VM-22 Appendices

The purpose of the VM-22 Appendices is to demonstrate how VM-22 quarterly and daily Statutory maximum valuation interest rates are calculated. The Appendices show the steps required to calculate the quarterly rates for non-jumbo contracts with premium determination dates of 1/1/18 through 3/31/18, and daily rates for a jumbo contract with a premium determination date of 1/11/18.

Appendices 1 through 5 show how to determine the inputs required for the valuation interest rate calculation. Appendix 6 then shows the calculation of the Statutory maximum valuation interest rates, using the inputs from Appendices 1 through 5.

Appendix 7 provides details on the timing and data sources used in the calculation of quarterly valuation interest rates.

Appendix 1: Determination of Weights

Section 1: Sample Calculation of Table 1 Weights for Valuation Rate Bucket B

The example below shows the calculation of 2018 Table 1 weights for valuation rate bucket B, following the steps in VM-22, Section 3.I. Table 1 weights for the other valuation rate buckets follow the same process.

1. Determine the products defined in VM-22 for the valuation rate bucket. Bucket B products are defined in VM-22, Section 3.I as follows:

   Bucket B:
   i. Single Life Annuity age 80 and 85 with 0, 5, and 10-year certain periods
   ii. 10-year certain only

2. Annual cash flows are projected assuming annuity payments are made at the end of each year. These cash flows are averaged for each valuation rate bucket across the annuity forms for that bucket using the statutory valuation mortality table in effect for the following calendar year for individual annuities for males, ANB.

   The following cash flows are based on a $5,000 payment and 2012 IAR Mortality Table Male for a person age x in year 2018.

   Note: Color bars show time period groups used in subsequent steps.

Valuation Rate Bucket B Annuity Calculation

Bucket B Calculation											
Iss Age	Att Age	SLA	SL w 5 yr certain	SL w 10 yr certain	Iss Age	Att Age	SLA	SL w 5 yr certain	SL w 10 yr certain	10 -Year Certain	Average
80	80	4,848.24	5,000.00	5,000.00	85	85	4,719.94	5,000.00	5,000.00	5,000.00	4938.31
80	81	4,683.37	5,000.00	5,000.00	85	86	4,422.93	5,000.00	5,000.00	5,000.00	4872.33
80	82	4,505.11	5,000.00	5,000.00	85	87	4,108.84	5,000.00	5,000.00	5,000.00	4801.99
80	83	4,315.13	5,000.00	5,000.00	85	88	3,781.62	5,000.00	5,000.00	5,000.00	4728.11
80	84	4,111.55	5,000.00	5,000.00	85	89	3,440.90	5,000.00	5,000.00	5,000.00	4650.35
80	85	3,893.64	3,893.64	5,000.00	85	90	3,090.57	3,090.57	5,000.00	5,000.00	4138.35
80	86	3,660.64	3,660.64	5,000.00	85	91	2,740.82	2,740.82	5,000.00	5,000.00	3971.85
80	87	3,412.17	3,412.17	5,000.00	85	92	2,393.16	2,393.16	5,000.00	5,000.00	3801.52
80	88	3,152.44	3,152.44	5,000.00	85	93	2,053.67	2,053.67	5,000.00	5,000.00	3630.32
80	89	2,879.59	2,879.59	5,000.00	85	94	1,733.27	1,733.27	5,000.00	5,000.00	3460.82
80	90	2,596.53	2,596.53	2,596.53	85	95	1,432.11	1,432.11	1,432.11	-	1726.56
80	91	2,312.83	2,312.83	2,312.83	85	96	1,168.14	1,168.14	1,168.14	-	1491.84
80	92	2,028.16	2,028.16	2,028.16	85	97	930.49	930.49	930.49	-	1267.99
80	93	1,747.57	1,747.57	1,747.57	85	98	726.15	726.15	726.15	-	1060.16
80	94	1,481.67	1,481.67	1,481.67	85	99	551.46	551.46	551.46	-	871.34
80	95	1,229.34	1,229.34	1,229.34	85	100	409.43	409.43	409.43	-	702.33
80	96	1,007.24	1,007.24	1,007.24	85	101	295.81	295.81	295.81	-	558.45
80	97	805.37	805.37	805.37	85	102	205.66	205.66	205.66	-	433.30
80	98	631.15	631.15	631.15	85	103	138.61	138.61	138.61	-	329.89
80	99	480.82	480.82	480.82	85	104	89.23	89.23	89.23	-	244.31
80	100	358.22	358.22	358.22	85	105	55.32	55.32	55.32	-	177.23
80	101	259.80	259.80	259.80	85	106	33.19	33.19	33.19	-	125.57
80	102	181.02	181.02	181.02	85	107	19.92	19.92	19.92	-	86.12
80	103	122.29	122.29	122.29	85	108	11.95	11.95	11.95	-	57.53
80	104	78.73	78.73	78.73	85	109	7.17	7.17	7.17	-	36.82
80	105	48.81	48.81	48.81	85	110	4.30	4.30	4.30	-	22.76
80	106	29.29	29.29	29.29	85	111	2.58	2.58	2.58	-	13.66
80	107	17.57	17.57	17.57	85	112	1.55	1.55	1.55	-	8.20
80	108	10.54	10.54	10.54	85	113	0.93	0.93	0.93	-	4.92
80	109	6.33	6.33	6.33	85	114	0.56	0.56	0.56	-	2.95
80	110	3.80	3.80	3.80	85	115	0.33	0.33	0.33	-	1.77
80	111	2.28	2.28	2.28	85	116	0.20	0.20	0.20	-	1.06
80	112	1.37	1.37	1.37	85	117	0.12	0.12	0.12	-	0.64
80	113	0.82	0.82	0.82	85	118	0.07	0.07	0.07	-	0.38
80	114	0.49	0.49	0.49	85	119	0.04	0.04	0.04	-	0.23
80	115	0.30	0.30	0.30	85	120	-	-	-	-	0.13
80	116	0.18	0.18	0.18			-	-	-	-	0.08
80	117	0.11	0.11	0.11			-	-	-	-	0.05
80	118	0.06	0.06	0.06			-	-	-	-	0.03
80	119	0.04	0.04	0.04			-	-	-	-	0.02
80	120	-	-	-			-	-	-	-	0.00

3. The average of the daily rates in the third quarter (the Quarterly Treasury Rates) for the 2-yr, 5-yr, 10-yr and 30-yr US Treasuries are downloaded from https://fred.stlouisfed.org as input to calculate the present values in Step 4.

Q3, 2017 Average Treasury (%)

2 Year	5 Year	10 Year	30 Year
1.36	1.81	2.24	2.82

4. The average cash flows are summed into four time period groups: years 1-3, years 4-7, years 8-15 and years 16-30. (Note: the present value of cash flows beyond year 30 are discounted to the end of year 30 and included in the years 16-30 bucket. This present value is based on the lower of 3% and the 30-year Treasury rate input in Step 3.)

Sum of Average Cash Flows

Duration	Sum of Average Cash Flows
1 - 3	Sum of Rows 1–3 from Table 1-5 = 14,612.63
4 - 7	Sum of Rows 4–7 from Table 1-5 = 17,488.65
8 - 15	Sum of Rows 8–15 from Table 1-5 = 17,310.56
16 - 30	Sum of Rows 16–30 from Table 1-5 = 2,804.03
31	Net Present Value of Rows 31+ using Interest Rate of 2.82% = 4.09

5. The present value of each summed cash flow group in Step 4 is then calculated by using the Step 3 US Treasury rates for the mid-point of that group (and using the linearly interpolated US Treasury rate when necessary).

Interpolated Average Treasury Rates

Time Period Group	1-3	4 - 7	8 - 15	16 – 30, 31+
Mid-Point of Group	2	5.5	11.5	23
Mid-Point Treasury Rates	1.36	1.85	2.28	2.62

Present Value of Sums of Cash Flows

Duration	PV Sum of Cash Flows
1 - 3	14,612.63/(1+.0136)^2 = 14,223.13
4 - 7	17,488.65/(1+.0185)^5.5 = 15,808.85
8 - 15	17,310.56/(1+.0228)^11.5 = 13,352.02
16 - 30, 31+	(2,804.03+4.09)/(1+.0262)^23 = 1,550.14

6. The duration-weighted present value of the cash flows is determined by multiplying the present value of the cash flow groups by the midpoint of the time period for each applicable group.

Present Value of Cash Flows Multiplied by Duration

Duration	PV Sum of Cash Flows * Mid-Point Duration
1 - 3	14,223.13 * 2 = 28,446.26
4 - 7	15,808.85*5.5 = 86,948.67
8 - 15	13,352.02*11.5 = 153,548.22
16 - 30, 31+	1,550.14*23 = 35,653.29
Total	304,596.45

7. Weights for each cash flow time period group within a valuation rate bucket are calculated by dividing the duration-weighted present value of the cash flow by the sum of the duration-weighted present value of cash flow for each valuation rate bucket.

Calculation of Table 1 Weights for Valuation Rate Bucket B

Duration	Table 1 Weights By Duration
2	28,446.26/304,596.45 = 0.0933900033
5	86,948.67/304,596.45 = 0.2854553068
10	153,548.22/304,596.45 = 0.5041037874
30	35,653.29/304,596.45 = 0.1170509025

Section 2: Determination of Weight Tables 2 through 4

The completed Weights Table 1 is shown below, calculated using the process described in Section 1 for valuation rate buckets A through D.

Weights Table 1				
Bucket	2 Year	5 Year	10 Year	30 Year
A	26.19582562%	50.86877631%	21.89565925%	1.03973882%
B	9.33900033%	28.54553068%	50.41037874%	11.70509025%
C	4.42359018%	14.74706367%	47.59367021%	33.23567594%
D	2.23031779%	7.52527717%	26.26320289%	63.98120215%

1. Table 2 is identical to Table 1

Weights Table 2				
Bucket	2 Year	5 Year	10 Year	30 Year
A	26.19582562%	50.86877631%	21.89565925%	1.03973882%
B	9.33900033%	28.54553068%	50.41037874%	11.70509025%
C	4.42359018%	14.74706367%	47.59367021%	33.23567594%
D	2.23031779%	7.52527717%	26.26320289%	63.98120215%

2. Table 3 is based on the same set of underlying weights as Table 1, but the 10 year and 30 year columns are combined since VM-20 default rates are only published for maturities of up to 10 years.

Weights Table 3			
Bucket	2 Year	5 Year	10 Year
A	26.19582562%	50.86877631%	22.93539807%
B	9.33900033%	28.54553068%	62.11546899%
C	4.42359018%	14.74706367%	80.82934615%
D	2.23031779%	7.52527717%	90.24440504%

3. Table 4 is derived from Table 1 as follows:

   a. Column 1 of Table 4 is identical to column 1 of Table 1.
   b. Column 2 of Table 4 is 50% of column 2 of Table 1.
   c. Column 3 of Table 4 is identical to column 2 of Table 4.
   d. Column 4 of Table 4 is 50% of column 3 of Table 1.
   e. Column 5 of Table 4 is identical to column 4 of Table 4.
   f. Column 6 of Table 4 is identical to column 4 of Table 1.

Weights Table 4						
Bucket	1Y - 3Y	3Y - 5Y	5Y - 7Y	7Y - 10Y	10Y - 15Y	+15Y
A	26.19582562%	25.43438815%	25.43438815%	10.94782963%	10.94782963%	1.03973882%
B	9.33900033%	14.27276534%	14.27276534%	25.20518937%	25.20518937%	11.70509025%
C	4.42359018%	7.37353184%	7.37353184%	23.79683510%	23.79683510%	33.23567594%
D	2.23031779%	3.76263858%	3.76263858%	13.13160144%	13.13160144%	63.98120217%

4. In every table, the weights in a given row (valuation rate bucket) must add to exactly 100%.

Appendix 2: Determination of Default Costs

1. From the NAIC website, download the VM-20 prescribed annual default cost table (Table A) in effect for the prior quarter.

   In our example, for a non-jumbo contract with a premium determination date in Q1, 2018, the appropriate Table A to use is the one in effect for Q4, 2017. This is the 2016 Table A (the 2017 Table A will be published during Q2, 2018).

2. For WALs 2, 5 and 10 years only, select the VM-20 Table A prescribed annual default costs for PBR Credit Ratings 1 through 10.

   The default costs to use are shown in the table below.

3. For WALs 2, 5 and 10 years only, calculate the expected default cost, which is a weighted average of the Table A prescribed annual default costs, using the following prescribed portfolio credit quality distribution as weights:
   - 5% Treasuries
   - 15% Aa bonds (5% PBR2, 5% PBR3, 5% PBR4)
   - 40% A bonds (13.33% PBR5, 13.33% PBR6, 13.33% PBR7)
   - 40% Baa bonds (13.33% PBR8, 13.33% PBR9, 13.33% PBR10)

Calculation of Expected Default Costs by WAL (using 2016 Table A)

WAL (Weighted Average Life)	Investment Grade PBR Credit Rating										
	1	2	3	4	5	6	7	8	9	10	**Expected Default Cost**
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-	
Portfolio Credit Quality Dist	0.00%	5.00%	5.00%	5.00%	13.33%	13.33%	13.33%	13.33%	13.33%	13.33%	
2	0.02	0.32	0.84	2.01	3.91	7.40	9.96	18.61	32.46	75.42	**19.86**
5	0.09	0.97	2.13	4.45	8.19	14.69	18.71	28.28	42.35	85.89	**26.79**
10	0.15	1.49	2.98	5.97	10.48	18.08	23.09	33.63	48.84	88.11	**30.15**

4. Calculate the default cost for each valuation rate bucket, which is a weighted average of the expected default costs for WALs 2, 5, and 10, using Table 3 for the current calendar year as weights.

Calculation of VM-22 Default Costs by Valuation Bucket

	Table 3 Weights			
Val Rate Bucket	2 Year	5 Year	10 Year	Default Cost
A	0.261958	0.508688	0.229354	25.75
B	0.093390	0.285455	0.621155	28.23
C	0.044236	0.147471	0.808293	29.20
D	0.022303	0.075253	0.902444	29.67

Example – Bucket A: 19.86 x 26.1958% + 26.79 x 50.8688% + 30.15 x 22.9354% = 25.75

Appendix 3: Determination of Spreads

1. From the NAIC website, download the VM-22 prescribed spread table (Table X) for the prior quarter.

   In our example, for a non-jumbo contract with a premium determination date in Q1, 2018, the appropriate Table X to use is the Q4, 2017 table.

2. For WALs 2, 5, 10 and 30 years only, select the VM-22 quarterly average Table X prescribed spreads for PBR Credit Ratings 1 through 10.

   The applicable rows from the Q4, 2017 Table X are shown in the table below.

3. Calculate Expected Spreads by WAL. For WALs 2, 5, 10 and 30 years only, calculate the expected spread, which is a weighted average of the Table X spreads, using the following prescribed portfolio credit quality distribution as weights:
   - 5% Treasuries
   - 15% Aa bonds (5% PBR2, 5% PBR3, 5% PBR4)
   - 40% A bonds (13.33% PBR5, 13.33% PBR6, 13.33% PBR7)
   - 40% Baa bonds (13.33% PBR8, 13.33% PBR9, 13.33% PBR10)

Calculation of 2018 Q1 Expected Spreads by WAL (using 2017 Q4 Table X)

WAL (Weighted Average Life)	Investment Grade PBR Credit Rating										
	1	2	3	4	5	6	7	8	9	10	**Expected Spreads**
	Aaa/AAA	Aa1/AA+	Aa2/AA	Aa3/AA-	A1/A+	A2/A	A3/A-	Baa1/BBB+	Baa2/BBB	Baa3/BBB-	
Portfolio Credit Quality Dist	0.00%	5.00%	5.00%	5.00%	13.33%	13.33%	13.33%	13.33%	13.33%	13.33%	
2	20.75	28.58	36.40	40.31	44.22	48.13	56.03	63.94	71.85	122.03	**59.42**
5	33.82	39.26	44.71	51.48	58.25	65.02	78.99	92.97	106.94	139.57	**79.00**
10	50.90	58.79	66.68	74.67	82.66	90.65	106.95	123.26	139.56	155.88	**103.20**
30	88.60	97.79	106.99	115.09	123.19	131.29	157.60	183.92	210.23	191.22	**148.99**

4. Calculate the Spread for each valuation rate bucket, which is a weighted average of the Expected Spread for WALs 2, 5, 10, and 30 using Table 2 for the current calendar year as weights.

Calculation of Spreads by Valuation Rate Bucket

Val Rate Bucket	Table 2 Weights				Spread
	2 Year	5 Year	10 Year	30 Year	
A	0.26196	0.50869	0.21896	0.0104	79.90*
B	0.09339	0.28546	0.5041	0.11705	97.57
C	0.04424	0.14747	0.47594	0.33236	112.91
D	0.0223	0.07525	0.26263	0.63981	129.70

*Example – Bucket A: (59.42 x .26196) + (79.00 x .50869) + (103.20 x .21896) + (148.99 x .0104) = 79.90

Appendix 4: Determination of Reference Rates

1. Download the average of the daily rates for the prior quarter (Q4, 2017) for the 2-yr, 5-yr, 10-yr and 30-yr US Treasuries from https://fred.stlouisfed.org

Average Quarterly US Treasury Rates

Quarterly US Treasury Rates from Federal Reserve Economic Database (FRED)				
Series Name	DGS2	DGS5	DGS10	DGS30
Constant Maturity	2-Yr Treasury	5-Yr Treasury	10-Yr Treasury	30-Yr Treasury
2017 Q4	1.69	2.07	2.37	2.82

2. Using weight Table 1, calculate a reference rate for each valuation rate bucket.

Calculation of Q1, 2018 Reference Rates by Valuation Rate Bucket

	Table A1-1				
Val Rate Bucket	2 Year	5 Year	10 Year	30 Year	Reference Rate
A	26.20%	50.87%	21.90%	1.04%	2.04%
B	9.34%	28.55%	50.41%	11.71%	2.27%
C	4.42%	14.75%	47.59%	33.24%	2.45%
D	2.23%	7.53%	26.26%	63.98%	2.62%

Example – Bucket A: (1.69 x .262) + (2.07 x .5087) + (2.37 x .2190) + (2.82 x .0104) = 2.04

Appendix 5: Determination of Daily and Average Daily Corporate Rates

Calculation of Daily Corporate Rates

The example below shows how the daily corporate rates would be calculated for a premium determination date of 1/11/18.

1. Download the Bank of America Merrill Lynch U.S. corporate effective yields for each index series shown in the sample below from the St. Louis Federal Reserve website: https://research.stlouisfed.org/fred2/categories/32348. To access a specific series, search the St. Louis Fed website for the series name by inputting the name into the Search box in the upper right corner, or input the following web address: https://research.stlouisfed.org/fred2/series/[replace with series name from Table A5-1 below].

Index Series Names

Maturity	Series Name
1Y - 3Y	BAMLC1A0C13YEY
3Y - 5Y	BAMLC2A0C35YEY
5Y - 7Y	BAMLC3A0C57YEY
7Y - 10Y	BAMLC4A0C710YEY
10Y - 15Y	BAMLC7A0C1015YEY
15Y+	BAMLC8A0C15PYEY

Sample for Business Day 1/10/18, Downloaded on 1/11/18

Index Series Name	BAMLC1A0C13YEY	BAMLC2A0C35YEY	BAMLC3A0C57YEY	BAMLC4A0C710YEY	BAMLC7A0C1015YEY	BAMLC8A0C15PYEY
Maturity	1Y – 3Y	3Y – 5Y	5Y – 7Y	7Y – 10Y	10Y – 15Y	15Y+
Rate	2.45	2.88	3.26	3.55	4.00	4.20

2. Calculate the daily corporate rate for each valuation rate bucket, which is a weighted average of the Bank of America Merrill Lynch U.S. corporate effective yields, using Table 4 for the current calendar year as weights.

Calculation of Daily Corporate Rates by Valuation Bucket for Business Day 1/10/18

Bucket	Table A1-4: Weights for Daily Corporate Rates (Sample)						Daily Corp Rate (%)
	1Y - 3Y	3Y - 5Y	5Y - 7Y	7Y - 10Y	10Y - 15Y	+15Y	
A	26.20%	25.43%	25.43%	10.95%	10.95%	1.04%	3.07*
B	9.34%	14.27%	14.27%	25.21%	25.21%	11.71%	3.50
C	4.42%	7.37%	7.37%	23.80%	23.80%	33.24%	3.75
D	2.23%	3.76%	3.76%	13.13%	13.13%	63.98%	3.96

*Weighted Average of Bucket A: (2.45 x .262) + (2.88 x .2543) + (3.26 x .2543) + (3.55 x .1095) + (4.00 x .1095) + (4.20 x .0104) = 3.07

Calculation of Average Daily Corporate Rates

The example below shows how the average daily corporate rates would be calculated using data from 7/1/17 through 9/30/17. These would be used for premium determination dates from 1/1/18 through 3/31/18.

1. Download the quarterly average Bank of America Merrill Lynch U.S. corporate effective yields for each index series shown in the sample below from the St. Louis Federal Reserve website: https://research.stlouisfed.org/fred2/categories/32348. To access a specific series, search the St. Louis Fed website for the series name by inputting the name into the Search box in the upper right corner, or input the following web address: https://research.stlouisfed.org/fred2/series/[replace with series name from below].

Downloaded Average Daily Corporate Rates

Index Series Name	BAMLC1A0C13YEY	BAMLC2A0C35YEY	BAMLC3A0C57YEY	BAMLC4A0C710YEY	BAMLC7A0C1015YEY	BAMLC8A0C15PYEY
Maturity	1Y – 3Y	3Y – 5Y	5Y – 7Y	7Y – 10Y	10Y – 15Y	15Y+
Rate	1.99	2.48	2.97	3.40	3.98	4.27

2. Calculate the Average Daily Corporate Rate for each valuation rate bucket, which is a weighted average of the quarterly average Bank of America Merrill Lynch U.S. corporate effective yields, using Table 4 for the calendar year which corresponds to the period over which the Average Daily Corporate Rate is determined as weights.

Calculation of Average Daily Corporate Rates by Valuation Bucket (period 07/01/2017 thru 9/30/2017)

	Table A1-4: Weights for Daily Corporate Rates (Sample)						
Bucket	1Y - 3Y	3Y - 5Y	5Y - 7Y	7Y - 10Y	10Y - 15Y	+15Y	Avg. Corp Rate (%)
A	25.5%	25.4%	25.4%	11.3%	11.3%	1.1%	2.772*
B	8.9%	13.9%	13.9%	25.4%	25.4%	12.4%	3.342
C	4.1%	7.0%	7.0%	23.6%	23.6%	34.6%	3.685
D	2.0%	3.5%	3.5%	12.7%	12.7%	65.6%	3.968

*Weighted Average of Bucket A: (1.99 x .255) + (2.48 x .254) + (2.97 x .254) + (3.40 x .113) + (3.98 x .113) + (4.27 x .011) = 2.772

Appendix 6: Calculation of Maximum Valuation Interest Rates

Section 1: Calculation of Statutory Maximum Quarterly Valuation Rate

The example below shows how the Statutory Maximum Valuation Interest Rates are calculated for premium determination dates from 1/1/18 – 3/31/18.

1. For each valuation rate bucket, calculate the Quarterly Valuation Rate as follows:

$$I_q = R + S - D - E$$

where:

a. R is the reference rate for that valuation rate bucket (see Appendix 4);
b. S is the spread for that valuation rate bucket (see Appendix 3);
c. D is the default cost for that valuation rate bucket (see Appendix 2); and
d. E is the spread deduction defined as 0.25%.

For non-jumbo contracts, the statutory maximum valuation interest rate is the Quarterly Valuation Rate (I_q) rounded to the nearest one-fourth of one percent (1/4 of 1%).

Sample Calculation for 1st Quarter 2018:

Calculation of Quarterly Statutory Maximum Valuation Interest Rate

	I_q Rounded to .25%	$I_q = R + S - D - E$	R	S	D	E
Bucket	Statutory Maximum Valuation Rate	Quarterly Valuation Rate	Reference Rate	Spread	Default Cost	Expense Provision
A	2.25%	2.34%	2.04%	0.80%	0.26%	0.25%
B	2.75%	2.72%	2.27%	0.98%	0.28%	0.25%
C	3.00%	3.03%	2.45%	1.13%	0.29%	0.25%
D	3.25%	3.37%	2.62%	1.30%	0.30%	0.25%

Section 2: Calculation of Statutory Maximum Daily Valuation Rates

$$I_d = I_q + C_{d-1} - C_q$$

where:

a. I_q is the Quarterly Valuation Rate for the calendar quarter preceding the business day immediately preceding the given date;
b. C_{d-1} is the Daily Corporate Rate (see Appendix 5) for the business day immediately preceding the given date; and
c. C_q is the Average Daily Corporate Rate (see Appendix 5) corresponding to the same period for which I_q is applicable.

For jumbo contracts, the statutory maximum valuation interest rate is the Daily Valuation Rate rounded to the nearest one-hundredth of one percent (1/100 of 1%).

Example for the Daily Valuation Rate Calculation for a premium determination date of 01/11/2018:

$$I_{(01/11/2018)} = I_{(4)} \text{ (based on data from 07/01/2017 thru 09/30/2017)} + C_{(01/10/2018)} - C_{(4)} \text{ (based on data from 07/01/2017 thru 09/30/2017)}$$

where:

a. $I_{(4)}$ is the Quarterly Valuation Rate for the calendar quarter preceding the business day **(01/10/2018)** immediately preceding the given date **(01/11/2018)**;

b. $C_{(01/10/18)}$ is the Daily Corporate Rate (see Appendix 5) for the business day **(01/10/2018)** immediately preceding the given date **(01/11/2018)**; and

c. $C_{(4)}$ is the Average Daily Corporate Rate (see Appendix 5) corresponding to the period **(07/01/2017 – 09/30/2017)** used to develop $I_{(4)}$.

Calculation of Daily Statutory Maximum Valuation Interest Rate

Bucket	I_d rounded to .01% Stat Maximum Valuation Rate	$I_{d = 01/11/2018}$ $= I_q + C_{d-1} - C_q$	$I_{q = 4}$	$C_{d-1 = 01/10/2018}$	$C_{q = 4}$
A	2.50%	2.497%	2.195%	3.074%	2.772%
B	2.83%	2.832%	2.674%	3.500%	3.342%
C	3.14%	3.136%	3.067%	3.754%	3.685%
D	3.48%	3.477%	3.481%	3.964%	3.968%

Appendix 7: Summary of Timing and Data Sources for q = Nth Quarter, Year 20XX

	I_q = Quarterly Valuation Rate for q=Nth Quarter (1)	**Reference Rate (R) (2)**	**Spread (S) (3)**	**Default Cost (D) (4)**	**Expense Provision (E) (5)**
Calculation Date	3rd business day of the Nth quarter*	**3rd business day of the Nth quarter**	**3rd business day of the Nth quarter***	**1st business day of the Nth quarter**	**N/A**
Publication Date on NAIC Website	3rd business day of the Nth quarter*	**N/A**	**N/A**	**N/A**	**N/A**
Data Sources	R + S – D – E	**2, 5, 10, and 30 Yr. US Treasury Rates**	**VM-22 Table X Spreads**	**VM-20 Table A in effect on valuation date.** **For Q1 and Q2, 20XX, use 20XX – 2 Table A. For Q3 and Q4, 20XX, use 20XX – 1 Table A.** **Example: For Q1 and Q2, 2018, use 2016 Table A. For Q3 and Q4, 2018, use 2017 Table A.**	**Determined by VM-22 Subgroup**
Data Source Time Period	See columns 2 - 5	**Average over N-1th quarter**	**Average over N-1th quarter**	**20XX Table A is based on default cost data updated through 20XX - 1**	**N/A**
Data Source Calculation Date	See columns 2 - 5	**3rd business day of Nth quarter**	**3rd business day of Nth quarter***	**VM-20 Table A is updated annually during the 2nd quarter**	**N/A. Held constant at 25 basis points**
Data Source Publication Date on NAIC Website	See columns 2 - 5	**N/A**	**Not currently published, but could be on the 3rd business day of Nth quarter**	**Annually during the 2nd quarter**	**N/A**
Weight Table Used for Year 20XX, effective 1st business day of 20XX)	See columns 2 - 5	**Table 1**	**Table 2**	**Table 3**	**N/A**