Personas for the Colorado Public Employees' Retirement Association (PERA)[1]

Member Profiles for example teachers in Colorado's Public Employees' Retirement Association (PERA) were generated using benefit parameters for new hires as established in the Colorado Revised Statutes (outlined in Table 1). The calculation method is documented in detail here.[2] To summarize, a teacher earns a retirement benefit (PERA-DB) that is the larger of the state's final average salary defined benefit plan (FAS-DB) or money purchase plan (MPP).

Using benefit provisions from the state statute (Table 1) as input, the model generates pension benefits earned by the example teacher who begins teaching at age 25 at each point in the teacher's career.[3] As seen in Figure 1, moving across the x-axis identifies retirement compensation earned by the example teacher for the number of years spent teaching in Colorado classrooms.

For each example teacher, we compare their retirement compensation (from Figure 1) to compensation from a cost-equivalent, smooth accrual defined benefit plan (SA-DB). The method for calculating the SA-DB plan is documented in detail here. The SA-DB plan costs the same, and has the same investment and longevity protection as the PERA-DB plan.[4] Figure 2 compares retirement compensation earned by the example teacher for the number of years spent teaching in Colorado classrooms under the PERA-DB plan and SA-DB plan.

Cohort Survival Probability

Separation and retirement hazard rates for the School Division are used to determine the percentage of public workers that leave before reaching different career milestones (i.e. the turnover rate). In each Comprehensive Financial Annual Report (CAFR),[5] PERA reports

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[1] Reference made to "Sections" in subsequent footnotes are statutory sections of Colorado's Public Employees' Retirement Association (PERA) law, codified in Title 24, Article 51, of the Colorado Revised Statutes (effective June 30, 2011), *available at* https://www.copera.org/pdf/5/5-6.pdf.

[2] The benefit tier for teachers who were hired after January 1, 2011, and before January 1, 2017, was used. For teachers hired on or after January 1, 2017, one of the retirement eligibility thresholds changed slightly (from Age ≥58 and Service ≥ 30 to Age ≥ 60 and Service ≥ 30). *See* Section 24-51-602(1.5)(a) and Section 24-51-602(1.7)(a),footnote 1, at 62-63.

[3] Salaries for the member profiles are based on the salary schedule of a teacher with a Master's Degree working in Denver Public Schools. *See* National Council on Teacher Quality, *Denver ProComp Salary Setting 2013-2014,* http://www.nctq.org/docs/Denver_ProComp_Salary_Info_2013-2014.pdf.

[4] In this model, contributions are equivalent to the employer normal cost (for the FAS-DB plan).

[5] *See* Comprehensive Annual Financial Reports, 2001-2013, *available at* https://www.copera.org/pera/formspubs/reports.htm#peracafr.

withdrawal and retirement hazard rates in buckets by age and years of service for its member population.[6] From these hazard rates, the turnover rate is generated.

The first step is to expand the hazard rates provided by PERA. To do this, we simply assume the rate holds for each year within the bucket. For example, let $h_{[a,b]}$ represent the rate from year *a* to year *b*. If the plan reports a rate, *x,* for the range *a* to *b*, the rate in *a* will be *x* and the rate in *b* will also be *x*. To be clear: $h_{[a,b]} = x$ and so $h_a = x$ and $h_b = x$.

The second step is to combine hazard rates. Specifically for each age, year of service combination the separation hazard rate is used when the member *is not* eligible ($e = 0$) for retirement and the retirement hazard rate is used when the member *is* eligible for retirement ($e = 1$).

$$total\ hazard_{a,yos} = h_{a,yos}^{separation}\ if\ e = 0$$

$$total\ hazard_{a,yos} = h_{a,yos}^{retirement}\ if\ e = 1$$

The final step is to calculate the survival rate for a cohort with the same entry age (or the percent of the cohort who remain in PERA after each year of service) from the total hazard rate, where the initial hazard rate begins at the age of entry, a_e, and 0 years of service. The second value of the hazard rate will be at one plus the entry age and one year of service. The third value of the hazard rate will be at two plus the entry age and two years of service, and so on. The initial survival rate at the age of entry is 1. From there on, the survival rate equals the rate in the previous year multiplied by the previous year's total hazard rate subtracted from 1. Note that the cohort's years of service are equal to the difference between the cohort's age today, *a* and their entry age. After calculating the survival rate (shown in Figure 3), it is easy to find the turnover rate.

$$Survival\ Rate_{a_e} = 1$$

$$Survival\ Rate_a = Survival\ Rate_{a-1,a>a_e} * (1 - total\ hazard_{a-1})$$

$$Turnover\ Rate_a = 1 - Survival\ Rate_a$$

[6] *See* 2013 Comprehensive Annual Financial Report, *Actuarial Section, Exhibit A and F* (132-134), *available at* https://www.copera.org/pdf/5/5-20-13.pdf#page=129. Note that the rates used are specific to the School Division, but include all occupations employed by school districts, and not just teachers. The rates are not provided for only teachers.

Table 1.a: Benefit Provisions from the Colorado State Statute

	PERA FAS-DB	PERA Money Purchase (MPP)
Member Contribution Rate[7]	8%	8%
Interest on PERA Member Contribution Accounts[8]	3%	3%
Annuitization Rate[9]	N/A	7.5%
Vesting[10][11]	5 years	Immediate vesting
Eligibility Thresholds[12]	<u>Unreduced:</u> Age ≥ 65 and Service ≥ 5 or Age ≥58 and Age + Service ≥ 88 or Service ≥ 35 <u>Reduced:</u> Age ≥ 60 and Service ≥ 5 or Age ≥ 55 and Service ≥ 20 or Age ≥ 50 and Service ≥ 25	Age ≥ 65 or Age ≥ 60 and Service ≥ 5 or Age ≥ 65 and Service ≥ 5 or Age ≥ 55 and Service ≥ 20 or Age ≥ 50 and Service ≥ 25 or Age ≥58 and Age + Service ≥ 88 or Service ≥ 35
Early Retirement Reduction[13]	Reduced by an actuarially determined percentage provided in Table 7 (page 26) of	None

[7] Member contribution rates are specified in the state statute. *See* Section 24-51-401(1.7)(a), footnote 1, at 34.

[8] Members earn interest at a rate specified by the board that shall not exceed five percent compounded annually. *See* Section 24-51-407(4), footnote 1, at 43-44. The current rate set by the board is 3 percent. *See* Tax-Deferred Interest on PERA Member Contribution Accounts, January 1, 2009 – present.

[9] The annuitization rate for the MPP is assumed to be the plan's expected rate of return on assets (7.5%) as described in state statute. *See* Section 24-51-101(1) and Part 8: Benefit Options, footnote 1, at 1, 76-77.

[10] A worker is vested upon completion of five years of service credit. *See* Section 24-51-101(51), footnote 1, at 10.

[11] Section 24-51-602(2) and Section 24-51-602(2.5) imply that members with less than five years of service that leave their contributions in the system until they are 65 will receive the state's MPP worth 200% of their contributions (plus interest). *See* footnote 1, at 64.

[12] Retirement age for the MPP is based on eligibility thresholds defined by the state statute. Sections 24-51-602 (1.5)(a), 24-51-602(2), and 24-51-602(2.5) imply that members with less than five years of service are eligible to receive the money purchase benefit upon reaching sixty-five years of age. *See* footnote 1, at 62, 64.

[13] Section 24-51-605 (4.a.), footnote 1, at 67, contains information on early retirement reductions for the FAS-DB plan. The actuarially determined percentage is provided in Table 7 (page 26) of the Colorado PERA Retirement Process Booklet. The money purchase plan is not subject to an early retirement reduction.

	the Colorado PERA Retirement Process Booklet	
Benefit Multiplier[14]	2.5%	N/A
Cost of living adjustment[15]	2.0%	2.0%
Highest Average Salary[16]	The highest three years of salary	N/A
Employer Match[17]	N/A	No-Refund: 100% of employee contributions and interest once the worker reaches retirement eligibility Refund: 50% of employee contributions and interest before the worker reaches retirement eligibility (if Service greater than five years) 100% of employee contributions and interest once the worker reaches retirement eligibility

Table 1.b: Economic Assumptions

	PERA FAS-DB	PERA Money Purchase (MPP)
Inflation[18]	2.8%	2.8%
Member Discount Rate[19]	5%	5%

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[14] *See* Section 24-51-603(1)(a), footnote 1, at 64.
[15] The actual annual increase earned by a worker is the lesser of 2 percent or the average monthly CPI for that year. *See* Section 24-51-1009(4)(c), footnote 1, at 90.
[16] *See* Section 24-51-603(1)(a), footnote 1, at 64.
[17] Sections 24-51-602(2), 24-51-602 (2.5), and 24-51-605.5 imply that members that leave their contributions in PERA until retirement will receive a 100 percent employer match on contributions. *See* footnote 1, at 64, 68. For workers who receive a refund, Section 24-51-408 (2 to 2.5) implies that members hired after Jan. 1, 2011, who are vested, and who are not retirement eligible will receive a 50 percent match on contributions plus interest; members hired after Jan. 1, 2011, who are vested, and who are retirement eligible will receive a 100 percent match on contributions plus interest; and members hired after Jan. 1, 2011, who are not vested will receive only their contributions plus interest.
[18] Public Employees Retirement Association of Colorado, Actuarial Valuation (2013), page 68 (see Price Inflation).
[19] For the present value calculations, we use a nominal interest rate of 5 percent, to measure the value of the benefit to the worker.

Figure 1

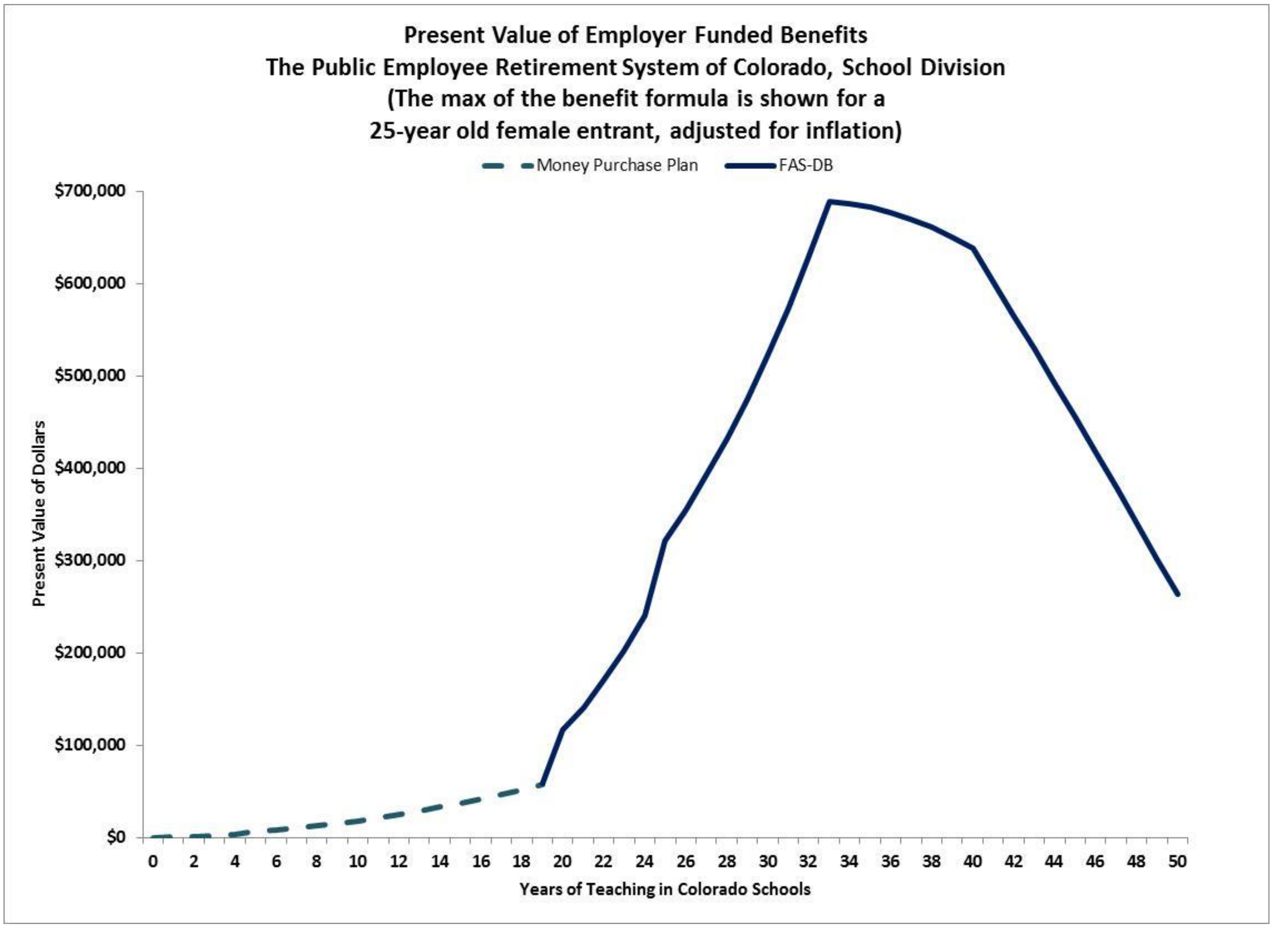
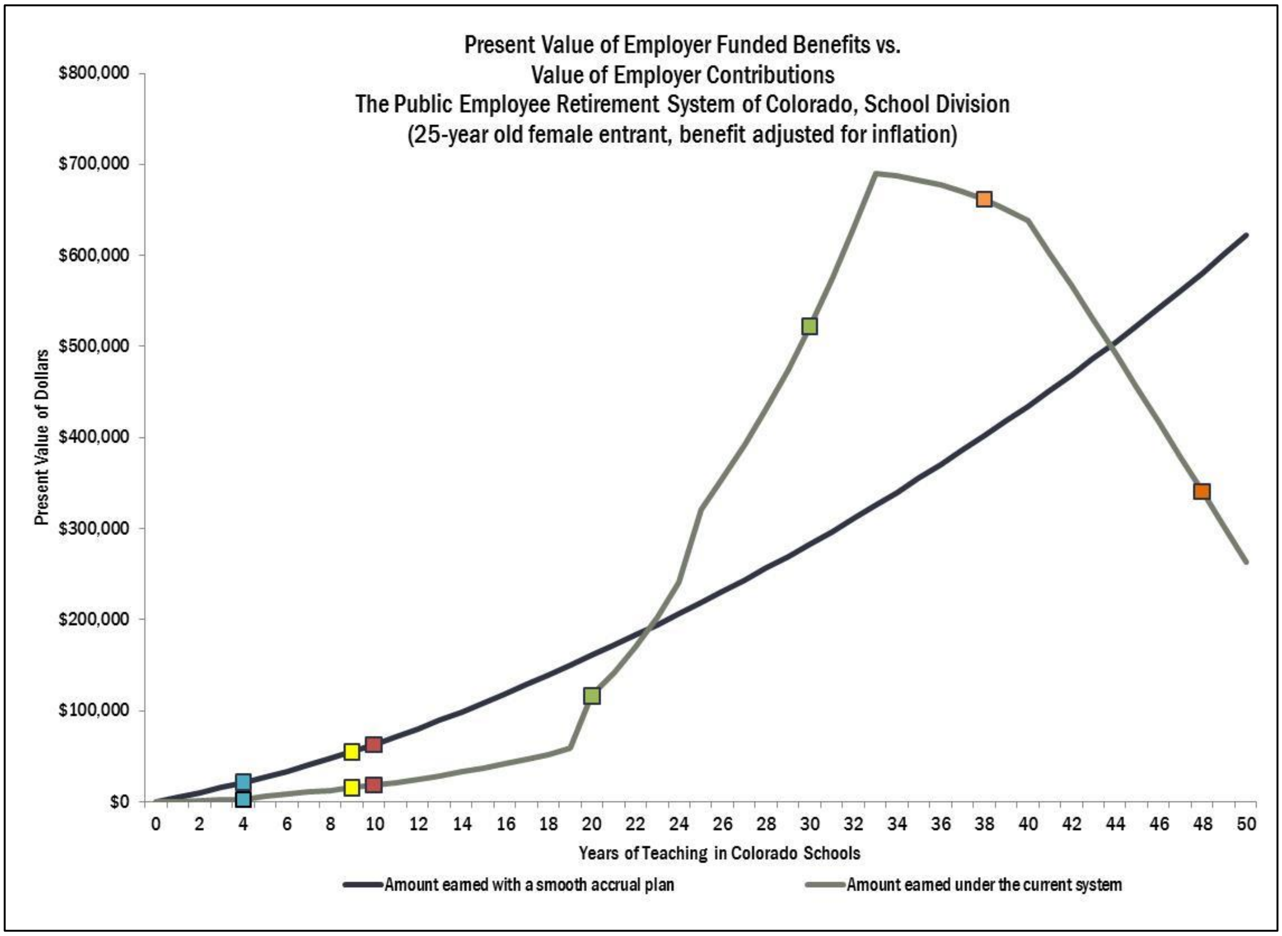
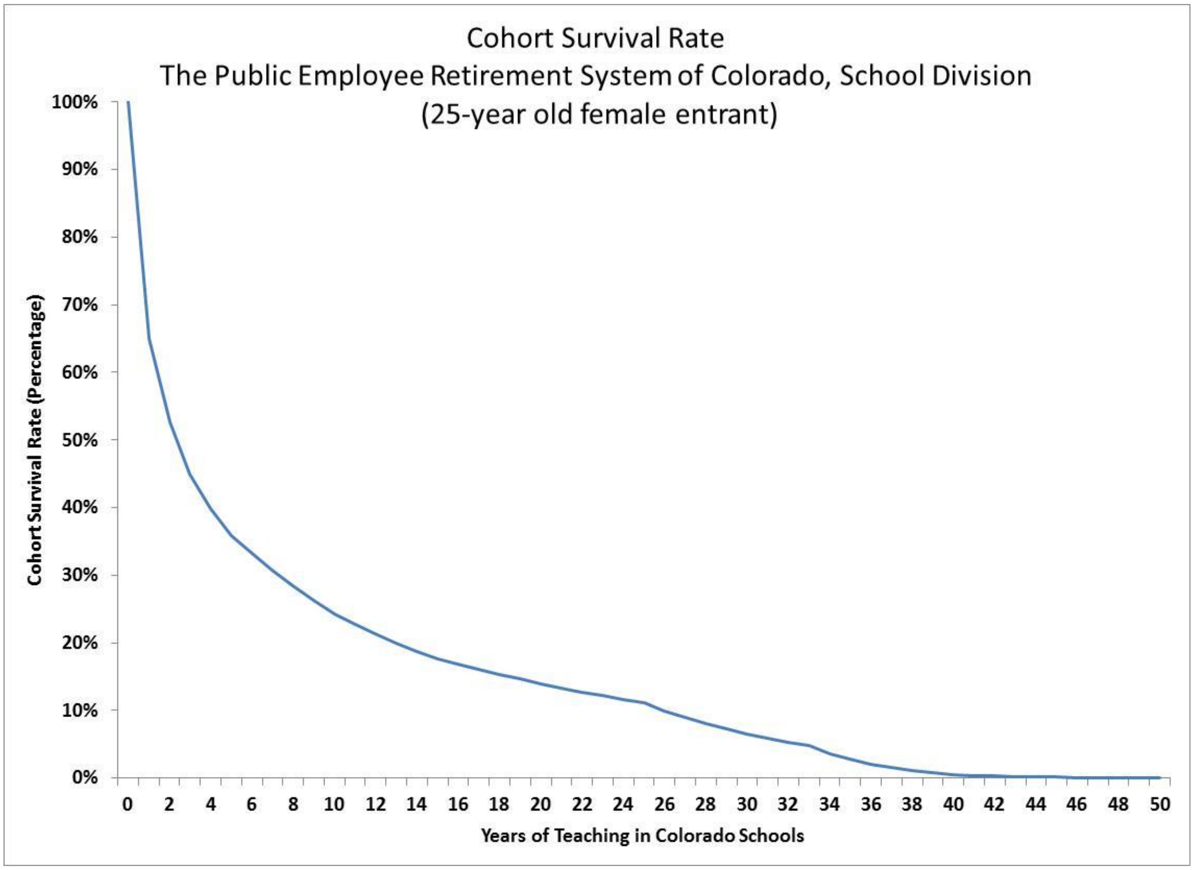

Present Value of Employer Funded Benefits
The Public Employee Retirement System of Colorado, School Division
(The max of the benefit formula is shown for a
25-year old female entrant, adjusted for inflation)
Money Purchase Plan
FAS-DB
Present Value of Dollars
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
Years of Teaching in Colorado Schools

Figure 2



Present Value of Employer Funded Benefits vs.
Value of Employer Contributions
The Public Employee Retirement System of Colorado, School Division
(25-year old female entrant, benefit adjusted for inflation)
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
Present Value of Dollars
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
Years of Teaching in Colorado Schools
Amount earned with a smooth accrual plan
Amount earned under the current system

Figure 3



Cohort Survival Rate
The Public Employee Retirement System of Colorado, School Division
(25-year old female entrant)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cohort Survival Rate (Percentage)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
Years of Teaching in Colorado Schools