Municipal Policemen's and Firemen's Pension and Relief Funds of West Virginia

Experience and Assumption Study
July 1, 2014 to June 30, 2017 Experience

Submitted by:

James Ritchie, ASA, EA, FCA, MAAA
Senior Consulting Actuary
443.573.3924
jritchie@boltonusa.com

Jordan McClane, FSA, EA, FCA, MAAA
Actuary
667.218.6935
jmcclane@boltonusa.com

![Bolton — Employee Benefits, Actuarial & Investment Consulting]

June 8, 2020

Mr. Blair M. Taylor
Executive Director
West Virginia Municipal Pensions Oversight Board
301 Eagle Mountain Road, Suite 251
Charleston, WV 25311

Dear Blair,

This report presents the results of our experience study of the 53 Municipal Policemen's and Firemen's Pension and Relief Funds of West Virginia and includes our recommended changes to plan assumptions. These recommendations are generally based on:

- Our findings from the study of the demographic and economic experience of the plans for the period June 1, 2014 through June 30, 2017, and
- Our expectations, based on professional judgement, estimates inherent in market data, emerging trends, and expert opinions, of future experience

We summarize our recommendations in the *Summary of Recommendations* section and analyze our findings in the *Demographic Assumptions* and *Economic Assumptions* sections. Finally, we present in the *Impact of Changes* section the effect of the proposed changes on plan liabilities, funding levels, and developed contributions, using the July 1, 2018 actuarial valuations as a proxy for the impact upon actual implementation of updated assumptions. Pursuant to the West Virginia Municipal Pensions Oversight Board *Experience Study Procedure* issued June 16, 2017, any updates to the assumptions will first be reflected in the July 1, 2020 actuarial valuations, which will be issued in the fall of 2021.

Recommended updates to actuarial methods, including the cost allocation and funding methods, asset smoothing methods, and rollforwards methods, will be presented in a forthcoming report.

Respectfully submitted,

James Ritchie, ASA, EA, FCA, MAAA

Jordan McClane, FSA, EA, FCA, MAAA

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Section I. Introduction

This report reviews the actuarial experience of the Municipal Policemen's and Firemen's Pension and Relief Funds of West Virginia during the three-year period from July 1, 2014 to June 30, 2017, in order to consider changes in actuarial assumptions. Based on the review of plan experience and considerations regarding future expectations, several changes in actuarial assumptions are recommended for approval by the West Virginia Municipal Pensions Oversight Board (WV MPOB).

The WV MPOB is entrusted with setting the assumptions for the plans it oversees. To keep the actuary's liability and contribution calculations in concert with reality, the assumptions used must be reasonably related to the circumstances surrounding the plans as currently written. Generally, the best way to maintain reasonable assumptions is to periodically review past plan experience in comparison to the assumptions incorporated by the actuary and, as a result of that review and the consideration of future expectations, recommend improvements, where necessary, for use in the valuation process.

Section V of the report shows the impact of proposed changes to the liabilities, funding levels, and annual contributions had these new assumptions been in place for the July 1, 2018 valuation. Actual changes will first impact the July 1, 2020 valuation, which will develop the contributions for FY 2022.

The actual long-term cost of the plans is not dependent on assumptions but rather is based on actual plan experience, including changes in plan demographics and fluctuations in the general economy (such as variations in inflation or interest rate levels), which translate into tangible costs for the plan through:

      (1) the plan benefits paid (including cost-of-living adjustments, COLAs, as applicable),
      (2) the investment return on plan assets, and
      (3) the payment of other plan-related expenses.

Despite the lack of influence that assumptions have on long-term plan costs, a current value of expected future plan benefits needs to be calculated regularly (generally, annually) to orderly determine an appropriate amount of money to set aside for prefunding benefits. Such a determination requires the use of assumptions about future events. As actual experience differs from the assumptions, the expected cost of the plans and, consequently, the contributions to fund the plans generally[1] will gradually change. Ideally, the assumptions will closely track actual experience. However, for some assumptions (e.g., investment return), actual experience will commonly and materially vary from the assumption from year to year. As such, reasonable assumptions should not only be appropriate for the purpose of the measurement, but they should also be unbiased in nature such that they balance expected upward and downward deviations in experience.

While the cost of the plan will "self-adjust" to reflect actual experience, it is important to review and reset the assumptions from time to time to:

      (1) minimize experience gains and losses,
      (2) reduce contribution volatility, and
      (3) achieve a better level of intergenerational taxpayer equity.

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[1] If the contribution calculation methodology does not adhere to actuarial principles for developing Actuarially Determined Contributions (ADCs) or if the plan sponsor does not make contributions that align with the ADC, differences between experience and plan assumptions may not impact actual plan contributions.

However, if a plan is not actuarially funded, such as the plans that use the Alternative and Conservation funding policies, the self-adjustment may not occur since experience might not impact plan funding.

For some assumptions (e.g., mortality), the experience of the plans alone is insufficient to be statistically significant, and as such, industry tables and experience should be considered when setting those assumptions. Also, certain economic assumptions (i.e., inflation) are not based solely on recent plan experience and require longer periods of experience to be considered in conjunction with future expectations. The three key assumptions tied to the economy are:

      (1) the COLAs or increases to the Consumer Price Index (CPI)
      (2) the salary increases
      (3) the investment return

In conducting this experience study, we emphasized the importance of developing assumptions that reflect a best estimate of *future* plan experience. Rather than change every assumption to exactly match actual recent experience, we have analyzed the *trends* inherent in that experience and have developed assumptions that reflect expectations of future experience. Additionally, for some assumptions, this report shows actual experience separately for Fire and Police members since the differences between them and the level of impact of the assumption warranted their independent study.

Bolton has prepared this report exclusively for the WV MPOB. The purpose of this report is to provide recommended assumption changes and the impact of those recommendations on plan liabilities and annual contributions for GASB 67/68 reporting. This report may not be used or relied upon by any other party or for any other purpose; Bolton Partners is not responsible for the consequences of any unauthorized use.

This report is based on data provided by the prior actuary, GRS, and the 53 municipal plans. The plans are solely responsible for the validity, accuracy and comprehensiveness of this information. If the data or plan provisions supplied are not accurate and complete, the experience study results may differ significantly from the results that would be obtained with accurate and complete information; such a scenario could require a later revision of this report.

Professional Qualifications

We are available to answer any questions on the material in this report or to provide explanations or further details as appropriate. The undersigned credentialed actuaries meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained in this report. We are not aware of any direct or material indirect financial interest or relationship, including investments or other services that could create a conflict of interest that would impair the objectivity of our work.

James Ritchie, ASA, EA, MAAA, FCA

Jordan McClane, FSA, EA, FCA, MAAA

Section II. Summary of Recommendations

The last 12 years have been an unusual period of time. When we started this study, the economic markets had largely recovered from the implosion of the real estate, debt and equity markets in 2008 and the first quarter of 2009. The recovery had been slow, with both short- and long-term effects on government finances. Then COVID-19 hit. We have tried to consider all of these environments in our review of the three years of demographic and economic pension plan experience from July 1, 2014 through June 30, 2017, and in our recommendations for changes to the assumptions used to determine the pension contributions and funding levels.

We have the following recommendations related to the demographic assumptions:
- Update the mortality assumption to the Society of Actuaries amounts-weighted Public Safety Mortality Table (PubS-2010) with a generational projection using Scale MP-2019. Use the below median income versions of the employee and healthy retiree tables
- Update the disabled mortality table to the PubS-2010 table with a five-year set forward of the 2010 base rates with a generational projection using Scale MP-2019
- Create separate retirement rate tables for police officers and firefighters and assume a higher retirement rate at age 50
- Create separate turnover rate tables for police officers and firefighters, increasing the rates for police officers and decreasing the rates for firefighters
- Increase disability rates 50% and lower the percentage assumed to be line-of duty from 60% to 50% of total disabilities
- Decrease the marriage assumption and decrease the load applied to survivor benefits to account for dependent beneficiaries

We make the following recommendations related to the economic assumptions:
- Decrease the inflation assumption from 2.75% to 2.50%
- Modify the method used to select the discount rate
- Tie the expense load to actual experience
- Lower the salary increase assumption
- Add a 6% pay spiking assumption for unused accrued leave for certain plans
- Decrease the premium tax increase assumption from 2.75% to 2.50% to keep it consistent with the inflation assumption

We discuss the actual experience and the reasons for these recommended assumption changes in Sections III (*Demographic Assumptions*) and IV (*Economic Assumptions*) and show the effect of these changes on the pension funding levels and required contributions in Section V.

Section III. Demographic Assumptions

This section addresses our review and recommendations regarding all demographic assumptions. The order in which we address these assumptions is generally the order of significance of the assumption in determining plan liabilities.

Mortality

The current assumption is:

> **Healthy (Post-Retirement):**
> RP-2014 Blue Collar Healthy Annuitant table projected generationally using two-dimensional mortality improvement scale MP-2014
>
> **Disabled**
> RP-2014 Blue Collar Healthy Annuitant table set forward four years, projected generationally using two-dimensional mortality improvement scale MP-2014
>
> **Healthy (Pre-Retirement):**
> RP-2014 Blue Collar Healthy Employee table projected generationally using two-dimensional mortality improvement scale MP-2014

The mortality experience over the last three years is as follows:

Population	Number of Deaths		
	Expected	Actual	Actual/Expected
Healthy Retirees and Beneficiaries	159.5	209	131%
Disabled Retirees	24.1	36	150%
Pre-Retirement	5.3	6	114%

The above results are based on headcounts (i.e. the number of deaths). Mortality rates also vary by income in that members with larger pensions are generally expected to live longer, on average, than members with lower pensions. The actual-to-expected ratio declines slightly when weighting mortality experience by benefit amounts:

Population	Amount-Weighted Deaths		
	Expected	Actual	Actual/Expected
Healthy Retirees and Beneficiaries	$3.551M	$4.241M	119%
Disabled Retirees	$0.467M	$0.649M	139%
Pre-Retirement	$0.171M	$0.144M	84%

On both a headcount-weighted and amount-weighted basis, the post-retirement healthy and disabled mortality deaths (headcounts and dollars) were higher than expected. This result is consistent with higher general mortality in the State compared to national averages.

The Board's June 16, 2017 *Experience Study* procedure includes the following statement:

> "The actuary must use the most recent accepted mortality tables as directed by the Actuarial Standards of Practice (ASOP) in effect at the time of the experience study. It is expected the mortality tables used will at a minimum be two-dimensional tables, which include a generational mortality component."

Section III. Demographic Assumptions

Mortality

In January 2019, the Society of Actuaries (SOA) released new mortality tables for public retirement plans, including tables specific to public safety employees (PubS-2010 mortality tables). Since membership in the West Virginia municipal plans is not large enough to allow us to create a table based solely on experience of the 53 plans, we recommend using the best available mortality tables that reflect the plan's demographics. We understand that this has been the policy adopted by the Board in the past. We would like the Board to consider adopting the following three mortality tables, two[2] of which are the below median income (B) versions of the tables to reflect lower-than-average salaries and higher-than-average mortality in West Virginia compared to the national average:

- Healthy retirees and beneficiaries: PubS-2010 (B) Healthy Retiree
- Disabled retirees: PubS-2010 Disabled Retiree with 2010 base rates set forward 5 years
- Employees pre-retirement: PubS-2010 (B) Employee

As is currently the case, we would use generational (a.k.a. two-dimensional) tables, which incorporate future mortality improvements. Currently, mortality rates are assumed to improve using the MP-2014 Improvement Scale. The most recent improvement scale published by the SOA is the MP-2019 Improvement Scale. This scale generally assumes slower declines in mortality rates than previous MP improvement scales. We recommend adopting this MP-2019 Improvement Scale as it considers more recent data than the prior scales and it incorporates the general actuarial industry sentiment that future mortality improvements will not be as large as originally anticipated by MP-2014.

The actual-to-expected amount-weighted ratios based on these tables and experience from the three-year study period are presented in the table below:

Population	Amount-Weighted Deaths		Actual/Expected
	Expected	Actual	
Healthy Retirees and Beneficiaries	$3.667M	$4.241M	116%
Disabled Retirees	$0.519M	$0.649M	125%
Pre-Retirement	$0.143M	$0.144M	101%

Currently, we assume 10% of active participant mortality is assumed to be service connected. We do not recommend any changes to this 10% assumption due to the small sample size of experience and the minimal impact (generally low level of incidences) of active mortality rates on plan liabilities.

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[2] The SOA did not create a below-median version of PubS-2010 disabled mortality table.

Section III. Demographic Assumptions

Mortality

The following three graphs show the amount-weighted mortality rates for the actual experience, as well as the current assumptions and proposed assumptions.

Post-Retirement Mortality - Healthy - Amounts

Mortality - Disabled - Amounts

Pre-Retirement Mortality - Healthy - Amounts
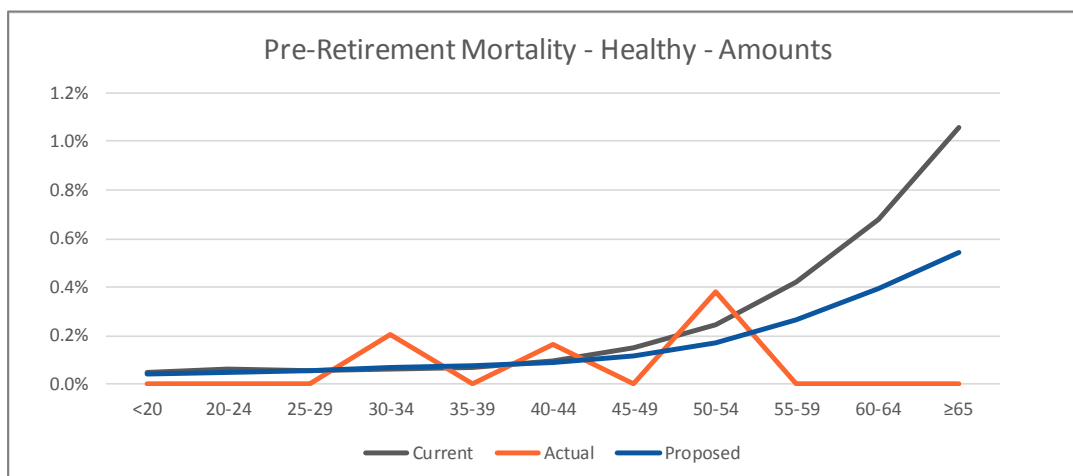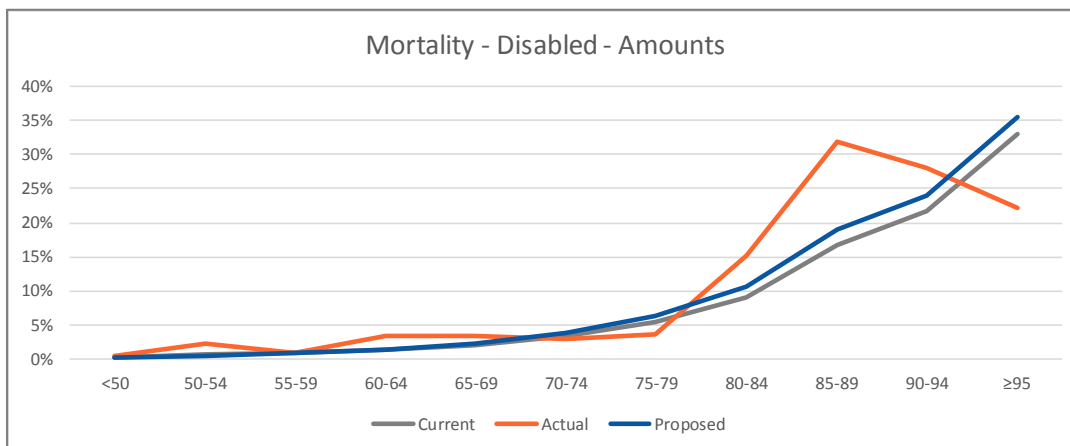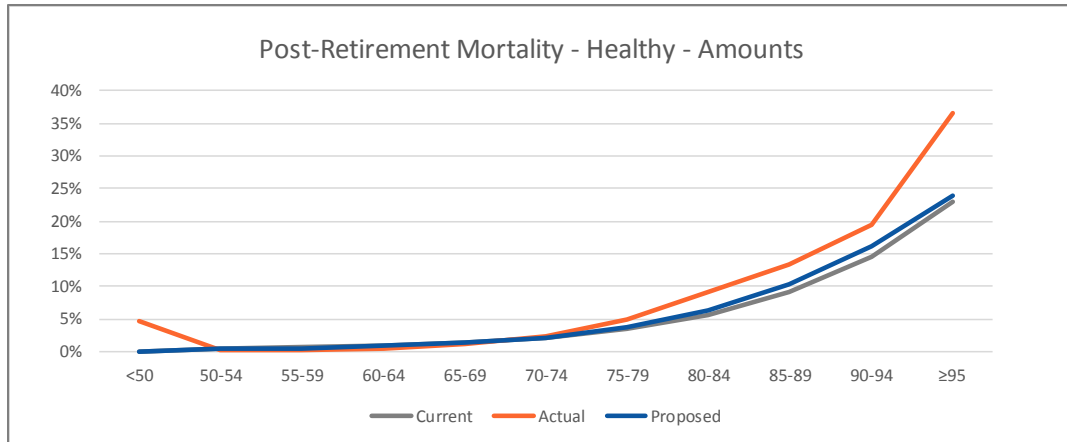
Section III. Demographic Assumptions

Retirement

Normal retirement is defined as the earlier of (1) age 50 and the completion of 20 years of service and (2) age 65. There are no early retirement benefits provided. Current retirement assumptions are based on age for those who have the required service:

Age	Rate
50	45%
51-55	30%
56-59	35%
60	100.0%

The experience (see tables on the following pages) shows that (1) more retirement-eligible employees are retiring at age 50 than expected, (2) there were noticeable differences between Police and Fire and (3) over 95% of participants retired before age 60.

We recommend the following proposed rates, which are reflected in the "Actual/Expected (Proposed Rates)" columns of the tables on the following pages:

Age	Current Rate	Proposed Police Rate	Proposed Fire Rate
50	45%	60%	55%
51-52	30%	40%	35%
53-54	30%	40%	25%
55	30%	50%	25%
56	35%	50%	25%
57-59	35%	40%	25%
60+	100%	100%	100%

The following two tables show, by age, the number of retirement exposures, the expected number of retirements using the current assumptions, the actual number of retirements, the actual-to-expected ratios using the current assumption, the expected number of retirements using our proposed assumptions, and the actual-to-expected ratios using the proposed assumptions.

Presented beneath each table is a graph of the rates of retirement based on actual experience, the current retirement assumptions, and the proposed retirement assumptions.

Section III. Demographic Assumptions

Retirement

		Retirement Rates (Police Only)				
Age	Exposures	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumption	Actual / Expected (Proposed Rates)
50	52	23.4	36	154%	31.2	115%
51	20	6.0	6	100%	8.0	75%
52	10	3.0	5	167%	4.0	125%
53	7	2.1	2	95%	2.8	71%
54	7	2.1	4	190%	2.8	143%
55	5	1.5	3	200%	2.5	120%
56	4	1.4	3	214%	2.0	150%
57	3	1.1	1	95%	1.2	83%
58	5	1.8	3	171%	2.0	150%
59	2	0.7	-	0%	0.8	0%
60	3	3.0	-	0%	3.0	0%
61	3	3.0	-	0%	3.0	0%
62	1	1.0	-	0%	1.0	0%
63	-	-	-	-	-	-
64	1	1.0	-	0%	1.0	0%
65	1	1.0	1	100%	1.0	100%
66	-	-	-	-	-	-
67	-	-	-	-	-	-
68	-	-	-	-	-	-
69	-	-	-	-	-	-
≥70	-	-	-	-	-	-
Total	**124**	**52.0**	**64**	**123%**	**60.3**	**106%**

Retirement (Police only)
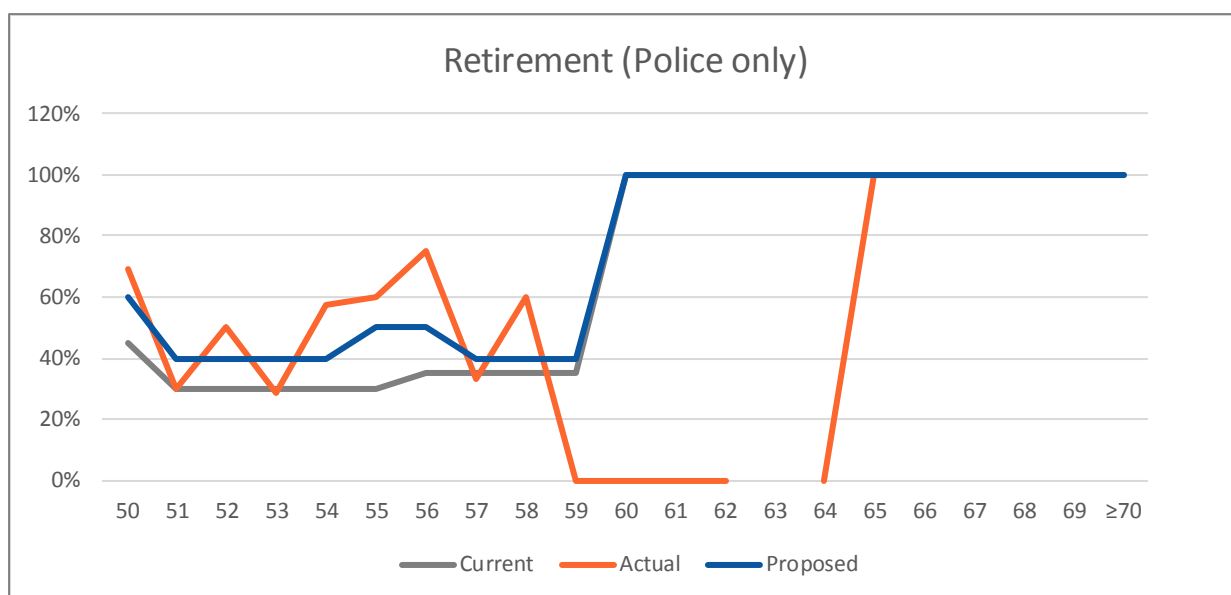
Section III. Demographic Assumptions

Retirement

		Retirement Rates (Fire Only)			Expected from Proposed Assumption	Actual / Expected (Proposed Rates)
Age	Exposures	Expected from Current Assumptions	Actual	Actual / Expected		
50	45	20.3	29	143%	24.8	117%
51	29	8.7	11	126%	10.2	108%
52	21	6.3	6	95%	7.4	82%
53	13	3.9	2	51%	3.3	62%
54	18	5.4	4	74%	4.5	89%
55	15	4.5	3	67%	3.8	80%
56	23	8.1	7	87%	5.8	122%
57	11	3.9	1	26%	2.8	36%
58	11	3.9	2	52%	2.8	73%
59	7	2.5	4	163%	1.8	229%
60	3	3.0	2	67%	3.0	67%
61	1	1.0	1	100%	1.0	100%
62	-	-	-	-	-	-
63	-	-	-	-	-	-
64	-	-	-	-	-	-
65	-	-	-	-	-	-
66	-	-	-	-	-	-
67	-	-	-	-	-	-
68	-	-	-	-	-	-
69	-	-	-	-	-	-
≥70	-	-	-	-	-	-
Total	**197**	**71.3**	**72**	**101%**	**70.8**	**103%**

Retirement (Fire only)
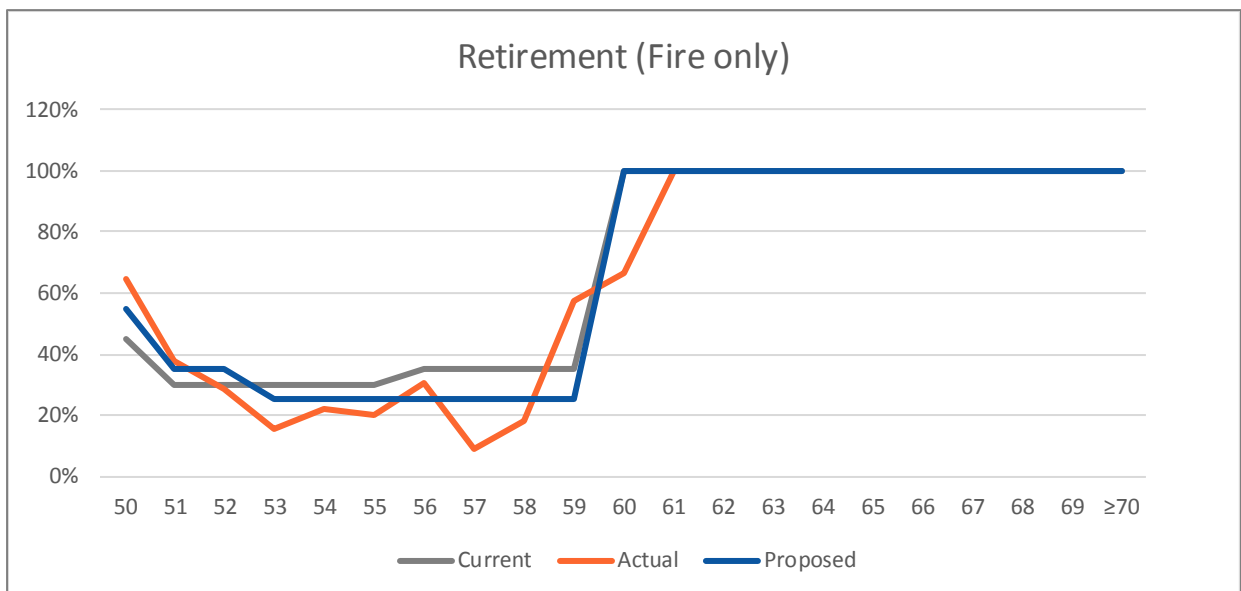
Section III. Demographic Assumptions

Termination of Employment

Current and proposed termination assumptions, which vary based on age, are displayed below:

Current Assumption				Proposed Assumption					
Age	Rate	Age	Rate	Age	Police	Fire	Age	Police	Fire
<20	15%	35	4%	<20	25%	15%	35	6%	2%
20	15%	36	3%	20	25%	15%	36	6%	2%
21	15%	37	2%	21	10%	15%	37	6%	2%
22	15%	38	2%	22	10%	15%	38	6%	2%
23	10%	39	2%	23	10%	9%	39	6%	2%
24	10%	40	2%	24	10%	8%	40	3.5%	2%
25	9%	41	2%	25	10%	7%	41	3.5%	2%
26	8%	42	2%	26	10%	6%	42	3.5%	2%
27	7%	43	2%	27	9%	5%	43	3.5%	2%
28	6%	44	2%	28	9%	5%	44	3.5%	2%
29	6%	45	2%	29	8%	5%	45	2%	1%
30	5%	46	2%	30	8%	5%	46	2%	1%
31	5%	47	2%	31	7%	4%	47	2%	1%
32	5%	48	2%	32	7%	4%	48	2%	1%
33	5%	49	2%	33	7%	4%	49	2%	1%
34	5%	>=50	0%	34	7%	4%	>=50	0%	0%

The following two tables show, by age, the number of termination exposures, the expected number of terminations using the current assumptions, the actual number of terminations, the actual-to-expected ratios using the current assumption, the expected number of terminations using our proposed assumptions, and the actual-to-expected ratios using the proposed assumptions. Presented beneath each table is a graph of the rates of termination based on actual experience, the current termination assumptions, and the proposed termination assumptions.

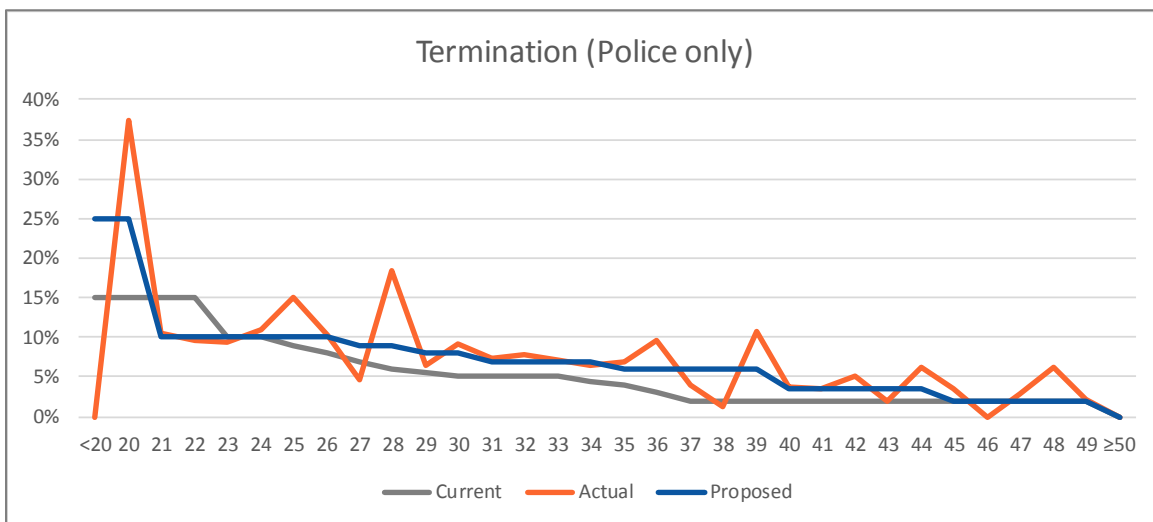| Termination Rates (Police Only)						
Age	Exposures	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumptions	Actual / Expected (Proposed Rates)
<20	1	0.2	-	0%	0.3	0%
20-24	136	16.5	16	97%	14.8	108%
25-29	351	24.5	39	159%	32.1	121%
30-34	460	22.5	35	155%	33.2	105%
35-39	406	10.7	27	253%	24.4	111%
40-44	484	9.7	20	207%	16.9	118%
45-49	454	9.1	13	143%	9.1	143%
Total	**2,491**	**93.1**	**150**	**161%**	**130.7**	**115%**

Section III. Demographic Assumptions

Termination of Employment

Termination (Police only)

Termination Rates (Fire Only)						
Age	Exposures	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumptions	Actual / Expected (Proposed Rates)
<20	-	-	-	-	-	-
20-24	40	4.4	2	45%	3.9	51%
25-29	156	10.6	11	104%	8.5	129%
30-34	331	16.2	15	93%	14.0	107%
35-39	452	11.7	6	51%	9.0	66%
40-44	483	9.7	7	72%	9.7	72%
45-49	446	8.9	9	101%	4.5	202%
Total	**2,181**	**61.5**	**50**	**81%**	**49.6**	**101%**

Termination (Fire only)
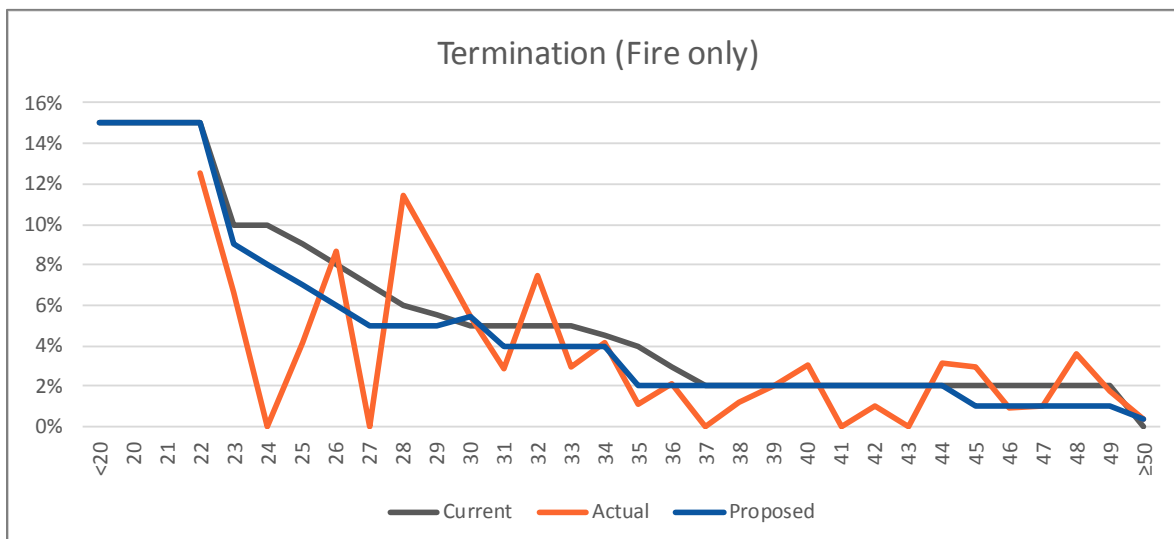
Section III. Demographic Assumptions

Termination of Employment

The current termination rates are highest at younger ages, with rates gradually declining with increases in age. Although this pattern (higher rates at younger ages and for members with fewer years of service) is common among public safety plans, we note that (1) the number (magnitude) of terminations at younger ages is lower than we would normally see for a group of this size likely because many of the WV plans are closed to new entrants and (2) the magnitude of terminations at ages just prior to (within five years of) retirement eligibility is higher than a typical public safety plan. Our recommended assumption continues to incorporate these trends as they are supported by experience. However, our recommended assumption generally includes higher rates for Police and lower rates for Fire in relation to the current rates in order to better align with recent plan experience.

Disability Incidence

Current disability assumptions are based on age. The assumed disability incidence rates at a few sample ages are presented below:

Age	Rates
30	0.22%
40	0.50%
50	0.79%

Disability rates generally increase with age. The current assumption is that 60% of all disabilities are duty related and 40% are non-duty related and that 10% of non-duty disabled members receive a 20% reduction in benefits due to gainful employment.

Experience from July 1, 2014 through June 30, 2017 is as follows:

		Disability Rates (Duty)				
Age	Exposures	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumptions	Actual / Expected (Proposed Rates)
<20	1	-	-	100%	-	100%
20-24	176	0.0	-	0%	0.0	0%
25-29	507	0.5	-	0%	0.6	0%
30-34	791	1.2	-	0%	1.5	0%
35-39	858	2.0	4	195%	2.6	156%
40-44	967	3.2	2	62%	4.0	50%
45-49	900	3.8	5	133%	4.7	107%
50-54	346	1.7	3	181%	2.1	145%
55-59	111	-	-	100%	-	100%
≥60	-	-	-	-	-	-
Totals	4,657	12.4	14	113%	15.4	91%

Section III. Demographic Assumptions

Disability Incidence
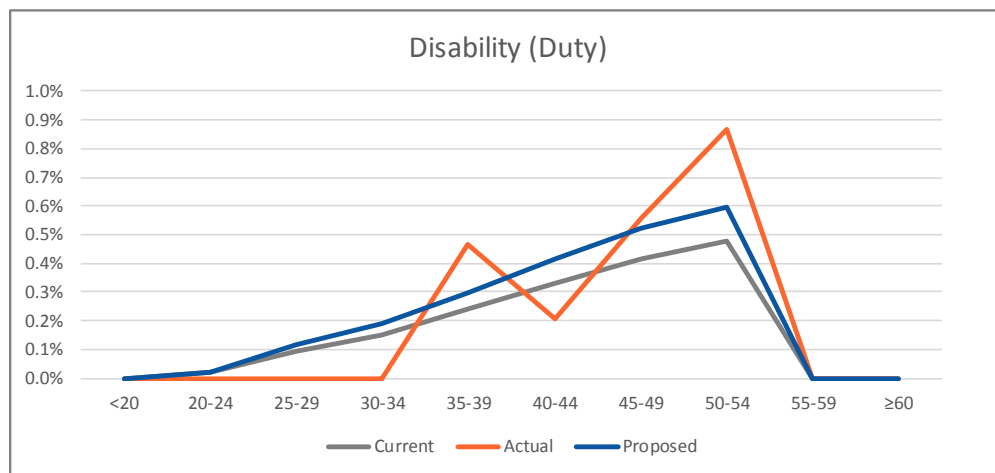
Disability (Duty)

	Disability Rates (Non-Duty)					
Age	Exposures	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumption	Actual / Expected (Proposed Rates)
<20	1	-	-	100%	-	100%
20-24	176	0.0	-	0%	0.0	0%
25-29	507	0.3	1	316%	0.6	168%
30-34	791	0.8	2	253%	1.5	135%
35-39	858	1.4	1	73%	2.6	39%
40-44	967	2.1	8	374%	4.0	199%
45-49	900	2.5	4	160%	4.7	85%
50-54	346	1.1	4	362%	2.1	193%
55-59	111	-	1	0%	-	0%
≥60	-	-	-	-	-	-
Totals	4,657	8.2	21	255%	15.4	136%

Disability (NonDuty)
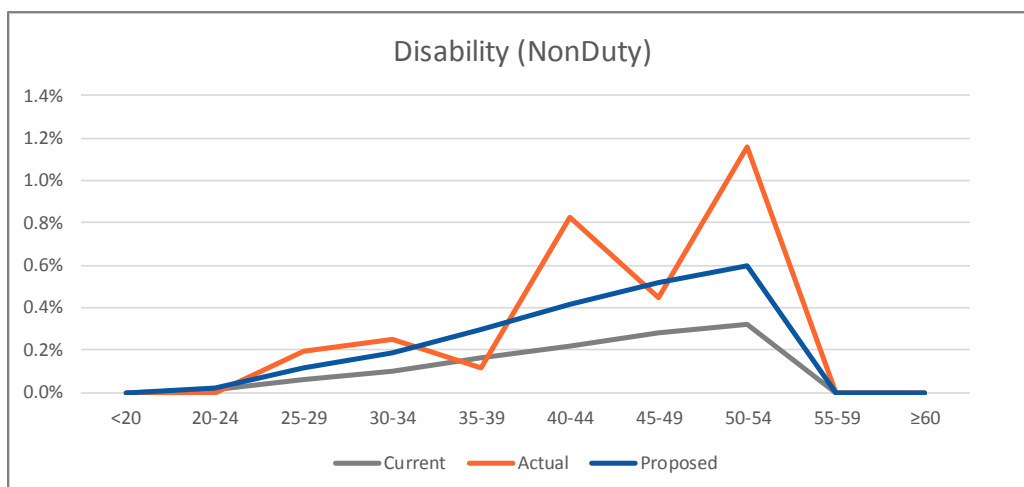
Section III. Demographic Assumptions

Disability Incidence

Overall, the ratio of actual-to-expected disabilities was approximately 170% (35/20.6) and only 40% were duty related. We recommend raising the combined (duty plus non-duty related) disability rates by 50% to better align the assumption with recent experience.

Using recent experience to estimate the percentage of expected total disabilities that will be duty related versus non-duty related is difficult due to the small number of actual disabilities over the study period. The prior experience study showed more duty related than non-duty related disabilities over the study period (July 1, 2009 through July 1, 2014) and, as such, the actuary recommended changing the then current assumption from 40% duty-related disabilities to 60% duty-related disabilities. The experience during the 2014-2017 period of this current study shows a reversion back to percentages similar to those used prior to the current assumptions. In order to account for the fluctuations between duty and non-duty related disabilities, we recommend changing the assumption to an even split: 50% duty related and 50% non-duty related.

Further, given that the plan benefit for non-duty disabilities is partially offset for gainful employment ($1 for every $3 of other income above $18,200 [in 2018; indexed by state minimum wage]), the current valuation assumption for disabilities also includes an additional assumption that 10% of non-duty disabled members receive a 20% reduction in benefits due to gainful employment. Gainful employment offset data was not available for this experience study period but of all 157 members on non-duty disability in the July 1, 2018 database, 81 were under age 65 on the valuation date, and only 2 of those members had offsets in the data. This would suggest that fewer than 10% of non-duty disabilities have gainful employment offsets; however, we are not confident that the gainful employment offset data has been recorded as intended in the database. We suggest lowering the percentage assumption for disabled members with gainful employment offsets from 10% to 5% and suggest applying the 20% reduction in benefits only through age 65.

Survivor Benefit Assumptions

Marriage Assumptions

The plan provides the same basic benefit, equal to 60% of the member's accrued benefit[3], for death both pre- and post- retirement. Currently, the actuarial valuation uses an assumption for the percentage of members who are married (90%) and applies a 12% load to active, pre-retirement survivor benefits to cover expected benefits for non-spouse dependent beneficiaries (children, parents, and siblings).

Nationally, rates of marriage vary by age and have generally decreased over time. One survey we found[4] showed that, in 1960, over 80% of men were married by age 30 and the rate stayed above 80% until about age 80. In 2013, only 40% were married by age 30 and the rate never reached 80%. During the retirement ages, the rate eventually declines as spouses die. A survey[5] from 2018 showed that 60% of employees are married and 10% have domestic partners. Finally, another survey[6] showed the percentage married at ages 65 and above as:

Percent Living with a Spouse

	Total	Males	Females
Age 65 & older	56.6%	70.7%	45.8%
Age 65 to 74	64.2%	73.6%	56.0%
Age 75 to 84	52.7%	70.1%	40.0%
Age 85 & older	33.2%	55.4%	21.7%

This certainly reflects that there are more widows than widowers at these ages.

We also looked at the number of actives and retirees who died in FY18. The results were the following:

- Active deaths with a beneficiary/all active deaths = 0/1 = 0%
- Retiree deaths with a beneficiary[7]/all retiree deaths = 31/46 = 67%

Based on this recent experience and national marriage trends, **we recommend decreasing the percentage marriage assumption from 90% to 70%**. For actives, the marriage assumption is generally applied at the date of decrement, while for retirees, the assumption is generally applied on the valuation date.

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[3] If a member has not reached the age and service eligibility requirements for retirement upon death, then for the purposes of the death benefit, the member is assumed to have been normal retirement eligible such that the member's accrued benefit would have been equal to 60% of average annual compensation.
[4] American Community Survey from US Department of Commerce (US Census)
[5] The MetLife 2018 US Employee Benefit Trends Study
[6] The Department of Commerce publishes reports based on census data for living arrangements of the household for the population age 65 and over
[7] For this purpose, we combined disabled retirees with other retirees. Some of these beneficiaries might not be spouses.

Section III. Demographic Assumptions

Survivor Benefit Assumptions:

Non-Spouse Load Assumption We also considered the load to provide benefits to dependent, non-spouse beneficiaries. Our understanding is that the benefits paid to those dependent individuals are:

- Child: 20% of the participant's benefit until[8] the child attains 18 or marries
- Orphaned child: 25% of the participant's benefit until[9] the child attains 18 or marries
- Parent: 10% of the participant's benefit for life
- Sibling: the sum of fifty dollars per month (but a total not to exceed $100 per month) until such individual attains the age of 18 or marries

There are more details to these provisions (e.g. cap of 100% of member's benefit), but for the purposes of this experience study, the above outlined provisions contain enough detail for our analysis. The benefits to dependent, non-spouse beneficiaries (excluding dependent parents) end at age 18 and the percentage payable to these dependents is less than the 60% paid to a spouse. Our understanding is that these benefits are paid in addition to the 60% spousal benefit (i.e. they are additive). The three benefits which end at age 18 have relatively little cost and are most likely to occur when an employee dies prior to retirement. Depending on when an employee dies and assuming the spouse lives to age 85, the child and sibling benefits would likely be paid for no more than 35% of the time that the spouse benefit would be paid and, in most cases, the non-spouse child or sibling would be over age 18 when the member dies. Given that the amount of the child benefit[10] is often only 33% of the spouse benefit (20%/60%) and the sibling benefit is much less, and considering the length of time these beneficiary benefits would likely be paid, a load of 5% on the value of the spousal pre-retirement death benefits is probably conservative for estimating the value of these benefits for active members.

Using a similar assumption development methodology, a load of 0.5% should be sufficient for post-retirement death benefits due to the older ages at death postretirement, the corresponding older ages of dependent beneficiaries, and, consequently, the shorter payment periods for those child and sibling dependent beneficiaries.

We expect that only a small percentage of parents are legally dependent on their children. The parent benefit is most likely to apply to retirees since that is when most deaths occur and a load for this would need to be less than 10%/60% = 16.7% due to the older ages of the parents and the possibility they may predecease the member. We recommend a load of 1.0% pre-retirement and 0.5% post retirement.

To summarize this section, our recommended total pre-retirement death benefit load is 6.0% (5% + 1%) and total post-retirement death benefit load is 1.0% (0.5% + 0.5%).

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[8] If the child is disabled, the payment continues beyond age 18 or marriage so long as the child remains disabled.
[9] If the orphaned child is disabled, the payment continues beyond age 18 or marriage so long as the orphaned child remains disabled.
[10] We give little value to the dependent brother/sister benefit

Section III. Demographic Assumptions

Survivor Benefit Assumptions:

Remarriage rate

Our understanding is that spousal benefits end on remarriage. There is no explicit assumption for this purpose. There is some available US Census data[11] but it is not all relevant. For example, for females age 60-69 we know:

- 5.9% were never married
- 64.0% were married once
- 22.4% were married twice
- 7.6% were married three or more times

Many of the marriages would be after divorce and not after the death of a spouse. This also does not tell us the likelihood that a surviving spouse will remarry when there is a pension incentive not to get remarried. Certainly, age when the member dies is a factor.

We recommend continuing the current assumption of no remarriages after member death.

Timing of Decrements

Currently, decrements (termination, retirement, disability, and death) are assumed to occur mid-year, except for ages at which there is a 100% retirement assumption, in which case retirement is assumed to occur at the beginning of the year. For example, for the 7/1/2018 valuation, the first decrements (other than 100% retirement) would be assumed to occur on 12/31/18. The timing of when a person leaves during the year is not very material when calculating normal cost and actuarial liabilities for most plans. However, when forecasting short-term cash flow or when valuing small, closed plans, the differences may be noticeable. **We are not recommending a change to this assumption as mid-year timing is reasonable** and avoids deviation from past precedence which could add unnecessary complexity to the valuation model.

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[11] American Community Survey from US Department of Commerce (US Census)

Section IV. Economic Assumptions

Inflation and COLA

The inflation assumption is at the heart of the economic assumptions, as it is used as a starting point for all other economic assumptions, including the Cost-of-Living Adjustment (COLA), salary improvement and investment return assumptions. Thus, our economic experience analysis starts with the inflation assumption. The current inflation assumption is 2.75%.

Unlike demographic assumptions where recent past experience is often a good predictor of future experience, economic assumptions, and particularly the investment return and inflation assumptions, typically reflect future expectations more than past experience. So, to review the current assumption, we analyzed inflation from two perspectives:

- Past experience – based on the Consumer Price Index for all Urban Consumers (CPI-U) over the last 5, 10, 15, 20 and 25 years

- Current expectations of future experience – based on investment experts' analysis and the Federal Reserve forecasts of future expected inflation.

The Supplemental Pension Benefits (i.e. COLAs) are also tied to increases in the CPI (with a cap). West Virginia Code §8-22-26a requires that all retirees, surviving beneficiaries, disability pensioners or future retirees receive a COLA payable on the first day of July, based on a percentage increase equal to any increase in the consumer price index as calculated by the United States Department of Labor, Bureau of Statistics for the preceding year. The COLA shall not exceed 4% per year and is not payable to a retiree until the first day of July after the second anniversary of the retiree's date of retirement. Additionally, the COLA shall only be calculated on the first $15,000 of the annual benefit paid and on the COLAs accumulated by the retiree since benefit commencement. If, at any time after the COLA becomes applicable, the total accumulated percentage increase in benefit on the allowable amount becomes less than 75% of the total accumulated percentage increase in the consumer price index over that same period of time, the 4% limitation shall be inapplicable until such time as the accumulated COLAs equal 75% of the accumulated increase in the consumer price index. The consumer price index used to determine the COLA is the CPI-U US City Average all items with a base of 1982-1984 equal to 100. The increase is measured as the increase in the annual average from the second prior calendar year to the annual average from the prior calendar year.

Past Experience

We first considered recent experience in developing our recommendation for the inflation assumption. Presented below are the average annual increases in the CPI-U, the same basis used for the determining the COLA percentage, over multiple time periods (ending with the annual average for calendar year 2019):

	Averaging Period				
	10 years	**20 years**	**25 years**	**30 years**	**35 years**
CPI-U Annual Average	1.77%	2.17%	2.20%	2.44%	2.61%

Section IV. Economic Assumptions

Inflation and COLA

Experts' Inflation Expectations
Next, we considered the inflation assumption built into investment return assumptions. The 2019 edition of the *Horizon Survey of Capital Market Assumptions* (Horizon Survey), which encompasses capital market assumptions from 34 investment advisors, shows an average 10-year future expected inflation rate of 2.21% and a 20-year rate of 2.29%[12].

The December forecast of the Federal Reserve Bank was 2.0%. In November 2019, the Philadelphia Federal Reserve published a 10-year expected rate of 2.2%.

Recommended Inflation Assumption
The past experience, the average of the expectations of the 34 investment managers represented in the Horizon Survey, and recent Federal Reserve expectations are all lower than the current inflation assumption, and as such, a decrease in the assumption likely is warranted. **We recommend decreasing the current 2.75% assumption for CPI increases to 2.50%.**

Additionally, although the COLA is capped at 4.00%, we recommend decreasing the COLA assumption by the same 25 basis points from 2.75% to 2.50%. This recommendation continues to align the COLA assumption with the inflation assumption, which is an appropriate relationship since expected future inflation rates are low, and resultingly, CPI increases above the 4.00% cap are expected to be infrequent. Given that both the recommended inflation and COLA assumptions are slightly higher than the aforementioned past experience and experts' expectations of future experience, this 2.50% assumption would likely be conservative for most purposes.

Investment Return / Discount Rate
The single assumption that has the largest effect on the determination of plan liabilities, funding levels and actuarially determined contributions (ADCs) is the investment return / discount rate assumption. This is not only an assumption about future expected returns on plan assets but also generally is the basis for setting the discount rate used to measure pension plan liabilities. The Board sets this assumption and it is the actuary's duty to provide information to the Board to help set all assumptions. Actuaries are also required to comply with Actuarial Standards of Practice No. 27 *Selection of Economic Assumptions for Measuring Pension Obligations* (ASOP 27) when setting the investment return / discount rate assumption that they recommend and use for the actuarial reports.

The most common way to set this assumption for a *single* plan is to look at the investment mix and expected future returns. We analyzed expected returns of the current aggregate investment mix of the plans using the Horizon Survey capital market assumptions. Based on this analysis, if this were a single plan that used a funding policy which adhered to actuarial principles and practices, then a reasonable discount rate might fall in the range of 5.64% to 6.42% (see the Appendix for additional details). We would like to note that the investment mix, in the aggregate, is more conservative than investment allocations for most other public sector plans, and therefore, results in lower expected returns.

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[12] When considering all 34 survey respondents. The rates are 2.30% and 2.29%, respectively, when considering only the 16 survey respondents who provided both a 10-year and 20-year inflation expectation.

Section IV. Economic Assumptions

Investment Return

However, this experience study does not cover just a single plan, but rather the 53 pension and relief funds for West Virginia municipal policemen and firemen, many of which have separate asset allocations and investment strategies. Since the actual investment return achieved for each fund is dependent on the asset allocation of each fund independently (not in the aggregate), an assumption needs to be determined for each plan individually. The prior actuary, GRS, created the following matrix to set the discount rate for each plan:

Funded Ratio as of Valuation Date[13]	Liquidity Ratio[14]	Equity Exposure[15]	Projected Funded Ratio after 15 Years[6]	Discount Rate
60% or more	10	50% or more	70% or more	6.5%
40% or more	8	40% or more	60% or more	6.0%
30% or more	6	30% or more	50% or more	5.5%
15% or more	4	N/A	40% or more	5.0%
Less than 15%	N/A	N/A	15% or more	4.5%
Less than 15%	N/A	N/A	Less than 15%	4.0%

Additionally, after discussions with the MPOB, GRS used a discount rate of 7.0% for plans that invest with the West Virginia Investment Management Board (IMB).

In analyzing this structure used for the discount rate selection process, we considered the following factors that were used by the prior actuary:

1. **Investment policy, including allocation to equities, alternative investments and other asset classes:** A cornerstone of financial economics is the correlation between risk and return resulting from the markets' demand for higher returns from riskier investments. An analysis of historical market returns shows that the returns for the equity markets have generally displayed greater variability but have generally outpaced the bond market returns over the long-term and a continuation of that trend is indicative in capital market assumptions today. These two investment categories (equities and bonds) together have historically comprised a majority allocation within the public pension fund universe. From their prevalence, the following generality has emerged: the higher a pension fund's equity allocation, the higher the expected return and, commensurately, the higher the degree of risk to which the plan is subject with respect to deviations of actual returns from expectation.

   In the current discount rate matrix, the highest tier for the equity exposure component is 50% or more. We recommend an update to the matrix to incorporate a 60% or more equity exposure tier since it is not uncommon for plans to have equity allocations around 60% and, generally, the expected portfolio return (assuming all else equal) is higher for a 60% equity allocation than a 50% equity allocation in order to compensate for the increased risk profile. Ideally, we would like to reflect other asset categories in the matrix, particularly return-seeking asset classes such as real estate and hedge funds but understand the complexity that doing so would create.

[13] Funded ratios based on a 6.0% investment return assumption for plans using an actuarially sound policy (Standard or Optional) and a 5.5% investment return assumption for other plans (Alternative or Conservation).
[14] Liquidity ratio equals assets as of the actuarial valuation date divided by expected benefit payments for the year.
[15] Based on target allocation percentage outlined in the investment policy.

Section IV. Economic Assumptions

Investment Return

In order to keep complexity levels in check while still developing a reasonable and appropriate assumption for each of the plans, we first created a base foundation for the assumption by leveraging the commonalities among the various allocations used by the plans. We removed some of the outlier plans (for example, plans with significant allocations to cash) from consideration and analyzed the allocations in the investment policy statements (IPSs) available to us (only some plans provided IPSs). Using this information, we generated a generalized allocation that is dependent on the total equity allocation (X%) of each plan. The allocation formula that resulted from this analysis is presented below and was used in conjunction with the remaining considerations (2. – 6.) to develop the final recommended assumption.

Investment Category	Portfolio Allocation
Equity – Large Cap	(X% - 5%) * 60%
Equity – Small/Mid Cap	(X% - 5%) * 40%
Equity – Non-US Emerging	5%
US Corporate Bonds	100% - X% - 5% - 5%
US Treasuries / Cash Equiv.	5%
Real Estate	5%

A limitation of this approach is that the resulting asset allocation based on the formula may not be exactly align with the target allocations for all plans. However, the formula should be appropriate for most plans, and combined with the considerations below, should produce reasonable assumptions.

2. **Funded ratio as of the valuation date:** When setting a discount rate to measure liabilities, consideration should be given to the level of plan assets, especially when the ratio of plan assets to plan liabilities is small. However, we believe that more emphasis should be given to the projected funded ratio.

3. **Projected funded ratio**: Even if a plan is poorly funded today, consideration should be given as to whether the plan is reasonably expected to be better funded in the future. Acknowledging that funded ratios can steadily increase due to expected future contributions which are developed using appropriate funding policies, GASB requires that future unfunded benefits be discounted to the valuation date using different interest rates than funded benefits.

4. **Liquidity requirements:** Having assets on hand to pay benefits is often correlated with the ability to invest using a long-term (and riskier) policy because it helps alleviate the worry of having to raise additional cash to pay benefits. However, liquidity requirements tend to be reflected in a plan's investment allocation as plans with higher liquidity requirements tend to allocate a higher percentage of their assets to cash or cash equivalents.

5. **Contribution policy (Alternative, Standard, Optional or Conservation):** The impact of the contribution policy is partially reflected in the *projected funded status in 15 years* component of the discount rate matrix since the contributions which are developed under the funding policy are added to plan assets in the projection. For this 15-year projection,

Section IV. Economic Assumptions

Investment Return

GRS applied another layer of impact as a result of the funding policy selection by using different discount rates depending on the policy: a discount rate of 6.0% was used for plans that use the Standard or Optional funding policies and a discount rate of 5.5% was used for other plans in this 15-year projection.

We suggest, for this 15-year projection, the continued use of a 6.0% discount rate for all plans that use the Standard or Optional funding policies but suggest a 5.0% discount rate for the plans that use the Alternative or Conservation funding policies. The rationale for increasing the difference, from 50 basis points to 100 basis points, between the discount rates used for the projections for these two sets of funding policies is to (1) reflect the generally lower funded status levels for plans using the Alternative and Conservation funding policies and (2) emphasize the shortcomings of these policies in regards to actuarial principles and practices (more on this topic in the following paragraphs).

The 15-year projection assumes that experience matches expectation, i.e. the projection represents a best-estimate scenario and does not reflect any sensitivity. However, if there are large deviations in plan experience or changes to assumptions or plan provisions, the contributions and, resultingly the funded status of the plans, would not fully reflect those changes for plans using the Alternative funding policy. Additionally, under these circumstances, contributions developed using the Conservation funding policy could inflate to unsustainable levels since contributions developed under that policy already are exposed to the risk of significant contribution increases as the plan matures.

By design, the Standard and Optional funding policies incorporate the relationship of plan assets to liabilities in the contribution development, and therefore, these plans can self-adjust to match experience though the amortization of gains and losses. The Alternative funding policy, by contrast, does not incorporate this relationship, and consequently, plans using this policy can suffer significant depreciation in funded status over time. Since the 15-year projection for the discount rate matrix considers neither the severe impact of unfavorable experience on the long-term funded status for plans using the Alternative or Conservation funding policies nor the sustainability of contributing the developed contributions, we suggest the use of a separate discount rate matrix, which incorporates an approach similar to that used for setting the discount rate for GASB accounting, for plans using these policies. To develop our recommended rates, we blended the portfolio expected returns with a hypothetical AA municipal bond rate of 4.00% based on the projected funded status of the plans in 15 years. We developed the 4.00% assumption based on historical yields on AA 20- and 30-year municipal bonds over the last 10-years.

Furthermore, if a plan is not making the required contributions under the funding policy, the 15-year projection would be modified to account for that by assuming that future contributions are based on the level of recent contributions.

6. **The West Virginia Investment Management Board (IMB):** The IMB generally employs a more aggressive investment strategy and generally has lower investment expenses due to achieving greater economies of scale than the average non-IMB investment manager.

Section IV. Economic Assumptions

Investment Return

Based on the above considerations, we are recommending the following two discount rate matrices:

Discount Rate Matrix for Plans Not Investing with the IMB					
Funded Ratio as of Valuation Date[16]	Liquidity Ratio[17]	Equity Exposure[18]	Projected Funded Ratio after 15 Years[16]	Discount Rate – Standard and Optional Policies	Discount Rate – Alternative and Conservation Policies
30% or more	N/A	60% or more	70% or more	6.50%	6.25%
30% or more	N/A	50% or more	70% or more	6.25%	6.00%
30% or more	N/A	40% or more	60% or more	6.00%	5.50%
15% or more	N/A	30% or more	50% or more	5.75%	5.00%
15% or more	N/A	20% or more	40% or more	5.50%	4.75%
Less than 15%	N/A	Less than 20%	15% or more	5.00%	4.25%
Less than 15%	N/A	Less than 20%	Less than 15%	5.00%	4.00%

Discount Rate Matrix for Plans Investing with the IMB					
Funded Ratio as of Valuation Date[16]	Liquidity Ratio[17]	Equity Exposure[18]	Projected Funded Ratio after 15 Years[16]	Discount Rate – Standard and Optional Policies[19]	Discount Rate – Alternative and Conservation Policies
30% or more	N/A	N/A	70% or more	7.00%	6.50%
30% or more	N/A	N/A	70% or more	7.00%	6.00%
15% or more	N/A	N/A	50% or more	7.00%	5.50%
15% or more	N/A	N/A	40% or more	7.00%	5.25%
Less than 15%	N/A	N/A	15% or more	7.00%	4.75%
Less than 15%	N/A	N/A	Less than 15%	7.00%	4.50%

If a plan has not funded the required contribution in the prior year, we recommend that the 15-year projection assume the actual dollar amount of the contribution made in that prior year continues.

The MPOB might also find interesting the NASRA survey of discount rates shown below. These rates tend to be higher than those used by the West Virginia plans. The primary reason for this discrepancy is the differences in funded ratios (West Virginia plans have lower funding levels than most of the plans in the survey) and funding policies (not all West Virginia plans fund the Actuarially Determined Contribution, i.e. a contribution that is developed based on actuarial practices and principles).

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[16] Funded ratios based on a 6.0% investment return assumption for plans using an actuarially sound policy (Standard or Optional) and a 5.0% investment return assumption for other plans (Alternative or Conservation).
[17] Liquidity ratio equals assets as of the actuarial valuation date divided by expected benefit payments for the year.
[18] Based on target allocation percentage outlined in the investment policy.
[19] Assumes the IMB maintains a current growth asset target above 70%. If this policy changes, the assumption should be reviewed

Section IV. Economic Assumptions

Investment Return

Figure 4: Change in Distribution of Public Pension Investment Return Assumptions. FY 01 to FY 20
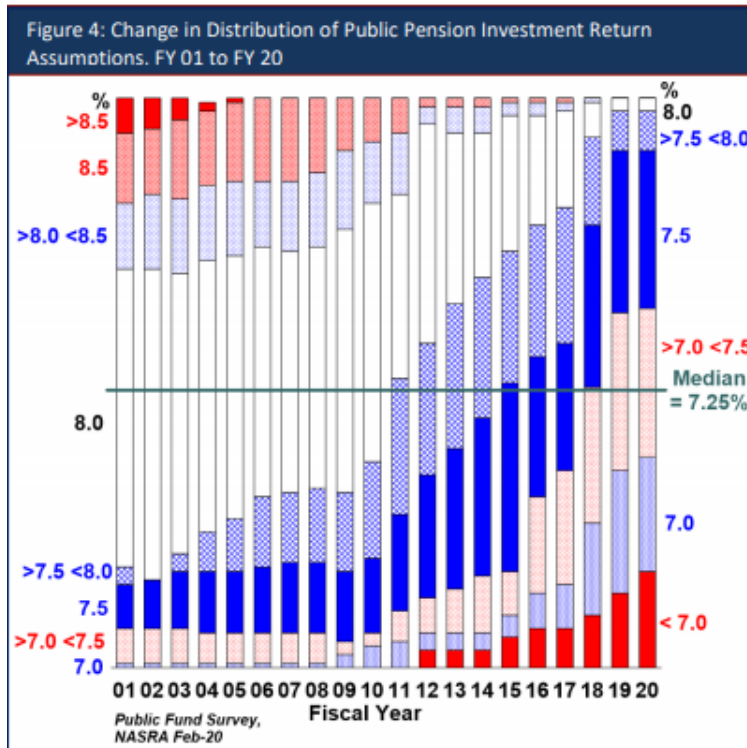
Risk Free Rates of Return (or Bond Rates) for Discount Rates
Like the other assumptions, the investment rate of return assumption is based on a best estimate methodology. We believe that the current method meets the current standard of practice and accounting rules. However, these rules are currently under discussion. Some believe that liabilities should be discounted at a rate that is independent of how assets are invested (e.g. the use of a bond rate to discount liabilities). The Actuarial Standards Board is working on new standards that would require disclosure of liabilities using bond rates. This is referred to as the *Low-Default-Risk Obligation Measure* in the exposure draft of Actuarial Standard of Practice No. 4.

Administrative Expenses

The current assumption for the amount of administrative (non-investment) expenses for the contribution year is the expense assumption used for the prior valuation, increased by 2.75% for inflation. We determined this expense assumption based on discussions with the MPOB and currently available information, recognizing that the assumption would be evaluated in this experience study. We note that the available administrative expense information has been inconsistent among the plans, with the trust statements for only some of the plans clearly labeling these expenses. Additionally, administrative expense information in the trust fund statements did not always match up with the assumption.

We recommend changing the current assumption for administrative expenses to be the average of the expenses from the prior two fiscal years, adjusted for inflation to the year of the contribution. This method is auto-adjusting and easily explained.

Section IV. Economic Assumptions

Pay Increases

The current pay increase assumption has three components. The values for each of these components are added together. The current assumptions are:

1. General Inflation: 2.75% *plus*
2. Wage Inflation Increment: 1.00% *plus*
3. Service-based Increase:

Years of Service[20]	Increase
0	20.00%
1	6.50%
2	3.50%
3	2.75%
4-8	2.50%
9-28	2.00%
29-33	1.25%
34+	0.00%

The analysis below is based on pay for the fiscal years beginning on July 1, 2015, 2016 and 2017 compared to the sum of the above three current components. Actual pay raises were varied throughout the three-year period.

Salary Increases (Police Only)					
Years of Service	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumptions	Actual / Expected (Proposed Rates)
0	23.75%	20.19%	85%	20.00%	101%
1	10.25%	7.89%	77%	9.00%	88%
2	7.25%	4.27%	59%	6.50%	66%
3	6.50%	2.97%	46%	6.00%	49%
4	6.25%	4.21%	67%	5.00%	84%
5-8	6.25%	3.82%	61%	5.00%	76%
9-13	5.75%	3.68%	64%	5.00%	74%
14-18	5.75%	4.87%	85%	5.00%	97%
19-23	5.75%	3.58%	62%	5.00%	72%
24-28	5.75%	4.54%	79%	5.00%	91%
29-33	5.00%	1.75%	35%	4.00%	44%
34-38	3.75%	2.51%	67%	3.50%	72%
≥39	3.75%	1.81%	48%	3.50%	52%

[20] The prior actuary presented this table beginning at 1 year of service. We have shifted the rates to better align with how we present this assumption, which is such that to determine the estimated salary for a year, the salary for the preceding year is multiplied by the rate corresponding to the years of service at the beginning of that preceding year. As an example, the 20% increase rate at 0 years of service is applied to the salary received during the first year of employment (from time 0 to time 1) in order to determine the expected salary payable during year 2 (from time 1 to time 2).

Section IV. Economic Assumptions

Pay Increases

Salary (Police only)
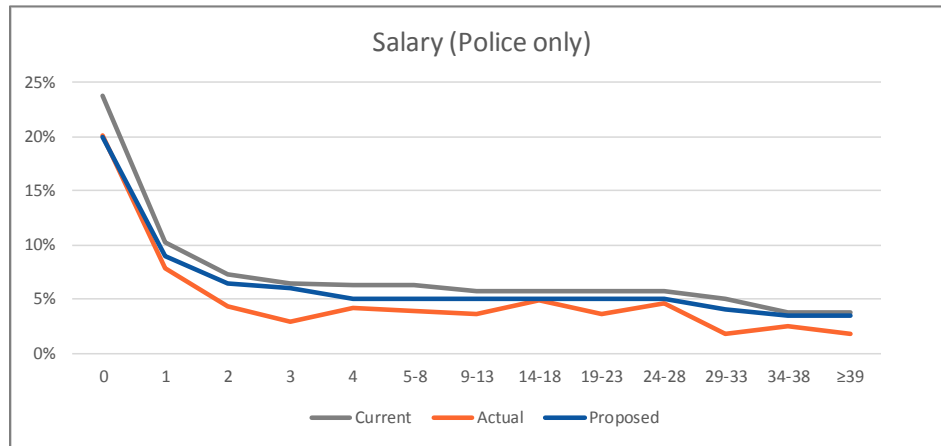
Salary Increases (Fire Only)					
Years of Service	Expected from Current Assumptions	Actual	Actual / Expected	Expected from Proposed Assumptions	Actual / Expected (Proposed Rates)
0	23.75%	17.43%	73%	20.00%	87%
1	10.25%	9.62%	94%	9.00%	107%
2	7.25%	3.93%	54%	6.50%	60%
3	6.50%	5.50%	85%	6.00%	92%
4	6.25%	5.62%	90%	5.00%	112%
5-8	6.25%	4.45%	71%	5.00%	89%
9-13	5.75%	4.25%	74%	5.00%	85%
14-18	5.75%	4.31%	75%	5.00%	86%
19-23	5.75%	5.03%	87%	5.00%	101%
24-28	5.75%	4.33%	75%	5.00%	87%
29-33	5.00%	3.12%	62%	4.00%	78%
34-38	3.75%	3.45%	92%	3.50%	99%
≥39	3.75%	N/A	100%	3.50%	100%

Salary (Fire only)
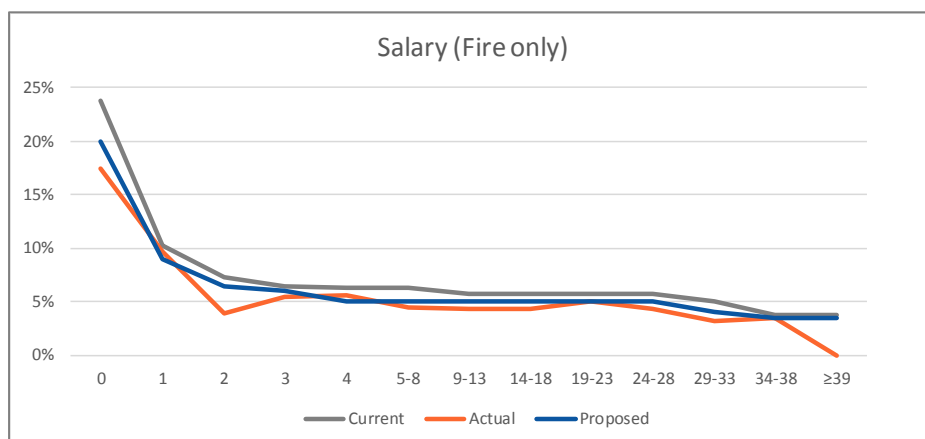
Section IV. Economic Assumptions

Pay Increases

We propose the following changes to this assumption to better align with recent experience and expected future experience. Please note that we are not recommending separate assumptions for Police and Fire because their increases, although not the same, were similar enough per year of service to justify the same assumption for both plans.

Years of Service	Current Total Rate	Proposed Total Rate
0	23.75%	20.00%
1	10.25%	9.00%
2	7.25%	6.50%
3	6.50%	6.00%
4-8	6.25%	5.00%
9-28	5.75%	5.00%
29-33	5.00%	4.00%
34+	5.00%	3.50%

New Hire Pay Growth Assumption

We assume the average pay for new hires will be 3.75% higher than the prior year's average new hire pay[21]. The 3.75% assumption is the sum of the general inflation assumption of 2.75% and the wage inflation increment of 1.00%.

We recommend lowering this assumption by the same 0.25% reduction that we are recommending for the inflation assumption. Thus, new hire pay will be assumed to increase 3.50% per year.

Note that this assumption generally aligns with the final rate of salary increase in the salary scale assumption since employees nearing the end of long careers generally have reached their peak job proficiency/abilities, and likewise, are not expected to receive many increases that exceed the sum of the general and additional wage inflation increases (i.e. no additional merit increases at those later years).

The final rate of assumed salary increase and the new hire pay growth assumption are also often related to an overall payroll growth assumption. Such is the case for plans that are assumed to have achieved a steady state population in which the number of actives in the plan remains level throughout a projection period. Plans (other than the WV plans) that develop contributions which include amortizations calculated as a level percentage of payroll use this assumption to determine amortization amounts. However, the WV plans use level dollar, rather than level percentage of pay, amortizations, and as such, the payroll growth assumption is not used for this valuation.

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[21] The ratio of pay for a new hire to the pay of a different new hire brought on board a year earlier.

Section IV. Economic Assumptions

Pay Spiking at Retirement

We looked at the level of increases in average compensation associated with the inclusion of unused accrued leave balances when determining a members' pension. Our sample size of data included only the members eligible for the Beckley Fire DROP. Additionally, a majority of the municipalities provided a general estimate of the average percentage of final compensation that is attributable to accrued leave time. Based on our analysis of this information and the Beckley Fire DROP data, we recommend the use of a 6% load to average annual compensation in the computation of active retirement and termination pension benefits for plans that pay out unused accrued leave time.

For the July 1, 2018 valuation, we asked each of the municipalities to indicate whether unused accrued leave (vacation and sick time) is paid to employees and therefore included in pensionable compensation for the plans. If a municipality responded "Yes", provided a percentage of pensionable compensation in the final year of employment that is attributable to leave time, or did not respond to the question, then we suggest applying this 6% load. If a municipality responded "No", then we recommend that no load be applied.

Premium tax increase assumption:

Historical net premium tax amounts (after expenses) for 2002 and the last nine years (2011-2019) are presented below. For this table, we have ignored reallocations but there may be some reallocations in the 2002 value. We show the amount for the year 2002 in addition to the nine most recent years in order to provide a longer-term average increase rate:

Year	Amount	Annual Increase in Premium Tax Amounts	Avg Compounded Increase to 2019	Avg Compounded CPI-U Increase to 2019 (based on December index)
2002	$9,9xx,xxx[22]	N/A	≈ 4.1%	2.1%
2011	16,169,054	3.0%	2.4%	1.6%
2012	16,646,793	(4.6%)	2.3%	1.6%
2013	15,877,441	3.2%	3.5%	1.6%
2014	16,382,554	1.4%	3.5%	1.8%
2015	16,619,183	4.7%	4.1%	2.1%
2016	17,406,426	2.8%	3.9%	2.1%
2017	$17,899,708	2.1%	4.4%	2.1%
2018	$18,280,163	6.7%	6.7%	2.3%
2019	$19,500,066	N/A	NA	NA

It seems clear that the premium taxes have increased faster than CPI in the past. The current assumption is that the premium taxes as well as the CPI will increase by 2.75% annually. During discussions with the MPOB, we debated whether increases in premium revenues could continue to outpace inflation. Additionally, we questioned whether any of the increases in premium tax revenue were the result of specific, one-time events, and therefore should be isolated from other increases when examining the assumption. The MPOB staff, as well as the experience study subcommittee believe that premium revenue increases in excess of inflation were unlikely in the future. As such, we recommend an assumption of 2.50%, consistent with our inflation and COLA assumption recommendations.

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[22] From page 11 of the *Consolidated Actuarial Valuation Report for the Year Beginning July 1, 2011* prepared by GRS

Section V. Impact of Changes

The estimated cost for the changes recommended in this report was developed based on the July 1, 2018 census and asset information. Below is a list of the impact on the actuarial accrued liability, the employer normal cost, the unfunded actuarial accrued liability, the funded ratio, and the GASB ADC. The tables that follow on this page present these metrics in total for each of Police, Fire, and Total, while the tables on the pages that follow present the metrics by plan. The GASB ADC is the ADC calculated for GASB purposes. For plans using the Standard or Optional funding policies, the GASB ADC matches the developed contribution required under the West Virginia Code for such funding policies. However, the GASB ADC will not match the required contribution for plans using either the Alternative or Conservation funding policy. We show the GASB ADC, rather than the required funding contribution, since, as discussed earlier in this report, the Alternative contribution is unaffected by valuation assumption changes and both the Alternative and Conservation policies generally do not adhere to actuarial principles. Note the assumption changes will take effect for the 2020 valuation (FY2022 contribution) and not the 2018 valuation (FY2020 contribution).

Police	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
A. Current Assumptions	776,177,809	14,942,381	541,535,228	30.23%	49,108,285
B. Proposed Assumptions	733,343,592	11,734,035	498,701,011	32.00%	43,023,021
C. Dollar Difference (B. – A.)	(42,834,217)	(3,208,346)	(42,834,217)	N/A	(6,085,264)
D. Percentage Difference (B. / A.)	-5.5%	-21.5%	-7.9%	1.77%	-12.4%

Fire	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
A. Current Assumptions	796,596,817	14,484,562	623,992,062	21.67%	52,369,306
B. Proposed Assumptions	737,379,815	13,912,948	564,775,060	23.41%	48,341,466
C. Dollar Difference (B. – A.)	(59,217,002)	(571,614)	(59,217,002)	N/A	(4,027,840)
D. Percentage Difference (B. / A.)	-7.4%	-3.9%	-9.5%	1.74%	-7.7%

Total	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
A. Current Assumptions	1,572,774,626	29,426,943	1,165,527,291	25.89%	101,477,591
B. Proposed Assumptions	1,470,723,407	25,646,983	1,063,476,072	27.69%	91,364,487
C. Dollar Difference (B. – A.)	(102,051,219)	(3,779,960)	(102,051,219)	N/A	(10,113,104)
D. Percentage Difference (B. / A.)	-6.5%	-12.8%	-8.8%	1.80%	-10.0%

Results by Plan

Plan	Assets	Current Assumptions						Proposed Assumptions					
		Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC	Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
Beckley Fire	18,449,645	4.50%	48,944,997	1,028,221	30,495,352	37.69%	2,840,851	4.25%	47,176,447	1,073,261	28,726,802	39.11%	2,732,777
Beckley Police	22,217,794	5.50%	38,426,374	835,404	16,208,580	57.82%	1,923,216	5.00%	39,026,003	779,382	16,808,209	56.93%	1,843,480
Belle Police	1,507,352	7.00%	1,651,540	180	144,188	91.27%	16,865	7.00%	1,508,571	180	1,219	99.92%	327
Bluefield Fire	4,404,012	5.00%	18,241,162	237,900	13,837,150	24.14%	1,103,935	4.75%	17,417,592	250,922	13,013,580	25.28%	1,043,042
Bluefield Police	6,117,195	6.00%	12,868,581	276,559	6,751,386	47.54%	752,872	6.25%	11,754,119	200,970	5,636,924	52.04%	608,375
Charles Town Police	490,865	5.00%	1,300,202	1,107	809,337	37.75%	85,216	5.75%	1,102,628	1,103	611,763	44.52%	67,356
Charleston Fire	20,062,367	4.50%	190,005,438	2,763,190	169,943,071	10.56%	12,798,513	4.25%	183,599,996	2,851,947	163,537,629	10.93%	12,230,829
Charleston Police	22,407,738	4.50%	181,855,357	2,871,029	159,447,619	12.32%	12,292,781	4.25%	175,277,700	2,345,096	152,869,962	12.78%	11,105,441
Chester Police	1,677,406	6.50%	2,255,142	24,027	577,736	74.38%	89,894	7.00%	1,999,303	14,432	321,897	83.90%	52,163
Clarksburg Fire	8,484,043	5.00%	34,179,340	725,750	25,695,297	24.82%	2,340,972	5.00%	32,124,750	701,873	23,640,707	26.41%	2,188,786
Clarksburg Police	8,282,821	5.00%	30,137,664	756,788	21,854,843	27.48%	2,134,042	5.00%	28,254,243	585,030	19,971,422	29.32%	1,840,963
Dunbar Fire	818,621	4.50%	14,074,600	280,825	13,255,979	5.82%	1,065,058	4.25%	13,444,139	295,129	12,625,518	6.09%	1,020,779
Dunbar Police	6,053,845	6.00%	8,313,055	128,921	2,259,210	72.82%	289,385	6.00%	7,882,721	106,154	1,828,876	76.80%	236,106
Elkins Fire	1,658,526	6.00%	1,477,538	44,649	(180,988)	112.25%	45,969	6.00%	1,446,357	42,984	(212,169)	114.67%	44,254
Elkins Police	3,521,226	6.50%	4,952,929	47,637	1,431,703	71.09%	210,482	6.25%	4,687,648	40,132	1,166,422	75.12%	171,065
Fairmont Fire	3,126,658	4.00%	45,565,515	993,224	42,438,857	6.86%	3,359,710	4.25%	41,080,927	878,171	37,954,269	7.61%	3,059,397
Fairmont Police	6,662,185	5.00%	29,191,914	490,383	22,529,729	22.82%	1,903,011	4.75%	28,208,464	399,525	21,546,279	23.62%	1,710,646
Grafton Fire	1,696,760	6.00%	2,776,762	10,800	1,080,002	61.11%	129,613	6.00%	2,580,941	10,376	884,181	65.74%	107,693
Grafton Police	1,571,613	6.00%	2,065,335	31,940	493,722	76.09%	87,053	6.00%	2,000,395	25,149	428,782	78.57%	72,937
Huntington Fire	26,976,494	5.00%	114,554,307	1,324,163	87,577,813	23.55%	6,800,973	5.75%	97,160,433	1,021,935	70,183,939	27.76%	5,789,617
Huntington Police	37,283,688	5.50%	102,850,245	1,262,248	65,566,557	36.25%	5,605,199	5.75%	95,435,714	896,331	58,152,026	39.07%	4,848,076
Logan Fire	829,246	6.00%	1,765,253	89,275	936,007	46.98%	194,610	6.50%	1,506,338	70,496	677,092	55.05%	149,045
Logan Police	834,749	6.00%	1,959,520	77,815	1,124,771	42.60%	203,522	6.50%	1,722,196	52,623	887,447	48.47%	154,302
Martinsburg Fire	2,975,500	4.50%	35,206,075	874,211	32,230,575	8.45%	2,785,253	4.25%	34,255,839	917,604	31,280,339	8.69%	2,719,356
Martinsburg Police	8,597,507	4.50%	39,836,208	1,167,405	31,238,701	21.58%	3,026,760	4.25%	39,189,259	1,003,022	30,591,752	21.94%	2,767,332
Morgantown Fire	12,718,148	4.50%	49,198,599	1,540,720	36,480,451	25.85%	3,716,017	4.25%	48,209,804	1,602,280	35,491,656	26.38%	3,658,405
Morgantown Police	15,731,259	4.50%	66,239,785	1,707,118	50,508,526	23.75%	4,709,414	4.25%	65,096,462	1,428,108	49,365,203	24.17%	4,271,131
Moundsville Fire	1,466,645	5.00%	4,017,754	40,307	2,551,109	36.50%	199,887	5.50%	3,434,160	34,603	1,967,515	42.71%	164,836
Moundsville Police	5,662,695	6.50%	7,885,483	91,329	2,222,788	71.81%	256,584	6.50%	7,477,128	70,065	1,814,433	75.73%	204,816
Nitro Fire	1,701,096	4.50%	10,171,804	319,763	8,470,708	16.72%	824,018	4.25%	9,883,368	336,849	8,182,272	17.21%	810,186
Nitro Police	4,135,800	5.00%	11,434,137	394,057	7,298,337	36.17%	857,476	4.75%	11,409,148	344,001	7,273,348	36.25%	791,505
Oak Hill Police	4,407,224	6.50%	3,636,525	57,306	(770,699)	121.19%	59,139	6.25%	3,514,930	45,298	(892,294)	125.39%	46,692
Parkersburg Fire	16,820,783	5.00%	63,270,260	1,031,278	46,449,477	26.59%	3,944,190	5.75%	53,714,762	800,088	36,893,979	31.32%	3,313,793
Parkersburg Police	13,675,772	5.00%	56,226,617	1,189,852	42,550,845	24.32%	3,864,328	5.75%	48,021,704	733,334	34,345,932	28.48%	3,073,107
Point Pleasant Police	1,117,892	5.00%	4,557,827	74,498	3,439,935	24.53%	433,713	5.75%	3,961,190	47,082	2,843,298	28.22%	356,196

Plan	Assets	Current Assumptions						Proposed Assumptions					
		Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC	Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
Princeton Fire	2,948,777	4.50%	11,439,828	255,241	8,491,051	25.78%	759,255	4.25%	11,043,479	262,891	8,094,702	26.70%	729,682
Princeton Police	4,367,431	5.00%	12,416,320	345,088	8,048,889	35.17%	853,954	4.75%	11,827,767	291,624	7,460,336	36.93%	749,195
South Charleston Fire	2,708,786	4.50%	35,699,812	978,675	32,991,026	7.59%	2,936,673	4.25%	34,904,965	1,019,221	32,196,179	7.76%	2,875,298
South Charleston Police	3,083,043	4.50%	27,866,357	857,005	24,783,314	11.06%	2,330,590	4.25%	27,141,283	712,152	24,058,240	11.36%	2,098,045
St. Albans Fire	2,647,869	4.00%	20,936,048	468,251	18,288,179	12.65%	1,488,837	4.00%	19,476,600	450,497	16,828,731	13.60%	1,390,027
St. Albans Police	7,014,938	5.50%	16,247,611	378,406	9,232,673	43.18%	995,398	5.00%	16,567,346	353,563	9,552,408	42.34%	956,103
Star City Police	1,649,870	6.50%	1,752,722	56,684	102,852	94.13%	66,009	6.25%	1,724,697	47,074	74,827	95.66%	53,849
Vienna Police	8,503,416	6.50%	10,615,418	212,034	2,112,002	80.10%	456,794	6.25%	10,580,187	181,179	2,076,771	80.37%	417,678
Weirton Fire	10,970,366	6.50%	15,154,723	334,242	4,184,357	72.39%	650,523	6.50%	14,431,269	330,278	3,460,903	76.02%	593,599
Weirton Police	5,423,826	4.50%	37,972,858	867,982	32,549,032	14.28%	2,797,576	5.75%	30,429,569	456,841	25,005,743	17.82%	2,158,141
Welch Police	2,789,094	6.50%	2,481,843	50,740	(307,251)	112.38%	52,363	6.50%	2,381,722	43,811	(407,372)	117.10%	45,213
Weston Fire	1,224,278	6.50%	1,764,480	47,775	540,202	69.38%	88,755	6.50%	1,675,888	47,411	451,610	73.05%	81,908
Weston Police	1,461,295	6.50%	1,454,284	25,980	(7,011)	100.48%	26,811	6.50%	1,353,853	19,553	(107,442)	107.94%	20,179
Westover Police	2,511,568	6.50%	2,773,906	34,921	262,338	90.54%	65,598	6.25%	2,689,764	33,012	178,196	93.38%	53,843
Wheeling Fire	28,267,209	5.50%	73,667,190	1,046,854	45,399,981	38.37%	4,058,715	6.00%	64,946,806	874,793	36,679,597	43.52%	3,443,997
Wheeling Police	24,663,385	6.00%	52,405,068	599,766	27,741,683	47.06%	2,541,090	6.00%	49,032,740	462,291	24,369,355	50.30%	2,165,716
Williamson Fire	1,648,926	5.50%	4,485,332	49,248	2,836,406	36.76%	236,979	6.00%	3,864,955	39,339	2,216,029	42.66%	194,160
Williamson Police	1,218,089	6.00%	2,546,982	28,172	1,328,893	47.82%	121,150	7.00%	2,085,138	15,918	867,049	58.42%	83,043
Total Police	**234,642,581**		**776,177,809**	**14,942,381**	**541,535,228**	**30.23%**	**49,108,285**		**733,343,592**	**11,734,035**	**498,701,011**	**32.00%**	**43,023,021**
Total Fire	**172,604,755**		**796,596,817**	**14,484,562**	**623,992,062**	**21.67%**	**52,369,306**		**737,379,815**	**13,912,948**	**564,775,060**	**23.41%**	**48,341,466**
Total	**407,247,335**		**1,572,774,626**	**29,426,943**	**1,165,527,291**	**25.89%**	**101,477,591**		**1,470,723,407**	**25,646,983**	**1,063,476,072**	**27.69%**	**91,364,487**

Difference by Plan

Plan	Assets	Difference (Proposed - Current) in Dollars						Difference (Proposed - Current) as a Percentage					
		Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC	Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
Beckley Fire	N/A	N/A	(1,768,550)	45,040	(1,768,550)	N/A	(108,074)	-0.25%	-3.6%	4.4%	-5.8%	1.42%	-3.8%
Beckley Police	N/A	N/A	599,629	(56,022)	599,629	N/A	(79,736)	-0.50%	1.6%	-6.7%	3.7%	-0.89%	-4.1%
Belle Police	N/A	N/A	(142,969)	-	(142,969)	N/A	(16,538)	0.00%	-8.7%	0.0%	-99.2%	8.65%	-98.1%
Bluefield Fire	N/A	N/A	(823,570)	13,022	(823,570)	N/A	(60,893)	-0.25%	-4.5%	5.5%	-6.0%	1.14%	-5.5%
Bluefield Police	N/A	N/A	(1,114,462)	(75,589)	(1,114,462)	N/A	(144,497)	0.25%	-8.7%	-27.3%	-16.5%	4.50%	-19.2%
Charles Town Police	N/A	N/A	(197,574)	(4)	(197,574)	N/A	(17,860)	0.75%	-15.2%	-0.4%	-24.4%	6.77%	-21.0%
Charleston Fire	N/A	N/A	(6,405,442)	88,757	(6,405,442)	N/A	(567,684)	-0.25%	-3.4%	3.2%	-3.8%	0.37%	-4.4%
Charleston Police	N/A	N/A	(6,577,657)	(525,933)	(6,577,657)	N/A	(1,187,340)	-0.25%	-3.6%	-18.3%	-4.1%	0.46%	-9.7%
Chester Police	N/A	N/A	(255,839)	(9,595)	(255,839)	N/A	(37,731)	0.50%	-11.3%	-39.9%	-44.3%	9.52%	-42.0%
Clarksburg Fire	N/A	N/A	(2,054,590)	(23,877)	(2,054,590)	N/A	(152,186)	0.00%	-6.0%	-3.3%	-8.0%	1.59%	-6.5%
Clarksburg Police	N/A	N/A	(1,883,421)	(171,758)	(1,883,421)	N/A	(293,079)	0.00%	-6.2%	-22.7%	-8.6%	1.84%	-13.7%
Dunbar Fire	N/A	N/A	(630,461)	14,304	(630,461)	N/A	(44,279)	-0.25%	-4.5%	5.1%	-4.8%	0.27%	-4.2%
Dunbar Police	N/A	N/A	(430,334)	(22,767)	(430,334)	N/A	(53,279)	0.00%	-5.2%	-17.7%	-19.0%	3.98%	-18.4%
Elkins Fire	N/A	N/A	(31,181)	(1,665)	(31,181)	N/A	(1,715)	0.00%	-2.1%	-3.7%	17.2%	2.42%	-3.7%
Elkins Police	N/A	N/A	(265,281)	(7,505)	(265,281)	N/A	(39,417)	-0.25%	-5.4%	-15.8%	-18.5%	4.03%	-18.7%
Fairmont Fire	N/A	N/A	(4,484,588)	(115,053)	(4,484,588)	N/A	(300,313)	0.25%	-9.8%	-11.6%	-10.6%	0.75%	-8.9%
Fairmont Police	N/A	N/A	(983,450)	(90,858)	(983,450)	N/A	(192,365)	-0.25%	-3.4%	-18.5%	-4.4%	0.80%	-10.1%
Grafton Fire	N/A	N/A	(195,821)	(424)	(195,821)	N/A	(21,920)	0.00%	-7.1%	-3.9%	-18.1%	4.63%	-16.9%
Grafton Police	N/A	N/A	(64,940)	(6,791)	(64,940)	N/A	(14,116)	0.00%	-3.1%	-21.3%	-13.2%	2.48%	-16.2%
Huntington Fire	N/A	N/A	(17,393,874)	(302,228)	(17,393,874)	N/A	(1,011,356)	0.75%	-15.2%	-22.8%	-19.9%	4.21%	-14.9%
Huntington Police	N/A	N/A	(7,414,531)	(365,917)	(7,414,531)	N/A	(757,123)	0.25%	-7.2%	-29.0%	-11.3%	2.82%	-13.5%
Logan Fire	N/A	N/A	(258,915)	(18,779)	(258,915)	N/A	(45,565)	0.50%	-14.7%	-21.0%	-27.7%	8.07%	-23.4%
Logan Police	N/A	N/A	(237,324)	(25,192)	(237,324)	N/A	(49,220)	0.50%	-12.1%	-32.4%	-21.1%	5.87%	-24.2%
Martinsburg Fire	N/A	N/A	(950,236)	43,393	(950,236)	N/A	(65,897)	-0.25%	-2.7%	5.0%	-2.9%	0.24%	-2.4%
Martinsburg Police	N/A	N/A	(646,949)	(164,383)	(646,949)	N/A	(259,428)	-0.25%	-1.6%	-14.1%	-2.1%	0.36%	-8.6%
Morgantown Fire	N/A	N/A	(988,795)	61,560	(988,795)	N/A	(57,612)	-0.25%	-2.0%	4.0%	-2.7%	0.53%	-1.6%
Morgantown Police	N/A	N/A	(1,143,323)	(279,010)	(1,143,323)	N/A	(438,283)	-0.25%	-1.7%	-16.3%	-2.3%	0.42%	-9.3%
Moundsville Fire	N/A	N/A	(583,594)	(5,704)	(583,594)	N/A	(35,051)	0.50%	-14.5%	-14.2%	-22.9%	6.21%	-17.5%
Moundsville Police	N/A	N/A	(408,355)	(21,264)	(408,355)	N/A	(51,768)	0.00%	-5.2%	-23.3%	-18.4%	3.92%	-20.2%
Nitro Fire	N/A	N/A	(288,436)	17,086	(288,436)	N/A	(13,832)	-0.25%	-2.8%	5.3%	-3.4%	0.49%	-1.7%
Nitro Police	N/A	N/A	(24,989)	(50,056)	(24,989)	N/A	(65,971)	-0.25%	-0.2%	-12.7%	-0.3%	0.08%	-7.7%
Oak Hill Police	N/A	N/A	(121,595)	(12,008)	(121,595)	N/A	(12,447)	-0.25%	-3.3%	-21.0%	15.8%	4.20%	-21.0%
Parkersburg Fire	N/A	N/A	(9,555,498)	(231,190)	(9,555,498)	N/A	(630,397)	0.75%	-15.1%	-22.4%	-20.6%	4.73%	-16.0%
Parkersburg Police	N/A	N/A	(8,204,913)	(456,518)	(8,204,913)	N/A	(791,221)	0.75%	-14.6%	-38.4%	-19.3%	4.16%	-20.5%
Point Pleasant Police	N/A	N/A	(596,637)	(27,416)	(596,637)	N/A	(77,517)	0.75%	-13.1%	-36.8%	-17.3%	3.69%	-17.9%

Plan	Assets	Difference (Proposed - Current) in Dollars						Difference (Proposed - Current) as a Percentage					
		Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC	Discount Rate	Actuarial Accrued Liability	Employer Normal Cost	Unfunded Accrued Liability	Funded Ratio	GASB ADC
Princeton Fire	N/A	N/A	(396,349)	7,650	(396,349)	N/A	(29,573)	-0.25%	-3.5%	3.0%	-4.7%	0.92%	-3.9%
Princeton Police	N/A	N/A	(588,553)	(53,464)	(588,553)	N/A	(104,759)	-0.25%	-4.7%	-15.5%	-7.3%	1.76%	-12.3%
South Charleston Fire	N/A	N/A	(794,847)	40,546	(794,847)	N/A	(61,375)	-0.25%	-2.2%	4.1%	-2.4%	0.17%	-2.1%
South Charleston Police	N/A	N/A	(725,074)	(144,853)	(725,074)	N/A	(232,545)	-0.25%	-2.6%	-16.9%	-2.9%	0.30%	-10.0%
St. Albans Fire	N/A	N/A	(1,459,448)	(17,754)	(1,459,448)	N/A	(98,810)	0.00%	-7.0%	-3.8%	-8.0%	0.95%	-6.6%
St. Albans Police	N/A	N/A	319,735	(24,843)	319,735	N/A	(39,295)	-0.50%	2.0%	-6.6%	3.5%	-0.84%	-3.9%
Star City Police	N/A	N/A	(28,025)	(9,610)	(28,025)	N/A	(12,160)	-0.25%	-1.6%	-17.0%	-27.2%	1.53%	-18.4%
Vienna Police	N/A	N/A	(35,231)	(30,855)	(35,231)	N/A	(39,116)	-0.25%	-0.3%	-14.6%	-1.7%	0.27%	-8.6%
Weirton Fire	N/A	N/A	(723,454)	(3,964)	(723,454)	N/A	(56,924)	0.00%	-4.8%	-1.2%	-17.3%	3.63%	-8.8%
Weirton Police	N/A	N/A	(7,543,289)	(411,141)	(7,543,289)	N/A	(639,435)	1.25%	-19.9%	-47.4%	-23.2%	3.54%	-22.9%
Welch Police	N/A	N/A	(100,121)	(6,929)	(100,121)	N/A	(7,150)	0.00%	-4.0%	-13.7%	32.6%	4.72%	-13.7%
Weston Fire	N/A	N/A	(88,592)	(364)	(88,592)	N/A	(6,847)	0.00%	-5.0%	-0.8%	-16.4%	3.67%	-7.7%
Weston Police	N/A	N/A	(100,431)	(6,427)	(100,431)	N/A	(6,632)	0.00%	-6.9%	-24.7%	1432.5%	7.46%	-24.7%
Westover Police	N/A	N/A	(84,142)	(1,909)	(84,142)	N/A	(11,755)	-0.25%	-3.0%	-5.5%	-32.1%	2.84%	-17.9%
Wheeling Fire	N/A	N/A	(8,720,384)	(172,061)	(8,720,384)	N/A	(614,718)	0.50%	-11.8%	-16.4%	-19.2%	5.15%	-15.1%
Wheeling Police	N/A	N/A	(3,372,328)	(137,475)	(3,372,328)	N/A	(375,374)	0.00%	-6.4%	-22.9%	-12.2%	3.24%	-14.8%
Williamson Fire	N/A	N/A	(620,377)	(9,909)	(620,377)	N/A	(42,819)	0.50%	-13.8%	-20.1%	-21.9%	5.90%	-18.1%
Williamson Police	N/A	N/A	(461,844)	(12,254)	(461,844)	N/A	(38,107)	1.00%	-18.1%	-43.5%	-34.8%	10.60%	-31.5%
Total Police	**N/A**	**N/A**	**(42,834,217)**	**(3,208,346)**	**(42,834,217)**	**N/A**	**(6,085,264)**	**N/A**	**-5.5%**	**-21.5%**	**-7.9%**	**1.77%**	**-12.4%**
Total Fire	**N/A**	**N/A**	**(59,217,002)**	**(571,614)**	**(59,217,002)**	**N/A**	**(4,027,840)**	**N/A**	**-7.4%**	**-3.9%**	**-9.5%**	**1.74%**	**-7.7%**
Total	**N/A**	**N/A**	**(102,051,219)**	**(3,779,960)**	**(102,051,219)**	**N/A**	**(10,113,104)**	**N/A**	**-6.5%**	**-12.8%**	**-8.8%**	**1.80%**	**-10.0%**

Section VI. Data, Methods and Assumptions Applied in the Experience Study

We used participant data initially prepared for the actuarial valuations for the years beginning:

- July 1, 2014
- July 1, 2015
- July 1, 2016
- July 1, 2017

We determined, for each year, the actual incidence of each demographic assumption, based on the participant's age nearest birthday and years of service as of the beginning of the year and compared that to the expected incidence, determined using the same factors.

Appendix

When examining the investment return / discount rate assumption, we determined the aggregate investment mix among all 53 municipal Police and Fire plans as of July 1, 2018 and mapped that allocation to the asset classes in the Horizon Survey. Since a detailed allocation of assets was not available for all plans, we made assumptions regarding the breakdown of broad categories into their more granular component units. For example, we assumed that the total equity allocation of approximately 55% was comprised of approximately 60% U.S. large cap and 40% U.S. small/mid cap equities. While the investment return / discount rate assumption should be determined independently for all 53 plans, should generally have a long horizon (typically 10 to 30 years), and be based on target allocations, using the July 1, 2018 current aggregate allocation is a useful exercise in understanding plan investments in total.

		10 Year	20 Year								
Horizon inflation		2.21%	2.29%								
Bolton WV MPOB recommendation		2.50%	2.50%								

Mapped to Horizon Asset Classes	Traget	Real Return (Net of Infl)		Horizon Inflation Assumption		Horizon Arithmetic Return		Horizon Geometric Return			Weighted
Asset Class	Allocation	10 Year	20 Year	10 Year	20 Year	10 Year	20 Year	10 Year	20 Year	St. Dev	St. Dev
US Equity - Large Cap	33.00%	5.05%	6.05%	2.21%	2.29%	7.26%	8.34%	6.03%	7.05%	16.17%	5.34%
US Equity - Small/Mid Cap	22.00%	6.24%	7.23%	2.21%	2.29%	8.45%	9.52%	6.55%	7.54%	20.15%	4.43%
Non-US Equity - Developed	0.00%	6.19%	7.01%	2.21%	2.29%	8.40%	9.30%	6.83%	7.70%	18.23%	0.00%
Non-US Equity - Emerging	0.00%	8.41%	9.38%	2.21%	2.29%	10.62%	11.67%	7.77%	8.67%	24.73%	0.00%
US Corp Bonds - Core	24.00%	1.53%	2.17%	2.21%	2.29%	3.74%	4.46%	3.58%	4.30%	5.47%	1.31%
US Corp Bonds - Long Dur.	0.00%	1.86%	2.68%	2.21%	2.29%	4.07%	4.97%	3.53%	4.39%	10.50%	0.00%
US Corp Bonds - High Yield	0.00%	3.39%	4.09%	2.21%	2.29%	5.60%	6.38%	5.10%	5.82%	10.06%	0.00%
Non-US Debt - Developed	0.00%	0.59%	1.52%	2.21%	2.29%	2.80%	3.81%	2.56%	3.43%	7.61%	0.00%
Non-US Debt - Emerging	0.00%	3.98%	4.47%	2.21%	2.29%	6.19%	6.76%	5.57%	6.06%	11.31%	0.00%
US Treasuries (Cash Equiv)	17.00%	0.50%	0.78%	2.21%	2.29%	2.71%	3.07%	2.66%	3.03%	2.31%	0.39%
TIPS (Inflation-Protected)	0.00%	1.08%	1.40%	2.21%	2.29%	3.29%	3.69%	3.10%	3.49%	6.11%	0.00%
Real Estate	0.00%	4.74%	5.65%	2.21%	2.29%	6.95%	7.94%	5.79%	6.82%	15.03%	0.00%
Hedge Funds	4.00%	3.42%	4.32%	2.21%	2.29%	5.63%	6.61%	5.27%	6.18%	8.38%	0.34%
Commodities	0.00%	3.20%	4.00%	2.21%	2.29%	5.41%	6.29%	3.90%	4.68%	17.66%	0.00%
Infrastructure	0.00%	5.58%	6.17%	2.21%	2.29%	7.79%	8.46%	6.78%	7.24%	14.39%	0.00%
Private Equity	0.00%	9.13%	10.53%	2.21%	2.29%	11.34%	12.82%	8.97%	10.10%	22.05%	0.00%
Private Debt	0.00%	5.88%	6.28%	2.21%	2.29%	8.09%	8.57%	7.37%	7.76%	11.62%	0.00%
	100.00%										
Portfolio Arithmetic Return						5.84%	6.70%				
Portfolio Variance										0.98%	
Portfolio Geometric Return (net of inv expenses)								5.35%	6.21%		
Adjustment for Bolton WV MPOB inflation recommendation								0.29%	0.21%		
Adjusted Portfolio Geometric Return (net of inv expenses)								**5.64%**	**6.42%**		