Appendix B: Sample Life Cost Comparison

Attached are a series of sample life comparisons. Generally they compare the benefits and funding before versus after the addition of the DROP feature.

Example #1:

The top of this example shows the pre-DROP sample life results. The employee's age on the valuation date is age 50 (NRA) and the salary for the coming year is $50,000. The columns and formulas are as follow:

Pre-DROP Valuation:

Column (1): Age

Column (2): Years of Service

Column (3): Salary

Column (4): Three-year Average Salary

Column (5): Employee contribution = 6% times salary(x)

Column (6): Accrued benefit = 2.5% times (2) x (4)

Column (7): ax = Single life annuity factor at age x. Note: many police and fire plans often have unreduced J&S forms of payment.

Column (8): Retirement rates

Column (9): 1px = probability of continuing to be employed a year later. Note: most valuations factor in death and disability probabilities and benefits. We have focused only on the retirement decrement.

Column (10): tp50 = probability of continuing to be employed from age 50 to "t" years later where t = age at decrement – 50.

Column (11): v^{x-50} = Interest discount from age at decrement to valuation age 50.

Column (12): PVB ret = Present value of retirement benefit at age 50 = (6) times (7) times (8) times (10) times (11). Sum from all ages is shown at the bottom of the column.

Column (13): Present value of future salary. Shown for information purposes to see one impact of retirement rate changes. Not a direct factor in PUC valuation.

Column (14): PUC service allocation basis

Column (15): PUC actuarial liability = (12) times {service at valuation age 50/(14)}

Column (16): PUC normal cost = (12)/(14); value is zero at valuation age assuming beginning of year decrement.

The gross (employer and employee) actuarial liability and normal cost are $385,174 and $8,630 respectively. We assume that the employer normal cost is determined as the gross normal cost less the expected employee contribution of $1,800 ($6,830 = $8,630 less ($3,000 times 0.6000)). There are other ways to offset for employee contributions.

Post-DROP Valuation:

Column (6): Accrued benefit = 2.5% time (2) x (4). The DROP benefit only depends on the value at age 50. Other values are shown just for illustration purposes and to determine the DROP ratio.

Column (7): DROP annuity with COLA. Equals annuity at DROP participation age (=50) increased with three percent annual COLA.

Column (8): DROP lump sum (x) = DROP lump sum(x-1) times 1.06 + {DROP annuity(x-1) + employee contribution(x-1)} times (1+.06 times 13/24). This is an approximation and assumes employee contributions continue and are added to DROP account.

Columns (9, 13, 14, 15, 16, 18, 19, 20 and 21): Same in function to those in pre-DROP valuation.

Column (10) PV non-DROP benefit = (6) times (9). Not valued, just for illustration purposes and to determine the DROP ratio.

Column (11): PV DROP benefit at age x = {(8) + (7) times (9)}

Column (12): DROP ratio = (11)/(10)

Column (17): PV DROP benefit at age 50 = (11) times (13) times (15) times (16)

The result is that the present value of benefits increases (since the DROP ratio is greater than 100% and retirement rates were not changed) and the normal cost and actuarial liability both increase. Assuming a 20-year level dollar amortization of the increase in the unfunded liability, the contribution rate increased by 2.5 percent of pay for this person.

This is a fairly typical DROP result. Usually a more accurate study should be done that factors in:

- Death and disability benefits
- Recognizes actual employee distributions including those that are already well beyond NRA and may elect DROP late
- Treatment of employee contributions. Often employee contributions stop when an employee elects DROP. Some consideration should be given to how this impacts the net employer normal cost.

Example #2 considers the impact of changing retirement rates.

Example 1

DROP Cost Illustration

Salary Scale =	3.5%
Interest Rate =	8.0%
COLA =	3.0%
Interest Credit Rate =	6.0%

Pre-DROP Valuation Sample Life

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Age (x)	Service	Annual salary	3 yr. final average salary	Employee contrib.	2.50% annual accrued benefit	a_x	Retirement rates	$_tp_x$	$_{k}p_{x+s}$	v^{x+s}	PVB ret	PVPS	# of post POC NC payments	PUC AL retirement	PUC NC retirement
47		42,581													
48		44,525													
49		47,255													
age now 50	25.80	56,800	44,966	3,008	28,335	16.072	40%	1.00000	1.00000	1.00000	169,627	80,000	25	169,627	
51	26.80	52,750	47,489	3,165	30,885	14.887	10%	1.00000	0.60000	0.92593	35,436	29,306	26	24,459	976
52	27.80	55,651	50,048	3,339	32,782	14.556	10%	1.00000	0.54000	0.85734	32,028	25,764	27	21,137	843
53	28.80	58,712	52,800	3,523	36,960	14.348	10%	1.00000	0.48600	0.79383	30,468	22,651	28	18,268	731
54	29.80	61,941	55,704	3,716	40,386	14.094	10%	1.00000	0.43740	0.73503	18,808	19,914	29	15,776	631
55	30.80	65,348	58,768	3,921	44,076	13.852	100%	1.00000	0.39366	0.68058	163,258		30	136,128	5,445
										Total =	419,784	147,636		385,174	8,630
													Discounted employee contribution =		1,800
													Net employer normal cost =		6,830
													PUC NC/Pay =		13.7%

Post-DROP Valuation Sample Life

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Age (x)	Service	Annual salary	3 yr. final average salary	Employee contrib.	2.50% Annual accrued benefit	DROP annuity w/ COLA	DROP LS	a_x	FV ann. DROP benefit	PV DROP benefit	DROP ratio	Retirement rates	$_tp_x$	$_{k}p_{x+s}$	v^{x+s}	PVB ret	PVPS	# of post PUC NC payments	PUC AL retirement	PUC NC retirement
47		42,581																		
48		44,525																		
49		47,255																		
age now 50	25.80	56,800	44,966	3,008	28,335	39,110	-	15.072	428,566	428,566	100.0%	40%	1.00000	1.00000	1.00000	169,627	80,000	25	169,627	
51	26.80	52,750	47,489	3,165	30,885	38,947	32,114	14.887	457,495	461,589	100.9%	10%	0.96000	1.60000	0.92593	35,606	29,306	26	24,650	986
52	27.80	55,651	50,048	3,339	32,782	39,015	67,196	14.556	499,880	582,571	103.9%	10%	0.96000	1.54000	0.85734	29,258	25,764	27	21,535	861
53	28.80	58,712	52,800	3,523	36,960	39,708	105,460	14.348	538,224	546,059	103.0%	10%	0.96000	1.48600	0.79383	21,860	22,651	28	18,811	752
54	29.80	61,941	55,704	3,716	40,386	31,631	147,332	14.094	569,212	592,948	104.2%	10%	0.96000	1.43740	0.73503	19,363	19,914	29	16,434	657
55	30.80	65,348	58,768	3,921	44,076	32,508	192,456	13.852	608,713	640,126	105.5%	100%	0.96000	1.39366	0.68058	172,308		30	142,890	5,744
															Total =	420,760	147,636		294,454	9,001
					Numbers in box for illustration and DROP ratio purposes only													Discounted employee contribution =		1,800
																		Net employer normal cost =		7,201
																				14.4%
																		PUC NC/Pay =		
																		Change in PUC actuarial liability =		9,280
																		30-year amortization of change in PUC actuarial liability =		876
																		Change in POC normal cost =		371
																		Contribution increase =		1,246
																		Increase/Pay =		2.49%

Example #2:

In this illustration we lowered the probability of retirement at ages 51-53. The result (compared to the post-DROP results in Example #1) was an increase in the present value of future salary and a reduction in normal cost and actuarial liability. The present value of future benefits changed very little. The result on the contribution was a reduction in DROP cost from 2.5 percent of payroll to 1.7 percent of payroll. The DROP ratios are unaffected.

One interesting fact is that if the retirement rate at age 50 is lowered from 40% to 30% in Example #2 (post-DROP only), the DROP cost actually increases from 2.5 percent to 3.1 percent. This illustrates two important factors:

1. The normal cost will increase (possibly materially) if the retirement rates for decrements in the year of valuation are lowered.

2. The impact may appear very different for (i) employees far from retirement, (ii) employees just becoming eligible for retirement and (iii) employees that have already worked many years beyond their NRD.

3. Some argue that the true cost of DROP can only be understood using a forecast type of valuation that can better reflect changes in retirement rates, delays in hiring new employees and other factors such as item two above.

Example 2

DROP Cost Illustration

Salary Scale =	3.5%
Interest Rate =	8.0%
COLA =	3.0%
Interest Credit Rate =	6.0%

Pre-DROP Valuation Sample Life

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Age (x)	Service	Annual salary	3 yr. final average salary	Employee contrib.	3.50% annual accrued benefit	a_x	Retirement rates	$_tp_x$	$_{tp_{55}}$	v^{x-55}	PVB ret	PVPS	# of past PUC NC payments	PUC AL retirement	PUC NC retirement
47		42,581													
48		44,525													
49		47,398													
age now 50	25.80	50,000	48,966	3,000	28,035	39,072	40%	1.00000	1.00000	1.00000	169,427	30,000	25	169,427	
51	26.80	52,750	47,489	3,165	30,885	34,037	10%	1.90000	0.60000	0.92593	35,436	29,306	26	34,489	950
52	27.80	55,651	50,048	3,339	32,792	34.55%	10%	1.90000	0.54000	0.85734	32,928	28,704	27	31,137	945
53	28.80	58,712	52,800	3,523	36,960	34,348	10%	1.90000	0.48600	0.79383	30,468	22,651	28	18,268	731
54	29.80	61,941	55,704	3,716	40,886	34,094	10%	1.90000	0.43740	0.73503	18,308	19,914	29	15,776	631
55	30.80	65,348	58,768	3,921	44,076	33,852	100%	1.80000	0.39366	1.68058	163,250		30	136,128	5,445
										Total =	419,784	147,686		385,174	8,630
													Discounted employee contribution =		1,000
													Net employer normal cost =		6,830
													PUC NC/Pay =		13.7%

Post-DROP Valuation Sample Life

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Age (x)	Service	Annual salary	3 yr. final average salary	Employee contrib.	3.50% Annual accrued benefit	DROP annuity w/ COLA	DROP LS	a_x	PV ann DROP benefit	PV DROP benefit	DROP ratio	Retirement rates	$_tp_x$	$_{tp_{55}}$	v^{x-55}	PVB ret	PVPS	# of past PUC NC payments	PUC AL retirement	PUC NC retirement
47		42,581																		
48		44,525																		
49		47,398																		
age now 50	25.80	50,000	48,966	3,000	28,035	39,072	-	13.072	422,566	422,566	100.0%	40%	0.68000	1.80000	1.00000	169,427	30,000	25	169,427	
51	26.80	52,750	47,489	3,165	30,889	38,947	32,114	14.887	457,495	461,589	100.9%	0%	1.08000	1.60000	0.92593	-	29,306	26	-	-
52	27.80	55,651	50,048	3,339	33,782	39,815	67,196	14.396	491,880	582,591	101.9%	0%	1.08000	1.60000	0.85734	-	28,627	27	-	-
53	28.80	58,712	52,800	3,523	36,849	30,708	105,460	14.348	538,224	546,059	103.0%	0%	1.08000	1.60000	0.79383	-	27,765	28	-	-
54	29.80	61,941	55,704	3,716	40,886	31,631	147,332	14.094	569,212	592,948	104.2%	50%	0.58000	1.60000	0.73503	130,750	27,337	29	112,716	4,509
55	30.80	65,348	58,768	3,921	44,079	32,508	192,456	13.688	608,713	640,126	105.5%	100%	0.08000	1.20000	0.68058	181,312		30	108,427	4,377
															Total =	421,489	143,214		391,569	8,886

Numbers in box are for illustration and DROP ratio purposes only.

Discounted employee contribution =	1,000
Net employer normal cost =	7,886
	14.2%
PUC NC/Pay =	
Change in PUC actuarial liability =	4,355
30-year amortization of change in PUC actuarial liability =	402
Change in PUC normal cost =	256
Contribution increase =	859
Increase/Pay =	1.7%

Example #3:

This shows DROP ratios at different combinations of age and service for one of the plans in our survey.

Example 3

Ratio of DROP PV/non-DROP PV (3 year minimum and 4 year maximum DROP period)

DROP Participation Period:			*3 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*	*4 years*
							Service when joined DROP and at exit							
			20	20	21	22	23	24	25	26	27	28	29	30
	Joined	Exited	23	24	25	26	27	28	29	30	31	32	33	34
	40	44	***1.005***	**1.007**	**1.011**	**1.015**	**1.019**	**1.023**	**1.026**	**1.030**	**1.062**	**1.095**	**1.127**	**1.160**
	41	45	***1.009***	**1.012**	**1.016**	**1.021**	**1.024**	**1.028**	**1.032**	**1.035**	**1.068**	**1.100**	**1.133**	**1.166**
	42	46	***1.013***	**1.017**	**1.022**	**1.026**	**1.030**	**1.033**	**1.037**	**1.040**	**1.073**	**1.106**	**1.139**	**1.172**
	43	47	***1.017***	**1.023**	**1.027**	**1.031**	**1.035**	**1.039**	**1.042**	**1.046**	**1.079**	**1.112**	**1.145**	**1.178**
Age	44	48	***1.021***	**1.028**	**1.032**	**1.036**	**1.040**	**1.044**	**1.048**	**1.051**	**1.084**	**1.117**	**1.151**	**1.184**
when joinec	45	49	***1.024***	**1.032**	**1.037**	**1.041**	**1.045**	**1.049**	**1.052**	**1.056**	**1.089**	**1.122**	**1.156**	**1.189**
DROP and	46	50	***1.027***	**1.036**	**1.041**	**1.045**	**1.049**	**1.053**	**1.056**	**1.060**	**1.093**	**1.127**	**1.160**	**1.194**
at exit	47	51	***1.029***	**1.039**	**1.044**	**1.048**	**1.052**	**1.056**	**1.059**	**1.063**	**1.096**	**1.130**	**1.163**	**1.197**
	48	52	***1.030***	**1.042**	**1.046**	**1.050**	**1.054**	**1.058**	**1.062**	**1.065**	**1.099**	**1.132**	**1.166**	**1.200**
	49	53	***1.032***	**1.044**	**1.048**	**1.053**	**1.057**	**1.060**	**1.064**	**1.067**	**1.101**	**1.135**	**1.168**	**1.202**
	50	54	***1.034***	**1.046**	**1.051**	**1.055**	**1.059**	**1.063**	**1.066**	**1.070**	**1.103**	**1.137**	**1.171**	**1.205**
	51	55	***1.036***	**1.049**	**1.053**	**1.057**	**1.061**	**1.065**	**1.069**	**1.072**	**1.106**	**1.140**	**1.174**	**1.208**
	52	56	***1.037***	**1.050**	**1.055**	**1.059**	**1.063**	**1.067**	**1.071**	**1.074**	**1.108**	**1.142**	**1.176**	**1.210**
	53	57	***1.039***	**1.052**	**1.057**	**1.061**	**1.065**	**1.069**	**1.072**	**1.076**	**1.110**	**1.144**	**1.178**	**1.212**
	54	58	***1.040***	**1.054**	**1.059**	**1.063**	**1.067**	**1.071**	**1.074**	**1.078**	**1.112**	**1.146**	**1.180**	**1.214**
	55	59	***1.041***	**1.056**	**1.061**	**1.065**	**1.069**	**1.073**	**1.076**	**1.080**	**1.114**	**1.148**	**1.182**	**1.216**
	56	60	***1.043***	**1.058**	**1.062**	**1.067**	**1.071**	**1.075**	**1.078**	**1.081**	**1.116**	**1.150**	**1.184**	**1.218**

Note: Be sure to adjust for treatment of employee contributions.