

Actuarial Assumptions & Methods

Part Two

OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

July 26, 2013

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Agenda

- Recommendation on cost allocation method
- Discussion of shortfall amortization
- Recommendation on rate collar method
- Review of investment return assumption
- Overview of other recommended assumptions
 - Demographic
 - Economic

Two-Year Rate-Setting Cycle

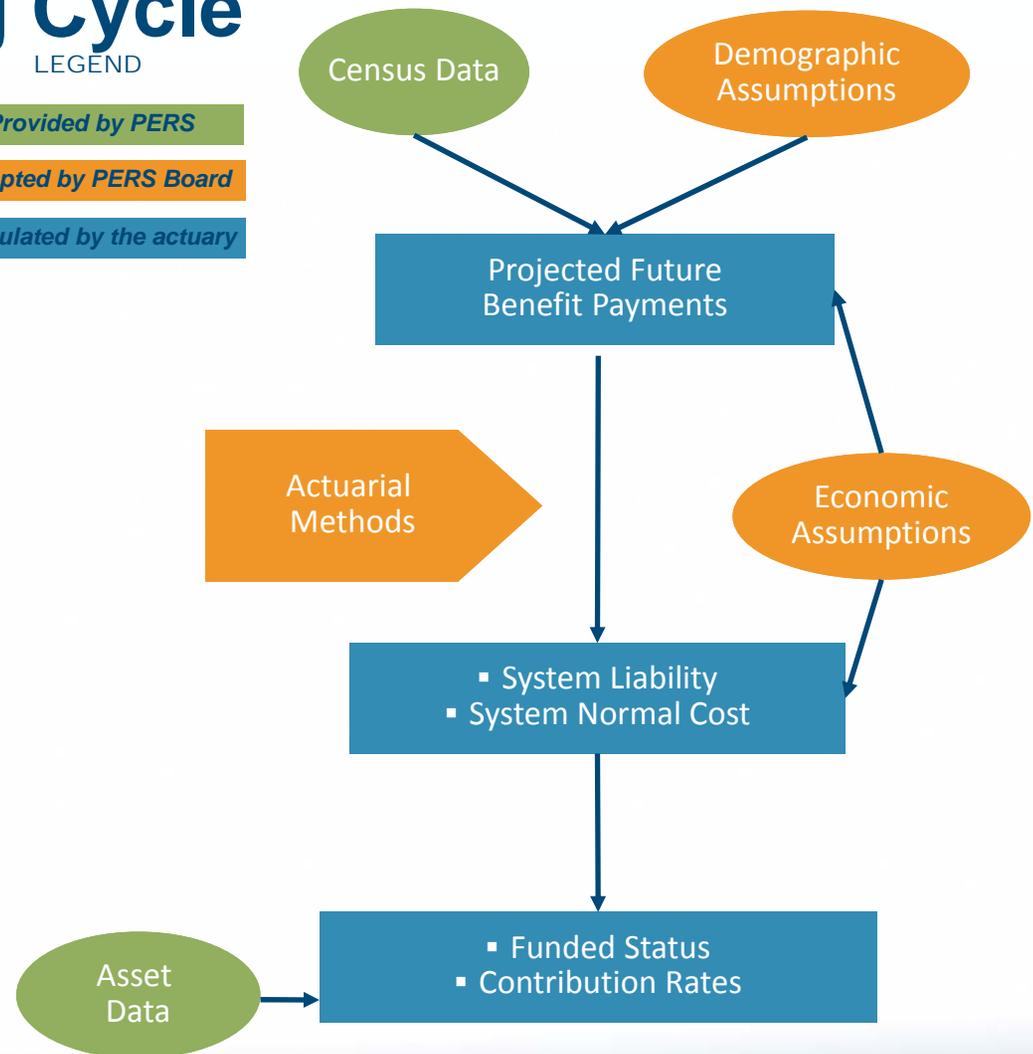
LEGEND

Provided by PERS

Adopted by PERS Board

Calculated by the actuary

- July 2013: Assumptions & methods endorsed by Board in consultation with the actuary
- September 2013: System-wide 12/31/12 “advisory” actuarial valuation results
- November 2013: Advisory 2015-2017 employer-specific contribution rates
- July 2014: System-wide 12/31/13 “rate-setting” actuarial valuation results
- September 2014: Disclosure & adoption of employer-specific 2015-2017 contribution rates



Objectives for Actuarial Methods & Assumptions

- Transparent
- Predictable and stable rates
- Protect funded status
- Equitable across generations
- Actuarially sound
- GASB compliant



Some of the objectives can compete with each other, particularly in periods with significant investment return volatility.

Overall system funding policies should seek an appropriate balance between competing objectives.

The Fundamental Cost Equation

- Long-term program costs are the contributions, which are governed by the “fundamental cost equation”:

$$\begin{aligned} & \textit{BENEFITS} = \\ & \textit{EARNINGS} + \\ & \textit{CONTRIBUTIONS} \end{aligned}$$



Governance Structure

- Benefits: Plan design set by Legislature
- Earnings: Asset allocation set by Oregon Investment Council (OIC); actual returns determined by market
- Contributions: Funding, methods & assumptions set by PERS Board
 - Since contributions are the balancing item in the equation, PERS Board funding policies primarily affect the **timing** of contributions
 - Different actuarial methods and assumptions produce different expected contribution patterns



Alternative Proposed Rate Setting Approach

- The assumptions and methods set this year will guide the employer rate calculations for the 2015-2017 biennium
- Today we will analyze the policy used for 2013-2015 employer rates versus an alternative recommended policy that:
 - *Calculates liabilities using the entry age normal (EAN) actuarial cost allocation method*
 - *Considers re-amortizing all accumulated 12/31/2013 Tier 1/Tier 2 shortfall over 20 years*
 - *Modifies the rate collar structure by having the double rate collar grade in from 70% to 60% funded status*
- The policy comparison includes a stress test under a wide variety of potential future investment return scenarios

Actuarial Cost Allocation Method

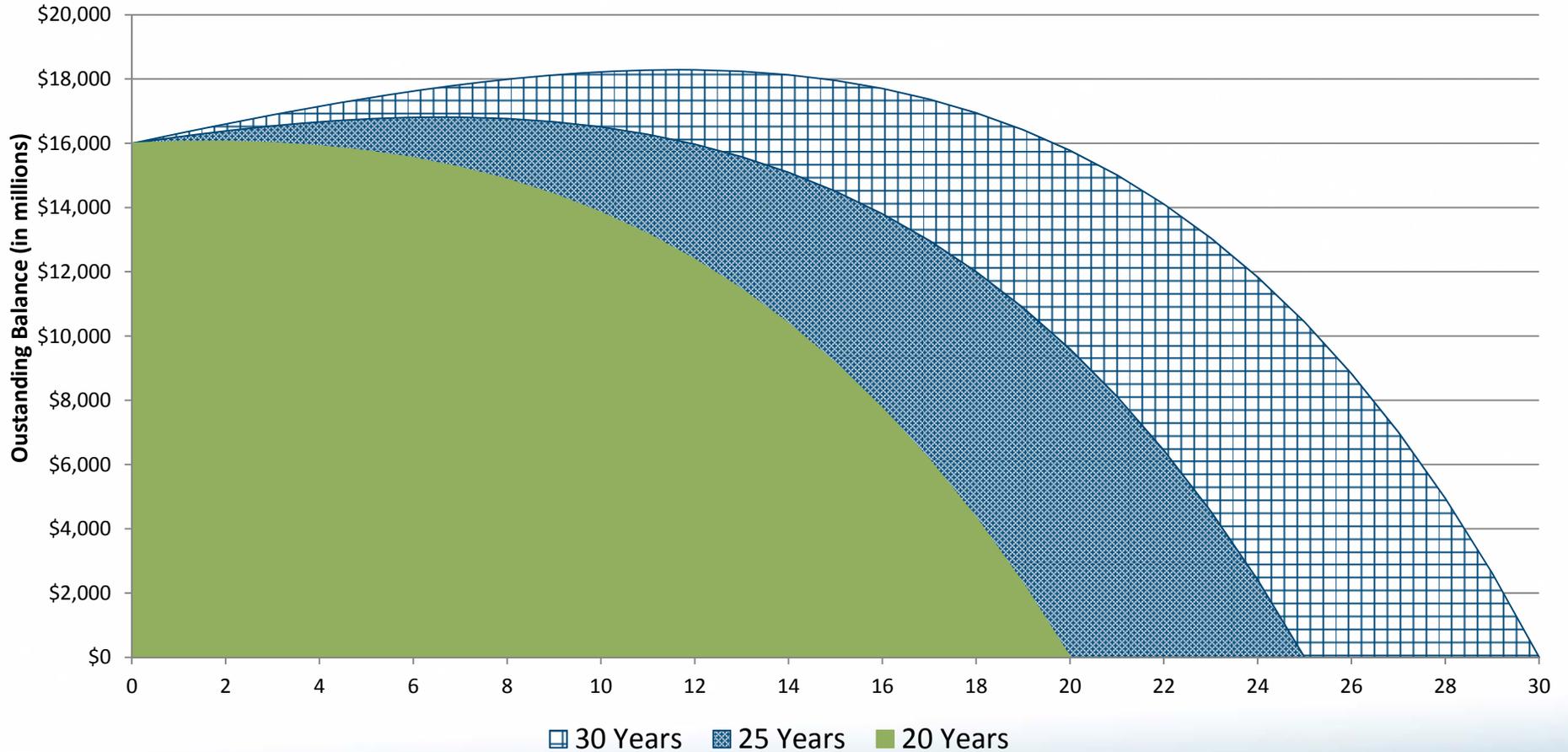
- Rates are calculated to pre-fund retirement benefits during a member's working career if all assumptions are met
- The division between past, current & future service is done through use of an actuarial cost allocation method
- We are recommending a change to the entry age normal (EAN) method from the projected unit credit (PUC) method
- Rationale:
 - EAN is required by GASB for financial reporting starting next year
 - Using EAN for contribution rates will avoid having two sets of numbers
 - EAN provides a reasonable proxy of the annual economic value of benefit costs as a level percentage of payroll

Shortfall Amortization

- A key part of contribution rate calculations is amortization of Tier 1 / Tier 2 shortfalls over twenty years as a level percentage of payroll
 - Current policy has been in place for the last three rate-setting valuations
 - The 12/31/2013 rate-setting valuation will have Tier 1/Tier 2 shortfall amortization bases ranging from 14 to 20 years remaining
- Recent funding policy guidance recommends periods of twenty years or less for amortizations of most shortfall sources as a best practice
- Twenty years avoids significant negative amortization, where shortfall actually increases in the initial “pay down” years even if assumptions are met and contributions are made
 - The following slide illustrates pay down of a \$16 billion shortfall over periods of 20, 25 or 30 years at current assumptions

Shortfall Amortization

UAL Balance by Amortization Period
Level % of Pay, 8.0% interest, 3.75% salary growth



Shortfall Amortization

- The recommended change to EAN creates a near-term increase to uncollared contribution rates compared to current policy
 - A decrease in the investment return assumption (discussed in the next section) would create an additional uncollared rate increase
 - Increases in the 2015-2017 base rate actually charged to employers can be managed via application of the rate collar
- With these changes, the board could also consider re-amortizing all existing Tier 1/Tier 2 shortfall as of 12/31/2013 over twenty years
 - Decision is a trade-off between two objectives: predictable and stable rates and protect funded status
 - Provides partial mitigation of rate hikes due to assumption and method changes
 - Limiting amortization period to twenty years avoids negative amortization

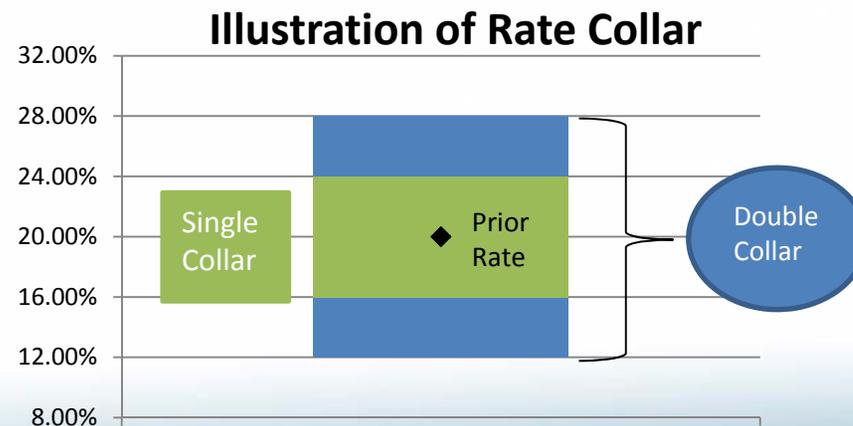
Rate Collar

- Period to period changes in base employer contribution rates are limited to a range defined by the “rate collar”
- After a downturn, the difference between the current contribution rate and the updated actuarially calculated rate may be large
 - The collar spreads actuarially needed increases across several periods
- The collar’s current design includes a “double collar” feature that widens the collar’s width, and thus the maximum permissible rate change, when funded status* falls below 80%

* Excluding side accounts

Rate Collar

- The rate collar's current design is shown below
 - The maximum change typically permitted by the collar is:
 - 20% of the rate currently in effect (3% of payroll minimum collar width)
 - If funded status is 70% or lower, the width of the collar doubles
 - 40% of rate currently in effect (6% of payroll minimum collar width)
 - If the funded status is between 70% and 80%, the collar size is pro-rated between the initial collar and double collar level



Rate Collar

- Our projection model indicates that rate increases will likely continue over the next few biennia if actual post-2012 investment returns fail to exceed assumption
- Beginning in 2017-2019, system average base rates (excluding IAP contributions and before reflecting the effects of side account rate offsets) are projected in the low-to-mid 20s as a percentage of payroll at median investment return forecast
 - At that level, a “single collar” increase would be in excess of 4% of payroll
- In most foreseeable scenarios, increases of 4%+ would restore funded status over time
 - Only the worst scenarios modeled would require larger increases

Rate Collar

- As such, we recommend modifying the “grade in range” for the double collar feature from 80%-70% downward to 70%-60%
- Such a change involves trade-offs, as it modifies the equilibrium between competing policy objectives
 - Predictable and stable rates
 - Protect funded status
- The rate collar only comes into effect after investment returns deviate significantly from assumption
 - Trade-offs of collar modifications are assessed using a stress test analysis with a wide variety of possible future investment returns
- In combination with the other recommended changes, the risk profile for the system is not materially modified by the proposed changes

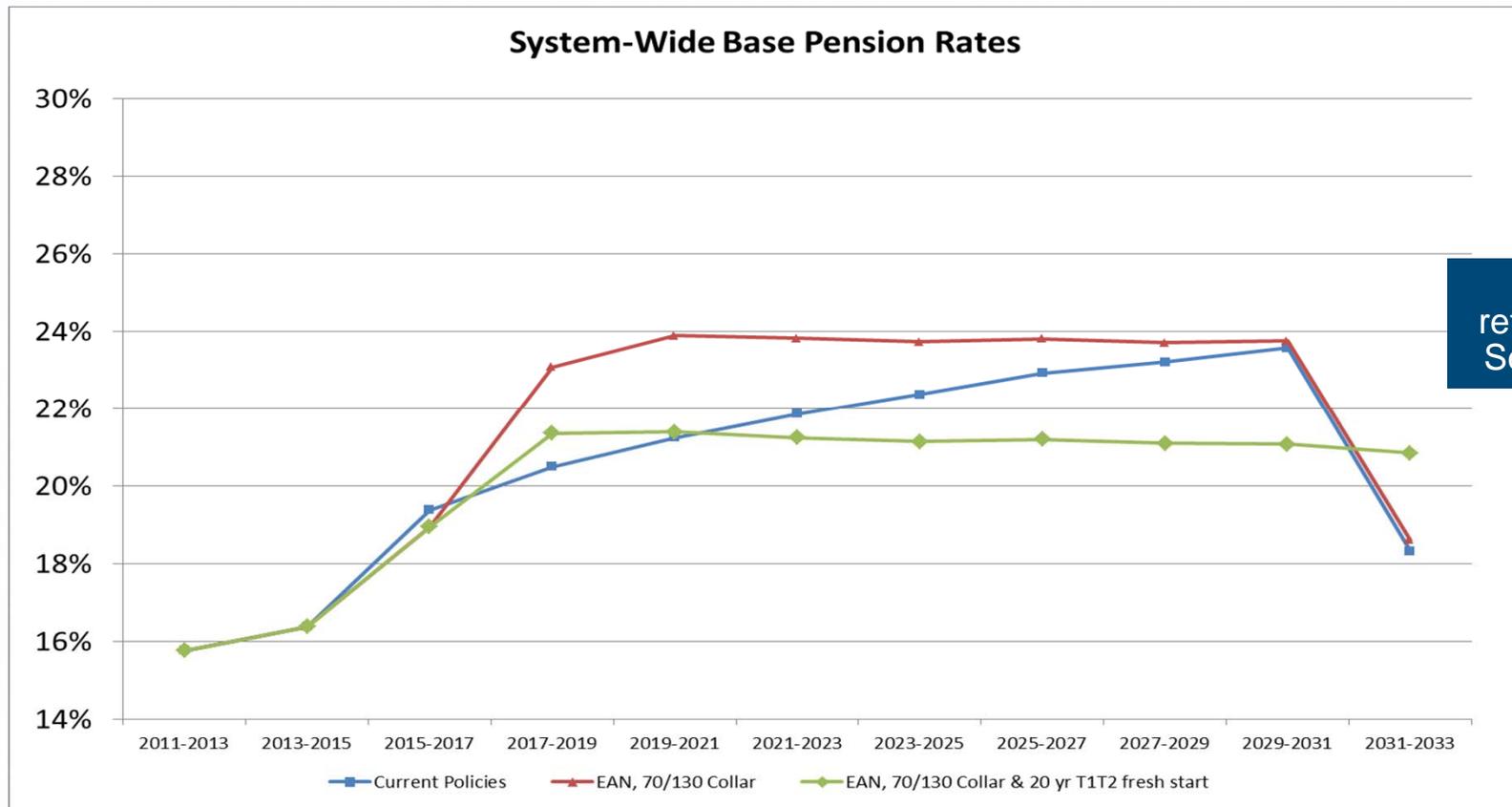
Analysis of Recommended Changes

Models and Inputs

- Policies can be compared with either a fixed return assumption or with a stochastic model that varies investment returns from year to year
- Modeling uses 12/31/2011 liabilities and assumptions, with **liabilities recalculated to reflect SB 822 changes**
- Modeling uses 12/31/2012 assets based on Board crediting decisions, and target investment policy selected by the OIC
- Modeling assumes 8% return assumption remains in place for duration of modeling period
- The model's results are a probability range instead of a single amount
 - The distribution is based on a stochastic simulation using 1,000 trials
 - Economic scenarios were developed by our national team that specializes in capital market models, and uses the OPERF asset allocation policy

Analysis of Recommended Changes

- Comparison of policies under an 8.00% assumed return with 7.50% fixed actual asset return



Modeling assumes 8% valuation assumption used for duration of projection

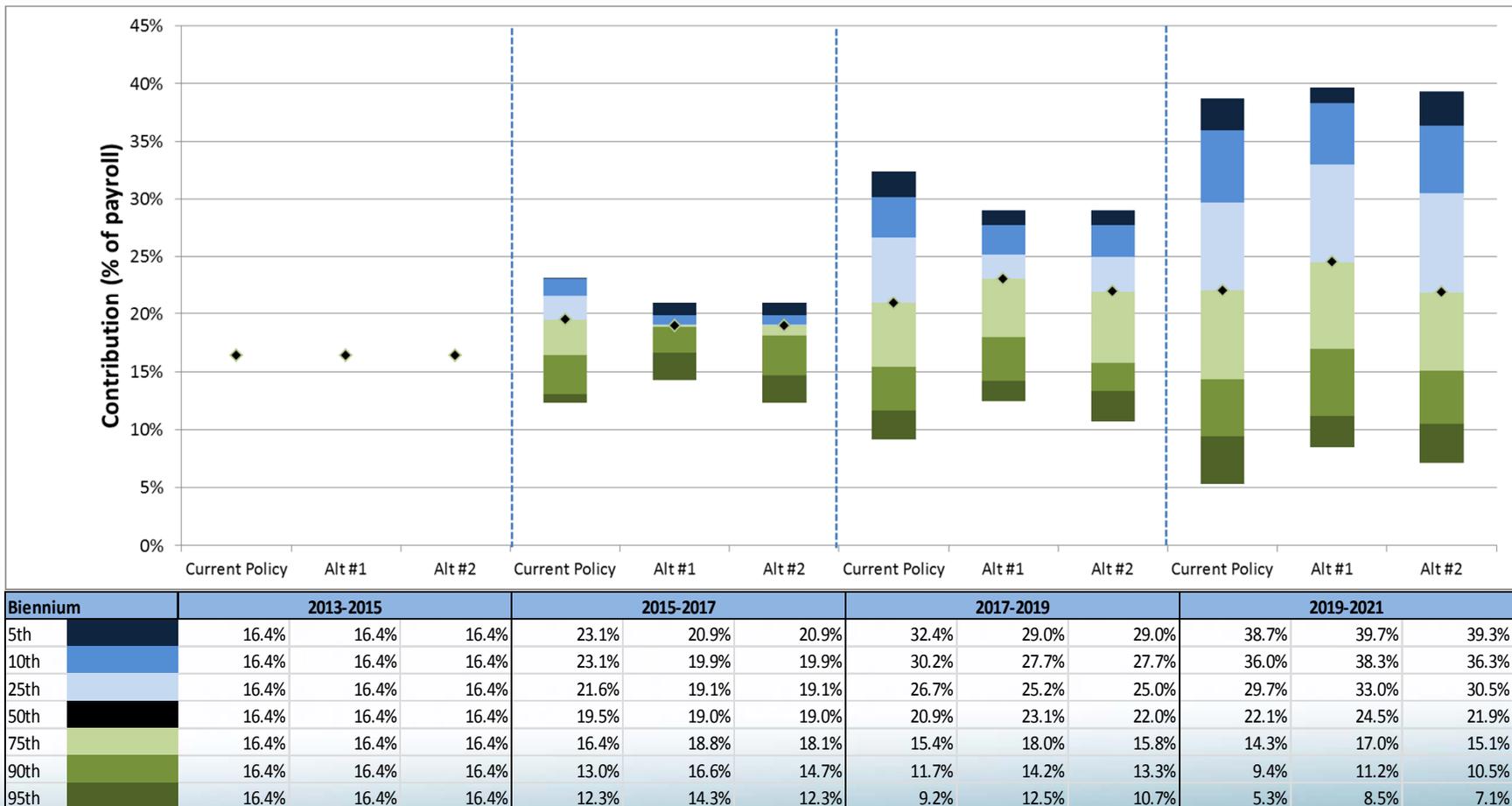
Analysis of Recommended Changes

- A stochastic “stress test” allows assessment of the likelihood of certain events in the 1,000 scenarios modeled
 - Effect of policy changes on these probabilities can be instructive
- The stress test model’s probability of specified events occurring at some point during the 20-year projection period under both current and alternative policies is shown below

Likelihood of Event	Current Policy	Alternative #1: EAN & Move Collar Threshold	Alternative #2: EAN, Move Collar & 20 Year Re-amortization
Funded Status < 60%	49.4%	50.6%	53.7%
Funded Status < 40%	12.4%	11.8%	14.6%
Base Rate >30% of Pay	54.3%	56.5%	52.6%

Analysis of Recommended Changes

- System average collared pension base rates with an 8% investment return assumption under 1,000 possible investment return scenarios



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Long-Term Investment Return Assumption

Uses of the Investment Return Assumption

- Uses of the long-term investment return assumption
 - As a “discount rate” for establishing the:
 - The actuarial accrued liability, which is a net present value
 - The associated unfunded actuarial liability, also called the UAL or actuarial shortfall
 - Guaranteed crediting level for regular Tier 1 active member account balances
 - Annuitization rate for converting member account balance to lifetime monthly Money Match benefits



Reflecting expectations for both investment earnings and benefit levels for certain members, the assumption helps set an appropriate glide path for employer contribution rates

Return Assumption and the Shortfall

- At the 8% investment return assumption, money in hand today is forecast to be insufficient to fully satisfy member benefit promises allocated to service already completed
- In present-day dollars, the shortfall is the \$16 billion unfunded accrued liability (UAL) in the 12/31/2011 actuarial valuation
- \$16 billion is prior to adjustment for:
 - SB 822 benefit changes,
 - 2012 investment returns in excess of assumption,
 - A change to the EAN cost allocation method, or
 - Any downward adjustment to the investment return assumption

Guidance to Set the Return Assumption

Given that we do not know what the fund will earn in the future, how should we proceed?

- Prudently select a best estimate
- Solicit forecasts from investment professionals
- Recognize that hoping for a result does not make it happen; the assumption does not affect actual investment returns
- Don't be myopic --- the objective is to make a sound 20-year estimate, not to get a single individual year right
- Neither ignore historical results nor be 100% beholden to them
- Since actual results will vary from assumption, review the forecasts' probability ranges and consider a margin for variance

Investment Return 20-Year Forecasts

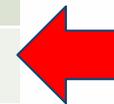
- To assist the Board, we have 20-year annualized return forecasts from two professional advisors
 - Strategic Investment Solutions (SIS)
 - Milliman
- Forecasts do not reflect any “alpha” due to managers potentially outperforming their peers and market benchmarks
- SIS consults to the Oregon Investment Council (OIC)
 - SIS provided us with their market outlook assumptions, which we placed into an industry standard mean/variance model
- Today’s speakers are not credentialed investment advisors
 - We are presenting results based on market outlook assumptions developed by Milliman’s credentialed investment professionals



Investment Return 20-Year Forecasts

- Forecasts are based on OIC target long-term asset allocation, and have been updated to reflect June 2013 OIC target changes
 - Current actual allocation differs somewhat from the target allocation

Percentile	Milliman	SIS
25 th	5.64%	5.61%
35 th	6.46%	6.49%
45 th	7.21%	7.28%
50th	7.57%	7.66%
55 th	7.93%	8.05%
65 th	8.68%	8.85%
75 th	9.53%	9.75%



50th percentile using OPERF's actual 5/31/2013 allocation produces 7.52% with Milliman assumptions

- In our opinion, the assumption should be lowered based on the data from the investment forecasts and review of the guiding principles

Effects of Lowering the Return Assumption

- For many employers, an assumption change does not affect the forecasted 2015-2017 base contribution rate
 - The combined effects of the downturn and the 2013-2015 cost increase deferral mandated by SB 822 means that the rate collar will likely set the 2015-2017 rate for many employers
- An assumption change does affect the forecast long-term (20 year) contribution rate to restore the system funded status
- The return assumption identifies the projected cruising altitude of contribution rates, but the rate collar sets the climb's steepness --- and rates are still ascending
- An assumption change decreases long-term costs by lowering future projected Money Match benefits



Effects of Lowering the Return Assumption

- A lower investment return assumption would produce higher reported liabilities and “cruising altitude” contribution rates
 - Modifies the forecast balance of the fundamental cost equation from earnings to contributions, so current assets are not assumed to cover as high a fraction of projected benefits
 - Effect of lowering the rate to 7.5% was previously estimated in November 2012 as a 3.0% of payroll increase in uncollared base rate
 - Lowering the return assumption to 7.75% would have approximately half as much rate impact --- 1.5% of payroll based on the November
 - SB 822 decreased plan liabilities since that estimate was made by 4%-5%
- For PERS, such a change would also lower benefits for future retirements calculated under Money Match as illustrated on the next slide

Effects of Lowering the Return Assumption

- Lowering the assumed rate from 8.0% to either 7.75% or 7.50% would affect the Money Match calculation for a member age 59 ½ with a \$135,000 member account balance as of 6/30/2013 as shown

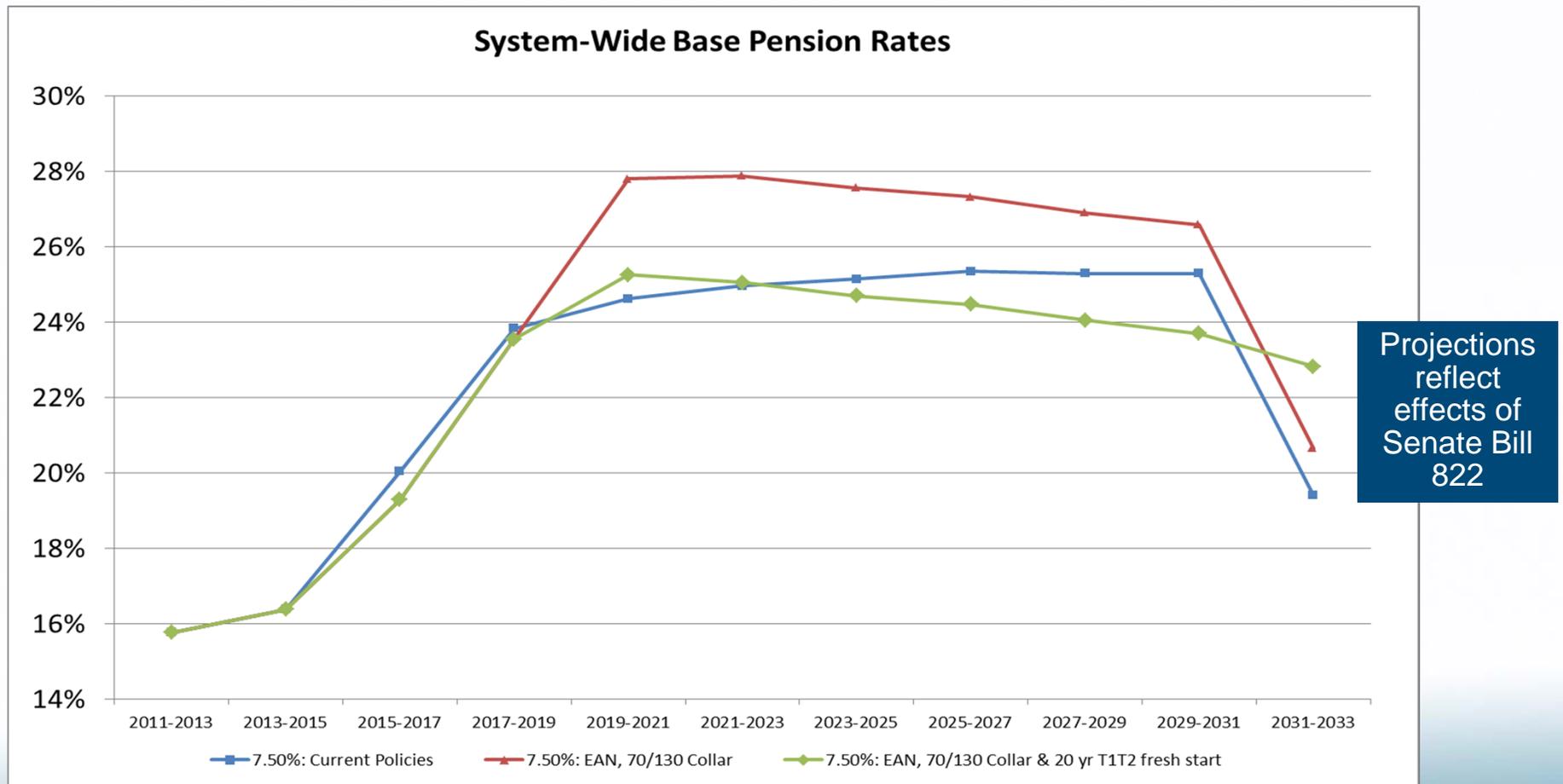
Benefit Commencement	7/1/2013	12/1/2013	1/1/2014	3/1/2014
Assumed Rate	8.00%	8.00%	7.75%	7.75%
Starting Benefit	\$2,093	\$2,172	\$2,144	\$2,176

Benefit Commencement	7/1/2013	12/1/2013	1/1/2014	6/1/2014
Assumed Rate	8.00%	8.00%	7.50%	7.50%
Starting Benefit	\$2,093	\$2,172	\$2,099	\$2,177

- At a 7.75% rate it would take about three months without retirement for the December 2013 initial benefit level to be reached
 - At 7.50%, it would take about six months

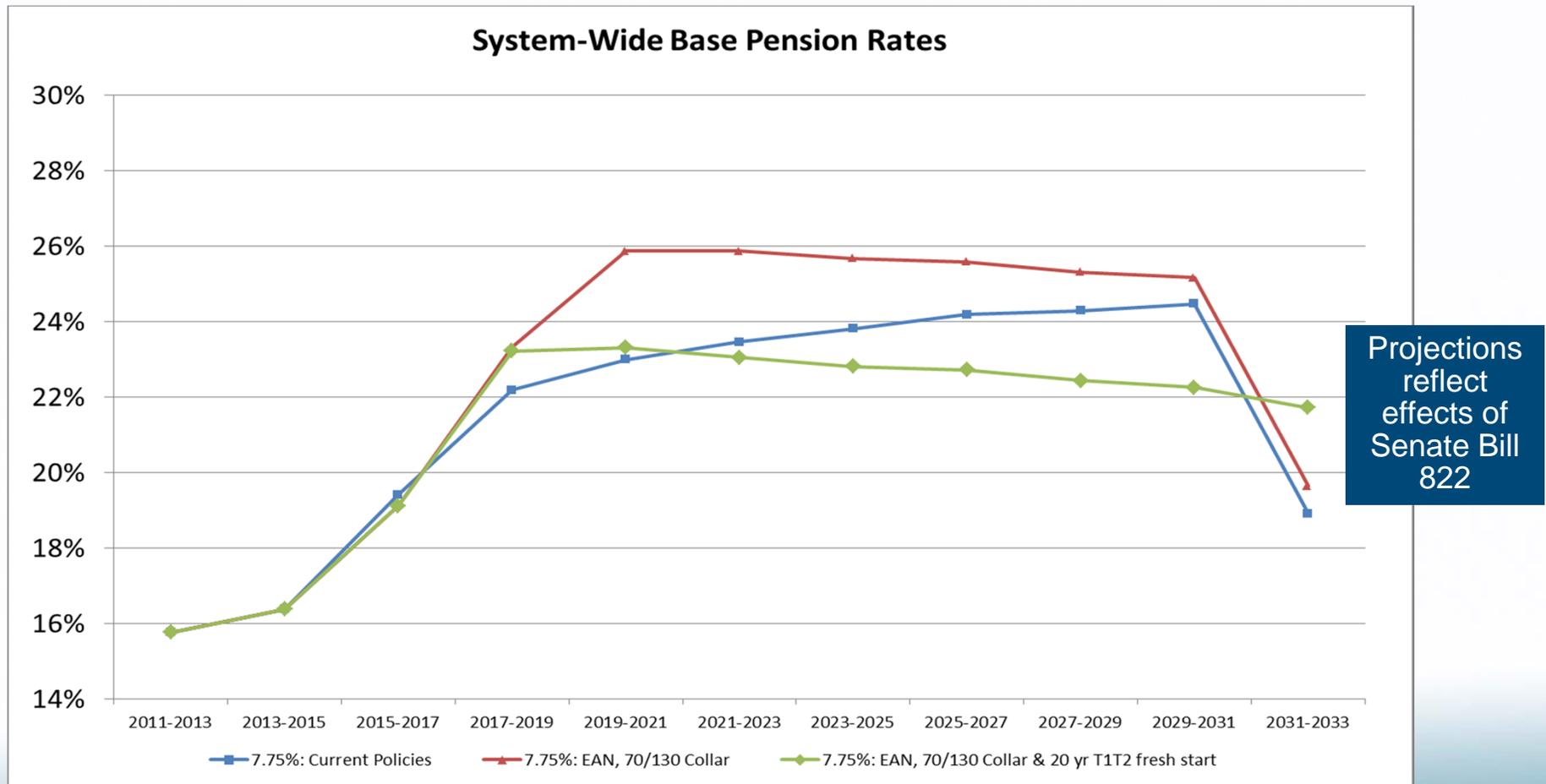
Effects of Lowering the Return Assumption

- Comparison of policies under a 7.50% assumed return with 7.50% fixed actual asset return



Effects of Lowering the Return Assumption

- Comparison of policies under a 7.75% assumed return with 7.50% fixed actual asset return



Overview of Other Recommended Assumptions

Other Recommended Assumptions

- We have statistically analyzed census data provided by PERS
 - Four years of data for most assumptions
 - Eight years of data for salary increases
- Recommended demographic assumptions were developed based on the statistical analysis
- With very limited exceptions, recommended assumptions are either identical or very similar to current assumptions
- Full details on the recommended assumptions are in our formal experience study report
- Economic assumptions were presented in May

Highlights of Demographic Assumptions

- Salary assumption for school district employees continued its downward trend, especially for long service members
- For full career (30+ year) general service members:
 - Retirement rates in the early to mid-50 decreased
 - Retirement rates in the mid to late 60s increased
- Post-retirement medical program assumptions
 - Participation (RHIA & RHIPA)
 - Healthcare inflation assumption for RHIPA program
 - Effect of the above assumptions on funded status
- Final Average Salary adjustments

Action Items - July Meeting

- Selection of a long-term investment return assumption for actuarial valuation
- Approval of recommendations for:
 - Cost allocation method: move to Entry Age Normal method
 - Shortfall amortization approach: decide whether to re-amortize UAL
 - Update to rate collar structure: set the grade-in range for the double collar as 70% to 60% funded status
- Approval of economic and demographic assumptions detailed in the 2012 Experience Study Report

Methods and assumptions adopted will be used in:

- December 31, 2012 “advisory” valuation that estimates 2015-2017 rates
- December 31, 2013 valuation that sets recommended 2015-2017 rates

Caveats and Disclaimers

This presentation discusses actuarial methods and assumptions for use in the valuation of the Oregon Public Employees Retirement System (“PERS” or “the System”). For the most recent complete actuarial valuation results, including cautions regarding the limitations of use of valuation calculations, please refer to our formal Actuarial Valuation Report as of December 31, 2011 (“the Valuation Report”) published on October 26, 2012. The Valuation Report, including all supporting information regarding data, assumptions, methods, and provisions, is incorporated by reference into this presentation. The statements of reliance and limitations on the use of this material is reflected in the actuarial report and still apply to this presentation.

In preparing this presentation, we relied, without audit, on information (some oral and some in writing) supplied by the System’s staff, as well as capital market expectations provided by Strategic Investment Solutions (SIS) and Pension Consulting Alliance (PCA). This information includes, but is not limited to, statutory provisions, employee data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

Milliman’s work product was prepared exclusively for Oregon PERS for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning PERS’ operations, and uses PERS’ data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. To the extent that Milliman’s work is not subject to disclosure under applicable public records laws, Milliman’s work may not be provided to third parties without Milliman’s prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Any third party recipient of Milliman’s work product who desires professional guidance should not rely upon Milliman’s work product, but should engage qualified professionals for advice appropriate to its own specific needs.

The consultants who worked on this assignment are pension actuaries. Milliman’s advice is not intended to be a substitute for qualified legal or accounting counsel.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

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Appendix

Actuarial Basis

Capital Market Assumptions - Milliman

For assessing the expected portfolio return under Milliman's capital market assumptions, we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown below. This allocation is based on the Oregon Investment Council's Statement of Investment Objectives and Policy Framework for the Oregon PERS Fund, as revised December 18, 2012, and the updated asset allocation adopted at the June 26 2013 OIC meeting.

	Annual Arithmetic Mean	30-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Large-Cap Equity	8.60%	7.20%	17.90%	11.65%
US Mid-Cap Equity	9.38%	7.30%	22.00%	3.88%
US Small-Cap Equity	10.38%	7.45%	26.40%	2.27%
Non-US Developed Equity	8.73%	6.90%	20.55%	14.20%
Emerging Markets Equity	11.51%	7.40%	31.70%	5.50%
Private Equity	11.95%	8.26%	30.00%	20.00%
US Universal Fixed Income	4.70%	4.50%	6.50%	7.20%
US Intermediate-Term Bonds	4.23%	4.10%	5.15%	3.00%
US Short-Term Bonds	3.70%	3.19%	10.50%	8.00%
High Yield Bonds	7.21%	6.66%	11.10%	1.80%
Real Estate	7.27%	6.51%	13.00%	13.75%
Global REITs	8.41%	6.76%	19.45%	2.50%
Commodities	7.71%	6.01%	19.70%	1.25%
Hedge Funds	6.46%	6.01%	10.00%	5.00%
US Inflation (CPI-U)		2.75%	2.00%	N/A
Fund Total (reflecting asset class correlations)	8.39%	7.57%*	13.01%	100.00%

* Reflects 0.12% average reduction for investment expense and 0.05% reduction for administrative expenses.

Appendix

Actuarial Basis

Capital Market Assumptions - SIS

For assessing the expected portfolio return under SIS's capital market assumptions, we applied the assumptions shown below provided by SIS.

	Annual Arithmetic Mean	Annual Standard Deviation	Policy Allocation	30-Year Annualized Geometric Mean
US Large-Cap Equity	9.1%	17.5%	15.00%	
US Small-Cap Equity	9.8%	20.0%	3.75%	
Non-US Developed Equity	9.8%	20.0%	14.25%	
Emerging Markets Equity	12.2%	29.0%	4.50%	
Private Equity	12.9%	25.0%	20.00%	
US Universal Fixed Income	2.5%	5.0%	8.00%	
Bank Loans	4.4%	7.5%	3.00%	
Short Duration Fixed Income	1.1%	1.3%	8.00%	
High Yield Bonds	5.1%	11.0%	1.00%	
Real Estate	9.2%	21.5%	12.50%	
Absolute Return	5.4%	10.0%	2.50%	
Commodities	8.0%	30.0%	2.50%	
Infrastructure	9.1%	24.0%	2.50%	
Hard Assets	10.8%	28.0%	2.50%	
Fund Total (reflecting asset class correlations)	8.71%	13.91%	100.0%	

* Reflects 0.12% average reduction for investment expense and 0.05% reduction for administrative expenses.

Appendix

Actuarial Basis

Data

We have based our projection of system liabilities on the data supplied by the Oregon Public Employees Retirement System (PERS) and summarized in the December 31, 2011 Actuarial Valuation (“2011 Valuation Report”) for Oregon PERS.

Assets as of December 31, 2011, were based on values provided by Oregon PERS as shown in the 2011 Valuation Report. Calendar year 2012 asset returns were assumed to be equal to the one-year returns published by the Oregon Investment Council as of December 31, 2012. For regular accounts, this was equal to a 14.29% return; for variable accounts, it is equal to a 16.98% return.

We have assumed that the active participant data reflected in the valuation of the Plan remains stable over the projection period (i.e. participants leaving employment are replaced by new hires in such a way that the total counts remain stable from year to year). No new members are assumed to be eligible for Tier 1 and Tier 2 benefits; all new entrants are assumed to become members under the OPSRP benefit formula.

Methods / Policies

Actuarial Cost Method: Projected Unit Credit, as described in the 2011 Valuation Report.

Normal cost: Normal cost increases with assumed wage growth adjusted for wage, demographic, and asset return experience (if applicable). Demographic experience follow assumptions described in the 2011 Valuation Report.

Accrued liability: Liabilities increase with normal cost and decrease with benefit payments. Results are adjusted for wage, demographic, and asset return experience (if applicable). Demographic experience follow assumptions described in the 2011 Valuation Report.

Contribution Rates: The projected contribution rates are calculated on each odd year valuation date in accordance with methodologies described in the 2011 Valuation Report. Rates are applied 18 months after the valuation date.

Appendix

Actuarial Basis

Methods / Policies (cont'd)

UAL Amortization: The UAL for Tier 1/Tier 2, OPSRP, and Retiree Health Care as of December 31, 2007 are amortized as a level percentage of combined valuation payroll over a closed period. For the Tier 1/Tier 2 UAL, this period is 20 years; for OPSRP, it is 16 years; for Retiree Health Care, it is 10 years. Gains and losses between subsequent odd-year valuations are amortized as a level percentage of combined valuation payroll over the amortization period (20 years for Tier/Tier 1, 16 years for OPSRP, 10 years for Retiree Health Care) from the odd-year valuation in which they are first recognized.

Contribution rate stabilization method: For valuation purposes, contribution rates for a rate pool (e.g. Tier 1/Tier 2 SLGRP, Tier 1/Tier 2 School Districts, OPSRP) are confined to a collar based on the prior contribution rate (prior to application of side accounts, pre-SLGRP liabilities, and 6 percent Independent Employer minimum). The new contribution rate will generally not increase or decrease from the prior contribution rate by more than the greater of 3 percentage points or 20 percent of the prior contribution rate. If the funded percentage excluding side accounts drops below 70% or increases above 130%, the size of the collar doubles. If the funded percentage excluding side accounts is between 70% and 80% or between 120% and 130%, the size of the rate collar is increased on a graded scale.

For system-wide contribution rate projections, the entire Tier 1/Tier 2 program was treated as a single rate pool.

Expenses: OPSRP administration expenses are assumed to be equal to \$6.6M and are added to the OPSRP normal cost.

Actuarial Value of Assets: Equal to Market Value of Assets excluding Contingency and Tier 1 Rate Guarantee Reserves. The Tier 1 Rate Guarantee Reserve is not excluded from assets if it is negative (i.e. in deficit status).

Appendix

Actuarial Basis

Assumptions

In general, all assumptions are as described in the 2011 Valuation Report.

The major assumptions used in our projections are shown below. They are aggregate average assumptions that apply to the whole population and were held constant throughout the projection period. The economic experience adjustments were allowed to vary in future years given the conditions defined in each economic scenario.

- Valuation interest rate – 8.00%
- Tier 1 Regular account growth – 8.00%
- Actual fund investment return– Varies by scenario according to capital market assumptions
- Variable account growth – 0.25% greater than fund investment return
- Inflation assumption – 2.75%
- Inflation experience – Varies by scenario according to capital market assumptions
- Wage growth assumption – 3.75%
- Wage growth experience– 1.00% greater than inflation experience
- Demographic experience – as described in 2011 Valuation report

Appendix

Actuarial Basis

Reserve Projection

Contingency Reserve as of 12/31/2012 was assumed to be \$603.7M, based on the PERS Board's preliminary 2012 crediting decisions. No future increases or decreases to this reserve were assumed.

The Tier 1 Rate Guarantee Reserve ("RGR") was assumed to be -\$19.8M (i.e., in deficit status) as of 12/31/2012, based on the PERS Board's preliminary 2012 crediting decisions. The reserve was assumed to grow with returns in excess of 8% on Tier 1 Member Accounts. When aggregate returns were below 8%, applicable amounts from the RGR were transferred to Tier 1 Member Accounts to maintain the 8% target growth on the member accounts. The RGR reserve is allowed to be negative, but the reserve is not excluded from valuation assets when it is negative. We did not include in rates any potential additional employer levy that could be required to eliminate a persistent negative RGR.

Provisions

Provisions valued are as described in the 2011 Valuation Report.

Appendix

Actuarial Basis

Capital Market Model

For each 20-year projection, we ran 1,000 stochastic scenarios for inflation and asset class rates of return. The scenarios were calibrated to represent Milliman's capital market assumptions in terms of expected average returns, the expected year-to-year volatility of the returns, and the expected correlation between the returns of different asset classes. Annual rates of return for each of the asset classes and inflation are generated from a multivariate lognormal probability distribution. Rates of return are independent from year to year.

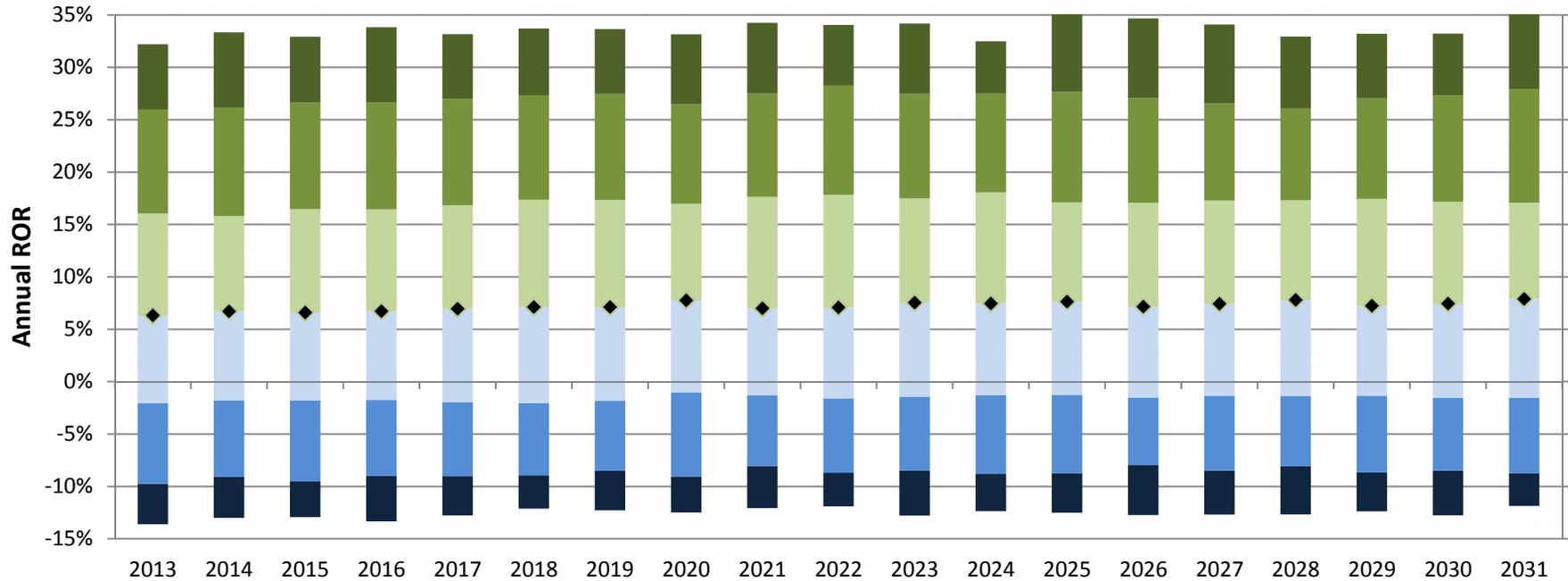
For this purpose, we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown below. This allocation is based on the Oregon Investment Council's Statement of Investment Objectives and Policy Framework for the Oregon PERS Fund, as revised December 18, 2012.

	Annual Arithmetic Mean	30-Year Annualized Geometric Mean	Annual Standard Deviation	Policy Allocation
US Large/Mid-Cap Equity	8.75%	7.25%	18.45%	17.81%
US Small-Cap Equity	9.70%	7.35%	23.45%	2.61%
Non-US Developed Large/Mid-Cap Equity	9.00%	7.10%	21.30%	15.20%
Non-US Developed Small-Cap Equity	9.80%	7.70%	22.15%	2.17%
Emerging Markets Equity	11.25%	7.50%	30.10%	5.21%
Private Equity	11.70%	8.00%	30.00%	16.00%
US Universal Fixed Income	5.00%	4.90%	4.10%	15.25%
Emerging Market Bonds	7.30%	6.25%	15.25%	2.50%
Leveraged Loans	6.90%	6.40%	10.20%	5.00%
High Yield	7.80%	7.25%	11.05%	2.50%
Real Estate	7.10%	6.50%	12.00%	10.30%
Global REITs	8.90%	6.60%	23.15%	2.20%
Natural Resources	6.55%	6.25%	8.30%	2.25%
Hedge Funds	6.50%	6.25%	7.35%	1.00%
US Inflation (CPI-U)	2.75%	2.75%	1.70%	N/A
Fund Total (reflecting asset class correlations)	8.45%	7.60%	14.25%	100.00%

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PERS Fund Rate of Return

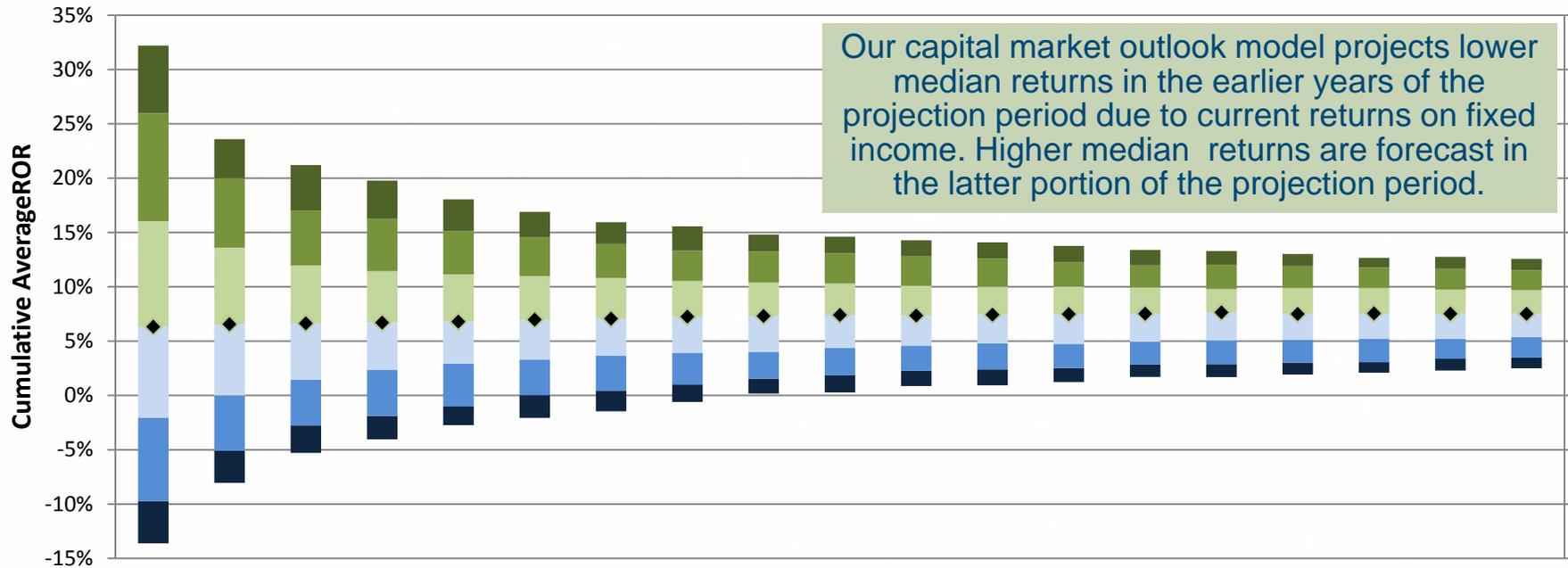
Annual Investment Return



PY Ending 12/31	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
95th	32.2%	33.3%	32.9%	33.8%	33.2%	33.7%	33.7%	33.2%	34.2%	34.0%	34.2%	32.5%	35.2%	34.7%	34.1%	32.9%	33.2%	33.2%	36.1%
90th	26.0%	26.2%	26.6%	26.7%	27.0%	27.4%	27.5%	26.5%	27.5%	28.3%	27.5%	27.5%	27.7%	27.1%	26.5%	26.1%	27.0%	27.3%	27.9%
75th	16.0%	15.8%	16.5%	16.4%	16.8%	17.4%	17.3%	17.0%	17.6%	17.8%	17.5%	18.1%	17.1%	17.1%	17.3%	17.3%	17.4%	17.2%	17.1%
50th	6.3%	6.7%	6.6%	6.7%	7.0%	7.1%	7.1%	7.8%	7.0%	7.1%	7.5%	7.5%	7.6%	7.2%	7.4%	7.8%	7.2%	7.4%	7.9%
25th	-2.0%	-1.8%	-1.8%	-1.7%	-1.9%	-2.0%	-1.8%	-1.1%	-1.3%	-1.6%	-1.4%	-1.3%	-1.3%	-1.5%	-1.3%	-1.4%	-1.3%	-1.6%	-1.5%
10th	-9.7%	-9.1%	-9.5%	-9.0%	-9.0%	-8.9%	-8.5%	-9.0%	-8.1%	-8.7%	-8.5%	-8.8%	-8.7%	-7.9%	-8.5%	-8.1%	-8.7%	-8.5%	-8.7%
5th	-13.6%	-13.0%	-12.9%	-13.3%	-12.8%	-12.1%	-12.3%	-12.5%	-12.1%	-11.9%	-12.8%	-12.4%	-12.5%	-12.7%	-12.7%	-12.7%	-12.4%	-12.8%	-11.9%

PERS Fund Rate of Return

Annualized Average Post-2012 Investment Return (Geometric Average)



PY Ending 12/31	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
95th	32.2%	23.6%	21.2%	19.8%	18.1%	16.9%	16.0%	15.6%	14.8%	14.6%	14.3%	14.1%	13.8%	13.4%	13.3%	13.0%	12.7%	12.8%	12.6%
90th	26.0%	20.0%	17.0%	16.2%	15.1%	14.6%	13.9%	13.3%	13.3%	13.1%	12.8%	12.6%	12.3%	12.0%	12.1%	11.9%	11.8%	11.7%	11.5%
75th	16.0%	13.6%	12.0%	11.4%	11.2%	11.0%	10.8%	10.5%	10.4%	10.3%	10.1%	10.0%	10.0%	9.9%	9.8%	9.9%	9.9%	9.7%	9.7%
50th	6.3%	6.6%	6.6%	6.7%	6.8%	7.0%	7.1%	7.3%	7.3%	7.4%	7.4%	7.4%	7.5%	7.5%	7.6%	7.5%	7.6%	7.5%	7.5%
25th	-2.0%	0.0%	1.5%	2.4%	2.9%	3.3%	3.7%	3.9%	4.0%	4.4%	4.6%	4.8%	4.8%	4.9%	5.1%	5.1%	5.2%	5.2%	5.4%
10th	-9.7%	-5.1%	-2.7%	-1.9%	-1.0%	0.0%	0.4%	1.0%	1.5%	1.8%	2.3%	2.4%	2.5%	2.8%	2.9%	3.0%	3.1%	3.4%	3.5%
5th	-13.6%	-8.1%	-5.3%	-4.0%	-2.7%	-2.1%	-1.5%	-0.6%	0.2%	0.3%	0.9%	0.9%	1.2%	1.7%	1.7%	1.9%	2.1%	2.3%	2.5%