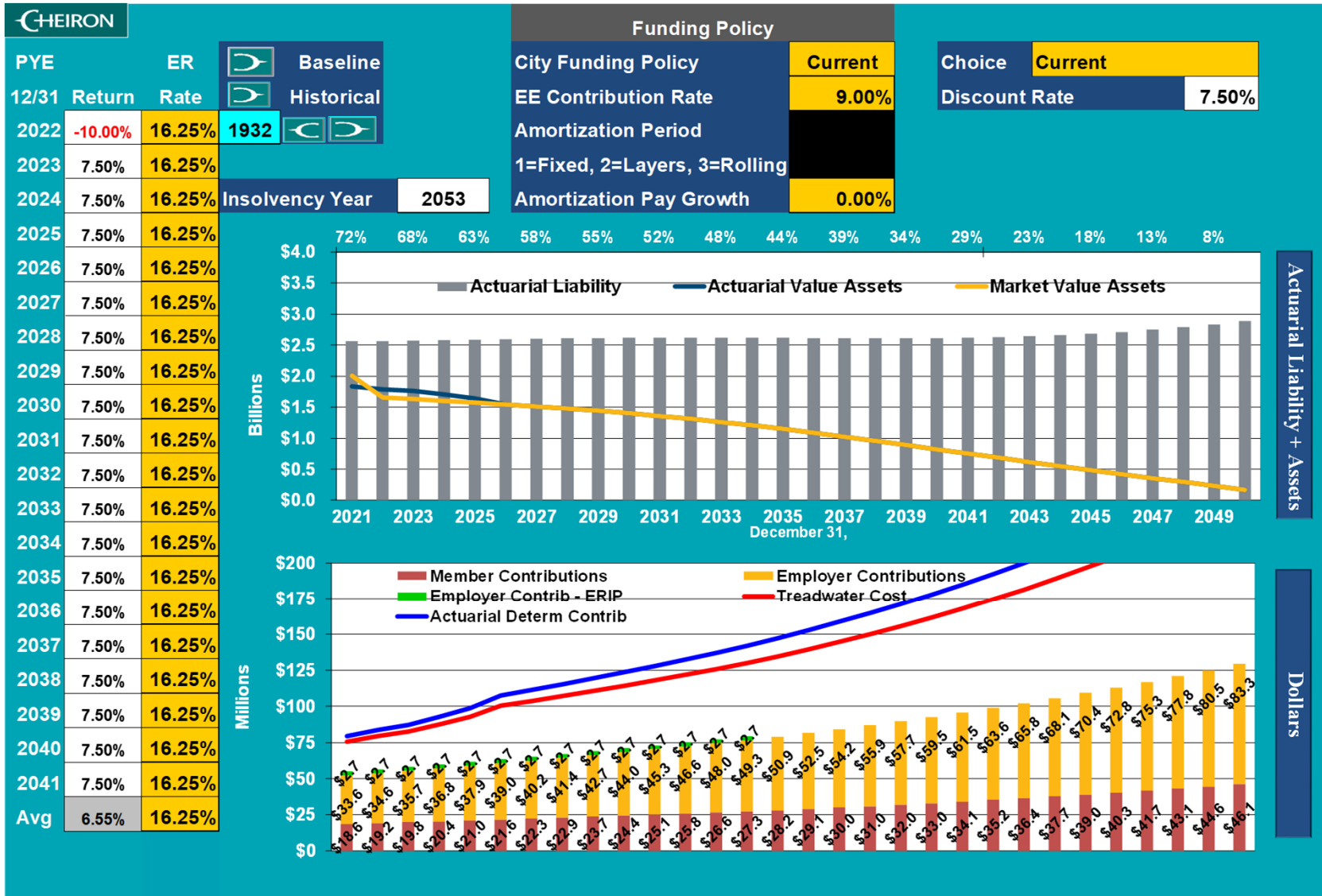
Impact of Economic Assumptions



Demographic Assumptions / Discount Rate*	December 31, 2021 Actuarial Liability (\$mil)	December 31, 2021 Funded Status (AVA)	Gross Normal Cost (% of Pay)	City's Actuarially Determined Contribution Rate
Proposed / 7.50%	\$ 2,595.2	70.6%	12.51%	34.46%
Proposed / 7.25%	\$ 2,657.5	68.9%	13.24%	36.89%
Proposed / 7.00%	\$ 2,722.4	67.3%	14.01%	39.36%

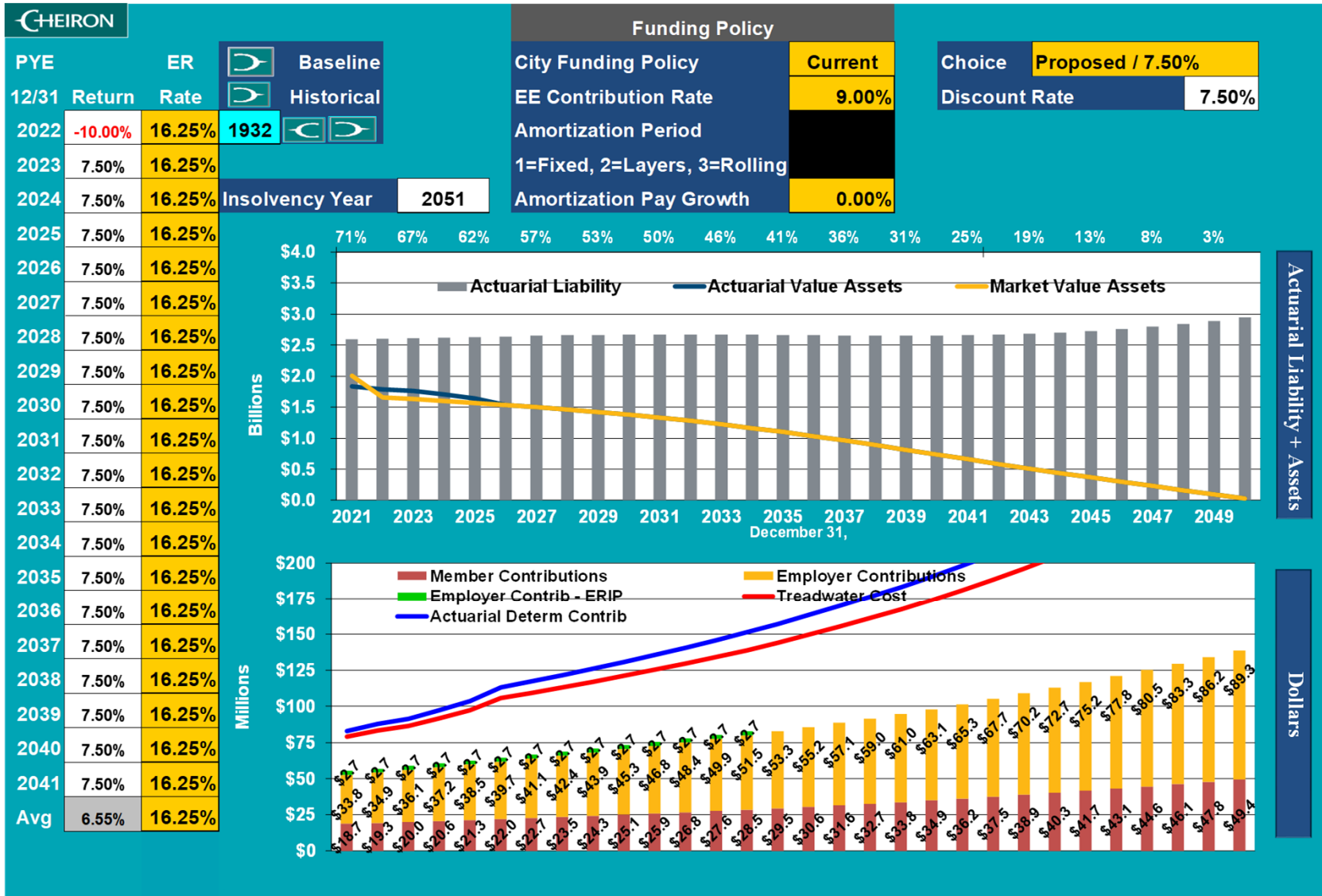
Inflation kept at 2.75% in all scenarios above.

Current Demographic Assumptions; 7.50% Discount Rate



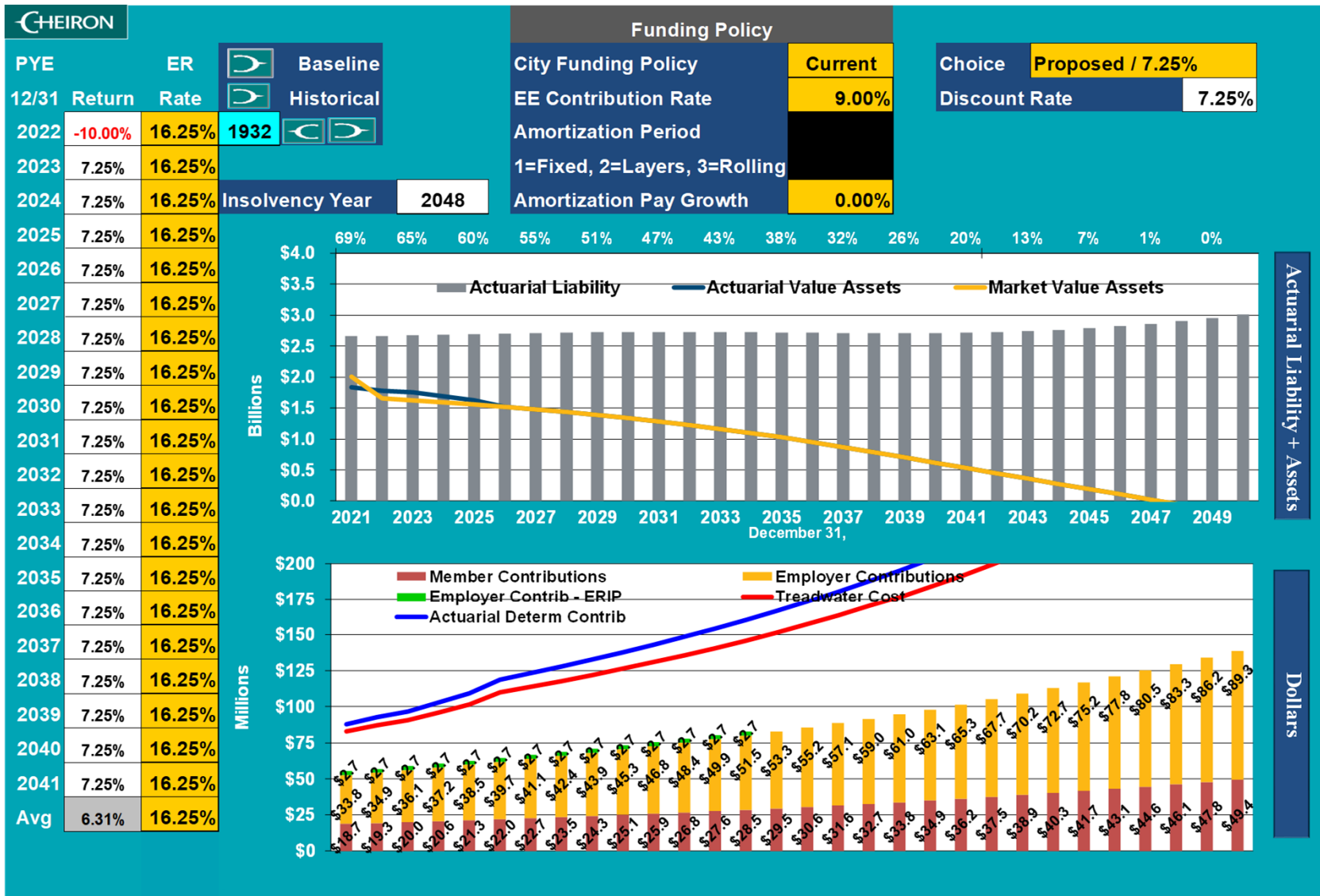
Based on December 31, 2021 valuation results but reflecting a return of -10% for 2022 per City.

Proposed Demographic Assumptions; 7.50% Discount Rate



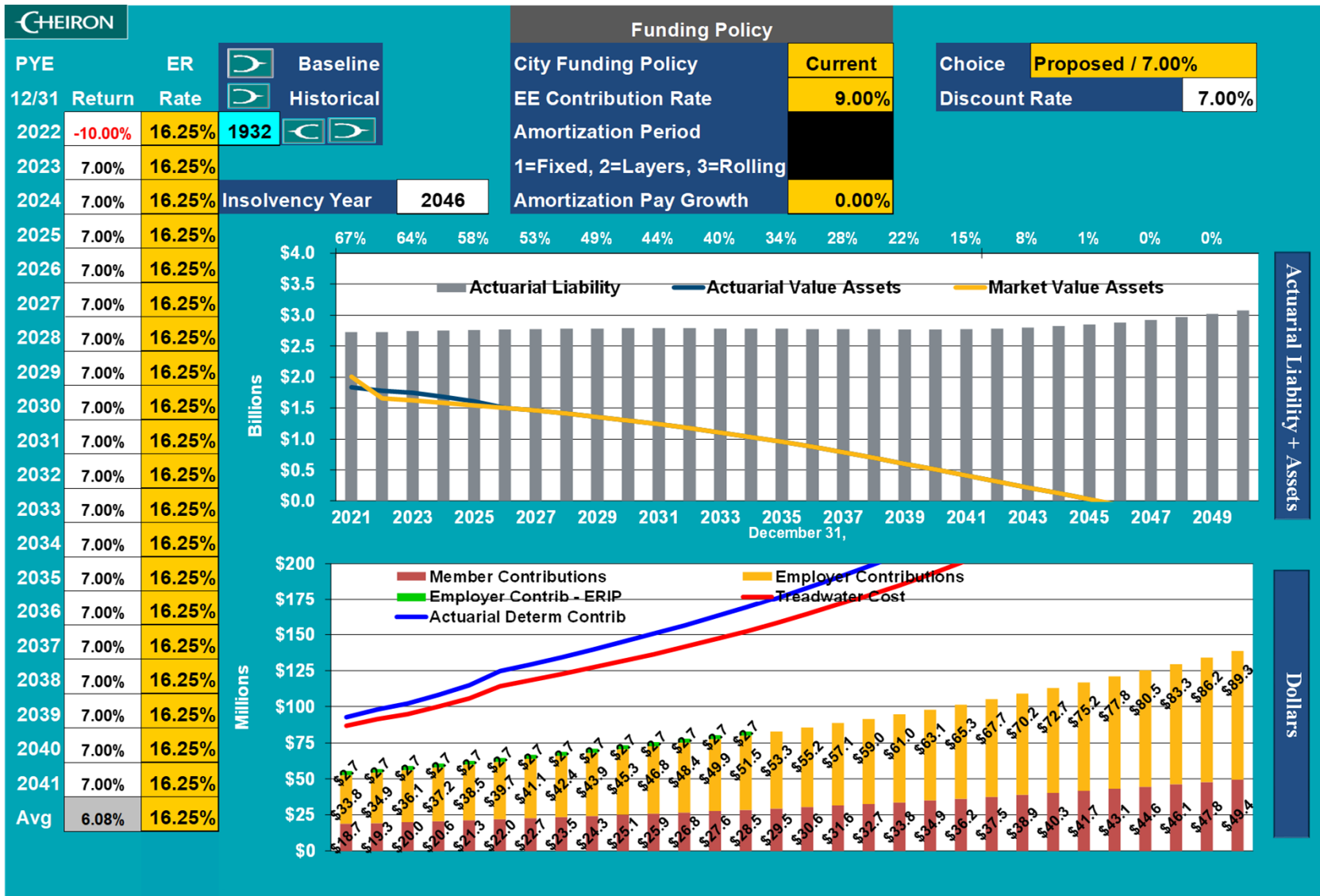
Based on December 31, 2021 valuation results but reflecting a return of -10% for 2022 per City.

Proposed Demographic Assumptions; 7.25% Discount Rate



Based on December 31, 2021 valuation results but reflecting a return of -10% for 2022 per City.

Proposed Demographic Assumptions; 7.00% Discount Rate



Based on December 31, 2021 valuation results but reflecting a return of -10% for 2022 per City.



- ASOP 4: Measuring Pension Obligations and Determining Pension Plan Costs or Contributions
- Revised ASOP 4 is effective for measurement dates on or after February 15, 2023
- First effective for CRS with the December 31, 2023 valuation

Revised ASOP 4 – Changes



- Major changes include:
 - Low-Default-Risk Obligation Measure (LDRROM)
 - Disclose a Reasonable Actuarially Determined Contribution (ADC)
 - Assess Implications of Funding Policy (current valuation report already includes this)

- For funding valuations, actuary must calculate and disclose a Low-Default-Risk Obligation Measure (LDROM)
 - Discount rate(s) “derived from low-default-risk fixed income securities whose cash flows are reasonably consistent with the pattern of benefits expected to be paid in the future” such as
 - US Treasury yields
 - Yields on highly rated corporate or municipal bonds

- Difference between LDRROM and Actuarial Liability can be viewed as:
 - The expected reduction in taxpayer cost from investing in a diversified portfolio, or
 - The expected cost of eliminating investment risk

Disclose a Reasonable ADC



- Actuarially Determined Contribution is reasonable if:
 - All significant assumptions selected by the actuary are reasonable
 - All significant prescribed assumptions or methods set by another party do not significantly conflict with actuary's professional judgement
 - Amortization method is consistent with ASOPs
 - Asset valuation method is consistent with ASOPs
 - Funding policy should be consistent with the plan accumulating assets adequate to make benefit payments when due

The purpose of this presentation is to present the results of the 2022 experience study for the Cincinnati Retirement System and to recommend assumptions for future valuations. This presentation is for the use of the Cincinnati Retirement System in selecting assumptions for ongoing actuarial valuations.

In preparing our presentation, we relied on information, some oral and some written, supplied by the Cincinnati Retirement System. This information includes, but is not limited to, the plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23, Data Quality.

The results of this presentation rely on future plan experience conforming to the underlying assumptions and methods outlined in this presentation. To the extent that the actual plan experience deviates from the underlying assumptions and methods, or there are any changes in plan provisions or applicable laws, the results would vary accordingly.

Cheiron utilizes and relies upon ProVal, an actuarial valuation software leased from Winklevoss Technologies for the intended purpose of calculating liabilities and projected benefit payments. As part of the review process for this presentation, we have performed a number of tests to verify that the results are reasonable and appropriate. We are not aware of any material inconsistencies, unreasonable output resulting from the aggregation of assumptions, material limitations or known weaknesses that would affect this presentation. This presentation includes deterministic projections of future contributions, assets, and funded status for the purpose of assisting the Board and CRS staff with the management of the System. We have used Cheiron's *P-Scan* model to develop these projections. The model is also used to stress test the impact of volatile asset returns over the projection period. The *P-Scan* projection uses standard roll-forward techniques that implicitly assume a stable active population. Changes in the demographic characteristics of the active population will lead to different results.

This presentation and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices and our understanding of the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board as well as applicable laws and regulations. Furthermore, as credentialed actuaries, we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this presentation. This presentation does not address any contractual or legal issues. We are not attorneys and our firm does not provide any legal services or advice.

This presentation was prepared exclusively for the Cincinnati Retirement System for the purpose described herein. Other users of this document are not intended users as defined in the Actuarial Standards of Practice, and Cheiron assumes no duty or liability to such other users.

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