



November 27, 2017



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Ms. Tantri Emo Interim Director, Finance Department City of Houston 611 Walker Houston, TX 77002

Re: HPOPS Proposed Risk Sharing Valuation Study as of July 1, 2017

Dear Tantri:

Texas Revised Statutes article 6243g-4 (the Article) sets forth requirements for a Risk Sharing Valuation Study (RSVS) of the Houston Police Officers' Pension System (HPOPS). The purpose of this study is to determine the City Contribution Rate for the following fiscal year. Retirement Horizons Inc. (RHI) was engaged by the City of Houston to perform this proposed Risk Sharing Valuation Study as of July 1, 2017 as the municipal actuary. This report provides the results of the Study and is organized as follows:

- Section 1 Risk Sharing Valuation Study Results
- Section 2 Actuarial Exhibits
- Section 3 Summary of Plan Provisions
- Section 4 Actuarial Methods and Assumptions
- Section 5 Summary of Valuation Data
- Section 6 Data Sources

RHI received Actuarial Data as defined in Section 1-a of the Article and required by Section 9A(a) of the Article. RHI conducted our proposed RSVS using the Actuarial Data provided and plan provisions as summarized in this report. The analysis presented in this report is based on the interest rate assumption and actuarial cost and asset methods prescribed by the Article. All other actuarial methods and assumptions summarized in this report were adopted by the City of Houston Finance Department with review and concurrence by RHI and based on existing assumptions used in the July 1, 2016 Risk Sharing Valuation Study as required by the Article.

As described in the Article, results of the Risk Sharing Valuation Study performed by the HPOPS actuary will be compared to the results in this report. If the results are greater than two percentage points different, then we will attempt to reconcile the results with the HPOPS actuary, or a mathematical average will be used. If the results are within two percentage points, then the HPOPS actuary's results will be used.

The actual costs, City Contribution Rates, and other results could be materially different from those described in this report in the future if actual plan experience differs significantly from the underlying valuation basis. Differences could occur for a number of reasons such as plan experience differing from the underlying demographic and economic assumptions or changes in plan provisions. Due to the limited scope of this report, analysis of the potential range of such future measurements has not been performed.

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The results in this report and any measures of funded status are predicated on the notion of the Fund's ongoing operation and should not be relied upon for assessing the sufficiency of plan assets for settlement of plan termination liabilities.

The information contained in this report was prepared as requested by the City of Houston and solely for the purpose of satisfying the RSVS requirements of the Article, and should not be used for any other purpose. As significantly different results from those contained in this report may be needed for other purposes, this report should only be provided to other parties in its entirety.

The signing actuary for this report is a member of the Society of Actuaries and other professional actuarial organizations and meets the "Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion." The undersigned is available to answer questions regarding the information contained in this report or to provide further explanations or details as needed.

Respectfully submitted by Retirement Horizons Inc.

David A. Sawyer, FSA EA MAAA

Senior Consultant

Risk Sharing Valuation Study Results

Corridor Midpoint

The table below contains the Corridor Midpoint, along with the corresponding Minimum and Maximum Contribution Rates using a 5% Corridor Margin as specified in the Article. Based on RHI's proposed RSVS results, the City Contribution Rate for FY 2019 would be 32.48% of pensionable payroll, which is within the Corridor.

EV	Corridor	Corridor	Corridor	Calculated City Contribution Rate (Before	Adjusted City Contribution
FY	Midpoint	Minimum	Maximum	Adjustment)	Rate
2018	31.77%	26.77%	36.77%	32.18%	31.77%
2019	31.85%	26.85%	36.85%	32.48%	
2020	31.82%	26.82%	36.82%		
2021	31.84%	26.84%	36.84%		
2022	31.92%	26.92%	36.92%		
2023	31.98%	26.98%	36.98%		
2024	32.03%	27.03%	37.03%		
2025	32.07%	27.07%	37.07%		
2026	32.10%	27.10%	37.10%		
2027	32.12%	27.12%	37.12%		
2028	32.13%	27.13%	37.13%		
2029	32.13%	27.13%	37.13%		
2030	32.13%	27.13%	37.13%		
2031	32.14%	27.14%	37.14%		
2032	32.14%	27.14%	37.14%		
2033	32.14%	27.14%	37.14%		
2034	32.15%	27.15%	37.15%		
2035	32.14%	27.14%	37.14%		
2036	32.14%	27.14%	37.14%		
2037	32.14%	27.14%	37.14%		
2038	32.14%	27.14%	37.14%		
2039	32.13%	27.13%	37.13%		
2040	32.14%	27.14%	37.14%		
2041	32.13%	27.13%	37.13%		
2042	32.13%	27.13%	37.13%		
2043	32.13%	27.13%	37.13%		
2044	32.13%	27.13%	37.13%	_	
2045	32.13%	27.13%	37.13%		
2046	32.13%	27.13%	37.13%		
2047	32.13%	27.13%	37.13%		
2048	14.17%	9.17%	19.17%		

Risk Sharing Valuation Study Results

City Contribution Rate

The City Contribution Rate is equal to the sum of the Employer Normal Cost and the Amortization Rate from any Liability Layers.

	Employer	Liability Layer Amortization	Estimated City Contribution
FY	Normal Cost	Rate	Rate
2018	13.24%	18.94%	32.18%
2019	13.74%	18.74%	32.48%
2020			
2021			
2022			
2023			
2024			
2025			
2026			
2027			
2028			
2029			
2030			
2031			
2032			
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2038			
2039			
2040			
2041			
2042			
2043			
2044			
2045			
2046			
2047			
2048			

3.1. Fair Value of Assets

3.1. Fair Value of Assets					
	July 1, 2016				July 1, 2017
A. Fair Value of Plan Assets	•	-			•
1. Cash & Short Term Investments	\$ 651,206,000			\$	844,916,000
2. Fixed Income	166,655,000				235,049,000
3. Equity Securities	1,303,740,000				1,435,775,000
4. Alternative Investments	1,919,630,000				1,939,049,000
5. Accrued City Contributions	14,284,000				0
6. Accrued Member Contributions	1,396,000				1,516,000
7. Other Receivables	26,269,000				4,481,000
8. Liabilities	(26,931,000)				(29,386,000)
9. Other	24,211,000				25,778,000
10. Total Fair Value	\$ 4,080,460,000	-		\$	4,457,178,000
B. Change in Fair Value			Change		
1. Contributions				-	
a. Members		\$	40,104,000		
b. City			133,805,000		
c. Total		\$	173,909,000	-	
2. Disbursements					
a. Benefit Payments		\$	(460,429,000)		
b. Administrative Expenses			(4,238,000)	_	
c. Total		\$	(464,667,000)		
3. Investment Return					
a. Interest and Dividends		\$	48,712,000		

b. Realized and Unrealized Gain/(Loss)

c. Plan Investment Expenses

d. Total Return

4. Net Change

632,857,000

(14,093,000)

\$ 667,476,000

\$ 376,718,000

3.2. Actuarial Value of Assets

1. Actuarial Value of Assets, beginning of prior year

\$4,758,079,034

2. Net Cash Flow

a. Contributions	\$ 173,909,000
b. Benefit Disbursements	(460,429,000)
c. Administrative Expenses	(4,238,000)
d. Net Cash Flow [2.a. + 2.b. + 2.c.]	\$ (290,758,000)

3. Expected Investment Return [1. x 0.07] + [2.d. x 0.035]

\$ 322,889,002

4. Expected Actuarial Value of Assets at end of year [1. + 2.d. + 3.]

\$4,790,210,036

5. Market Value of Assets at end of year ¹

\$5,182,230,367

6. Difference [5. - 4.]

\$ 392,020,331

7. Development of Actuarial Value of Assets, end of year

	Remaining
	Deferrals of
	Excess
iscal	(Shortfall) of
'ear	Investment

Fiscal	(Shortfall) of					
Year	Investment	Offsetting of	Net Deferrals	Years	Recognized for	Remaining after
End	Income	Gains/(Losses)	Remaining	Remaining	This Valuation	This Valuation
2013	N/A	N/A	N/A	1	N/A	N/A
2014	N/A	N/A	N/A	2	N/A	N/A
2015	N/A	N/A	N/A	3	N/A	N/A
2016	-	-	-	4	-	-
2017	392,020,331	-	392,020,331	5	78,404,066	313,616,265
Total	\$ 392,020,331	\$ -	\$392,020,331	•	\$78,404,066	\$ 313,616,265

8. Actuarial Value of Assets as of July 1, 2017 (5. - 7.)

\$4,868,614,102

9. Rate of Return on Actuarial Value of Assets (Net of Investment Expenses)

8.7%

3.3. Actuarial Accrued Liability

	July 1, 2016		July 1, 2017
A. Discount Rate	7.0%		7.0%
B. Actuarial Accrued Liability			
1. Active	\$2,785,521,245		\$2,468,708,246
2. Terminated Vested	\$6,440,221		\$6,435,472
3. Disabled	\$104,387,919		\$107,853,703
4. Retired	\$3,262,975,448		\$3,699,615,778
5. Total	\$6,159,324,833	-	\$6,282,613,199
C. Change in Actuarial Accrued Liability		2017 Fiscal Year	
1. Benefits Accumulated		\$96,909,193	
2. Benefits Paid		(\$460,429,000)	
3. Decrease in Discount Period		\$418,644,733	
4. Plan Experience		\$68,163,440	
5. Actuarial Assumptions		\$0	
6. Actuarial Methods		\$0	
7. Plan Amendments		\$0	
8. Net Change		\$123,288,366	
D. Actuarial Value of Assets	\$4,758,079,034		\$4,868,614,102
E. Unfunded Actuarial Liability	\$1,401,245,799		\$1,413,999,097
F. Total Normal Cost % of Payroll ¹	23.74%		24.24%
G. Member Contribution % of Payroll	10.50%		10.50%
H. Employer Normal Cost Rate [F - G]	13.24%		13.74%

¹ Includes administrative expense load

3.4. Gain/Loss Analysis

		Liability	Assets	Unfunded
A.	Values at Prior Year Beginning	\$6,159,324,833	\$ (4,758,079,034)	\$ 1,401,245,799
B.	Expected Changes During Year			
	1. Normal Cost	\$ 96,909,193	N/A	\$ 96,909,193
	2. Contributions	N/A	(173,909,000)	(173,909,000)
	3. Benefits Paid	(460,429,000)	460,429,000	0
	4. Plan Expenses	N/A	4,238,000	4,238,000
	5. Interest on			
	a. Item A	431,152,738	(333,065,532)	98,087,206
	b. Item B.1	3,334,456	N/A	3,334,456
	c. Item B.2	N/A	(5,983,868)	(5,983,868)
	d. Item B.3	(15,842,461)	15,842,461	0
	e. Item B.4	N/A	145,821	145,821
	6. Total Expected Changes	\$ 55,124,926	(\$32,303,118)	\$ 22,821,808
C.	Expected Values at Prior Year End	\$6,214,449,759	\$ (4,790,382,152)	\$ 1,424,067,607
D.	Other Changes			
	1. Plan Experience	\$68,163,440	(\$78,231,950)	(\$10,068,510)
	2. Actuarial Assumptions	0	0	0
	3. Actuarial Methods	0	0	0
	4. Plan Amendments	0	0	0
	5. Total Other Changes	\$68,163,440	(\$78,231,950)	(\$10,068,510)
E.	Actual Values as of Current Year Beginning	\$6,282,613,199	\$ (4,868,614,102)	\$1,413,999,097

3.5. Liability Layers

			Remaining				Level Percent
		Liability Layer to	Amortization		A	mortization	of Payroll
Fiscal	Initial Amount of	be Amortized at	Period as of	Payoff	Ar	mount for FY	Amortization
Year	Liability Layer (BOY)	the Valuation Date	7/1/2018	Year		2019	Rate
							_
2016	\$1,401,245,799	\$1,420,121,991	29	2047	\$	85,212,911	18.82%
2017	(\$6,122,894)	(\$6,122,894)	29	2047	\$	(378,959)	-0.08%
	,		-				
Total		\$1,413,999,097			\$	84,833,952	18.74%

Summary of Plan Provisions

Eligibility and Participation

Any police officer shall automatically become a participant in the plan upon graduation from the police academy.

Final Average Pay (FAP)

The average of the 78 bi-weekly payroll periods of salary prior to termination of employment or DROP date, before reduction for pre-tax employee contributions and salary deferrals but excluding overtime, executive level pay, strategic officer staffing program pay, motorcycle allowance, clothing allowance and mentor pay.

Credited Service

Elapsed time from date of hire, for all periods of service classified as full-time, fully paid, active duty employment with the City of Houston Police Department, but excluding any period of DROP participation.

Retirement Benefit

Eligibility

Sworn prior to October 9, 2004

Earlier of 20 years of service or the age at which the member attains both age 60 and at least 10 years of service.

Sworn after October 9, 2004

Rule of 70, when age plus service total at least 70.

Amount

Sworn prior to October 9, 2004

Accrued benefit of 2.75% of FAP times credited service up to 20 years of service, plus 2.0% of FAP for credited service in excess of 20 years. In addition, the member will receive a \$5,000 lump sum.

Sworn after October 9, 2004

Accrued benefit of 2.25% of FAP times credited service up to 20 years of service, plus 2.0% of FAP for credited service in excess of 20 years, up to a maximum of 80% of FAP.

Termination Benefit

Eligibility

Termination of employment prior to satisfying the retirement eligibility requirements.

Amount

Less than 10 years of service: Lump Sum refund of member contributions without interest.

At least 10 but less than 20 years of service:

Choice of

- o Refund of contributions without interest, or
- Monthly benefit determined as set forth above payable at normal retirement age

Retirement Horizons Inc.

Summary of Plan Provisions

On-Duty Disability

Eligibility No age or service requirements.

Amount Officers who are not capable of performing their normal and

customary police officer duties receive the greater of their accrued retirement benefit or 45% of FAP (100% of FAP for officers with a Catastrophic Disability). If sworn prior to October 9, 2004, the benefit is the greater of the accrued retirement benefit or 55% of FAP, and the member will receive

a \$5,000 lump sum.

Off-Duty Disability

Eligibility No age or service requirements.

Benefit Officers who are not capable of performing their normal and

customary police officer duties receive the greater of their accrued retirement benefit or 22.5% of FAP (27.5% of FAP if

sworn prior to October 9, 2004, plus \$5,000 lump sum).

Active Member Death

Eligibility No age or service requirements.

Duty Related Benefit 100% of Final Average Pay (FAP). In addition, if the member

was sworn before October 9, 2004, a \$5,000 lump sum will be

paid, divided equally among eligible survivors.

Non-Duty Related Benefit Greater of the accrued retirement benefit or Off-Duty Disability

benefit. In addition, if the member was sworn before October 9, 2004, a \$5,000 lump sum will be paid, divided equally among

eligible survivors.

Allocation to Beneficiaries The benefit amount above is payable to a surviving spouse, or

allocated 50% to the surviving spouse with the remaining 50% divided equally among any eligible children, or otherwise paid

to any eligible parents.

Retired Member Death

Eligibility Retired and receiving monthly pension.

Amount 100% of monthly pension the retired member was receiving.

The benefit is paid for at least five years following the member's retirement date, even if the beneficiary dies.

Allocation to Beneficiaries The benefit amount above is payable to a surviving spouse, or

allocated 50% to the surviving spouse with the remaining 50% divided equally among any eligible children, or otherwise paid

to any eligible parents.

Summary of Plan Provisions

Supplemental Annuity

An extra monthly benefit of \$150 is payable for life to any retired or disabled member or to an eligible survivor of a deceased member.

Cost of Living Adjustment

The five-year investment return less 5%. The COLA will be no less than 0% nor greater than 4%. Only retired members or survivors who are age 55 or older, received benefits prior to June 8, 1995, or survivors of members who died in the line of duty will be eligible for the COLA. Notwithstanding the foregoing, there will be no COLA for retired members or survivors under age 70 for the first three years after July 1, 2017.

DROP

Upon reaching retirement eligibility, members sworn prior to October 9, 2004 may enter the Deferred Retirement Option Plan (DROP). The member's monthly annuity (without COLA) is added to a notional account. Interest is credited on the account using 65% of the 5-year compound average of the Fund's rate of return, with a minimum of 2.5%. Members may remain in DROP for a maximum of 20 years.

PROP

Members sworn prior to October 9, 2004 may have participated in the Post Retirement Option Plan (PROP) at or after service retirement and prior to July 1, 2017. No new amounts are credited to PROP after that date. Account balances are credited with interest at the same rate credited to DROP balances.

PLOP

Members sworn after October 9, 2004 are eligible for the Partial Lump Sum Option Plan (PLOP) at service retirement eligibility. The member receives a reduced monthly benefit plus a lump sum of up to 20% of the value of the unreduced annuity.

Contribution Rates

Members 10.50% of pensionable pay.

City The City Contribution Rate from the RSVS applied to

pensionable payroll.

Actuarial Cost Methods

Measurement Date Census data as of July 1, 2017 for all members. Impact of plan

changes measured on future accruals only; no impact to accruals through the valuation date, including for back-DROP accruals

based on dates before the valuation date.

Actuarial Value of Assets Fair market value of assets as of June 30, 2017, less a five-year

phase-in of the excess (shortfall) between expected investment return and actual income. The calculation is based on the difference between actual fair market value and the expected actuarial value of assets each year. The cumulative excess return (shortfall) is recognized at a minimum rate of 20% per year. Gains may be used to offset outstanding losses, and vice versa, to accelerate the amortization. Expected earnings are based on the assumed rate of return on investments and are net of investment expenses. The fair market value for June 30, 2017 includes \$750,000,000 of Pension Obligation Bonds discounted for half a year at 7.00% interest. The smoothing

method was reset as of July 1, 2016.

Actuarial Cost Method

The Ultimate Entry Age Normal Actuarial Cost Method A method under which the actuarial present value of all potential future projected benefits of each individual included in the valuation is calculated, based on the underlying demographic and economic assumptions. The *normal cost* is calculated as the average uniform percentage of payroll which, if applied to the compensation of each participant during the entire period of anticipated covered service, would meet the cost of all benefits payable based on benefits provisions for new hires. The portion of the actuarial present value of future benefits not provided for at the valuation date by the present value of future normal costs is called the *actuarial accrued liability*.

Key Economic Assumptions

Interest Rate 7.0% as prescribed by the Article.

Inflation 2.25%.

Wage Inflation 2.75%.

Payroll Growth 2.75%.

Individual Pay Increase Rate

A service-related assumption:

Service	Rate
1	14.75%
2	11.75%
3	10.00%
4	8.75%
5	8.25%
6	7.75%
7	7.00%
8	6.75%
9	6.25%
10	6.00%
11	5.75%
12	5.50%
13	5.25%
14	5.00%
15	4.75%
16	4.50%
17	4.25%
18+	2.75%

DROP Interest Crediting Rate

5.10%. Due to the use of the Ultimate Entry Age cost method, regression of historical balances does not impact cost results, so historical balances were regressed at 5.10% as well.

COLA 2.00%

Demographic Assumptions

Mortality Rates

➤ Healthy retirees

The RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment with male rates multiplied by 109% and female rates multiplied by 103%. The rates are projected on a fully generational basis by scale BB.

Disabled males and females

The RP2000 Disabled Retiree Mortality Tables without adjustment. The rates are projected on a fully generational basis by scale BB.

> Active members

The RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment with male rates multiplied by 54% and female rates multiplied by 51%. The rates are projected on a fully generational basis by scale BB. An additive factor of .0003 is applied to all active mortality rates.

Retirement Rates

	Service				
Age	<25	25 - 29	30+		
40 - 49	4.0%	6.0%	10.0%		
50 - 54	4.0%	6.0%	10.0%		
55 - 59	6.8%	10.2%	17.0%		
60 - 64	9.6%	14.4%	24.0%		
65+	100.0%	100.0%	100.0%		

For members sworn after October 9, 2004, rates in the first year of eligibility were increased by 30%, less 3% for each year below age 55. For members currently in DROP, the rates above were multiplied by 1.1.

Eligible members are assumed to enter DROP at first eligibility and remain in DROP until retirement or reaching the maximum 20 years in DROP. The retirement rates are set to 100% after 20 years in DROP.

Disability Rates

Age	Males	Females
20	0.1149%	0.1149%
25	0.1145%	0.1145%
30	0.1197%	0.1197%
35	0.1321%	0.1321%
40	0.1516%	0.1516%
45	0.1785%	0.1785%
50	0.2126%	0.2126%
55	0.2538%	0.2538%
60	0.3023%	0.3023%

Percentage of Deaths and Disabilities in the Line of Duty

• Deaths

100%

Disabilities

100%

Termination Rates

Sample Rates

Service	Termination Rate	
1	2.71%	
3	1.95%	
5	1.40%	
7	1.01%	
9	0.72%	
11	0.52%	
13	0.37%	
15	0.27%	
17	0.19%	
19	0.14%	
20+	0.10%	

For participants with at least 10 years of service but less than 20 years, 50% are assumed to elect a contribution refund, and 50% are assumed to elect a deferred monthly benefit. A commencement age of 60 was used for members hired prior to 2004, and a commencement age of 55 was used for members hired in 2004 and later.

Percentage married 90% of participants are assumed to be married.

No beneficiaries other than the spouse assumed.

Age difference Husbands assumed to be three years older than wives.

Child Beneficiaries Child beneficiaries are assumed to receive payments until age

24.

Development of Valuation Pay Valuation pay is projected by increasing the maximum of the

past five years of pay or \$31,000 with the nominal individual pay increase rate. Historical valuation pay for years before data was available was regressed with the nominal individual pay

increase rate.

Payment of DROP Balances Installments over 10 years. The value of the DROP balance is

multiplied by a factor which reflects the difference between the assumed DROP interest crediting rate and the interest rate assumption (0.9310 at 5.10% DROP interest crediting and 7.0%)

interest).

Administrative Expenses 1.00% of payroll

Funding Policy The City is assumed to contribute the City Contribution Rate

from the prior year. The actuarially determined City

Contribution Rate is measured as the normal cost rate, plus the administrative expenses rate, plus 30-year amortization rate of the Unfunded Actuarial Accrued Liability (UAAL) from the initial RSVS, plus the amortization rates of all subsequently-determined Liability Layers, less the member contribution rate, adjusted with interest to mid-year. The closed amortization rates for the Liability Layers are calculated as a level percent of pay. The initial amortization period for a Liability Loss Layer is 30 years. The initial amortization period for a Liability Gain

largest Liability Loss Layer.

Benefits Not Valued Due to limitations of the data received, no adjustment has been

made for the difference between pay based on the classified

Layer is equal to the remaining amortization period for the

position and executive level pay.

Summary of Valuation Data

	July 1, 2016	July 1, 2017
A. Active Members Not in DROP		
1. Number	3,204	3,362
2. Valuation payroll	\$235,020,845	\$255,268,155
3. Average pay	\$73,352	\$75,927
4. Average age	36.5	36.2
5. Average service	8.8	8.4
B. Active Members in DROP		
1. Number	2,057	1,802
2. Valuation payroll	\$191,140,953	\$172,168,428
3. Average pay	\$92,922	\$95,543
4. Average age	52.1	51.8
5. Average service	26.5	25.9
C. Terminated Vested		
1. Number	32	26
2. Total benefits	\$785,327	\$713,634
3. Average Annual benefits	\$24,541	\$27,447
D. Disabled		
1. Number	161	166
2. Total benefits	\$7,221,170	\$7,509,664
3. Average Annual benefits	\$44,852	\$45,239
E. Retired		
1. Number	3,002	3,322
2. Total benefits	\$155,529,581	\$175,803,413
3. Average Annual benefits	\$51,809	\$52,921
F. Beneficiaries		
1. Number	713	759
2. Total benefits	\$30,196,683	\$32,806,386
3. Average Annual benefits	\$42,352	\$43,223

Notes:

1. DROP Balance values not shown.

Data Sources

Data and inputs used in this report were provided from the following sources:

- Individual census data as of July 1, 2017 was originally provided by the HPOPS actuary on October 9, 2017.
- The fair value of assets of \$5,182,230,367 as of June 30, 2017 was developed based on the HPOPS actuary's RSVS dated November 7, 2017. This amount includes the discounted value of the \$750 million of Pension Obligation Bonds anticipated to be deposited to the trust December 31, 2017.
- Fiscal Year 2018 payroll of \$440,614,002 was based on input regarding the City of Houston's budgeted payroll.
- The provisions of the Article are contained in the enrolled text of Senate Bill 2190, which was signed by the Governor on May 31, 2017.