



# ROANOKE COUNTY

Purchasing Division

5204 Bernard Drive, Suite 300-F, P.O. Box 29800

Roanoke, Virginia 24018-0798

TEL: (540) 772-2061 FAX: (540) 772-2074

March 9, 2020

## ADDENDUM NO. 2 TO ALL OFFERRORS:

Reference – RFP 2020-055

Description: Actuarial Services

Issue Date: February 14, 2020

Proposal Due: March 13, 2020

The above Project is hereby changed as addressed below:

1. **Responses to Vendor Questions:** Please see Attachment A to this addendum for questions received to date, and the responses provided by RCPS/ Roanoke County as we are able.
2. **Attachment B: Select Actuarial Services proposal.**
3. **Attachments C and D: recent actuarial reports.**
  - a. Attachment C: Estimate of Ultimate and Outstanding Losses: County of Roanoke, April 11, 2018.
  - b. Attachment D: Estimate of Ultimate and Outstanding Losses: County of Roanoke School Board, May 28, 2019.

**Note:** A signed acknowledgment of this addendum must be received at the location indicated on the original solicitation either prior to the proposal due date or attached to your proposal. Signature on this addendum does not substitute for your signature on the original proposal/bid document. The original proposal/bid document must be signed.

Thank you,

Kate Hoyt

Phone: (540) 283-8146

[KHoyt@roanokecountyva.gov](mailto:KHoyt@roanokecountyva.gov)

\_\_\_\_\_  
Sign Name:

\_\_\_\_\_  
Print Name:

\_\_\_\_\_  
Name of Firm:

\_\_\_\_\_  
Date:

## ADDENDUM NO. 2 TO ALL OFFERORS

Reference – RFP 2020-055

Description: Actuarial Services

### ATTACHMENT A

#### Responses to Vendor Questions

1. Item A under Section 7 (pg.14) of the RFP specifies that "Offeror shall be a Fellow of the Casualty Actuarial Society." Can this requirement be adjusted to read "Member of the Casualty Actuarial Society" instead of "Fellow of the Casualty Actuarial Society"?  
*The County/Schools are open to associates performing work on the resulting contract. However, a fellow would be preferred to review, approve, and sign off on the report provided.*
2. Is the contractor for the prior term eligible to participate in this RFP? Have County personnel been happy with the services provided by the prior contractor?  
*Yes; any vendor, including the incumbent, is eligible to participate in the RFP process, providing they meet the qualifications and specifications provided therein. The County/Schools have been satisfied with the services provided.*
3. Can you provide a copy of the winning proposal from the last time this project was out for bid?  
*Please see Attachment B.*
4. Was the work required in prior years similar to that described in the current RFP? Are there any improvements, or additional services that the County is seeking?  
*Yes, the work as specified is similar to that of prior years; there are no improvements or additional services.*
5. Page 12, item H, of the RFP states that "It is the policy of the County of Roanoke to maximize participation by minority and women owned business enterprises in all aspects of County contracting opportunities."
  - a. Is there a MBE/WBE subcontractor participating in the current contract? If yes, can you provide the name, a brief description of their services, and the dollar amount of their annual fee?  
*There is not a subcontractor providing service on this contract. Claims information is provided by VACORP to the actuarial company.*
  - b. In what way will this policy be incorporated into the selection process for this RFP?  
*While MBE/WBE participation will be considered, there is no specific weighted selection criteria in regards to that participation. As a local government entity, Roanoke County/ RCPS does not have the specific requirements on this subject which are enforced at the state level.*

- c. Does this RFP have a MBE/WBE participation goal?  
*There is not a participation goal for this RFP.*
- 6. Does the County expect the selected vendor to attend meetings at the client site? If so, how often?  
*Yes; a single meeting is expected, to review the new actuarial report. Roanoke County/RCPS would consider videoconferencing options for this meeting if necessary.*
- 7. Can a copy of the most recent actuarial report be provided?  
*Please see Attachments C and D.*



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# **Proposal to Perform Actuarial Services**

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Roanoke County, Virginia  
Department of Finance  
Purchasing Division  
RFQ # KJ032907

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March 29, 2007

Original

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## **Proposal to Perform Actuarial Services**

Roanoke County, Virginia

### **Scope of Services**

Select Actuarial Services proposes to perform actuarial consulting services for Roanoke County, Virginia. The purpose of the study will be to assist the County in the management and planning of its self-insured workers compensation and automobile and general liability programs and the self-insured workers compensation program of the County School Board. The assistance shall include:

- 1) Submission of a formal document addressing actuarial evaluations of reserves and funding requirements, signed by a Member and Fellow of the Casualty Actuarial Society.
- 2) Personal presentation and explanation of report results and conclusions.
- 3) Ongoing consultation, as necessary, with regard to interpretation of values presented and the implementation of recommendations.

### **Actuarial Analyses**

The objectives of this study will be:

- ◆ To evaluate reserves required as of June 30, 2007, to fund outstanding retained losses;
  - ◆ To project losses for the 2007/08 and 2008/09 years;
  - ◆ To evaluate the adequacy of fund balances as of June 30, 2007, and to project funding requirements through the 2008/09 year; and
  - ◆ To provide estimated cash flow requirements for prior incurred claims and projected future claims by fiscal year.
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The analyses will include an estimation of the statistical variability inherent in the actuarial estimates, providing for projections at various confidence levels including the 50<sup>th</sup>, 75<sup>th</sup> and 90<sup>th</sup> percentiles. Provision of estimates at other than expected allows the County to evaluate the variability inherent in the estimates. The reserve analyses will be performed reflecting the self-insured retentions in effect during each policy year. Loss projections can be provided at the current retentions and/or one or more potential future retentions. Results will be presented on both discounted and undiscounted bases, with and without the reflection of the time value of money.

A comparison of the results of this analysis with the prior study, as of June 30, 2005, will be included. This exhibit will display actual experience as of June 30, 2007, with projections based on the previous analysis, showing how any changes in estimated ultimate losses reflect changes in experience relative to expectations. To allow for future audits of the experience, whether by Select or by another firm, we will include projections of paid and reported losses as of each fiscal year end through 2008/09.

### **Presentation of Results**

The results of the analyses will be presented first in draft form for the County's review, followed by a formal written report and oral presentation to the County's Self-Insurance Board of Trustees. The written report will contain an Executive Summary outlining the assumptions on which the analysis is based and the conclusions reached. The format of the Executive Summary will be accessible to individuals who are not expert in the insurance field, including graphs outlining the significant findings. The balance of the written report will document sources of data, material assumptions, and methods used in sufficient detail for the County's auditors or another actuary to evaluate the work performed and the conclusions reached.

Our oral presentation of the results will focus on overall funding adequacy, trends in experience, and projections of future losses, rather than on the actuarial methodology employed to reach the conclusions.



## **Performance Schedule**

Select Actuarial Services will complete the proposed services in accordance with the timetable outlined in the County's Request for Proposal. We propose the following target dates for completion of the project:

<b>Date</b>	<b>Action Item</b>
<b>April 2007</b>	<b>Contract Awarded</b>
<b>Week of July 9</b>	<b>Data Provided</b>
<b>Week of July 23</b>	<b>Draft Conclusions and Report Delivered</b>
<b>July 30 – August 3</b>	<b>Review of Results and Draft Report</b>
<b>Week of August 6</b>	<b>Oral Presentation of Results</b>
<b>August 15</b>	<b>Final Report Delivered</b>

## **Contractor Description**

### **Select Actuarial Services**

Select Actuarial Services is an independent consulting firm providing expert, professional casualty actuarial services necessary to the sound management and administration of risk management and insurance programs. Select actuaries conduct ongoing research into improved methods of analysis and apply state-of-the-art techniques to the estimation of insurance and self-insurance liabilities. Our staff, which includes four fully qualified Fellows of the Casualty Actuarial Society, provides the depth of knowledge, years of experience and critical peer-review support necessary to meet the County's needs. In fact, governmental entities make up about twenty-five percent of Select Actuarial Services' client base. Our experience with these entities has given us insight into how the issues facing governmental clients differ from those of the private sector. Experience with a diverse base of captive, self-insured, and insurance company clients, together with a concerted effort to stay informed with the insurance industry and our clients' interests makes Select Actuarial Services well prepared to provide the expert actuarial and related consulting services our clients have come to rely on.



Select's studies are objective evaluations of risk financing programs. Reports are logically self-contained. We pride ourselves in producing clearly written reports that can be understood by non-actuaries. The selection of actuarial techniques is related to the client's insurance and risk management program. Support for subjective judgments is explicitly identified and can be readily scrutinized. Report conclusions have clean audit trails and can be replicated by non-actuaries. This approach ensures the value of actuarial studies in helping clients achieve their objectives.

All studies performed by Select Actuarial Services meet applicable American Academy of Actuaries Standards of Practice. In addition, Select's studies also meet internal client service standards relating to product content and review requirements. These standards relate to the product as a document which can be used by non-actuaries for a variety of purposes. As an example, our internal standards require that all reserve analyses performed include exhibits and narrative outlining the reasons for changes in estimated ultimate losses relative to prior analyses. Our clients have found such discussions to be very helpful in determining whether changes in ultimate losses are within normal expectations or require corrective action.

Internal service standards also require peer review by a second, credentialed actuary (not otherwise assigned to the project) of all major studies before final release to the client. Review by another actuary outside the project ensures that assumptions are clearly delineated and that all relevant alternatives have been considered.

### **Office Location and Key Personnel**

Professional actuarial services will be provided by:

*Select Actuarial Services  
28 White Bridge Road, Suite 205  
Nashville, Tennessee 37205  
615-269-4469 (voice)  
615-269-4878 (fax)*

The proposed studies will be performed by Claire Janaway, analyst, under the direction of Mary Frances Miller, FCAS, MAAA, CPCU, ARe, AIM. Peer review will be provided by Cheryl White, FCAS, MAAA. Mrs. Miller will present the results of the studies to the Self-Insurance Board of Trustees. Resumes of our team members are contained in Section 2 of this proposal.

Mrs. Miller and Ms. White have extensive experience in the evaluation of public entity self-insurance programs. A listing of representative projects





recently completed under their direction is contained in Section 3 of this proposal.

## **Data Requirements**

In order to complete the proposed study, we will need the following data:

- 1) A listing of individual auto and general liability losses as of June 30, 2006, and as of June 30, 2007.
- 2) Paid and reported losses and claim counts by accident year as of June 30, 2006, and June 30, 2007, for the County and School Board workers compensation coverages.
- 3) A listing of all workers compensation individual claims with reported losses in excess of \$50,000 as of June 30, 2007.
- 4) Updates to payrolls, automobile counts and operating expenditures and projections for the forecast years.
- 5) Retentions and limits of coverage for the 06/07, 07/08, and 08/09 years. Please confirm the limits shown in the most recent actuarial study for the 04/05 and 05/06 years.
- 6) Range of rates of return to be used in discounting outstanding loss reserves and forecast losses (the 2005 study used a 3% rate).
- 7) Current fund balances and as of June 30, 2007.

## **Conclusion**

Thank you for giving us the opportunity to submit this proposal. We look forward to continuing to provide high quality, individualized consulting services to the County.



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## Team Members

### **Mary Frances Miller, FCAS, MAAA, CPCU, AR<sub>e</sub>, AIM**

Mrs. Miller is a founder and the senior consulting actuary with Select Actuarial Services. With more than 20 years of property and casualty actuarial experience, she provides actuarial consulting services on several major accounts and is additionally responsible for the professional development of the other members. Her expertise is frequently called upon to assist clients in making decisions regarding the maintenance and design of their risk management programs.

Prior to the formation of Select Actuarial Services, Mrs. Miller was the Senior Vice President and Chief Actuary for five years at Sedgwick Actuarial Services. As Chief Actuary she performed a wide spectrum of actuarial studies and also managed the actuarial staff. Before joining Sedgwick in 1993, Mrs. Miller was reinsurance actuary with American States Insurance Companies, where her duties included pricing within the Reinsurance Division, as well as the design and development of specialized software targeting property catastrophe exposures, case reserving for automobile and workers' compensation long-term disability claims, and evaluating treaty commutation proposals.

Mrs. Miller graduated with highest honor from the Honors College at Michigan State University with Bachelor of Arts degrees in Mathematics and Linguistics. She is a Fellow of the Casualty Actuarial Society, a member of the American Academy of Actuaries, a Fellow of the Conference of Consulting Actuaries, and a Chartered Property and Casualty Underwriter. She was elected an Honorary Fellow of the Institute of Actuaries (UK) in 2005. She has been an active contributor to the actuarial profession since achieving fellowship in 1988, and has chaired the CAS Professionalism Education Committee, the Education Policy Committee, and task forces on mutual recognition and future education planning. She was Vice-President for Admissions of the Casualty Actuarial Society from 2000 to 2002, President-Elect in 2003, President in 2004, and she chaired the CAS Board in 2005. She has been a member of the Board of Directors of the American Academy of Actuaries and is a current member of the Board of Directors of the Conference of Consulting Actuaries. As a member of the Actuarial Standards Board subcommittee

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on reserves, Mrs. Miller was a drafter of ASOP #36, the standard for reserve opinions in the United States.

### **Cheryl White, FCAS, MAAA**

Ms. White is a founder and consulting actuary with Select Actuarial Services. She has over thirteen years of experience in the property casualty actuarial field. As a member of Select Actuarial Services, she provides expert consulting services to many of our clients and provides leadership as the signing actuary for numerous projects produced by other members of the practice. Her experience includes reserve analyses, loss forecasting, probability analyses, and large loss modeling. In addition to consulting, Ms. White helps to keep Select Actuarial Services running by handling many of the day-to-day responsibilities involved in managing a small business.

Prior to the formation of Select Actuarial Services, Ms. White was an Associate Consulting Actuary with Sedgwick Actuarial Services where she served for four and a half years. Prior to joining Sedgwick in 1994, she worked for the Tennessee Department of Insurance in the Property and Casualty Rating section.

Ms. White holds a Bachelor of Science degree from the University of Mississippi in Mathematics and a Master of Science degree from Vanderbilt University in Mathematics. She is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. She is an active member of the CAS and currently serves on the Examination Committee of the Society.

### **Claire Janaway**

Ms. Janaway assists in providing actuarial consulting services to a wide variety of Select's clients, including studies in workers compensation and automobile, general, and property liabilities. Ms. Janaway has been with Select since January 2005.

Ms. Janaway is actively pursuing membership in the Casualty Actuarial Society, and has completed two of the required nine examinations. She graduated cum laude from Tennessee Technological University with a Bachelor of Science degree in Mathematics and a minor in Business.



## Representative Experience

The proposed team members have provided projects similar to the proposed studies to a large number of public and private entities. Representative projects include:

Client	Project	Contact	Team Member
Virginia Association of Counties	Annual Reserve Evaluation, Forecast and Premium Adequacy Opinion	Wayne Faddis VACo Insurance Programs 5115 Bernard Drive Suite 103 Roanoke, Virginia 24018 (540) 772-6972	Mary Frances Miller
Nebraska Association of School Boards	Annual Reserve Evaluation and Forecast for WC, Liability, and PR lines	Sheri Shonka Sedgwick of Nebraska 10909 Mill Valley Rd #200 Omaha, Nebraska 68154 (402) 496-2000	Cheryl White
Oklahoma Municipal Assurance Group	Annual Reserve Evaluation and Forecast for GL, AL, APD, and PR lines	Harold Pumford 4130 N. Lincoln Blvd, Ste A Oklahoma City, OK 73105 (405) 525-6624	Cheryl White
Cox Enterprises, Inc.	Semi-Annual Reserve Evaluations and Annual Forecasts on WC, GL, AL, and Garage Liability lines	Shelia Clinton 1400 Lake Hearn Drive, NE Atlanta, GA 30319 (404) 843-5000	Mary Frances Miller
Blount County, Tennessee	Self-insured loss and loss adjustment reserve evaluation for WC liability in Tennessee	Don Stallions Blount County TN Government 387 Court St Maryville, TN 37804-5906 (865) 273-5772	Claire Janaway
Marion County, Oregon	Reserve evaluation and loss forecast for WC, AL, GL lines	Sara Stevenson Marion County Risk Management PO Box 14500 Salem, OR 97309 (503)-373-4426	Cheryl White
School District of Palm Beach County, Florida	Estimate of ultimate and outstanding losses for WC, GL, and AL lines	Brian Marinar Palm Beach County School Board 3370 Forest Hill Blvd., Suite A-106 West Palm Beach, FL 33406 (561) 434-8634	Cheryl White
Oklahoma Schools Insurance Group	Reserve evaluation and outstanding premium estimate for AL, GL, APD, and PR lines	Bruce J. Wilson Arthur J Gallagher & Co 1300 S Main Tulsa, OK 74119 (918) 764-1673	Cheryl White Mary Frances Miller



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# **Estimate of Ultimate and Outstanding Losses**

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County of Roanoke

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April 11, 2018

Based on data evaluated as of December 31, 2017

# Estimate of Ultimate and Outstanding Losses

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County of Roanoke

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April 11, 2018

Based on data evaluated as of December 31, 2017

*Prepared by:  
Alex Shofner and*

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*Mary Frances Miller, FCAS, MAAA, CPCU, ARe, AIM*

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*Jack Pipa, ACAS, MAAA*

*Select Actuarial Services  
28 White Bridge Road, Suite 205  
Nashville, TN 37205  
(615) 269-4469 ext 110  
(615) 269-4878 (fax)  
maryfrances.miller@selectactuarial.com*

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Section 8	Appendices

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## Executive Summary

The purpose of this report is to provide the County of Roanoke, Virginia, with an evaluation of the liabilities associated with its retained workers compensation and general and automobile liability exposures. The specific objectives are (a) to evaluate reserves required as of December 31, 2017, to fund outstanding retained losses arising from accident periods from July 1, 1988, through December 31, 2017, for workers compensation claims, and July 1, 1994, through December 31, 2017, for automobile and general liability claims, (b) to project ultimate liabilities for the forecast period beginning July 1, 2018, through June 30, 2019, (c) to estimate required funding as of December 31, 2017, and to project funding requirements through the 2018/19 year; and (d) to provide estimated cash flow requirements for prior incurred claims and projected future claims by fiscal year.

Key assumptions in this analysis include the use of:

- 1) Historical reporting and payment patterns of the combined experience of the County and School Board, supplemented by those of the Virginia Association of Counties, to estimate ultimate workers compensation losses for past accident years;
- 2) Virginia Association of Counties loss development statistics to estimate ultimate general and automobile liability losses for past accident years;
- 3) External economic indices to estimate trends;
- 4) Use of various statistical distributions to model the loss generating process and to measure the variability in the loss estimates; and
- 5) A 2.5% rate of return in discounting outstanding losses.

Table 1 following this executive summary displays the estimated ultimate limited losses, the limited reported and paid losses and the case reserves, along with undiscounted and discounted outstanding losses through December 31, 2017, as of December 31, 2017, for workers compensation and liability. Table 2 shows projected loss payments during the remainder of the 2017/18 year and the following ten fiscal years for each of the three

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lines. Table 3 shows the required funding for each line if funding is set at the expected level.

The graphs following this Executive Summary illustrate the results of this analysis. The top graphs show estimated ultimate losses for each policy period, divided into paid losses, adjusters' reserves on known claims (case reserves) and unreported (IBNR) losses. Also shown are the forecasts for the remaining six months of 2017/18 and the 2018/19 and 2019/20 years. The exposures are displayed as a line scaled on the right side of each graph.

The bottom graphs illustrate the comparison of current projections of ultimate losses with estimates as displayed in our prior report. For each period displayed, the bars represent ultimate limited losses as of the date specified.

Throughout the analysis we have estimated ultimate losses using data as of December 31, 2017. Unless otherwise specified, "losses" includes allocated expenses but not unallocated claims handling charges throughout this report. For liability, given the limited volume of data, we have relied on the Virginia Association of Counties paid loss experience to project the pattern of future payments.

## Workers Compensation

Since the previous analysis, as of December 31, 2015, year to year experience for workers compensation was varied. For claims occurring in older accident periods, prior to 2015/16, reported losses developed higher than projected. This adverse experience can be associated with large increases (between \$25,000 and \$160,000) on 16 claims. On the other hand, very favorable experience was observed for the 2015/16 accident period, which had reported losses come in 58% less than projected, offsetting some of the adverse experience for the older years. Results for the latest accident periods, 2016/17 and 2017/18, were essentially a wash with reported losses tracking higher than expected for 2016/17 and lower than expected for 2017/18. Estimated ultimate losses for all years combined have been adjusted up \$83,000 from estimates in the previous report.

Estimated total required reserves for all periods (1988/89 through 2017/18) as of December 31, 2017, are \$2,064,000. The reserve estimate is made up of \$823,000 in case reserves and \$1,241,000 in incurred but not reported losses. Discounted at a rate of 2.5%, the value of the estimated outstanding losses is \$1,852,000.

Ultimate losses for the 2018/19 forecast period are estimated to be \$787,000 at the expected level. This is based on an average loss cost

estimate of \$1.47 per \$100 of payroll and \$53.5 million in projected payroll. The \$1.47 estimate is a 4.5% decrease from the 2016/17 estimate of \$1.54 selected in the previous actuarial report. Both claim frequency and the average cost per \$100 payroll have come down in recent years. Favorable experience is more than offsetting the effects of inflation. For 2018/19, we project a total of 104 claims at an average of \$7,600 per claim.

## Automobile Liability

With the exception of the 2012/13 accident year, year to year reported losses for automobile liability have emerged in line with, or below, projections. We note that claim #772012064162, from the 2012/13 period, increased \$18,000 during the past 24 months and remains open as of December 31, 2017, with \$26,085 in case reserves. All new claims that have been reported since the previous evaluation as of December 31, 2015, are small (under \$10,000). For the 1994/95 through 2017/18 years combined, reported losses are \$51,000, or 6%, less than projected. Overall, selected ultimate losses have been decreased \$66,000, or 6%, from estimates in the previous report.

The total required reserve for all periods for automobile liability as of December 31, 2017, is \$92,000. Taking into account the time value of money, discounted required reserves total \$89,000.

We project 18 claims for the 2018/19 year at an average cost of \$4,200, resulting in forecast losses of \$74,000. The projected cost per vehicle is \$174. This is up from the previous selected rate for 2016/17 of \$171 per vehicle. Favorable experience partially offset the effects of inflation.

## General Liability

Overall reported losses for general liability have developed about \$22,000 higher than projected since December 31, 2015. This is almost entirely driven by the emergence of claim #772017184570 from the 2016/17 accident year with reported losses totaling \$35,000. As of December 31, 2017, this claim remains open with \$9,456 in case reserves. Development on other claims was minimal. Of the 35 new claims reported since December 31, 2015, 22 were closed with no payment. For all years through 2017/18 combined, we have increased our ultimate loss selection by \$23,000.

The estimated required reserve for general liability as of December 31, 2017, is \$37,900. Discounted at a rate of 2.5%, the value of the estimated required reserve is \$36,100.

For the 2018/19 year, we project about 7 claims, with a total cost of approximately \$15,000. The projected cost per \$10,000 of net operating expense is \$3.34.

It must be understood that the evaluation of ultimate levels of past liabilities requires estimation of future transactions. In projecting future loss emergence, we have assumed that historical patterns, with specific adjustments as noted, are predictive of future loss emergence. We have not anticipated any extraordinary changes to the legal, social, and economic environment that might affect the cost and frequency of all claims, again except as noted. Actual results may differ significantly from the estimates provided in this analysis.

**Calculation of Required Reserves  
As of December 31, 2017**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Accident Period	Selected Ultimate Losses	Limited Paid Losses	Limited Reported Losses	Case Reserves	IBNR Reserves	Total Required Reserves	Discount Factor at 2.5%	Total Discounted Reserves at 2.5%
88-89 through 95-96	NA	\$1,365,074	\$1,365,074	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$445,183	\$445,183	\$445,183	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$176,952	\$176,952	\$176,952	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$372,377	\$372,377	\$372,377	\$0	\$0	\$0	0.988	\$0
7/1/99-00	\$634,838	\$634,838	\$634,838	\$0	\$0	\$0	0.965	\$0
7/1/00-01	\$335,000	\$327,224	\$332,102	\$4,878	\$3,000	\$8,000	0.945	\$8,000
7/1/01-02	\$904,000	\$840,191	\$894,006	\$53,815	\$10,000	\$64,000	0.928	\$59,000
7/1/02-03	\$307,000	\$270,850	\$302,776	\$31,926	\$4,000	\$36,000	0.913	\$33,000
7/1/03-04	\$516,000	\$478,540	\$508,655	\$30,115	\$7,000	\$37,000	0.899	\$33,000
7/1/04-05	\$405,000	\$359,745	\$398,446	\$38,701	\$7,000	\$46,000	0.888	\$41,000
7/1/05-06	\$629,000	\$592,637	\$617,092	\$24,454	\$12,000	\$36,000	0.879	\$32,000
7/1/06-07	\$807,000	\$608,612	\$789,023	\$180,411	\$18,000	\$198,000	0.873	\$173,000
7/1/07-08	\$737,000	\$634,082	\$717,859	\$83,777	\$19,000	\$103,000	0.868	\$89,000
7/1/08-09	\$799,000	\$680,513	\$774,538	\$94,025	\$24,000	\$118,000	0.865	\$102,000
7/1/09-10	\$359,000	\$345,315	\$345,315	\$0	\$14,000	\$14,000	0.865	\$12,000
7/1/10-11	\$1,540,000	\$1,480,357	\$1,506,068	\$25,711	\$34,000	\$60,000	0.866	\$52,000
7/1/11-12	\$500,000	\$428,011	\$469,981	\$41,970	\$30,000	\$72,000	0.870	\$63,000
7/1/12-13	\$753,000	\$676,906	\$697,693	\$20,788	\$55,000	\$76,000	0.876	\$67,000
7/1/13-14	\$833,000	\$697,441	\$744,925	\$47,484	\$88,000	\$135,000	0.884	\$119,000
7/1/14-15	\$989,000	\$818,595	\$845,313	\$26,718	\$144,000	\$171,000	0.893	\$153,000
7/1/15-16	\$436,000	\$272,878	\$286,884	\$14,006	\$149,000	\$163,000	0.905	\$147,000
7/1/16-17	\$951,000	\$531,519	\$620,434	\$88,916	\$331,000	\$420,000	0.916	\$385,000
7/1-12/31/17	\$328,000	\$20,747	\$35,643	\$14,896	\$292,000	\$307,000	0.925	\$284,000
<b>Total</b>	<b>\$13,757,000</b>	<b>\$13,058,586</b>	<b>\$13,881,176</b>	<b>\$822,590</b>	<b>\$1,241,000</b>	<b>\$2,064,000</b>		<b>\$1,852,000</b>
96-97 through 12/31/17	\$13,757,000	\$11,693,512	\$12,516,102	\$822,590	\$1,241,000	\$2,064,000		\$1,852,000
1/1-6/30/18	\$328,000							

Column (B): Exhibit X; prorated for 7/1/17-18  
Columns (C), (D): Exhibit I, limited to retention  
Column (E) = (D) - (C)  
Column (F) = (B) - (D); judgmentally selected for 88/89 thorough 95/96  
Column (G) = (E) + (F)  
Column (H): Appendix D  
Column (I) = (G) \* (H)

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 1/1-6/30/18	Paid During 2018-19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$8,000	\$300	\$600	\$500	\$500	\$400	\$400	\$300	\$300	\$300	\$200	\$200
7/1/01-02	\$64,000	\$2,700	\$5,000	\$4,300	\$3,800	\$3,400	\$3,000	\$2,700	\$2,400	\$2,200	\$2,000	\$1,800
7/1/02-03	\$36,000	\$1,600	\$2,900	\$2,600	\$2,200	\$2,000	\$1,700	\$1,500	\$1,400	\$1,200	\$1,100	\$1,000
7/1/03-04	\$37,000	\$1,800	\$3,200	\$2,700	\$2,400	\$2,100	\$1,800	\$1,600	\$1,400	\$1,300	\$1,200	\$1,000
7/1/04-05	\$46,000	\$2,400	\$4,200	\$3,600	\$3,100	\$2,700	\$2,300	\$2,000	\$1,800	\$1,600	\$1,400	\$1,300
7/1/05-06	\$36,000	\$2,000	\$3,500	\$2,900	\$2,500	\$2,100	\$1,900	\$1,600	\$1,400	\$1,300	\$1,100	\$1,000
7/1/06-07	\$198,000	\$11,600	\$20,300	\$17,000	\$14,300	\$12,200	\$10,500	\$9,100	\$7,900	\$7,000	\$6,200	\$5,500
7/1/07-08	\$103,000	\$6,500	\$11,300	\$9,300	\$7,700	\$6,500	\$5,600	\$4,800	\$4,100	\$3,600	\$3,200	\$2,800
7/1/08-09	\$118,000	\$8,200	\$13,900	\$11,300	\$9,200	\$7,700	\$6,500	\$5,500	\$4,800	\$4,100	\$3,600	\$3,200
7/1/09-10	\$14,000	\$1,100	\$1,800	\$1,400	\$1,100	\$900	\$800	\$700	\$600	\$500	\$400	\$400
7/1/10-11	\$60,000	\$5,000	\$8,300	\$6,400	\$5,100	\$4,100	\$3,400	\$2,800	\$2,400	\$2,000	\$1,700	\$1,500
7/1/11-12	\$72,000	\$6,700	\$10,800	\$8,200	\$6,400	\$5,100	\$4,100	\$3,400	\$2,800	\$2,400	\$2,000	\$1,700
7/1/12-13	\$76,000	\$7,900	\$12,500	\$9,200	\$7,000	\$5,400	\$4,300	\$3,500	\$2,900	\$2,400	\$2,000	\$1,700
7/1/13-14	\$135,000	\$16,100	\$24,500	\$17,400	\$12,700	\$9,700	\$7,500	\$6,000	\$4,800	\$4,000	\$3,300	\$2,800
7/1/14-15	\$171,000	\$23,400	\$34,400	\$23,400	\$16,500	\$12,100	\$9,200	\$7,200	\$5,700	\$4,600	\$3,800	\$3,200
7/1/15-16	\$163,000	\$25,800	\$36,500	\$23,500	\$15,900	\$11,300	\$8,300	\$6,300	\$4,900	\$3,900	\$3,100	\$2,600
7/1/16-17	\$420,000	\$75,000	\$104,500	\$64,100	\$41,100	\$27,900	\$19,700	\$14,500	\$11,000	\$8,500	\$6,800	\$5,500
7/1-12/31/17	\$307,000	\$56,900	\$82,600	\$50,800	\$31,000	\$20,000	\$13,500	\$9,600	\$7,000	\$5,300	\$4,100	\$3,300
Subtotal	\$2,064,000	\$255,000	\$381,000	\$259,000	\$183,000	\$136,000	\$105,000	\$83,000	\$68,000	\$56,000	\$47,000	\$41,000
1/1-6/30/18	\$328,000	\$61,000	\$88,000	\$54,000	\$33,000	\$21,000	\$14,000	\$10,000	\$8,000	\$6,000	\$4,000	\$4,000
7/1/18-19	\$787,000	--	\$206,000	\$192,000	\$118,000	\$72,000	\$46,000	\$31,000	\$22,000	\$16,000	\$12,000	\$10,000
Total	\$3,179,000	\$316,000	\$675,000	\$505,000	\$334,000	\$229,000	\$165,000	\$124,000	\$98,000	\$78,000	\$63,000	\$55,000

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A2 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 12/31/17)]\}$ .

***Funding at the Expected Level***

(1) <i>Estimated Outstanding Losses as of 12/31/17</i> <i>{ Exhibit XII-1 }</i>	\$2,064,000
(2) <i>Forecast Losses for 1/1-6/30/18</i> <i>{ Exhibit XII-1 }</i>	\$328,000
<hr/>	
<b>(3) <i>Required Funding as of 12/31/17</i></b> <b><i>{ (1) + (2) }</i></b>	<b>\$2,392,000</b>
(4) <i>Projected Payments during 1/1-6/30/18</i> <i>{ Exhibit XIII-1 }</i>	\$316,000
(5) <i>Estimated Outstanding Losses as of 6/30/18</i> <i>{ (3) – (4) }</i>	\$2,076,000
(6) <i>Forecast Losses for 7/1/18-19</i> <i>{ Exhibit VI }</i>	\$787,000
<hr/>	
<b>(7) <i>Required Funding as of 6/30/18</i></b> <b><i>{ (5) + (6) }</i></b>	<b>\$2,863,000</b>
(8) <i>Projected Payments during 7/1/18-19</i> <i>{ Exhibit XIII-1 }</i>	\$675,000
(9) <i>Estimated Outstanding Losses as of 6/30/19</i> <i>{ (7) – (8) }</i>	\$2,188,000
(10) <i>Forecast Losses for 7/1/19-20</i> <i>{ Exhibit VI }</i>	\$809,000
<hr/>	
<b>(11) <i>Required Funding as of 6/30/19</i></b> <b><i>{ (9) + (10) }</i></b>	<b>\$2,997,000</b>

**Calculation of Required Reserves  
As of December 31, 2017**

(A) Accident Period	(B) Selected Ultimate Losses	(C) Limited Paid Losses	(D) Limited Reported Losses	(E) Case Reserves	(F) IBNR Reserves	(G) Total Required Reserves	(H) Discount Factor at 2.5%	(I) Total Discounted Reserves at 2.5%
7/1/94-95	\$3,353	\$3,353	\$3,353	\$0	\$0	\$0	1.000	\$0
7/1/95-96	\$18,395	\$18,395	\$18,395	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$13,214	\$13,214	\$13,214	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$19,700	\$19,700	\$19,700	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$11,376	\$11,376	\$11,376	\$0	\$0	\$0	1.000	\$0
7/1/99-00	\$15,316	\$15,316	\$15,316	\$0	\$0	\$0	1.000	\$0
7/1/00-01	\$32,819	\$32,819	\$32,819	\$0	\$0	\$0	1.000	\$0
7/1/01-02	\$116,482	\$116,482	\$116,482	\$0	\$0	\$0	1.000	\$0
7/1/02-03	\$17,543	\$17,543	\$17,543	\$0	\$0	\$0	1.000	\$0
7/1/03-04	\$35,067	\$35,067	\$35,067	\$0	\$0	\$0	1.000	\$0
7/1/04-05	\$123,899	\$123,899	\$123,899	\$0	\$0	\$0	1.000	\$0
7/1/05-06	\$42,764	\$42,764	\$42,764	\$0	\$0	\$0	1.000	\$0
7/1/06-07	\$66,223	\$66,223	\$66,223	\$0	\$0	\$0	1.000	\$0
7/1/07-08	\$23,803	\$23,803	\$23,803	\$0	\$0	\$0	1.000	\$0
7/1/08-09	\$26,281	\$26,281	\$26,281	\$0	\$0	\$0	1.000	\$0
7/1/09-10	\$30,280	\$30,280	\$30,280	\$0	\$0	\$0	1.000	\$0
7/1/10-11	\$4,321	\$4,321	\$4,321	\$0	\$0	\$0	1.000	\$0
7/1/11-12	\$45,045	\$45,045	\$45,045	\$0	\$0	\$0	1.000	\$0
7/1/12-13	\$89,000	\$61,905	\$87,990	\$26,085	\$1,000	\$27,000	0.988	\$26,700
7/1/13-14	\$27,294	\$27,294	\$27,294	\$0	\$0	\$0	0.976	\$0
7/1/14-15	\$17,861	\$17,861	\$17,861	\$0	\$0	\$0	0.972	\$0
7/1/15-16	\$58,000	\$46,689	\$46,689	\$0	\$11,000	\$11,000	0.969	\$10,700
7/1/16-17	\$51,000	\$25,478	\$25,478	\$0	\$26,000	\$26,000	0.965	\$25,100
7/1-12/31/17	\$36,000	\$7,647	\$11,929	\$4,282	\$24,000	\$28,000	0.958	\$26,800
<b>Total</b>	<b>\$925,000</b>	<b>\$832,758</b>	<b>\$863,124</b>	<b>\$30,366</b>	<b>\$62,000</b>	<b>\$92,000</b>		<b>\$89,000</b>
1/1-6/30/18	\$35,000							

Column (B): Exhibit X; prorated for 7/1/17-18

Columns (C), (D): Exhibit IX

Column (E) = (D) - (C)

Column (F) = (B) - (D)

Column (G) = (E) + (F)

Column (H): Appendix D

Column (I) = (G) \* (H)

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 1/1-6/30/18	Paid During 2018-19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28
7/1/94-95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/95-96	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/01-02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/02-03	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/03-04	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/04-05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/06-07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/07-08	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/08-09	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/09-10	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/10-11	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/11-12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/12-13	\$27,000	\$27,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/13-14	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/14-15	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/15-16	\$11,000	\$3,400	\$4,100	\$1,800	\$1,600	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/16-17	\$26,000	\$6,500	\$10,000	\$5,200	\$2,300	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0
7/1-12/31/17	\$28,000	\$5,100	\$9,100	\$7,100	\$3,600	\$1,600	\$1,400	\$0	\$0	\$0	\$0	\$0
Subtotal	\$92,000	\$42,000	\$23,200	\$14,100	\$7,500	\$3,600	\$1,400	\$0	\$0	\$0	\$0	\$0
1/1-6/30/18	\$35,000	\$6,000	\$11,300	\$8,800	\$4,600	\$2,000	\$1,800	\$0	\$0	\$0	\$0	\$0
7/1/18-19	\$76,000	--	\$20,400	\$22,100	\$17,200	\$8,900	\$4,000	\$3,500	\$0	\$0	\$0	\$0
Total	\$203,000	\$48,000	\$54,900	\$45,000	\$29,300	\$14,500	\$7,200	\$3,500	\$0	\$0	\$0	\$0

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A2 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 12/31/17)]\}$ .



***Funding at the Expected Level***

(1) <i>Estimated Outstanding Losses as of 12/31/17</i> <i>{ Exhibit XII-1 }</i>	\$92,000
(2) <i>Forecast Losses for 1/1-6/30/18</i> <i>{ Exhibit XII-1 }</i>	\$35,000
<hr/>	
<b>(3) <i>Required Funding as of 12/31/17</i></b> <b><i>{ (1) + (2) }</i></b>	<b>\$127,000</b>
(4) <i>Projected Payments during 1/1-6/30/18</i> <i>{ Exhibit XIII-1 }</i>	\$48,000
(5) <i>Estimated Outstanding Losses as of 6/30/18</i> <i>{ (3) – (4) }</i>	\$79,000
(6) <i>Forecast Losses for 7/1/18-19</i> <i>{ Exhibit VI }</i>	\$74,000
<hr/>	
<b>(7) <i>Required Funding as of 6/30/18</i></b> <b><i>{ (5) + (6) }</i></b>	<b>\$153,000</b>
(8) <i>Projected Payments during 7/1/18-19</i> <i>{ Exhibit XIII-1 }</i>	\$55,000
(9) <i>Estimated Outstanding Losses as of 6/30/19</i> <i>{ (7) – (8) }</i>	\$98,000
(10) <i>Forecast Losses for 7/1/19-20</i> <i>{ Exhibit VI }</i>	\$76,000
<hr/>	
<b>(11) <i>Required Funding as of 6/30/19</i></b> <b><i>{ (9) + (10) }</i></b>	<b>\$174,000</b>

**Calculation of Required Reserves  
As of December 31, 2017**

(A) <i>Accident Period</i>	(B) <i>Selected Ultimate Losses</i>	(C) <i>Limited Paid Losses</i>	(D) <i>Limited Reported Losses</i>	(E) <i>Case Reserves</i>	(F) <i>IBNR Reserves</i>	(G) <i>Total Required Reserves</i>	(H) <i>Discount Factor at 2.5%</i>	(I) <i>Total Discounted Reserves at 2.5%</i>
7/1/94-95	\$1,216	\$1,216	\$1,216	\$0	\$0	\$0	1.000	\$0
7/1/95-96	\$70	\$70	\$70	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$1,745	\$1,745	\$1,745	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$5,850	\$5,850	\$5,850	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$36,007	\$36,007	\$36,007	\$0	\$0	\$0	1.000	\$0
7/1/99-00	\$28,350	\$28,350	\$28,350	\$0	\$0	\$0	1.000	\$0
7/1/00-01	\$3,429	\$3,429	\$3,429	\$0	\$0	\$0	1.000	\$0
7/1/01-02	\$3,276	\$3,276	\$3,276	\$0	\$0	\$0	1.000	\$0
7/1/02-03	\$23,269	\$23,269	\$23,269	\$0	\$0	\$0	1.000	\$0
7/1/03-04	\$9,501	\$9,501	\$9,501	\$0	\$0	\$0	1.000	\$0
7/1/04-05	\$298	\$298	\$298	\$0	\$0	\$0	1.000	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	1.000	\$0
7/1/06-07	\$1,417	\$1,417	\$1,417	\$0	\$0	\$0	1.000	\$0
7/1/07-08	\$15,813	\$15,813	\$15,813	\$0	\$0	\$0	1.000	\$0
7/1/08-09	\$17,156	\$17,156	\$17,156	\$0	\$0	\$0	1.000	\$0
7/1/09-10	\$544	\$544	\$544	\$0	\$0	\$0	1.000	\$0
7/1/10-11	\$1,380	\$1,380	\$1,380	\$0	\$0	\$0	1.000	\$0
7/1/11-12	\$103	\$103	\$103	\$0	\$0	\$0	1.000	\$0
7/1/12-13	\$0	\$0	\$0	\$0	\$0	\$0	0.988	\$0
7/1/13-14	\$5,858	\$5,858	\$5,858	\$0	\$0	\$0	0.972	\$0
7/1/14-15	\$50	\$50	\$50	\$0	\$0	\$0	0.963	\$0
7/1/15-16	\$13,700	\$7,129	\$7,129	\$0	\$6,600	\$6,600	0.958	\$6,300
7/1/16-17	\$54,300	\$28,813	\$46,425	\$17,612	\$7,900	\$25,500	0.953	\$24,300
7/1-12/31/17	\$6,900	\$1,109	\$1,109	\$0	\$5,800	\$5,800	0.945	\$5,500
<b>Total</b>	<b>\$230,200</b>	<b>\$192,382</b>	<b>\$209,994</b>	<b>\$17,612</b>	<b>\$20,300</b>	<b>\$37,900</b>		<b>\$36,100</b>
1/1-6/30/18	\$6,800							

Column (B): Exhibit X; prorated for 7/1/17-18

Columns (C), (D): Exhibit IX

Column (E) = (D) - (C)

Column (F) = (B) - (D)

Column (G) = (E) + (F)

Column (H): Appendix D

Column (I) = (G) \* (H)

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

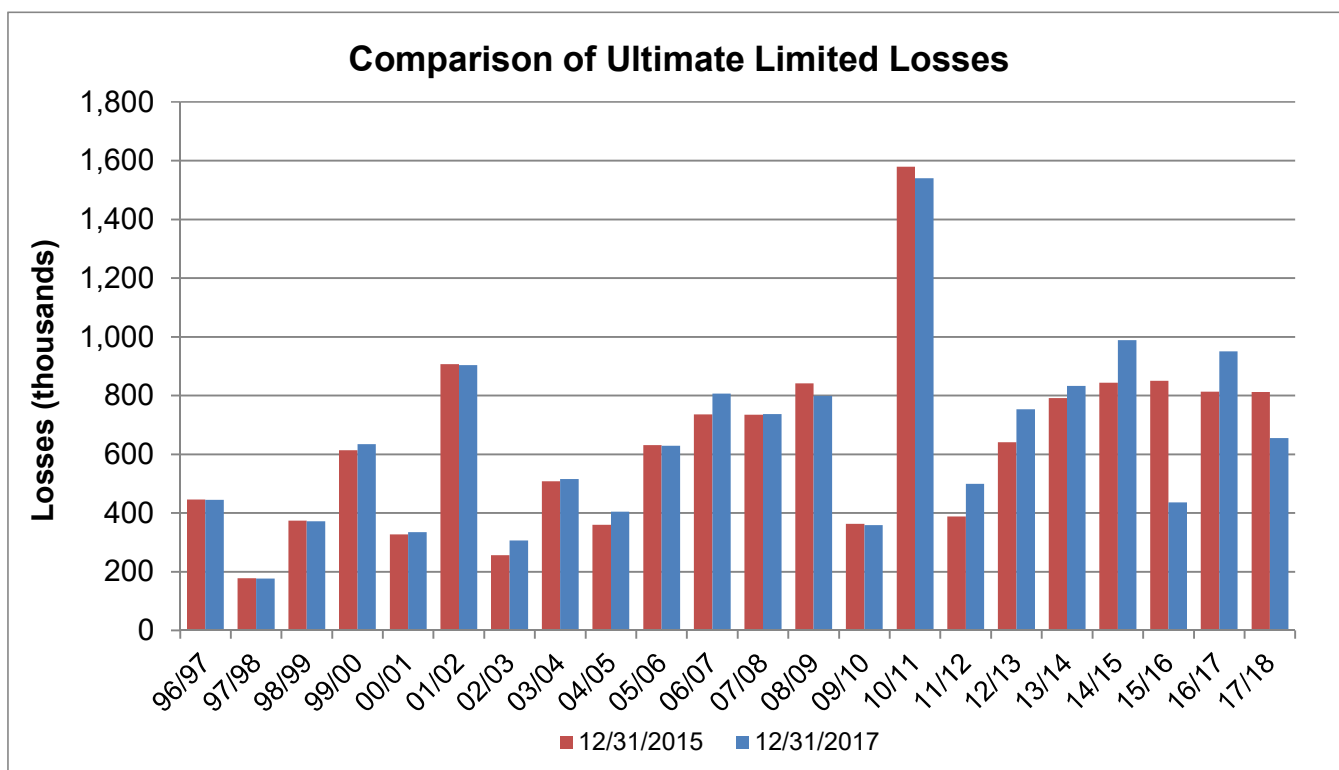
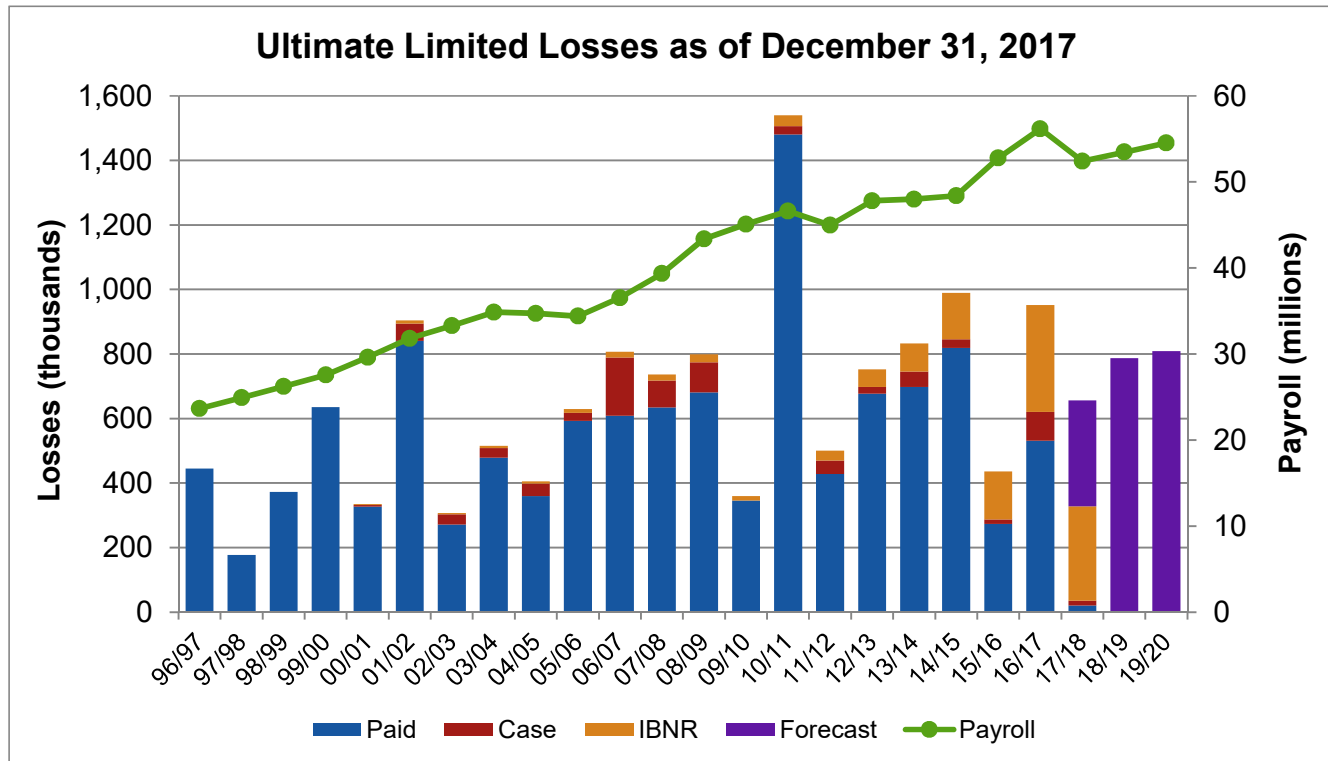
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 1/1-6/30/18	Paid During 2018-19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28
7/1/94-95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/95-96	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/01-02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/02-03	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/03-04	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/04-05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/06-07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/07-08	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/08-09	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/09-10	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/10-11	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/11-12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/12-13	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/13-14	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/14-15	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/15-16	\$6,600	\$1,400	\$2,000	\$1,100	\$2,100	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/16-17	\$25,500	\$4,800	\$7,800	\$4,900	\$2,800	\$5,200	\$0	\$0	\$0	\$0	\$0	\$0
7/1-12/31/17	\$5,800	\$700	\$1,600	\$1,300	\$800	\$500	\$900	\$0	\$0	\$0	\$0	\$0
Subtotal	\$37,900	\$6,900	\$11,400	\$7,300	\$5,700	\$5,700	\$900	\$0	\$0	\$0	\$0	\$0
1/1-6/30/18	\$6,800	\$900	\$1,900	\$1,500	\$900	\$600	\$1,000	\$0	\$0	\$0	\$0	\$0
7/1/18-19	\$15,300	--	\$2,800	\$4,000	\$3,200	\$2,000	\$1,200	\$2,100	\$0	\$0	\$0	\$0
Total	\$60,000	\$7,800	\$16,100	\$12,800	\$9,800	\$8,300	\$3,100	\$2,100	\$0	\$0	\$0	\$0

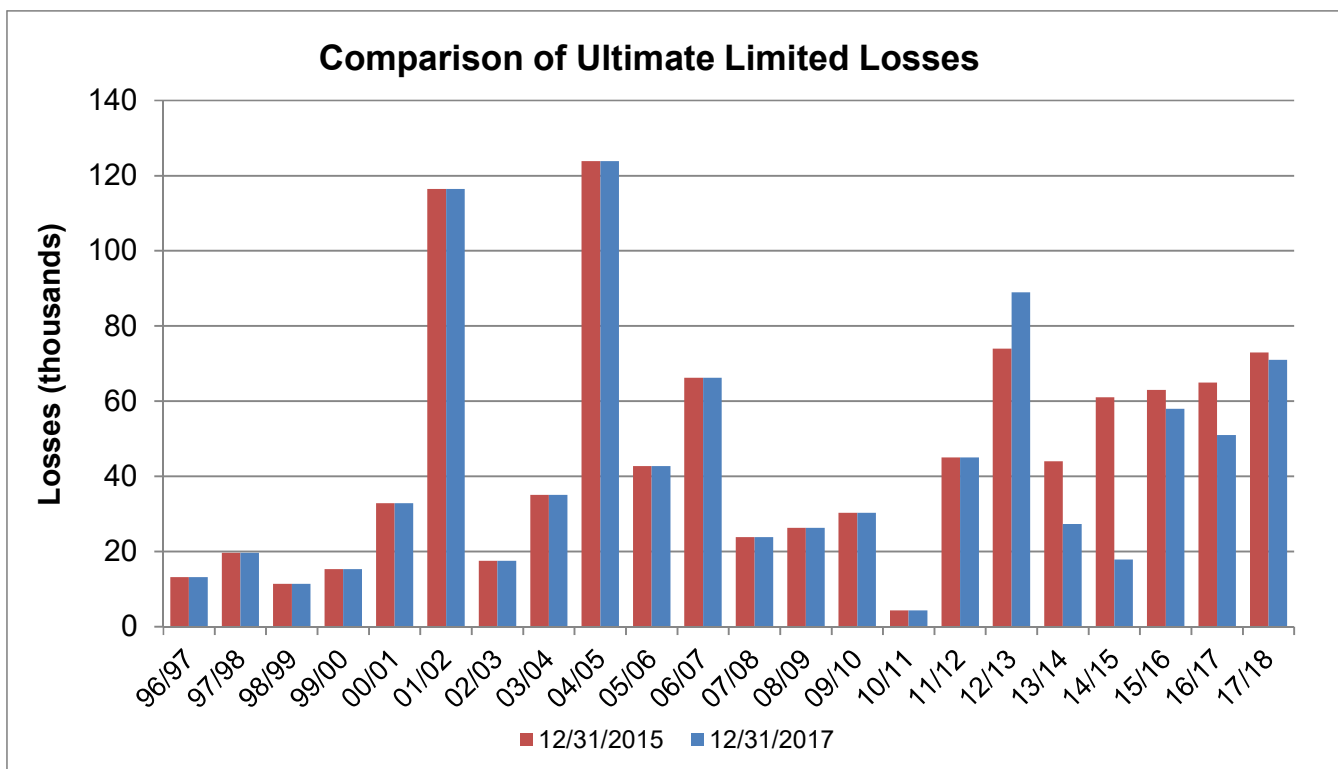
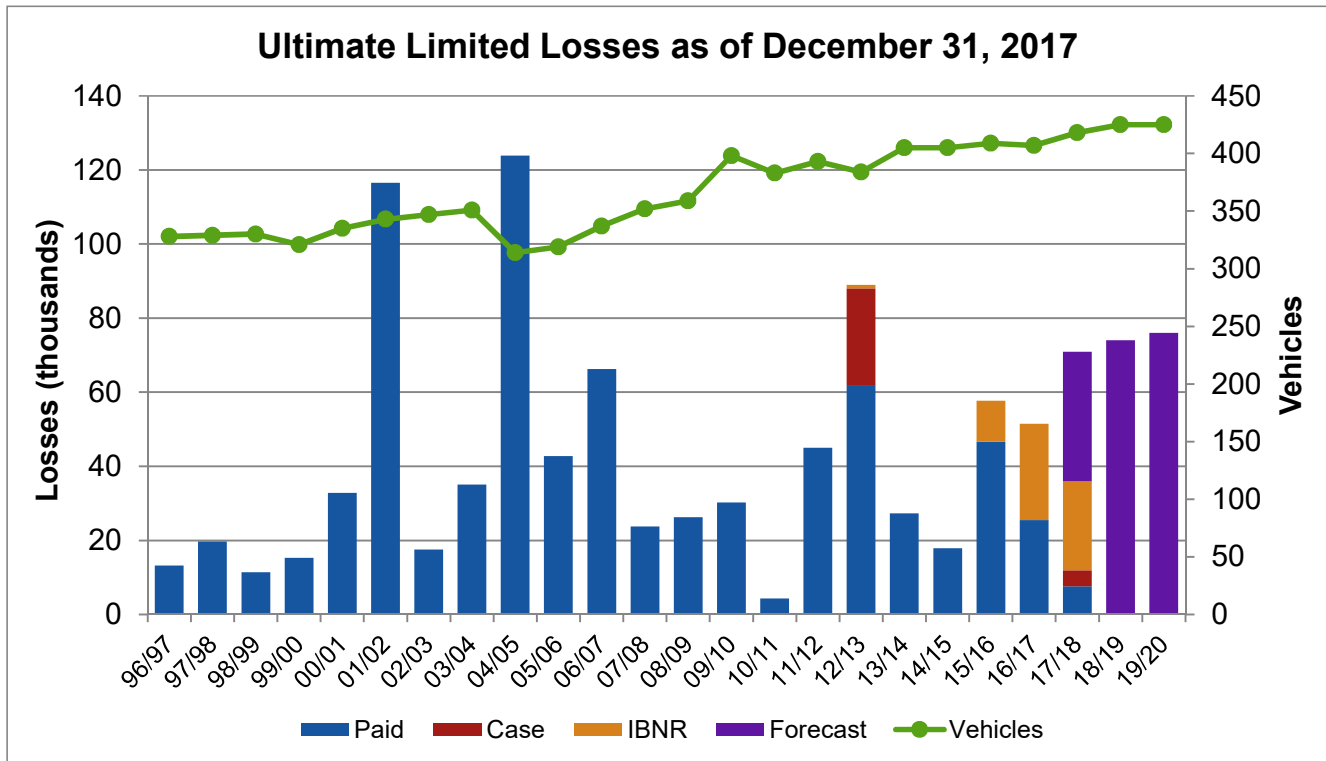
Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

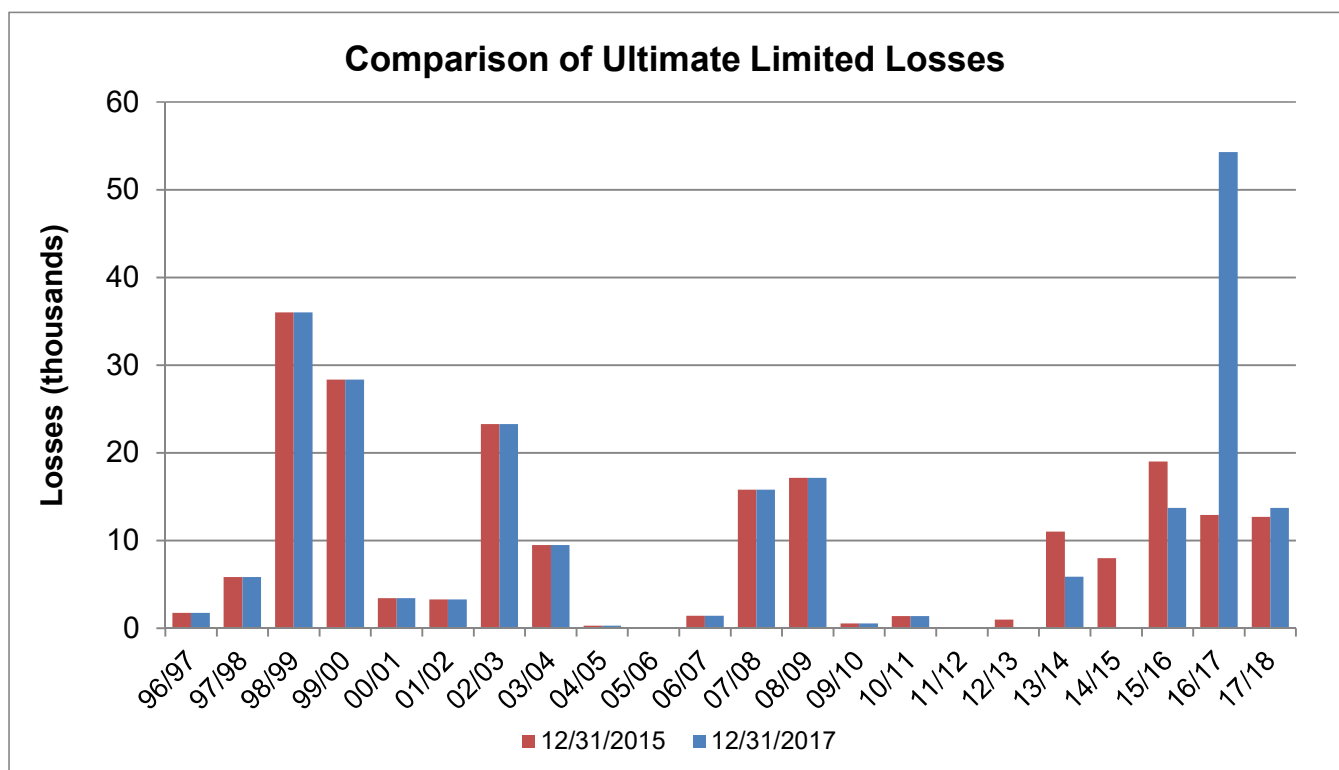
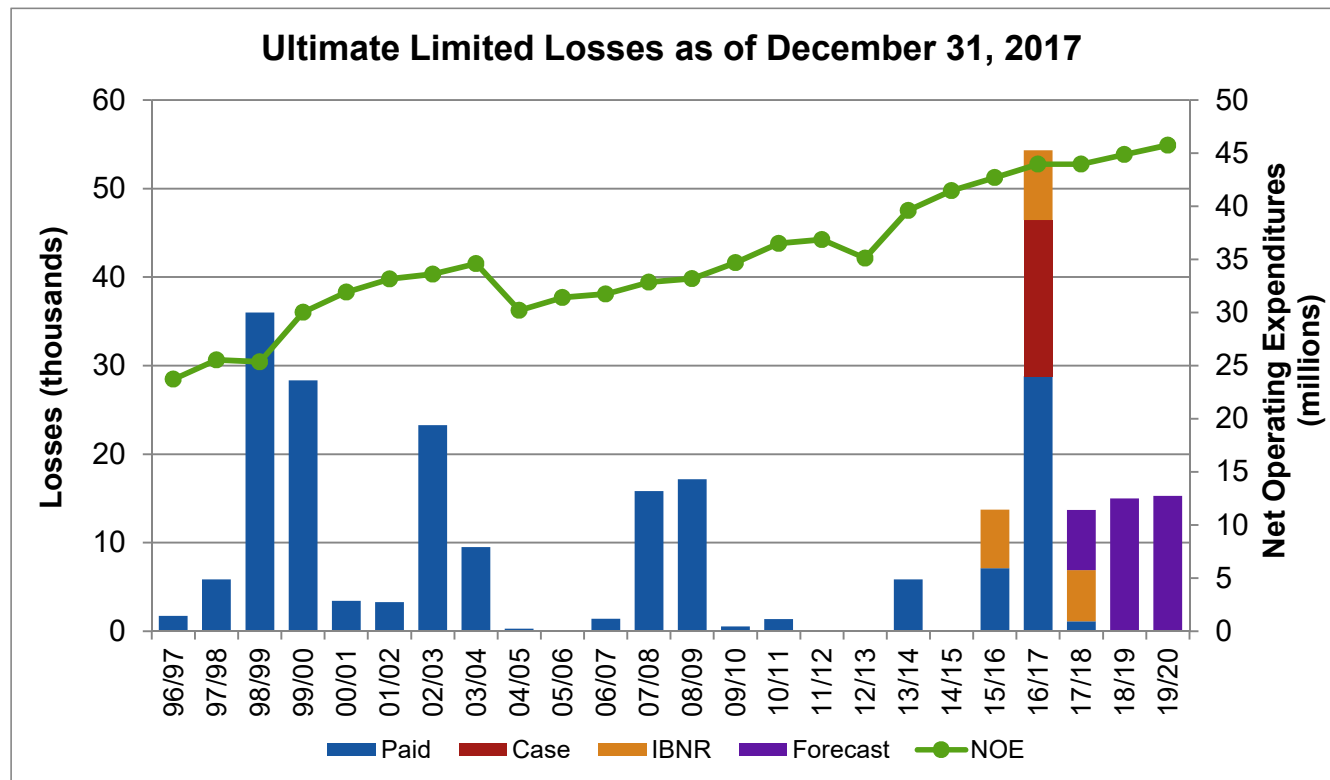
Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A2 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 12/31/17)]\}$ .

***Funding at the Expected Level***

(1) <i>Estimated Outstanding Losses as of 12/31/17</i> <i>{ Exhibit XII-1 }</i>	\$37,900
(2) <i>Forecast Losses for 1/1-6/30/18</i> <i>{ Exhibit XII-1 }</i>	\$6,800
<hr/>	
<b>(3) <i>Required Funding as of 12/31/17</i></b> <b><i>{ (1) + (2) }</i></b>	<b>\$44,700</b>
(4) <i>Projected Payments during 1/1-6/30/18</i> <i>{ Exhibit XIII-1 }</i>	\$7,800
(5) <i>Estimated Outstanding Losses as of 6/30/18</i> <i>{ (3) – (4) }</i>	\$36,900
(6) <i>Forecast Losses for 7/1/18-19</i> <i>{ Exhibit VI }</i>	\$15,000
<hr/>	
<b>(7) <i>Required Funding as of 6/30/18</i></b> <b><i>{ (5) + (6) }</i></b>	<b>\$51,900</b>
(8) <i>Projected Payments during 7/1/18-19</i> <i>{ Exhibit XIII-1 }</i>	\$16,100
(9) <i>Estimated Outstanding Losses as of 6/30/19</i> <i>{ (7) – (8) }</i>	\$35,800
(10) <i>Forecast Losses for 7/1/19-20</i> <i>{ Exhibit VI }</i>	\$15,300
<hr/>	
<b>(11) <i>Required Funding as of 6/30/19</i></b> <b><i>{ (9) + (10) }</i></b>	<b>\$51,100</b>







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## Introduction

Select Actuarial Services has prepared this report for Roanoke County, Virginia (hereinafter referred to as “the County”) at the request of Ms. Rebecca Owens, Director of Finance for Roanoke County. The specific objectives are (a) to evaluate reserves required as of December 31, 2017, to fund outstanding retained losses arising from accident periods from July 1, 1988, through December 31, 2017, for workers compensation claims, and July 1, 1994, through December 31, 2017, for automobile and general liability claims; (b) to project ultimate liabilities for the forecast period beginning July 1, 2018, through June 30, 2019; (c) to estimate required funding as of December 31, 2017, and to project funding requirements through the 2018/19 year; and (d) to provide estimated cash flow requirements for prior incurred claims and projected future claims by fiscal year.

This report is an actuarial analysis of data, conditions, and practices communicated as of February 14, 2018, to Select Actuarial Services as described in the section entitled “Considerations.” While Select Actuarial Services believes these communications to be reliable, it has not attempted to audit the information and cannot guarantee the accuracy of any information supplied. However, the data have been reviewed for reasonableness and consistency through comparison with the prior analysis. The estimates in this report are based upon appropriate actuarial assumptions and procedures described in the section of this report entitled “Analysis.” Select Actuarial Services assumes no responsibility for any loss or damage that might arise from the use of or reliance upon this report other than for the purposes set forth herein.

This report was prepared for the use of and is only to be relied upon by Roanoke County. This report also may be provided to the County's auditors, insurance brokers, and risk manager. No portion of the report may be provided to any other party without Select Actuarial Services' prior written consent. In the event such consent is provided, the report must be provided in its entirety. We recommend that any such party have its own actuary review this report to ensure that the party understands the assumptions and uncertainties inherent in our estimates.



Mary Frances Miller is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. Jack Pipa is an Associate of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. Both actuaries meet the Qualification Standards of the American Academy of Actuaries to render actuarial opinions for property/casualty reserves. This report is prepared in accordance with Actuarial Standard of Practice No. 43, *Property/Casualty Unpaid Claim Estimates*.

## Section 3

### Considerations

Appropriate actuarial methods for performing a reserve evaluation and forecast can only be identified in light of the coverage involved, claims information available, and other considerations. Key considerations motivating the selection of techniques employed in this analysis are set forth below.

### Workers Compensation

The County has retained risk for its workers compensation exposures since July 1, 1986. Retentions and limits are shown in Table C-1. As of December 31, 2017, ten claims have exceeded the County's retention: one in accident year 88/89, one in 92/93, two in 93/94, one in 96/97, one in 98/99, two in 99/00, and two in 10/11.

**Table C-1**

Accident Year	All Time per Accident Retention
7/1/86 - 01	\$250,000
7/1/01 - 03	\$300,000
7/1/03 - 05	\$350,000
7/1/05 - 11	\$400,000
7/1/11 - 13	\$450,000
7/1/13 - 14	\$500,000
7/1/14 - 15	\$500,000*
7/1/15 - present	\$200,000

\* SIR for Emergency Codes is \$550,000

## Automobile Liability and General Liability

The County's retention of risk for liability dates to July 1, 1987. Retentions are displayed in Table C-2. No claims have exceeded the applicable retentions.

**Table C-2**

Accident Year	All Time per Accident Retention
7/1/87 - 91	\$1,000,000
7/1/91 - 94	\$300,000
7/1/94 - 96	\$325,000
7/1/96 - present	\$250,000

## Available Data

Loss information was provided by Mr. Chris Carey, VACORP. Workers compensation claims were administered by Trigon Administrators, Inc., through December 31, 1997, for claims incurred through June 30, 1996. Landin, Inc., began administering claims on July 1, 1996, for claims incurred after that date, and took over administration of prior claims on January 1, 1998. Claims for the 99/00 year were administered by Zurich while claims occurring during the 00/01 year were administered by ERC. Midwest administered claims for the accident years 01/02 through 03/04 until ERC once again administered claims for the 04/05 year. July 1, 2005, and subsequent claims have been handled by the Virginia Association of Counties, and all open claims are now administered by the Association. Loss data included:

- reported and paid losses on an individual claim basis evaluated as of June 30, 2017, and as of December 31, 2017, for workers compensation. Only partial data were included for 2000/01 and prior claims, but all open claims were included in the listing.
- a listing of all claims evaluated as of December 31, 2017, for auto and general liability claims.
- Exposure information for workers compensation in the form of payroll, for automobile liability in the form of vehicle counts, and for general liability in the form of net operating expenses was provided by Mr. Chris Carey, VACORP.

## Development

Development is defined as the change over time in certain quantities pertaining to a given set of incidents. As claims for a given program year are reported, adjusted, litigated, and ultimately paid out, the number of claims, along with the paid losses and case reserves on those claims, will change.

Ideally, a client's own development patterns should be utilized in order to reflect its unique claims reporting procedures, claims administration arrangements, and settlement philosophy. Because the historical losses are available at multiple evaluation dates, it was possible to analyze Roanoke County's own workers compensation development experience. County and School Board workers compensation losses have been combined in order to increase the volume of data upon which development selections are made. To improve the stability of the estimates, factors based on Virginia Association of Counties statistics are also given weight in the selection of development factors. The selected development patterns are shown in Appendix A.

Due to the low volume of automobile and general liability claims, development factors for these lines are based on the experience of the Virginia Association of Counties. The Virginia Association of Counties handles the claims.

## Trends and External Influences

Trends are defined as changes over time in underlying claims costs. Trend factors are used to adjust losses and exposures from past years to the level at which they would have been, had they occurred during a future period. This is vital since historical losses may have occurred in a different environment in terms of both monetary inflation and benefit levels. In this analysis, trends have been measured by examining changes in the Employment Cost Index and Consumer Price Index as compiled by the U.S. Department of Labor and U.S. Claims Cost Indices as compiled by Willis Towers Watson.

## Loss Models

Statistical distributions are often used by the insurance industry to model the loss generating process. In this analysis, the lognormal probability distribution has been used to model limited ultimate losses. This technique allows for the projection of ultimate losses at various confidence levels or percentiles. The variation estimated in this modeling technique is the variation inherent in the historical experience; it does not include potential

variation due to unanticipated changes in the environment or to misestimation of parameters.

For the periods beginning July 1, 2018, and July 1, 2019, aggregate small losses for the forecast period are modeled by the lognormal probability distribution. Large claim frequencies are modeled by a Poisson distribution. The inverse Weibull distribution is used to model large claim severities.

## Actuarial Central Estimate

The estimates of ultimate losses at the “expected” or “selected” level in this analysis are actuarial central estimates - estimates that represent an expected value over the range of reasonably possible outcomes. Such range of reasonably possible outcomes may not include all conceivable outcomes. For example, it would not include conceivable extreme events where the contribution of such events to an expected value estimate is not reliably measurable.

## Subrogation and Recoveries

Subrogation and recoveries are reflected in the primary loss reports. Recoveries were infrequent, and did not provide a basis for estimating potential recoveries over and above those reflected in the loss runs. Accordingly, no explicit reductions for collateral sources have been incorporated into the estimates.

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## Analysis

Actuarial procedures employed to project ultimate and outstanding losses consist of a number of steps, and can be summarized as follows:

- Combined County and School Board paid and reported loss development patterns for workers compensation are analyzed and supplemented by insurance industry experience to estimate future development on past accident periods through December 31, 2017.
- Paid and reported loss development patterns for automobile and general liabilities, based on the Virginia Association of Counties' experience, are used to estimate future development on past accident periods through December 31, 2017.
- Losses for past years are adjusted by trend factors and related to the level of their underlying exposures to derive ultimate adjusted pure premiums.
- The historical pure premiums for "small" losses are used to determine a forecast "small" loss pure premium and forecast ultimate "small" losses for the upcoming periods.
- The historical frequencies for "large" losses are used to determine a forecast frequency and when combined with estimated "large" loss severity, forecast ultimate "large" losses for the upcoming periods.
- Paid losses deducted from ultimate losses to derive estimated outstanding losses, which are then discounted to reflect anticipated investment income.

Exhibits representing the various steps in the process are explained in this section of the report.

## Exhibit I

Exhibit I displays a summary of the historical reported claims information as of the most recent evaluation date. Paid losses, reported losses, claim counts, and exposures are displayed for each accident year.

## Exhibit II

Exhibit II displays a listing of claims which exceed \$50,000/\$30,000 for workers compensation/liability.

## Exhibit III

Exhibit III shows the estimation of ultimate losses less than \$100,000 (\$50,000 for liability) trended to the 2018/19 accident year level. Historical losses are developed to ultimate using the loss development factors derived in Appendix A. Losses in Exhibit III are also trended to reflect the increase in claim costs to the mid point of the forecast year. Appendix B presents the derivation of trend factors utilized in this analysis.

## Exhibit IV

In Exhibit IV, adjusted ultimate losses less than \$100,000/\$50,000 from prior years are restated on a common basis: that is, per adjusted unit exposure, or as pure premiums. These pure premiums provide a basis of comparison across accident years since all experience has been adjusted to an ultimate, common inflationary, per exposure level. Then a pure premium that best represents the 2018/19 forecast year is selected. This selected pure premium is multiplied by the forecast period's exposures to derive an estimate of the projected ultimate losses less than \$100,000/\$50,000 for the 2018/19 accident year.

## Exhibit V (Workers Compensation and Auto Liability Only)

This exhibit summarizes the calculation of the expected number of large claims for the forecast period. The numbers of claims exceeding \$100,000 (\$50,000 for Auto Liability) are developed to ultimate and related to the applicable level of exposure to derive frequency rates. A frequency rate based on the observed historical frequencies is selected and applied to the respective projected exposure to derive the forecast number of large claims for 2018/19.

Given the small volume of the general liability line, the expected number of large claims exceeding \$50,000 is based on a combination of Roanoke County and Virginia Association of Counties experience.

## Exhibit VI

On this exhibit, the forecast number of large claims is multiplied by the expected large claim severity to determine the forecast losses for claims over \$100,000/\$50,000 limited to the forecast per occurrence retention level. The expected large claim severity for workers compensation is based on fitting the claims in Exhibit II to a loss severity distribution. For automobile and general liability, the expected severity of large claims exceeding \$50,000 is based on the Virginia Association of Counties large claim experience. The large claim forecast is then combined with the forecast losses for claims less than \$100,000/\$50,000 from Exhibit IV to determine the ground-up loss forecast for the 2018/19 period. The 2018/19 loss forecast is then adjusted for trend to determine the ground-up loss forecast for the 2016/17, 2017/18, and 2019/20 periods.

## Exhibit VII

The distribution shown in this exhibit provides a measure of the variability or risk underlying the forecast. The results displayed are derived based on statistical modeling of each of the components of the loss forecast. Suitable distributions were selected as best fits, and these distributions were then combined to derive the forecast losses at various percentiles or confidence levels. The variation estimated in this modeling technique is the variation inherent in the historical experience; it does not include potential variation due to unanticipated changes in the environment or to misestimation of parameters.

## Exhibit VIII

Exhibit VIII shows the estimation of ultimate losses using the loss development methods. Losses are projected by accident year using both reported and paid loss development methods, taking per occurrence retentions into account.

The methods are based on reported and paid losses as of December 31, 2017, and the development factors derived in Appendix A. Large losses are first deducted from the total. The result is then developed to ultimate and a provision for the large losses is added back to this ultimate.

## Exhibit IX

Exhibit IX estimates ultimate losses using the paid and reported Bornhuetter/Ferguson techniques. These methods, also referred to as the estimated unpaid and estimated unreported methods, combine the prior estimate of ultimate losses for each year with current paid and reported



losses to produce a blended estimate which places less emphasis on the most recent changes in the loss data.

## Exhibit X

In Exhibit X, the results of the various techniques for estimating ultimate losses are summarized, and selections are made based upon the consistency of the results with one another and with losses reported to date.

## Exhibit XI

Claim frequencies, shown in Exhibit XI, Page 1, are calculated by developing reported claims to ultimate and relating them to their underlying exposures.

Average claim size is shown in Exhibit XI, Page 2. This is the ratio of selected ultimate losses and ultimate claim counts. Cost per exposure is also shown for all lines.

## Exhibit XII

Outstanding losses as of December 31, 2017, are estimated in page 1 of Exhibit XII. Outstanding losses are the difference between estimated ultimate losses and losses paid for each period. Similarly, unreported (IBNR) losses are the difference between estimated ultimate losses and losses reported to date. The estimated outstanding losses are also provided on a discounted basis at a rate of 2.5% using discount factors derived in Appendix D.

Page 2 shows estimated outstanding losses at various percentiles of the aggregate distribution for all accident periods through December 31, 2017. The aggregate distribution of these years is based on the observed variation in prior years' development.

## Exhibit XIII

Page 1 projects loss payments during the remainder of the 2017/18 year and the following ten fiscal years. Projected payments are based on the outstanding and forecast losses as of December 31, 2017, along with the paid loss development patterns used throughout the analysis.

Page 2 shows projected paid losses at different percentiles of the aggregate distribution for accident years 1996/97 through 2018/19 (1994/95 through 2018/19 for liability).

## Exhibit XIV

Exhibit XIV compares the results of this analysis with those of the previous analysis, as of December 31, 2015. Using loss and development information available as of the previous report's evaluation, the expected paid and reported losses as of the latest evaluation are calculated. These estimated amounts are compared to the actual paid and reported losses as of the latest evaluation, to determine if the loss experience has developed as expected. Also included on this exhibit is a comparison of the ultimate losses for each analysis.

## Exhibit XV

Exhibit XV shows the required funding as of December 31, 2017, June 30, 2018, and June 30, 2019, if funding is set at the expected level. Required funding is based on the estimated outstanding and forecast losses, and projected payments over the next 18 months.

## Section 5

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### Exhibits: Workers Compensation

The “Analysis” section of this report presents a discussion of the following exhibits:

Exhibit I	Summary of Experience
Exhibit II	Summary of Claims Over \$50,000
Exhibit III	Estimation of Ultimate Small Losses at 7/1/18-19 Cost Level
Exhibit IV	Calculation of Forecast Small Losses
Exhibit V	Calculation of Forecast Number of Large Losses
Exhibit VI	Calculation of Forecast Losses
Exhibit VII	Forecast Losses at Various Confidence Levels
Exhibit VIII	Estimation of Ultimate Losses: Loss Development Methods
Exhibit IX	Estimation of Ultimate Losses: Bornhuetter/Ferguson Methods
Exhibit X	Selection of Ultimate Limited Loss Estimates
Exhibit XI	Estimated Ultimate Claims Estimation of Claim Severities
Exhibit XII	Calculation of Required Reserves Estimated Outstanding Losses at Various Confidence Levels
Exhibit XIII	Projection of Loss Payments Over the Next Ten Years Projected Payment Pattern at Various Confidence Levels
Exhibit XIV	Comparison of Results: Current to Prior Estimates
Exhibit XV	Required Funding

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**Summary of Experience\***

(A) Period Begin End		(B) Evaluation Date	(C) Maturity (months)	(D) Reported Claims	(E) Gross Paid Losses	(F) Collections	(G) Net Paid Losses	(H) Net Reported Losses	(I) Exposure (Payroll - Thousands)+
7/1/1988	6/30/1989	12/31/2017	354	2	\$662,121	\$59,835	\$602,286	\$703,177	
7/1/1989	6/30/1990	12/31/2017	342	0	\$0	\$0	\$0	\$0	
7/1/1990	6/30/1991	12/31/2017	330	2	\$537	\$0	\$537	\$537	
7/1/1991	6/30/1992	12/31/2017	318	1	\$0	\$0	\$0	\$0	
7/1/1992	6/30/1993	12/31/2017	306	1	\$364,231	\$1,122	\$363,109	\$380,561	
7/1/1993	6/30/1994	12/31/2017	294	3	\$742,616	\$2,040	\$740,576	\$771,423	
7/1/1994	6/30/1995	12/31/2017	282	7	\$138,971	\$277	\$138,694	\$138,694	
7/1/1995	6/30/1996	12/31/2017	270	7	\$69,792	\$0	\$69,792	\$69,792	
7/1/1996	6/30/1997	12/31/2017	258	134	\$481,456	\$0	\$481,456	\$481,456	\$23,656
7/1/1997	6/30/1998	12/31/2017	246	123	\$176,952	\$0	\$176,952	\$176,952	\$24,923
7/1/1998	6/30/1999	12/31/2017	234	122	\$381,724	\$201	\$381,523	\$381,523	\$26,231
7/1/1999	6/30/2000	12/31/2017	222	168	\$826,380	\$122,924	\$703,456	\$879,116	\$27,569
7/1/2000	6/30/2001	12/31/2017	210	121	\$327,279	\$55	\$327,224	\$332,102	\$29,620
7/1/2001	6/30/2002	12/31/2017	198	159	\$841,413	\$1,222	\$840,191	\$894,006	\$31,807
7/1/2002	6/30/2003	12/31/2017	186	113	\$274,792	\$3,942	\$270,850	\$302,776	\$33,303
7/1/2003	6/30/2004	12/31/2017	174	128	\$479,984	\$1,443	\$478,540	\$508,655	\$34,870
7/1/2004	6/30/2005	12/31/2017	162	108	\$362,563	\$2,818	\$359,745	\$398,446	\$34,727
7/1/2005	6/30/2006	12/31/2017	150	103	\$598,303	\$5,666	\$592,637	\$617,092	\$34,401
7/1/2006	6/30/2007	12/31/2017	138	103	\$615,053	\$6,441	\$608,612	\$789,023	\$36,539
7/1/2007	6/30/2008	12/31/2017	126	120	\$711,614	\$77,533	\$634,082	\$717,859	\$39,352
7/1/2008	6/30/2009	12/31/2017	114	103	\$684,946	\$4,433	\$680,513	\$774,538	\$43,368
7/1/2009	6/30/2010	12/31/2017	102	105	\$346,876	\$1,562	\$345,315	\$345,315	\$45,078
7/1/2010	6/30/2011	12/31/2017	90	114	\$1,777,445	\$178,898	\$1,598,547	\$1,692,040	\$46,606
7/1/2011	6/30/2012	12/31/2017	78	102	\$430,512	\$2,501	\$428,011	\$469,981	\$44,985
7/1/2012	6/30/2013	12/31/2017	66	116	\$681,258	\$4,352	\$676,906	\$697,693	\$47,804
7/1/2013	6/30/2014	12/31/2017	54	108	\$699,205	\$1,764	\$697,441	\$744,925	\$48,000
7/1/2014	6/30/2015	12/31/2017	42	123	\$819,751	\$1,156	\$818,595	\$845,313	\$48,387
7/1/2015	6/30/2016	12/31/2017	30	90	\$282,144	\$9,266	\$272,878	\$286,884	\$52,777
7/1/2016	6/30/2017	12/31/2017	18	97	\$535,167	\$3,648	\$531,519	\$620,434	\$56,170
7/1/2017	6/30/2018	12/31/2017	6	53	\$20,747	\$0	\$20,747	\$35,643	\$52,427
7/1/2018	6/30/2019								\$53,476
7/1/2019	6/30/2020								\$54,546
Total				2,536	\$14,333,834	\$493,100	\$13,840,734	\$15,055,956	\$970,623

\* Loss and exposure information supplied by VACO; loss data incomplete for 1995/96 and prior

+ Estimated for 2017-18 through 2019-20

**Summary of Claims That Exceed \$50,000**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Claim Number	Accident Date	Net Paid Losses	Net Reported Losses	Historical Retention	Severity Development Factor	Developed Losses	Trend Factor to 7/1/18-19	Trended Developed Losses
WC077014933	9/13/1988	\$73,783	\$73,783	\$250,000	1.004	\$74,060	3.019	\$223,616
WC077014318	6/15/1989	\$528,503	\$629,394	\$250,000	1.004	\$631,756	3.019	\$1,907,518
WC077014648	3/22/1993	\$363,109	\$380,561	\$250,000	1.005	\$382,448	2.469	\$944,279
WC077014938	7/7/1993	\$330,435	\$330,435	\$250,000	1.005	\$332,203	2.381	\$790,866
WC077014654	4/13/1994	\$327,873	\$358,721	\$250,000	1.005	\$360,640	2.381	\$858,567
231-76-2134	6/28/1994	\$82,267	\$82,267	\$250,000	1.005	\$82,707	2.381	\$196,899
WC077016258	10/11/1994	\$86,294	\$86,294	\$250,000	1.006	\$86,794	2.331	\$202,305
223-72-8520	10/24/1994	\$51,704	\$51,704	\$250,000	1.006	\$52,003	2.331	\$121,213
266-48-3605	7/29/1995	\$58,067	\$58,067	\$250,000	1.006	\$58,432	2.269	\$132,592
WC077014248	11/14/1996	\$286,273	\$286,273	\$250,000	1.007	\$288,237	2.186	\$630,212
229-64-5563	12/6/1996	\$85,752	\$85,752	\$250,000	1.007	\$86,340	2.186	\$188,778
WC077014731	3/27/1998	\$90,266	\$90,266	\$250,000	1.008	\$90,943	2.102	\$191,133
WC077014928	7/26/1998	\$259,146	\$259,146	\$250,000	1.008	\$261,286	2.020	\$527,909
WC077014629	3/22/2000	\$255,462	\$420,890	\$250,000	1.009	\$424,729	1.935	\$821,801
WC077014732	3/28/2000	\$313,156	\$323,388	\$250,000	1.009	\$326,337	1.935	\$631,425
WC077014935	8/10/2000	\$135,059	\$135,059	\$250,000	1.010	\$136,427	1.856	\$253,142
WC077016521	11/10/2000	\$117,456	\$122,333	\$250,000	1.010	\$123,573	1.856	\$229,290
WC077016015	7/3/2001	\$51,593	\$88,280	\$300,000	1.011	\$89,279	1.777	\$158,663
228-15-9736	7/14/2001	\$59,982	\$59,982	\$300,000	1.011	\$60,661	1.777	\$107,804
WC077014383	12/5/2001	\$172,064	\$189,192	\$300,000	1.011	\$191,334	1.777	\$340,029
229-02-7534	3/28/2002	\$60,804	\$60,804	\$300,000	1.011	\$61,492	1.777	\$109,280
WC077021974	4/4/2002	\$94,920	\$94,920	\$300,000	1.011	\$95,995	1.777	\$170,597
WC077014539	5/8/2002	\$112,245	\$112,245	\$300,000	1.011	\$113,515	1.777	\$201,734
228-70-5155	5/21/2002	\$71,164	\$71,164	\$300,000	1.011	\$71,969	1.777	\$127,901
WC077014402	9/11/2002	\$124,667	\$156,593	\$300,000	1.013	\$158,586	1.689	\$267,901
WC077014927	11/26/2002	\$64,446	\$64,446	\$300,000	1.013	\$65,266	1.689	\$110,255
WC077015459	2/17/2004	\$59,509	\$84,027	\$350,000	1.014	\$85,240	1.603	\$136,678
WC077014249	6/14/2004	\$146,869	\$146,869	\$350,000	1.014	\$148,989	1.603	\$238,897
WC077014595	6/17/2004	\$93,425	\$99,022	\$350,000	1.014	\$100,451	1.603	\$161,069
WC077014278	7/6/2004	\$179,034	\$217,735	\$350,000	1.016	\$221,326	1.524	\$337,207
WC077014323	4/28/2005	\$72,506	\$72,506	\$350,000	1.016	\$73,702	1.524	\$112,290
WC077017076	11/18/2005	\$192,439	\$200,684	\$400,000	1.019	\$204,506	1.452	\$296,973
WC077016396	11/21/2005	\$58,792	\$58,792	\$400,000	1.019	\$59,912	1.452	\$87,001
WC077020699	5/25/2006	\$135,406	\$151,615	\$400,000	1.019	\$154,503	1.452	\$224,361
WC077020620	8/17/2006	\$104,478	\$104,478	\$400,000	1.022	\$106,802	1.406	\$150,138
WC077020505	9/11/2006	\$2,287	\$51,672	\$400,000	1.022	\$52,821	1.406	\$74,254
WC077020602	9/18/2006	\$135,143	\$135,143	\$400,000	1.022	\$138,148	1.406	\$194,205
WC077021627	12/4/2006	\$13,622	\$50,536	\$400,000	1.022	\$51,660	1.406	\$72,622
WC077022010	1/8/2007	\$207,852	\$223,544	\$400,000	1.022	\$228,515	1.406	\$321,240
WC077027682	1/26/2007	\$2,090	\$51,000	\$400,000	1.022	\$52,134	1.406	\$73,289
WC077023841	5/7/2007	\$53,182	\$82,693	\$400,000	1.022	\$84,532	1.406	\$118,833
WC077025935	9/12/2007	\$147,224	\$147,224	\$400,000	1.026	\$151,099	1.372	\$207,358
WC077026466	10/1/2007	\$55,729	\$55,729	\$400,000	1.026	\$57,196	1.372	\$78,492
WC077027046	10/29/2007	\$77,841	\$77,841	\$400,000	1.026	\$79,889	1.372	\$109,635
WC077028303	12/21/2007	\$8,755	\$51,039	\$400,000	1.026	\$52,382	1.372	\$71,885
WC077030205	4/4/2008	\$67,845	\$69,738	\$400,000	1.026	\$71,573	1.372	\$98,223
WC077031076	5/20/2008	\$11,340	\$50,941	\$400,000	1.026	\$52,281	1.372	\$71,747

**Summary of Claims That Exceed \$50,000**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Claim Number	Accident Date	Net Paid Losses	Net Reported Losses	Historical Retention	Severity Development Factor	Developed Losses	Trend Factor to 7/1/18-19	Trended Developed Losses
WC077031945	7/2/2008	\$54,473	\$56,439	\$400,000	1.032	\$58,225	1.352	\$78,729
WC077036591	2/26/2009	\$57,614	\$57,614	\$400,000	1.032	\$59,437	1.352	\$80,367
WC077037957	3/10/2009	\$8,519	\$53,591	\$400,000	1.032	\$55,287	1.352	\$74,756
WC077037038	3/17/2009	\$98,144	\$98,144	\$400,000	1.032	\$101,251	1.352	\$136,905
WC077037010	3/20/2009	\$3,642	\$50,431	\$400,000	1.032	\$52,027	1.352	\$70,348
WC077038596	5/21/2009	\$50,395	\$50,395	\$400,000	1.032	\$51,990	1.352	\$70,297
WC077038945	6/12/2009	\$214,889	\$214,889	\$400,000	1.032	\$221,690	1.352	\$299,755
WC077041380	10/28/2009	\$84,976	\$84,976	\$400,000	1.039	\$88,273	1.324	\$116,891
WC077049813	11/21/2010	\$428,172	\$472,501	\$400,000	1.049	\$495,514	1.276	\$632,469
WC077051657	2/16/2011	\$298,276	\$298,276	\$400,000	1.049	\$312,804	1.276	\$399,259
WC077054411	5/13/2011	\$490,018	\$513,471	\$400,000	1.049	\$538,480	1.276	\$687,310
WC077054807	6/27/2011	\$55,427	\$81,137	\$400,000	1.049	\$85,089	1.276	\$108,607
WC077060838	1/19/2012	\$88,631	\$100,285	\$450,000	1.063	\$106,604	1.236	\$131,785
WC077063814	4/30/2012	\$187,441	\$205,671	\$450,000	1.063	\$218,630	1.236	\$270,275
WC077067567	12/11/2012	\$270,304	\$279,310	\$450,000	1.085	\$302,985	1.203	\$364,485
WC077070681	5/17/2013	\$135,834	\$147,616	\$450,000	1.085	\$160,128	1.203	\$192,631
WC077070705	5/17/2013	\$67,246	\$67,246	\$450,000	1.085	\$72,946	1.203	\$87,752
WC077072247	7/5/2013	\$79,059	\$79,059	\$500,000	1.120	\$88,567	1.168	\$103,469
WC077073250	8/12/2013	\$77,173	\$86,636	\$500,000	1.120	\$97,055	1.168	\$113,386
WC077085458	8/30/2013	\$274,302	\$308,363	\$500,000	1.120	\$345,448	1.168	\$403,572
WC077101159	2/13/2014	\$55,907	\$55,907	\$500,000	1.120	\$62,630	1.168	\$73,168
WC077113428	9/17/2014	\$257,565	\$257,565	\$500,000	1.184	\$305,006	1.131	\$344,942
WC077116473	11/17/2014	\$212,534	\$224,501	\$500,000	1.184	\$265,852	1.131	\$300,662
WC077125293	5/23/2015	\$125,748	\$135,499	\$500,000	1.184	\$160,456	1.131	\$181,466
WC077147185	9/30/2015	\$69,859	\$72,501	\$200,000	1.318	\$95,531	1.097	\$104,815
WC077181547	12/29/2016	\$124,376	\$146,022	\$200,000	1.673	\$244,257	1.064	\$259,837
WC077185519	3/14/2017	\$164,957	\$181,086	\$200,000	1.673	\$302,909	1.064	\$322,231
WC077190287	5/12/2017	\$56,413	\$85,150	\$200,000	1.673	\$142,434	1.064	\$151,519

Columns (A) through (E): Provided by VACO

Column (F) = RLDF/CCDF

Column (G) = (D) \* (F)

Column (H): Appendix B

Column (I) = (G) \* (H)

**Estimation of Ultimate Losses Less Than \$100,000  
At the 2018-19 Loss Level  
Using Loss Development Method**

<i>Reported Method</i>						
(A) Accident Period	(B) Net Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Reported Develop. Factor	(F) Trend Factor to 7/1/18-19	(G) Ultimate on Small Claims
7/1/96-97	\$481,456	\$372,025	\$109,431	1.007	2.186	\$241,000
7/1/97-98	\$176,952	\$90,266	\$86,686	1.008	2.102	\$184,000
7/1/98-99	\$381,523	\$259,146	\$122,377	1.008	2.020	\$249,000
7/1/99-00	\$879,116	\$744,278	\$134,838	1.009	1.935	\$263,000
7/1/00-01	\$332,102	\$257,393	\$74,709	1.010	1.856	\$140,000
7/1/01-02	\$894,006	\$676,588	\$217,418	1.011	1.777	\$391,000
7/1/02-03	\$302,776	\$221,038	\$81,737	1.013	1.689	\$140,000
7/1/03-04	\$508,655	\$329,918	\$178,737	1.014	1.603	\$291,000
7/1/04-05	\$398,446	\$290,241	\$108,206	1.017	1.524	\$168,000
7/1/05-06	\$617,092	\$352,299	\$264,793	1.019	1.452	\$392,000
7/1/06-07	\$789,023	\$545,858	\$243,165	1.022	1.406	\$349,000
7/1/07-08	\$717,859	\$225,065	\$492,794	1.026	1.372	\$694,000
7/1/08-09	\$774,538	\$313,034	\$461,504	1.032	1.352	\$644,000
7/1/09-10	\$345,315	\$84,976	\$260,338	1.039	1.324	\$358,000
7/1/10-11	\$1,692,040	\$1,365,386	\$326,654	1.049	1.276	\$437,000
7/1/11-12	\$469,981	\$305,956	\$164,025	1.063	1.236	\$216,000
7/1/12-13	\$697,693	\$426,926	\$270,768	1.085	1.203	\$353,000
7/1/13-14	\$744,925	\$474,058	\$270,866	1.120	1.168	\$355,000
7/1/14-15	\$845,313	\$617,566	\$227,747	1.185	1.131	\$305,000
7/1/15-16	\$286,884	\$72,501	\$214,383	1.320	1.097	\$310,000
7/1/16-17	\$620,434	\$412,258	\$208,177	1.687	1.064	\$374,000
Total	\$12,956,129	\$8,436,775	\$4,519,353			\$6,854,000

<i>Paid Method</i>						
(H) Accident Period	(I) Net Paid Losses	(J) Paid on Large Claims	(K) Paid on Small Claims	(L) Paid Develop. Factor	(M) Trend Factor to 7/1/18-19	(N) Ultimate on Small Claims
7/1/96-97	\$481,456	\$372,025	\$109,431	1.026	2.186	\$245,000
7/1/97-98	\$176,952	\$90,266	\$86,686	1.028	2.102	\$187,000
7/1/98-99	\$381,523	\$259,146	\$122,377	1.030	2.020	\$255,000
7/1/99-00	\$703,456	\$568,618	\$134,838	1.032	1.935	\$269,000
7/1/00-01	\$327,224	\$252,515	\$74,709	1.035	1.856	\$144,000
7/1/01-02	\$840,191	\$622,773	\$217,418	1.039	1.777	\$401,000
7/1/02-03	\$270,850	\$189,113	\$81,737	1.043	1.689	\$144,000
7/1/03-04	\$478,540	\$299,803	\$178,737	1.047	1.603	\$300,000
7/1/04-05	\$359,745	\$251,539	\$108,206	1.053	1.524	\$174,000
7/1/05-06	\$592,637	\$327,845	\$264,793	1.059	1.452	\$407,000
7/1/06-07	\$608,612	\$500,656	\$107,956	1.067	1.406	\$162,000
7/1/07-08	\$634,082	\$225,065	\$409,017	1.077	1.372	\$605,000
7/1/08-09	\$680,513	\$313,034	\$367,479	1.090	1.352	\$542,000
7/1/09-10	\$345,315	\$84,976	\$260,338	1.107	1.324	\$382,000
7/1/10-11	\$1,598,547	\$1,271,893	\$326,654	1.129	1.276	\$471,000
7/1/11-12	\$428,011	\$276,073	\$151,938	1.161	1.236	\$218,000
7/1/12-13	\$676,906	\$406,138	\$270,768	1.208	1.203	\$393,000
7/1/13-14	\$697,441	\$430,534	\$266,907	1.282	1.168	\$400,000
7/1/14-15	\$818,595	\$595,848	\$222,747	1.415	1.131	\$356,000
7/1/15-16	\$272,878	\$69,859	\$203,020	1.694	1.097	\$377,000
7/1/16-17	\$531,519	\$345,746	\$185,773	2.514	1.064	\$497,000
Total	\$11,904,993	\$7,753,463	\$4,151,530			\$6,929,000

Columns (B), (I): Exhibit I  
Columns (C), (J): Exhibit II  
Column (D) = (B) - (C)  
Column (E): Appendix A2  
Columns (F), (M): Appendix B

Column (G) = (D) \* (E) \* (F)  
Column (K) = (I) - (J)  
Column (L): Appendix A4  
Column (N) = (K) \* (L) \* (M)

**Calculation of Forecast Losses Less Than \$100,000**

(A) Accident Period	(B) Trended Ultimate Losses	(C) Exposure (Thousands)	(D) Exposure Trend Factors	(E) Trended Exposures	(F) Pure Premium
7/1/96-97	\$243,000	\$23,656	1.764	\$41,723	\$5.82
7/1/97-98	\$186,000	\$24,923	1.703	\$42,433	\$4.38
7/1/98-99	\$252,000	\$26,231	1.643	\$43,110	\$5.85
7/1/99-00	\$266,000	\$27,569	1.585	\$43,698	\$6.09
7/1/00-01	\$142,000	\$29,620	1.527	\$45,241	\$3.14
7/1/01-02	\$396,000	\$31,807	1.477	\$46,972	\$8.43
7/1/02-03	\$142,000	\$33,303	1.433	\$47,727	\$2.98
7/1/03-04	\$296,000	\$34,870	1.395	\$48,657	\$6.08
7/1/04-05	\$171,000	\$34,727	1.361	\$47,276	\$3.62
7/1/05-06	\$400,000	\$34,401	1.325	\$45,592	\$8.77
7/1/06-07	\$256,000	\$36,539	1.284	\$46,920	\$5.46
7/1/07-08	\$650,000	\$39,352	1.244	\$48,946	\$13.28
7/1/08-09	\$593,000	\$43,368	1.215	\$52,687	\$11.26
7/1/09-10	\$370,000	\$45,078	1.195	\$53,880	\$6.87
7/1/10-11	\$454,000	\$46,606	1.177	\$54,851	\$8.28
7/1/11-12	\$217,000	\$44,985	1.158	\$52,104	\$4.16
7/1/12-13	\$373,000	\$47,804	1.139	\$54,451	\$6.85
7/1/13-14	\$378,000	\$48,000	1.119	\$53,704	\$7.04
7/1/14-15	\$331,000	\$48,387	1.096	\$53,046	\$6.24
7/1/15-16	\$344,000	\$52,777	1.072	\$56,590	\$6.08
7/1/16-17	\$436,000	\$56,170	1.047	\$58,831	\$7.41
<b>Total</b>	<b>\$6,896,000</b>	<b>\$810,174</b>		<b>\$1,038,440</b>	<b>\$6.64</b>

7/1/18-19

Selected Pure Premium\*  
{ Wtd Avg of 08-09 through 16-17 }

\$7.13

Forecast Exposure

\$53,476

Forecast Small Losses

\$381,000

\* Adjusted for trend where applicable

Column (B) = Average of (G) and (N) from Exhibit III

Column (C): Exhibit I

Column (D): Appendix C

Column (E) = (C) x (D)

Column (F) = (B) / (E)



***Forecast Number of Large Losses Over \$100,000***

(A)	(B)	(C)	(D)	(E)	(F)
<i>Accident Period</i>	<i>Number of Claims</i>	<i>Claim Development Factor</i>	<i>Estimated Ultimate Claims</i>	<i>Trended Exposure</i>	<i>Frequency</i>
7/1/96-97	2	1.000	2.0	\$41,723	0.048
7/1/97-98	1	1.000	1.0	\$42,433	0.024
7/1/98-99	1	1.000	1.0	\$43,110	0.023
7/1/99-00	2	1.000	2.0	\$43,698	0.046
7/1/00-01	2	1.000	2.0	\$45,241	0.044
7/1/01-02	7	1.000	7.0	\$46,972	0.149
7/1/02-03	2	1.000	2.0	\$47,727	0.042
7/1/03-04	3	1.000	3.0	\$48,657	0.062
7/1/04-05	2	1.000	2.0	\$47,276	0.042
7/1/05-06	2	1.000	2.0	\$45,592	0.044
7/1/06-07	4	1.000	4.0	\$46,920	0.085
7/1/07-08	2	1.000	2.0	\$48,946	0.041
7/1/08-09	2	1.000	2.0	\$52,687	0.038
7/1/09-10	1	1.000	1.0	\$53,880	0.019
7/1/10-11	4	1.000	4.0	\$54,851	0.073
7/1/11-12	2	1.000	2.0	\$52,104	0.038
7/1/12-13	2	1.000	2.0	\$54,451	0.037
7/1/13-14	3	1.000	3.0	\$53,704	0.056
7/1/14-15	3	1.000	3.0	\$53,046	0.057
7/1/15-16	1	1.002	1.0	\$56,590	0.018
7/1/16-17	3	1.009	3.0	\$58,831	0.051
<b>Total</b>	<b>51</b>		<b>51.0</b>	<b>\$1,038,440</b>	<b>0.049</b>

7/1/18-19

*Selected Frequency* 0.043  
*{ Wtd Avg of 11-12 through 16-17 }*

*Exposure* \$53,476

*Forecast Number of Large Losses* 2.3

*Column (B): Claims from Exhibit II*  
*Column (C): Appendix A6*  
*Column (D) = (B) \* (C)*  
*Column (E): Exhibit IV*  
*Column (F) = (D) / (E) \* 1,000*

**Calculation of Forecast Losses**

	<u>7/1/16-17</u>	<u>7/1/17-18</u>	<u>7/1/18-19</u>	<u>7/1/19-20</u>
(1) Forecast Losses less than \$100,000: { Exhibit IV }			\$381,000	
(2) Expected Number of Losses over \$100,000: { Exhibit V }			2.3	
(3) Expected Severity of Losses over \$100,000 Limited to \$200,000: { Derived from Losses in Exhibit II }			\$178,000	

(4) Forecast Losses Limited to \$200,000: { Line(1) + Line(2) * Line(3) for 7/1/18-19; Line(5) * Line(6) for other forecast periods }	\$814,000	\$765,000	\$787,000	\$809,000
(5) Forecast Exposure { Exhibit I }	\$56,170	\$52,427	\$53,476	\$54,546
(6) Forecast Loss Rate { Line(4) / Line(5) for 7/1/18-19; 7/1/18-19 rate adjusted for trend for 7/1/16-17, 7/1/17-18 and 7/1/19-20 }	\$14.49	\$14.60	\$14.72	\$14.84

**Aggregate Loss Distribution  
For Forecast Periods  
Limited to \$200,000 Per Occurrence**

(A) <i>Probability That Losses Will Be Less Than Or Equal to Column (B)</i>	(B) <i>Estimated 7/1/18-19 Ultimate Limited Losses</i>	(C) <i>Estimated 7/1/19-20 Ultimate Limited Losses</i>	(D) <i>Probability That Losses Will Be Greater Than Column (B)</i>
50%	\$758,000	\$779,000	50%
55%	\$795,000	\$817,000	45%
60%	\$836,000	\$859,000	40%
65%	\$877,000	\$902,000	35%
70%	\$923,000	\$949,000	30%
75%	\$977,000	\$1,004,000	25%
80%	\$1,032,000	\$1,061,000	20%
85%	\$1,103,000	\$1,134,000	15%
90%	\$1,191,000	\$1,224,000	10%
95%	\$1,346,000	\$1,384,000	5%
<i>Expected Losses</i>			
54%	\$787,000	\$809,000	46%
<i>Discounted at 2.5%</i>			
	\$725,000	\$745,000	

- Based on Lognormal Distribution for Small Losses,  
Inverse Weibull Distribution for Large Loss Severity  
and Poisson Distribution for Large Loss Frequency

**Estimation of Limited Ultimate Losses  
Using Loss Development Method**

(A) Accident Period	(B) Net Reported Losses	(C) Reported on Large Claims	Reported Method		(F) Ultimate on Small Claims	(G) Provision for Large Claims	(H) Estimated Ultimate Losses
			(D) Reported on Small Claims	(E) Reported Develop. Factor			
7/1/96-97	\$481,456	\$286,273	\$195,183	1.007	\$197,000	\$250,000	\$447,000
7/1/97-98	\$176,952	\$0	\$176,952	1.008	\$178,000	\$0	\$178,000
7/1/98-99	\$381,523	\$259,146	\$122,377	1.008	\$123,000	\$250,000	\$373,000
7/1/99-00	\$879,116	\$744,278	\$134,838	1.009	\$136,000	\$500,001	\$636,000
7/1/00-01	\$332,102	\$0	\$332,102	1.010	\$335,000	\$0	\$335,000
7/1/01-02	\$894,006	\$0	\$894,006	1.011	\$904,000	\$0	\$904,000
7/1/02-03	\$302,776	\$0	\$302,776	1.013	\$307,000	\$0	\$307,000
7/1/03-04	\$508,655	\$0	\$508,655	1.014	\$516,000	\$0	\$516,000
7/1/04-05	\$398,446	\$0	\$398,446	1.017	\$405,000	\$0	\$405,000
7/1/05-06	\$617,092	\$0	\$617,092	1.019	\$629,000	\$0	\$629,000
7/1/06-07	\$789,023	\$0	\$789,023	1.022	\$807,000	\$0	\$807,000
7/1/07-08	\$717,859	\$0	\$717,859	1.026	\$737,000	\$0	\$737,000
7/1/08-09	\$774,538	\$0	\$774,538	1.032	\$799,000	\$0	\$799,000
7/1/09-10	\$345,315	\$0	\$345,315	1.039	\$359,000	\$0	\$359,000
7/1/10-11	\$1,692,040	\$985,972	\$706,068	1.049	\$740,000	\$800,029	\$1,540,000
7/1/11-12	\$469,981	\$0	\$469,981	1.063	\$500,000	\$0	\$500,000
7/1/12-13	\$697,693	\$0	\$697,693	1.085	\$757,000	\$0	\$757,000
7/1/13-14	\$744,925	\$0	\$744,925	1.120	\$835,000	\$0	\$835,000
7/1/14-15	\$845,313	\$0	\$845,313	1.185	\$1,001,000	\$0	\$1,001,000
7/1/15-16	\$286,884	\$0	\$286,884	1.320	\$379,000	\$0	\$379,000
7/1/16-17	\$620,434	\$327,108	\$293,327	1.687	\$495,000	\$403,419	\$898,000
Total	\$12,956,129	\$2,602,777	\$10,353,351		\$11,139,000	\$2,203,450	\$13,342,000

(I) Accident Period	(J) Net Paid Losses	(K) Paid on Large Claims	Paid Method		(N) Ultimate on Small Claims	(O) Provision for Large Claims	(P) Estimated Ultimate Losses
			(L) Paid on Small Claims	(M) Paid Develop. Factor			
7/1/96-97	\$481,456	\$286,273	\$195,183	1.026	\$200,000	\$250,000	\$450,000
7/1/97-98	\$176,952	\$0	\$176,952	1.028	\$182,000	\$0	\$182,000
7/1/98-99	\$381,523	\$259,146	\$122,377	1.030	\$126,000	\$250,000	\$376,000
7/1/99-00	\$703,456	\$568,618	\$134,838	1.032	\$139,000	\$500,001	\$639,000
7/1/00-01	\$327,224	\$0	\$327,224	1.035	\$339,000	\$0	\$339,000
7/1/01-02	\$840,191	\$0	\$840,191	1.039	\$873,000	\$0	\$873,000
7/1/02-03	\$270,850	\$0	\$270,850	1.043	\$282,000	\$0	\$282,000
7/1/03-04	\$478,540	\$0	\$478,540	1.047	\$501,000	\$0	\$501,000
7/1/04-05	\$359,745	\$0	\$359,745	1.053	\$379,000	\$0	\$379,000
7/1/05-06	\$592,637	\$0	\$592,637	1.059	\$628,000	\$0	\$628,000
7/1/06-07	\$608,612	\$0	\$608,612	1.067	\$649,000	\$0	\$649,000
7/1/07-08	\$634,082	\$0	\$634,082	1.077	\$683,000	\$0	\$683,000
7/1/08-09	\$680,513	\$0	\$680,513	1.090	\$742,000	\$0	\$742,000
7/1/09-10	\$345,315	\$0	\$345,315	1.107	\$382,000	\$0	\$382,000
7/1/10-11	\$1,598,547	\$918,190	\$680,357	1.129	\$768,000	\$800,029	\$1,568,000
7/1/11-12	\$428,011	\$0	\$428,011	1.161	\$497,000	\$0	\$497,000
7/1/12-13	\$676,906	\$0	\$676,906	1.208	\$817,000	\$0	\$817,000
7/1/13-14	\$697,441	\$0	\$697,441	1.282	\$894,000	\$0	\$894,000
7/1/14-15	\$818,595	\$0	\$818,595	1.415	\$1,158,000	\$0	\$1,158,000
7/1/15-16	\$272,878	\$0	\$272,878	1.694	\$462,000	\$0	\$462,000
7/1/16-17	\$531,519	\$289,333	\$242,185	2.514	\$609,000	\$403,419	\$1,012,000
Total	\$11,904,993	\$2,321,561	\$9,583,432		\$11,310,000	\$2,203,450	\$13,513,000

Columns (B), (J): Exhibit I  
Columns (C), (K): Exhibit II  
Column (D) = (B) - (C)  
Column (E): Appendix A2  
Column (F) = (D) x (E)  
Columns (G), (O): Claim count in (C) x CCDF x Specific Retention

Column (H) = (F) + (G)  
Column (L) = (J) - (K)  
Column (M): Appendix A4  
Column (N) = (L) x (M)  
Column (P) = (N) + (O)

**Estimation of Limited Ultimate Losses  
Using the Bornhuetter-Ferguson Method**

Reported Method							
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Previous Estimate or Forecast Losses	Large Losses in Prior	Reported LDF	Estimated Percent Unreported	Estimated IBNR Losses	Limited Reported Losses as of 12/31/2017	Estimated Ultimate Losses
7/1/96-97	\$446,000	\$250,000	1.007	1%	\$1,000	\$445,183	\$446,000
7/1/97-98	\$178,000	\$0	1.008	1%	\$1,000	\$176,952	\$178,000
7/1/98-99	\$374,000	\$250,000	1.008	1%	\$1,000	\$372,377	\$373,000
7/1/99-00	\$614,000	\$250,000	1.009	1%	\$3,000	\$634,838	\$638,000
7/1/00-01	\$328,000	\$0	1.010	1%	\$3,000	\$332,102	\$335,000
7/1/01-02	\$907,000	\$0	1.011	1%	\$10,000	\$894,006	\$904,000
7/1/02-03	\$257,000	\$0	1.013	1%	\$3,000	\$302,776	\$306,000
7/1/03-04	\$508,000	\$0	1.014	1%	\$7,000	\$508,655	\$516,000
7/1/04-05	\$360,000	\$0	1.017	2%	\$6,000	\$398,446	\$404,000
7/1/05-06	\$632,000	\$0	1.019	2%	\$12,000	\$617,092	\$629,000
7/1/06-07	\$736,000	\$0	1.022	2%	\$16,000	\$789,023	\$805,000
7/1/07-08	\$735,000	\$0	1.026	3%	\$19,000	\$717,859	\$737,000
7/1/08-09	\$842,000	\$0	1.032	3%	\$26,000	\$774,538	\$801,000
7/1/09-10	\$364,000	\$0	1.039	4%	\$14,000	\$345,315	\$359,000
7/1/10-11	\$1,579,000	\$400,000	1.049	5%	\$55,000	\$1,506,068	\$1,561,000
7/1/11-12	\$389,000	\$0	1.063	6%	\$23,000	\$469,981	\$493,000
7/1/12-13	\$641,000	\$0	1.085	8%	\$50,000	\$697,693	\$748,000
7/1/13-14	\$792,000	\$0	1.120	11%	\$85,000	\$744,925	\$830,000
7/1/14-15	\$844,000	\$0	1.185	16%	\$132,000	\$845,313	\$977,000
7/1/15-16	\$850,000	\$0	1.320	24%	\$206,000	\$286,884	\$493,000
7/1/16-17	\$814,000	\$0	1.687	41%	\$331,000	\$620,434	\$951,000
7/1/17-18	\$765,000	\$0	5.284	81%	\$620,000	\$35,643	\$656,000
Total	\$13,955,000				\$1,624,000	\$12,516,102	\$14,140,000

Paid Method							
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Previous Estimate or Forecast Losses	Large Losses in Prior	Paid LDF	Estimated Percent Unpaid	Estimated Unpaid Losses	Limited Paid Losses as of 12/31/2017	Estimated Ultimate Losses
7/1/96-97	\$446,000	\$250,000	1.026	3%	\$5,000	\$445,183	\$450,000
7/1/97-98	\$178,000	\$0	1.028	3%	\$5,000	\$176,952	\$182,000
7/1/98-99	\$374,000	\$250,000	1.030	3%	\$4,000	\$372,377	\$376,000
7/1/99-00	\$614,000	\$250,000	1.032	3%	\$11,000	\$634,838	\$646,000
7/1/00-01	\$328,000	\$0	1.035	3%	\$11,000	\$327,224	\$338,000
7/1/01-02	\$907,000	\$0	1.039	4%	\$34,000	\$840,191	\$874,000
7/1/02-03	\$257,000	\$0	1.043	4%	\$10,000	\$270,850	\$281,000
7/1/03-04	\$508,000	\$0	1.047	4%	\$23,000	\$478,540	\$502,000
7/1/04-05	\$360,000	\$0	1.053	5%	\$18,000	\$359,745	\$378,000
7/1/05-06	\$632,000	\$0	1.059	6%	\$35,000	\$592,637	\$628,000
7/1/06-07	\$736,000	\$0	1.067	6%	\$46,000	\$608,612	\$655,000
7/1/07-08	\$735,000	\$0	1.077	7%	\$53,000	\$634,082	\$687,000
7/1/08-09	\$842,000	\$0	1.090	8%	\$70,000	\$680,513	\$751,000
7/1/09-10	\$364,000	\$0	1.107	10%	\$35,000	\$345,315	\$380,000
7/1/10-11	\$1,579,000	\$400,000	1.129	11%	\$135,000	\$1,480,357	\$1,615,000
7/1/11-12	\$389,000	\$0	1.161	14%	\$54,000	\$428,011	\$482,000
7/1/12-13	\$641,000	\$0	1.208	17%	\$110,000	\$676,906	\$787,000
7/1/13-14	\$792,000	\$0	1.282	22%	\$174,000	\$697,441	\$871,000
7/1/14-15	\$844,000	\$0	1.415	29%	\$247,000	\$818,595	\$1,066,000
7/1/15-16	\$850,000	\$0	1.694	41%	\$348,000	\$272,878	\$621,000
7/1/16-17	\$814,000	\$0	2.514	60%	\$490,000	\$531,519	\$1,022,000
7/1/17-18	\$765,000	\$0	10.716	91%	\$694,000	\$20,747	\$715,000
Total	\$13,955,000				\$2,612,000	\$11,693,512	\$14,307,000

Column (B): Prior analysis; Exhibit VI for 2016-17 and 2017-18  
Column (C): Claims exceeding retention in prior analysis  
Column (D): Appendix A  
Column (E) =  $[1 - 1 / (D)]$

Column (F) =  $[(B) - (C)] \times (E)$   
Column (G): Exhibit I, limited to retention  
Column (H) = (F) + (G)

***Summary and Selection of Limited Ultimate Losses***

(A)	(B)	(C)	(D)	(E)	(F)	(G)
<i>Accident Period</i>	<i>Prior Estimate or Forecast</i>	<i>Reported Loss Development Method</i>	<i>Paid Loss Development Method</i>	<i>Reported Bornhuetter- Ferguson Method</i>	<i>Paid Bornhuetter- Ferguson Method</i>	<i>Selected Ultimate Losses</i>
7/1/96-97	\$446,000	\$447,000	\$450,000	\$446,000	\$450,000	<b>\$445,183</b>
7/1/97-98	\$178,000	\$178,000	\$182,000	\$178,000	\$182,000	<b>\$176,952</b>
7/1/98-99	\$374,000	\$373,000	\$376,000	\$373,000	\$376,000	<b>\$372,377</b>
7/1/99-00	\$614,000	\$636,000	\$639,000	\$638,000	\$646,000	<b>\$634,838</b>
7/1/00-01	\$328,000	\$335,000	\$339,000	\$335,000	\$338,000	<b>\$335,000</b>
7/1/01-02	\$907,000	\$904,000	\$873,000	\$904,000	\$874,000	<b>\$904,000</b>
7/1/02-03	\$257,000	\$307,000	\$282,000	\$306,000	\$281,000	<b>\$307,000</b>
7/1/03-04	\$508,000	\$516,000	\$501,000	\$516,000	\$502,000	<b>\$516,000</b>
7/1/04-05	\$360,000	\$405,000	\$379,000	\$404,000	\$378,000	<b>\$405,000</b>
7/1/05-06	\$632,000	\$629,000	\$628,000	\$629,000	\$628,000	<b>\$629,000</b>
7/1/06-07	\$736,000	\$807,000	\$649,000	\$805,000	\$655,000	<b>\$807,000</b>
7/1/07-08	\$735,000	\$737,000	\$683,000	\$737,000	\$687,000	<b>\$737,000</b>
7/1/08-09	\$842,000	\$799,000	\$742,000	\$801,000	\$751,000	<b>\$799,000</b>
7/1/09-10	\$364,000	\$359,000	\$382,000	\$359,000	\$380,000	<b>\$359,000</b>
7/1/10-11	\$1,579,000	\$1,540,000	\$1,568,000	\$1,561,000	\$1,615,000	<b>\$1,540,000</b>
7/1/11-12	\$389,000	\$500,000	\$497,000	\$493,000	\$482,000	<b>\$500,000</b>
7/1/12-13	\$641,000	\$757,000	\$817,000	\$748,000	\$787,000	<b>\$753,000</b>
7/1/13-14	\$792,000	\$835,000	\$894,000	\$830,000	\$871,000	<b>\$833,000</b>
7/1/14-15	\$844,000	\$1,001,000	\$1,158,000	\$977,000	\$1,066,000	<b>\$989,000</b>
7/1/15-16	\$850,000	\$379,000	\$462,000	\$493,000	\$621,000	<b>\$436,000</b>
7/1/16-17	\$814,000	\$898,000	\$1,012,000	\$951,000	\$1,022,000	<b>\$951,000</b>
7/1/17-18	\$765,000	--	--	\$656,000	\$715,000	<b>\$656,000</b>
<b>Total</b>	<b>\$13,955,000</b>	<b>\$13,342,000</b>	<b>\$13,513,000</b>	<b>\$14,140,000</b>	<b>\$14,307,000</b>	<b>\$14,085,000</b>

Column (B): Prior analysis as of 12/31/2015; Exhibit VI for 2016-17 and 2017-18

Columns (C), (D): Exhibit VIII

Columns (E), (F): Exhibit IX

Column (G): Limited reported losses for 96-97 through 99-00

Column (C) for 00-01 through 11-12

Average of (C) and (E) for 12-13 through 15-16

Column (E) for 16-17 and 17-18

**Estimated Ultimate Reported Claims  
and Claim Frequencies**

(A)	(B)	(C)	(D)	(E)	(F)
Accident Period	Number of Claims	Claim Development Factor	Estimated Ultimate Claims	Trended Exposure (thousands)	Claim Frequency*
7/1/96-97	134	1.000	134.0	\$41,723	3.2
7/1/97-98	123	1.000	123.0	\$42,433	2.9
7/1/98-99	122	1.000	122.0	\$43,110	2.8
7/1/99-00	168	1.000	168.0	\$43,698	3.8
7/1/00-01	121	1.000	121.0	\$45,241	2.7
7/1/01-02	159	1.000	159.0	\$46,972	3.4
7/1/02-03	113	1.000	113.0	\$47,727	2.4
7/1/03-04	128	1.000	128.0	\$48,657	2.6
7/1/04-05	108	1.000	108.0	\$47,276	2.3
7/1/05-06	103	1.000	103.0	\$45,592	2.3
7/1/06-07	103	1.000	103.0	\$46,920	2.2
7/1/07-08	120	1.000	120.0	\$48,946	2.5
7/1/08-09	103	1.000	103.0	\$52,687	2.0
7/1/09-10	105	1.000	105.0	\$53,880	1.9
7/1/10-11	114	1.000	114.0	\$54,851	2.1
7/1/11-12	102	1.000	102.0	\$52,104	2.0
7/1/12-13	116	1.000	116.0	\$54,451	2.1
7/1/13-14	108	1.000	108.0	\$53,704	2.0
7/1/14-15	123	1.000	123.1	\$53,046	2.3
7/1/15-16	90	1.002	90.1	\$56,590	1.6
7/1/16-17	97	1.009	97.8	\$58,831	1.7
<b>Total</b>	<b>2,460</b>		<b>2,461.1</b>	<b>\$1,038,440</b>	<b>2.4</b>

	<u>7/1/17-18</u>	<u>7/1/18-19</u>
(1) Selected Claim Frequency { Average of 12-13 through 16-17 }	2.0	1.9
(2) Projected Exposure { Exhibit I }	\$52,427	\$53,476
(3) Estimated Ultimate Reported Claims: { Line (1) x Line (2) / 1,000 }	104.2	103.9
(4) Estimated claims unreported { (1 - 1 / CCDF) x (3) }	56.4	
(5) Reported claims { Exhibit I }	53	
(6) Estimate of Ultimate Claims { (4) + (5) or (3) }	109.4	103.9

\*Shown as claims per million of exposure, record only claims omitted

Column (B): Exhibit I  
Column (C): Appendix A6  
Column (D) = (B) \* (C)  
Column (E) = Exhibit IV  
Column (F) = (D) / (E) \* 1,000

***Estimation of Claim Severities***

(A)	(B)	(C)	(D)	(E)	(F)
<i>Accident Period</i>	<i>Estimated Ultimate Claims</i>	<i>Selected Estimated Ultimate Losses</i>	<i>Estimated Ultimate Severity</i>	<i>Exposure (Hundreds)</i>	<i>Cost per \$100 Payroll</i>
7/1/96-97	134.0	\$445,183	\$3,300	\$236,563	\$1.88
7/1/97-98	123.0	\$176,952	\$1,400	\$249,231	\$0.71
7/1/98-99	122.0	\$372,377	\$3,100	\$262,307	\$1.42
7/1/99-00	168.0	\$634,838	\$3,800	\$275,685	\$2.30
7/1/00-01	121.0	\$335,000	\$2,800	\$296,197	\$1.13
7/1/01-02	159.0	\$904,000	\$5,700	\$318,066	\$2.84
7/1/02-03	113.0	\$307,000	\$2,700	\$333,032	\$0.92
7/1/03-04	128.0	\$516,000	\$4,000	\$348,699	\$1.48
7/1/04-05	108.0	\$405,000	\$3,700	\$347,271	\$1.17
7/1/05-06	103.0	\$629,000	\$6,100	\$344,011	\$1.83
7/1/06-07	103.0	\$807,000	\$7,800	\$365,393	\$2.21
7/1/07-08	120.0	\$737,000	\$6,100	\$393,519	\$1.87
7/1/08-09	103.0	\$799,000	\$7,800	\$433,684	\$1.84
7/1/09-10	105.0	\$359,000	\$3,400	\$450,781	\$0.80
7/1/10-11	114.0	\$1,540,000	\$13,500	\$466,060	\$3.30
7/1/11-12	102.0	\$500,000	\$4,900	\$449,855	\$1.11
7/1/12-13	116.0	\$753,000	\$6,500	\$478,039	\$1.58
7/1/13-14	108.0	\$833,000	\$7,700	\$480,000	\$1.74
7/1/14-15	123.1	\$989,000	\$8,000	\$483,874	\$2.04
7/1/15-16	90.1	\$436,000	\$4,800	\$527,772	\$0.83
7/1/16-17	97.8	\$951,000	\$9,700	\$561,703	\$1.69
7/1/17-18	109.4	\$656,000	\$6,000	\$524,275	\$1.25
7/1/18-19	103.9	\$787,000	\$7,600	\$534,760	\$1.47
<b>Total</b>	<b>2,674.4</b>	<b>\$14,872,000</b>	<b>\$5,600</b>	<b>\$9,160,778</b>	<b>\$1.62</b>

Columns (B): Exhibit XI, page 1

Column (C): Exhibit X; Exhibit VI for the forecast period

Column (D) = (C) / (B)

Column (E): Exhibit I

Column (F) = (C) / (E)



**Calculation of Required Reserves  
As of December 31, 2017**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Accident Period	Selected Ultimate Losses	Limited Paid Losses	Limited Reported Losses	Case Reserves	IBNR Reserves	Total Required Reserves	Discount Factor at 2.5%	Total Discounted Reserves at 2.5%
88-89 through 95-96	NA	\$1,365,074	\$1,365,074	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$445,183	\$445,183	\$445,183	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$176,952	\$176,952	\$176,952	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$372,377	\$372,377	\$372,377	\$0	\$0	\$0	0.988	\$0
7/1/99-00	\$634,838	\$634,838	\$634,838	\$0	\$0	\$0	0.965	\$0
7/1/00-01	\$335,000	\$327,224	\$332,102	\$4,878	\$3,000	\$8,000	0.945	\$8,000
7/1/01-02	\$904,000	\$840,191	\$894,006	\$53,815	\$10,000	\$64,000	0.928	\$59,000
7/1/02-03	\$307,000	\$270,850	\$302,776	\$31,926	\$4,000	\$36,000	0.913	\$33,000
7/1/03-04	\$516,000	\$478,540	\$508,655	\$30,115	\$7,000	\$37,000	0.899	\$33,000
7/1/04-05	\$405,000	\$359,745	\$398,446	\$38,701	\$7,000	\$46,000	0.888	\$41,000
7/1/05-06	\$629,000	\$592,637	\$617,092	\$24,454	\$12,000	\$36,000	0.879	\$32,000
7/1/06-07	\$807,000	\$608,612	\$789,023	\$180,411	\$18,000	\$198,000	0.873	\$173,000
7/1/07-08	\$737,000	\$634,082	\$717,859	\$83,777	\$19,000	\$103,000	0.868	\$89,000
7/1/08-09	\$799,000	\$680,513	\$774,538	\$94,025	\$24,000	\$118,000	0.865	\$102,000
7/1/09-10	\$359,000	\$345,315	\$345,315	\$0	\$14,000	\$14,000	0.865	\$12,000
7/1/10-11	\$1,540,000	\$1,480,357	\$1,506,068	\$25,711	\$34,000	\$60,000	0.866	\$52,000
7/1/11-12	\$500,000	\$428,011	\$469,981	\$41,970	\$30,000	\$72,000	0.870	\$63,000
7/1/12-13	\$753,000	\$676,906	\$697,693	\$20,788	\$55,000	\$76,000	0.876	\$67,000
7/1/13-14	\$833,000	\$697,441	\$744,925	\$47,484	\$88,000	\$135,000	0.884	\$119,000
7/1/14-15	\$989,000	\$818,595	\$845,313	\$26,718	\$144,000	\$171,000	0.893	\$153,000
7/1/15-16	\$436,000	\$272,878	\$286,884	\$14,006	\$149,000	\$163,000	0.905	\$147,000
7/1/16-17	\$951,000	\$531,519	\$620,434	\$88,916	\$331,000	\$420,000	0.916	\$385,000
7/1-12/31/17	\$328,000	\$20,747	\$35,643	\$14,896	\$292,000	\$307,000	0.925	\$284,000
<b>Total</b>	<b>\$13,757,000</b>	<b>\$13,058,586</b>	<b>\$13,881,176</b>	<b>\$822,590</b>	<b>\$1,241,000</b>	<b>\$2,064,000</b>		<b>\$1,852,000</b>
96-97 through 12/31/17	\$13,757,000	\$11,693,512	\$12,516,102	\$822,590	\$1,241,000	\$2,064,000		\$1,852,000
1/1-6/30/18	\$328,000							

Column (B): Exhibit X; prorated for 7/1/17-18  
Columns (C), (D): Exhibit I, limited to retention  
Column (E) = (D) - (C)  
Column (F) = (B) - (D); judgmentally selected for 88/89 thorough 95/96  
Column (G) = (E) + (F)  
Column (H): Appendix D  
Column (I) = (G) \* (H)

**Estimated Outstanding Losses  
At Various Confidence Levels  
As of December 31, 2017**

Confidence Level	(A) Estimated Ultimate Losses	(B) Limited Paid Losses	(C) Limited Reported Losses	(D) Case Reserves	(E) Estimated Unreported Losses	(F) Estimated Outstanding Losses	(G) Discount Factor at 2.5%	(H) Discounted Outstanding Losses
50%	\$13,703,000	\$11,693,512	\$12,516,102	\$822,590	\$1,187,000	\$2,009,000	0.897	\$1,803,000
55%	\$13,786,000	\$11,693,512	\$12,516,102	\$822,590	\$1,270,000	\$2,092,000	0.897	\$1,877,000
60%	\$13,867,000	\$11,693,512	\$12,516,102	\$822,590	\$1,351,000	\$2,173,000	0.897	\$1,950,000
65%	\$13,954,000	\$11,693,512	\$12,516,102	\$822,590	\$1,438,000	\$2,260,000	0.897	\$2,028,000
70%	\$14,049,000	\$11,693,512	\$12,516,102	\$822,590	\$1,533,000	\$2,355,000	0.897	\$2,113,000
75%	\$14,148,000	\$11,693,512	\$12,516,102	\$822,590	\$1,632,000	\$2,454,000	0.897	\$2,202,000
80%	\$14,257,000	\$11,693,512	\$12,516,102	\$822,590	\$1,741,000	\$2,563,000	0.897	\$2,300,000
85%	\$14,392,000	\$11,693,512	\$12,516,102	\$822,590	\$1,876,000	\$2,698,000	0.897	\$2,421,000
90%	\$14,555,000	\$11,693,512	\$12,516,102	\$822,590	\$2,039,000	\$2,861,000	0.897	\$2,567,000
95%	\$14,821,000	\$11,693,512	\$12,516,102	\$822,590	\$2,305,000	\$3,127,000	0.897	\$2,806,000

Column (A): Based on Lognormal Fit to Historical Development Experience

Columns (B), (C): Exhibit XII, page 1

Column (D) = (C) - (B)

Column (E) = (A) - (C)

Column (F) = (A) - (B) = (D) + (E)

Column (G): Average Discount from Exhibit XII, page 1

Column (H) = (F) \* (G)

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 1/1-6/30/18	Paid During 2018-19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$8,000	\$300	\$600	\$500	\$500	\$400	\$400	\$300	\$300	\$300	\$200	\$200
7/1/01-02	\$64,000	\$2,700	\$5,000	\$4,300	\$3,800	\$3,400	\$3,000	\$2,700	\$2,400	\$2,200	\$2,000	\$1,800
7/1/02-03	\$36,000	\$1,600	\$2,900	\$2,600	\$2,200	\$2,000	\$1,700	\$1,500	\$1,400	\$1,200	\$1,100	\$1,000
7/1/03-04	\$37,000	\$1,800	\$3,200	\$2,700	\$2,400	\$2,100	\$1,800	\$1,600	\$1,400	\$1,300	\$1,200	\$1,000
7/1/04-05	\$46,000	\$2,400	\$4,200	\$3,600	\$3,100	\$2,700	\$2,300	\$2,000	\$1,800	\$1,600	\$1,400	\$1,300
7/1/05-06	\$36,000	\$2,000	\$3,500	\$2,900	\$2,500	\$2,100	\$1,900	\$1,600	\$1,400	\$1,300	\$1,100	\$1,000
7/1/06-07	\$198,000	\$11,600	\$20,300	\$17,000	\$14,300	\$12,200	\$10,500	\$9,100	\$7,900	\$7,000	\$6,200	\$5,500
7/1/07-08	\$103,000	\$6,500	\$11,300	\$9,300	\$7,700	\$6,500	\$5,600	\$4,800	\$4,100	\$3,600	\$3,200	\$2,800
7/1/08-09	\$118,000	\$8,200	\$13,900	\$11,300	\$9,200	\$7,700	\$6,500	\$5,500	\$4,800	\$4,100	\$3,600	\$3,200
7/1/09-10	\$14,000	\$1,100	\$1,800	\$1,400	\$1,100	\$900	\$800	\$700	\$600	\$500	\$400	\$400
7/1/10-11	\$60,000	\$5,000	\$8,300	\$6,400	\$5,100	\$4,100	\$3,400	\$2,800	\$2,400	\$2,000	\$1,700	\$1,500
7/1/11-12	\$72,000	\$6,700	\$10,800	\$8,200	\$6,400	\$5,100	\$4,100	\$3,400	\$2,800	\$2,400	\$2,000	\$1,700
7/1/12-13	\$76,000	\$7,900	\$12,500	\$9,200	\$7,000	\$5,400	\$4,300	\$3,500	\$2,900	\$2,400	\$2,000	\$1,700
7/1/13-14	\$135,000	\$16,100	\$24,500	\$17,400	\$12,700	\$9,700	\$7,500	\$6,000	\$4,800	\$4,000	\$3,300	\$2,800
7/1/14-15	\$171,000	\$23,400	\$34,400	\$23,400	\$16,500	\$12,100	\$9,200	\$7,200	\$5,700	\$4,600	\$3,800	\$3,200
7/1/15-16	\$163,000	\$25,800	\$36,500	\$23,500	\$15,900	\$11,300	\$8,300	\$6,300	\$4,900	\$3,900	\$3,100	\$2,600
7/1/16-17	\$420,000	\$75,000	\$104,500	\$64,100	\$41,100	\$27,900	\$19,700	\$14,500	\$11,000	\$8,500	\$6,800	\$5,500
7/1-12/31/17	\$307,000	\$56,900	\$82,600	\$50,800	\$31,000	\$20,000	\$13,500	\$9,600	\$7,000	\$5,300	\$4,100	\$3,300
Subtotal	\$2,064,000	\$255,000	\$381,000	\$259,000	\$183,000	\$136,000	\$105,000	\$83,000	\$68,000	\$56,000	\$47,000	\$41,000
1/1-6/30/18	\$328,000	\$61,000	\$88,000	\$54,000	\$33,000	\$21,000	\$14,000	\$10,000	\$8,000	\$6,000	\$4,000	\$4,000
7/1/18-19	\$787,000	--	\$206,000	\$192,000	\$118,000	\$72,000	\$46,000	\$31,000	\$22,000	\$16,000	\$12,000	\$10,000
Total	\$3,179,000	\$316,000	\$675,000	\$505,000	\$334,000	\$229,000	\$165,000	\$124,000	\$98,000	\$78,000	\$63,000	\$55,000

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A2 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 12/31/17)]\}$ .

**Projected Payment Pattern  
At Various Confidence Levels  
for Accident Periods 96-97 through 18-19**

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
					Projected Limited		
Aggregate Percentile	Limited Ultimate Losses	Limited Outstanding & Forecast Losses	Limited Paid Losses as of 12/31/2017	Projected Paid Losses as of 6/30/2018	Outstanding & Forecast Losses as of 6/30/2018	Projected Paid Losses as of 6/30/2019	Projected Outstanding Losses as of 6/30/2019
50%	\$14,813,000	\$3,119,000	\$11,693,512	\$12,004,000	\$2,809,000	\$12,666,000	\$2,147,000
55%	\$14,905,000	\$3,211,000	\$11,693,512	\$12,013,000	\$2,892,000	\$12,695,000	\$2,210,000
60%	\$15,005,000	\$3,311,000	\$11,693,512	\$12,023,000	\$2,982,000	\$12,726,000	\$2,279,000
65%	\$15,111,000	\$3,417,000	\$11,693,512	\$12,033,000	\$3,078,000	\$12,759,000	\$2,352,000
70%	\$15,215,000	\$3,521,000	\$11,693,512	\$12,044,000	\$3,171,000	\$12,792,000	\$2,423,000
75%	\$15,338,000	\$3,644,000	\$11,693,512	\$12,056,000	\$3,282,000	\$12,830,000	\$2,508,000
80%	\$15,477,000	\$3,783,000	\$11,693,512	\$12,070,000	\$3,407,000	\$12,873,000	\$2,604,000
85%	\$15,644,000	\$3,950,000	\$11,693,512	\$12,086,000	\$3,558,000	\$12,925,000	\$2,719,000
90%	\$15,857,000	\$4,163,000	\$11,693,512	\$12,107,000	\$3,750,000	\$12,991,000	\$2,866,000
95%	\$16,183,000	\$4,489,000	\$11,693,512	\$12,140,000	\$4,043,000	\$13,093,000	\$3,090,000
<i>Expected</i>	\$14,872,000	\$3,179,000	\$11,693,512	\$12,010,000	\$2,862,000	\$12,685,000	\$2,187,000

Column (A): Percentile estimates are based on a lognormal distribution.

Column (B) = (C) - (A)

Column (C): Exhibit XII, page 2

Column (D) = { (% of outstanding as of 12/31/17 expected to be paid during 1/1-6/30/18 from Exhibit XIII, page 1) \* (B) } + (C)

Column (E) = (A) - (D)

Column (F) = { (% of outstanding as of 6/30/18 expected to be paid during 2018-19 from Exhibit XIII, page 1) \* (E) } + (D)

Column (G) = (A) - (F)

**Comparison of Results with Report Valued as of December 31, 2015**

(A) Accident Period	(B) Reported Losses 12/31/2015	(C) Expected Reported Losses 12/31/2017	(D) Actual Reported Losses 12/31/2017	(E) Percent Difference	(F) Estimated Ultimate Losses 12/31/2015	(G) Estimated Ultimate Losses 12/31/2017	(H) Percent Difference
7/1/96-97	\$445,183	\$445,310	\$445,183	0%	\$446,000	\$445,183	0%
7/1/97-98	\$176,952	\$177,121	\$176,952	0%	\$178,000	\$176,952	-1%
7/1/98-99	\$372,377	\$372,652	\$372,377	0%	\$374,000	\$372,377	0%
7/1/99-00	\$610,155	\$610,839	\$634,838	4%	\$614,000	\$634,838	3%
7/1/00-01	\$323,711	\$324,514	\$332,102	2%	\$328,000	\$335,000	2%
7/1/01-02	\$894,006	\$896,573	\$894,006	0%	\$907,000	\$904,000	0%
7/1/02-03	\$252,687	\$253,589	\$302,776	19%	\$257,000	\$307,000	19%
7/1/03-04	\$498,881	\$500,908	\$508,655	2%	\$508,000	\$516,000	2%
7/1/04-05	\$352,926	\$354,603	\$398,446	12%	\$360,000	\$405,000	13%
7/1/05-06	\$616,843	\$620,691	\$617,092	-1%	\$632,000	\$629,000	0%
7/1/06-07	\$715,423	\$721,044	\$789,023	9%	\$736,000	\$807,000	10%
7/1/07-08	\$710,629	\$717,833	\$717,859	0%	\$735,000	\$737,000	0%
7/1/08-09	\$807,439	\$818,563	\$774,538	-5%	\$842,000	\$799,000	-5%
7/1/09-10	\$345,371	\$351,946	\$345,315	-2%	\$364,000	\$359,000	-1%
7/1/10-11	\$1,498,744	\$1,530,061	\$1,506,068	-2%	\$1,579,000	\$1,540,000	-2%
7/1/11-12	\$353,393	\$368,900	\$469,981	27%	\$389,000	\$500,000	29%
7/1/12-13	\$558,850	\$599,184	\$697,693	16%	\$641,000	\$753,000	17%
7/1/13-14	\$640,020	\$724,926	\$744,925	3%	\$792,000	\$833,000	5%
7/1/14-15	\$544,330	\$735,428	\$845,313	15%	\$844,000	\$989,000	17%
7/1/15-16	\$204,771	\$681,867	\$286,884	-58%	\$850,000	\$436,000	-49%
7/1/16-17		\$514,367	\$620,434	21%	\$814,000	\$951,000	17%
7/1/17-18		\$160,478	\$35,643	-78%	\$812,000	\$656,000	-19%
Total	\$10,922,692	\$12,481,395	\$12,516,102	0%	\$14,002,000	\$14,085,000	1%

Variance from Expected

\$34,708

Change in Ultimates

\$83,000

(A) Accident Period	(B) Paid Losses 12/31/2015	(C) Expected Paid Losses 12/31/2017	(D) Actual Paid Losses 12/31/2017	(E) Percent Difference	(F) Estimated Ultimate Losses 12/31/2015	(G) Estimated Ultimate Losses 12/31/2017	(H) Percent Difference
7/1/96-97	\$445,183	\$445,290	\$445,183	0%	\$446,000	\$445,183	0%
7/1/97-98	\$176,952	\$177,095	\$176,952	0%	\$178,000	\$176,952	-1%
7/1/98-99	\$372,377	\$372,608	\$372,377	0%	\$374,000	\$372,377	0%
7/1/99-00	\$610,155	\$610,732	\$634,838	4%	\$614,000	\$634,838	3%
7/1/00-01	\$315,629	\$317,581	\$327,224	3%	\$328,000	\$335,000	2%
7/1/01-02	\$835,287	\$847,240	\$840,191	-1%	\$907,000	\$904,000	0%
7/1/02-03	\$238,110	\$241,444	\$270,850	12%	\$257,000	\$307,000	19%
7/1/03-04	\$468,296	\$475,746	\$478,540	1%	\$508,000	\$516,000	2%
7/1/04-05	\$338,101	\$342,485	\$359,745	5%	\$360,000	\$405,000	13%
7/1/05-06	\$559,164	\$574,781	\$592,637	3%	\$632,000	\$629,000	0%
7/1/06-07	\$482,571	\$541,058	\$608,612	12%	\$736,000	\$807,000	10%
7/1/07-08	\$624,444	\$652,057	\$634,082	-3%	\$735,000	\$737,000	0%
7/1/08-09	\$568,337	\$642,767	\$680,513	6%	\$842,000	\$799,000	-5%
7/1/09-10	\$345,371	\$350,926	\$345,315	-2%	\$364,000	\$359,000	-1%
7/1/10-11	\$1,345,554	\$1,422,481	\$1,480,357	4%	\$1,579,000	\$1,540,000	-2%
7/1/11-12	\$304,615	\$335,618	\$428,011	28%	\$389,000	\$500,000	29%
7/1/12-13	\$501,603	\$559,224	\$676,906	21%	\$641,000	\$753,000	17%
7/1/13-14	\$577,362	\$677,918	\$697,441	3%	\$792,000	\$833,000	5%
7/1/14-15	\$473,781	\$670,097	\$818,595	22%	\$844,000	\$989,000	17%
7/1/15-16	\$83,449	\$525,983	\$272,878	-48%	\$850,000	\$436,000	-49%
7/1/16-17		\$344,498	\$531,519	54%	\$814,000	\$951,000	17%
7/1/17-18		\$78,179	\$20,747	-73%	\$812,000	\$656,000	-19%
Total	\$9,666,342	\$11,205,806	\$11,693,512	4%	\$14,002,000	\$14,085,000	1%

Columns (B), (F): From previous actuarial report  
Column (C): Derived using LDF's from previous actuarial report  
Column (D): Exhibit I, limited to retention

Column (E) = [(D) / (C)] - 1  
Column (G): Exhibit V  
Column (H) = [(G) / (F)] - 1

***Funding at the Expected Level***

(1) <i>Estimated Outstanding Losses as of 12/31/17</i> <i>{ Exhibit XII-1 }</i>	\$2,064,000
(2) <i>Forecast Losses for 1/1-6/30/18</i> <i>{ Exhibit XII-1 }</i>	\$328,000
<hr/>	
(3) <b><i>Required Funding as of 12/31/17</i></b> <b><i>{ (1) + (2) }</i></b>	<b>\$2,392,000</b>
(4) <i>Projected Payments during 1/1-6/30/18</i> <i>{ Exhibit XIII-1 }</i>	\$316,000
(5) <i>Estimated Outstanding Losses as of 6/30/18</i> <i>{ (3) – (4) }</i>	\$2,076,000
(6) <i>Forecast Losses for 7/1/18-19</i> <i>{ Exhibit VI }</i>	\$787,000
<hr/>	
(7) <b><i>Required Funding as of 6/30/18</i></b> <b><i>{ (5) + (6) }</i></b>	<b>\$2,863,000</b>
(8) <i>Projected Payments during 7/1/18-19</i> <i>{ Exhibit XIII-1 }</i>	\$675,000
(9) <i>Estimated Outstanding Losses as of 6/30/19</i> <i>{ (7) – (8) }</i>	\$2,188,000
(10) <i>Forecast Losses for 7/1/19-20</i> <i>{ Exhibit VI }</i>	\$809,000
<hr/>	
(11) <b><i>Required Funding as of 6/30/19</i></b> <b><i>{ (9) + (10) }</i></b>	<b>\$2,997,000</b>

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## Exhibits: Automobile Liability

The “Analysis” section of this report presents a discussion of the following exhibits:

Exhibit I	Summary of Experience
Exhibit II	Summary of Claims Over \$30,000
Exhibit III	Estimation of Ultimate Small Losses at 7/1/18-19 Cost Level
Exhibit IV	Calculation of Forecast Small Losses
Exhibit V	Calculation of Forecast Number of Large Losses
Exhibit VI	Calculation of Forecast Losses
Exhibit VII	Forecast Losses at Various Confidence Levels
Exhibit VIII	Estimation of Ultimate Losses: Loss Development Methods
Exhibit IX	Estimation of Ultimate Losses: Bornhuetter/Ferguson Methods
Exhibit X	Selection of Ultimate Limited Loss Estimates
Exhibit XI	Estimated Ultimate Claims Estimation of Claim Severities
Exhibit XII	Calculation of Required Reserves Estimated Outstanding Losses at Various Confidence Levels
Exhibit XIII	Projection of Loss Payments Over the Next Ten Years Projected Payment Pattern at Various Confidence Levels
Exhibit XIV	Comparison of Results: Current to Prior Estimates
Exhibit XV	Required Funding

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**Summary of Experience\***

(A)		(B)	(C)	(D)	(E)	(F)	(G)
Period		Evaluation	Maturity	Reported	Paid	Reported	
Begin	End	Date	(months)	Claims	Losses	Losses	Vehicles+
7/1/1994	6/30/1995	12/31/2017	282	4	\$3,353	\$3,353	326
7/1/1995	6/30/1996	12/31/2017	270	16	\$18,395	\$18,395	327
7/1/1996	6/30/1997	12/31/2017	258	7	\$13,214	\$13,214	328
7/1/1997	6/30/1998	12/31/2017	246	10	\$19,700	\$19,700	329
7/1/1998	6/30/1999	12/31/2017	234	7	\$11,376	\$11,376	330
7/1/1999	6/30/2000	12/31/2017	222	14	\$15,316	\$15,316	321
7/1/2000	6/30/2001	12/31/2017	210	23	\$32,819	\$32,819	335
7/1/2001	6/30/2002	12/31/2017	198	18	\$116,482	\$116,482	343
7/1/2002	6/30/2003	12/31/2017	186	18	\$17,543	\$17,543	347
7/1/2003	6/30/2004	12/31/2017	174	22	\$35,067	\$35,067	351
7/1/2004	6/30/2005	12/31/2017	162	11	\$123,899	\$123,899	314
7/1/2005	6/30/2006	12/31/2017	150	17	\$42,764	\$42,764	319
7/1/2006	6/30/2007	12/31/2017	138	14	\$66,223	\$66,223	337
7/1/2007	6/30/2008	12/31/2017	126	17	\$23,803	\$23,803	352
7/1/2008	6/30/2009	12/31/2017	114	25	\$26,281	\$26,281	359
7/1/2009	6/30/2010	12/31/2017	102	9	\$30,280	\$30,280	398
7/1/2010	6/30/2011	12/31/2017	90	10	\$4,321	\$4,321	383
7/1/2011	6/30/2012	12/31/2017	78	18	\$45,045	\$45,045	393
7/1/2012	6/30/2013	12/31/2017	66	10	\$61,905	\$87,990	384
7/1/2013	6/30/2014	12/31/2017	54	12	\$27,294	\$27,294	405
7/1/2014	6/30/2015	12/31/2017	42	9	\$17,861	\$17,861	405
7/1/2015	6/30/2016	12/31/2017	30	23	\$46,689	\$46,689	409
7/1/2016	6/30/2017	12/31/2017	18	26	\$25,478	\$25,478	407
7/1/2017	6/30/2018	12/31/2017	6	13	\$7,647	\$11,929	418
7/1/2018	6/30/2019						425
7/1/2019	6/30/2020						425
<b>Total</b>				<b>353</b>	<b>\$832,758</b>	<b>\$863,124</b>	<b>9,470</b>

\* Loss and exposure information supplied by VACO

+ Estimated for 2017-18 through 2019-20



**Summary of Claims over \$30,000**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
<i>Claim Number</i>	<i>Accident Date</i>	<i>Paid Losses</i>	<i>Reported Losses</i>	<i>Historical Retention</i>	<i>Severity Development Factor</i>	<i>Developed Losses</i>	<i>Trend Factor to 7/1/18-19</i>	<i>Trended Developed Losses</i>
772001003296	7/5/2001	\$63,854	\$63,854	\$250,000	1.000	\$63,854	1.839	\$117,421
772005013905	6/11/2005	\$104,942	\$104,942	\$250,000	1.000	\$104,942	1.618	\$169,838
772006021563	11/29/2006	\$33,620	\$33,620	\$250,000	1.000	\$33,620	1.482	\$49,822
772012064162	7/31/2012	\$16,915	\$43,000	\$250,000	1.013	\$43,552	1.183	\$51,541

Columns (A) through (E): Provided by VACO

Column (F) = RLDF/CCDF

Column (G) = (D) \* (F)

Column (H): Appendix B

Column (I) = (G) \* (H)

**Estimation of Ultimate Limited Losses Less Than \$50,000  
At the 2018-19 Loss Level  
Using Loss Development Method**

Reported Method						
(A) Accident Period	(B) Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Trend Factor to 7/1/18-19	(F) Reported Develop. Factor	(G) Ultimate on Small Claims
7/1/94-95	\$3,353	\$0	\$3,353	2.436	1.000	\$8,000
7/1/95-96	\$18,395	\$0	\$18,395	2.340	1.000	\$43,000
7/1/96-97	\$13,214	\$0	\$13,214	2.255	1.000	\$30,000
7/1/97-98	\$19,700	\$0	\$19,700	2.174	1.000	\$43,000
7/1/98-99	\$11,376	\$0	\$11,376	2.093	1.000	\$24,000
7/1/99-00	\$15,316	\$0	\$15,316	2.003	1.000	\$31,000
7/1/00-01	\$32,819	\$0	\$32,819	1.919	1.000	\$63,000
7/1/01-02	\$116,482	\$63,854	\$52,628	1.839	1.000	\$97,000
7/1/02-03	\$17,543	\$0	\$17,543	1.763	1.000	\$31,000
7/1/03-04	\$35,067	\$0	\$35,067	1.692	1.000	\$59,000
7/1/04-05	\$123,899	\$104,942	\$18,957	1.618	1.000	\$31,000
7/1/05-06	\$42,764	\$0	\$42,764	1.549	1.000	\$66,000
7/1/06-07	\$66,223	\$0	\$66,223	1.482	1.000	\$98,000
7/1/07-08	\$23,803	\$0	\$23,803	1.420	1.000	\$34,000
7/1/08-09	\$26,281	\$0	\$26,281	1.359	1.000	\$36,000
7/1/09-10	\$30,280	\$0	\$30,280	1.306	1.000	\$40,000
7/1/10-11	\$4,321	\$0	\$4,321	1.259	1.000	\$5,000
7/1/11-12	\$45,045	\$0	\$45,045	1.216	1.000	\$55,000
7/1/12-13	\$87,990	\$43,000	\$44,990	1.183	1.013	\$54,000
7/1/13-14	\$27,294	\$0	\$27,294	1.151	1.033	\$32,000
7/1/14-15	\$17,861	\$0	\$17,861	1.117	1.085	\$22,000
7/1/15-16	\$46,689	\$0	\$46,689	1.086	1.226	\$62,000
7/1/16-17	\$25,478	\$0	\$25,478	1.057	1.619	\$44,000
Total	\$851,195	\$211,796	\$639,399			\$1,008,000

Paid Method						
(H) Accident Period	(I) Paid Losses	(J) Paid on Large Claims	(K) Paid on Small Claims	(L) Trend Factor to 7/1/18-19	(M) Paid Develop. Factor	(N) Ultimate on Small Claims
7/1/94-95	\$3,353	\$0	\$3,353	2.436	1.000	\$8,000
7/1/95-96	\$18,395	\$0	\$18,395	2.340	1.000	\$43,000
7/1/96-97	\$13,214	\$0	\$13,214	2.255	1.000	\$30,000
7/1/97-98	\$19,700	\$0	\$19,700	2.174	1.000	\$43,000
7/1/98-99	\$11,376	\$0	\$11,376	2.093	1.000	\$24,000
7/1/99-00	\$15,316	\$0	\$15,316	2.003	1.000	\$31,000
7/1/00-01	\$32,819	\$0	\$32,819	1.919	1.000	\$63,000
7/1/01-02	\$116,482	\$63,854	\$52,628	1.839	1.000	\$97,000
7/1/02-03	\$17,543	\$0	\$17,543	1.763	1.000	\$31,000
7/1/03-04	\$35,067	\$0	\$35,067	1.692	1.000	\$59,000
7/1/04-05	\$123,899	\$104,942	\$18,957	1.618	1.000	\$31,000
7/1/05-06	\$42,764	\$0	\$42,764	1.549	1.000	\$66,000
7/1/06-07	\$66,223	\$0	\$66,223	1.482	1.000	\$98,000
7/1/07-08	\$23,803	\$0	\$23,803	1.420	1.000	\$34,000
7/1/08-09	\$26,281	\$0	\$26,281	1.359	1.000	\$36,000
7/1/09-10	\$30,280	\$0	\$30,280	1.306	1.000	\$40,000
7/1/10-11	\$4,321	\$0	\$4,321	1.259	1.000	\$5,000
7/1/11-12	\$45,045	\$0	\$45,045	1.216	1.000	\$55,000
7/1/12-13	\$61,905	\$16,915	\$44,990	1.183	1.033	\$55,000
7/1/13-14	\$27,294	\$0	\$27,294	1.151	1.071	\$34,000
7/1/14-15	\$17,861	\$0	\$17,861	1.117	1.169	\$23,000
7/1/15-16	\$46,689	\$0	\$46,689	1.086	1.453	\$74,000
7/1/16-17	\$25,478	\$0	\$25,478	1.057	2.421	\$65,000
Total	\$825,110	\$185,712	\$639,399			\$1,045,000

Columns (B), (I): Exhibit I  
Columns (C), (J): Exhibit II  
Column (D) = (B) - (C)  
Columns (E), (L): Appendix B  
Column (F): Appendix A1

Column (G) = (D) \* (E) \* (F)  
Column (K) = (I) - (J)  
Column (M): Appendix A2  
Column (N) = (K) \* (L) \* (M)

**Calculation of Forecast Losses Less Than \$50,000**

(A)	(B)	(C)	(D)	(E)	(F)
Accident Period	Trended Ultimate Small Losses	Exposure	Trend Factor 7/1/18-19	Trended Exposure	Loss Rate
7/1/94-95	\$8,000	326	1.000	326	\$25
7/1/95-96	\$43,000	327	1.000	327	\$131
7/1/96-97	\$30,000	328	1.000	328	\$91
7/1/97-98	\$43,000	329	1.000	329	\$131
7/1/98-99	\$24,000	330	1.000	330	\$73
7/1/99-00	\$31,000	321	1.000	321	\$97
7/1/00-01	\$63,000	335	1.000	335	\$188
7/1/01-02	\$97,000	343	1.000	343	\$283
7/1/02-03	\$31,000	347	1.000	347	\$89
7/1/03-04	\$59,000	351	1.000	351	\$168
7/1/04-05	\$31,000	314	1.000	314	\$99
7/1/05-06	\$66,000	319	1.000	319	\$207
7/1/06-07	\$98,000	337	1.000	337	\$291
7/1/07-08	\$34,000	352	1.000	352	\$97
7/1/08-09	\$36,000	359	1.000	359	\$100
7/1/09-10	\$40,000	398	1.000	398	\$101
7/1/10-11	\$5,000	383	1.000	383	\$13
7/1/11-12	\$55,000	393	1.000	393	\$140
7/1/12-13	\$55,000	384	1.000	384	\$143
7/1/13-14	\$33,000	405	1.000	405	\$81
7/1/14-15	\$23,000	405	1.000	405	\$57
7/1/15-16	\$68,000	409	1.000	409	\$166
7/1/16-17	\$55,000	407	1.000	407	\$135
<b>Total</b>	<b>\$1,028,000</b>	<b>8,202</b>		<b>8,202</b>	<b>\$125</b>

7/1/18-19

Selected Loss Rate:  
{ Wtd Avg of All Years } \$125

Forecast Exposure:  
{ Exhibit I } 425

**Forecast Small Losses** **\$53,000**  
{ Line (1) x Line (2) }

Column (B) = Average of (G) and (N), Exhibit III

Column (C): Exhibit I

Column (D): No Trend for Vehicles

Column (E) = (C) \* (D)

Column (F) = (B) / (E)

**Forecast Number of Large Losses Over \$50,000**

(A)	(B)	(C)	(D)	(E)
Accident Period	Number of Claims	Claim Development Factor	Estimated Ultimate Claims	Trended Exposure
7/1/94-95	0	1.000	0.0	326
7/1/95-96	0	1.000	0.0	327
7/1/96-97	0	1.000	0.0	328
7/1/97-98	0	1.000	0.0	329
7/1/98-99	0	1.000	0.0	330
7/1/99-00	0	1.000	0.0	321
7/1/00-01	0	1.000	0.0	335
7/1/01-02	1	1.000	1.0	343
7/1/02-03	0	1.000	0.0	347
7/1/03-04	0	1.000	0.0	351
7/1/04-05	1	1.000	1.0	314
7/1/05-06	0	1.000	0.0	319
7/1/06-07	0	1.000	0.0	337
7/1/07-08	0	1.000	0.0	352
7/1/08-09	0	1.000	0.0	359
7/1/09-10	0	1.000	0.0	398
7/1/10-11	0	1.000	0.0	383
7/1/11-12	0	1.000	0.0	393
7/1/12-13	1	1.000	1.0	384
7/1/13-14	0	1.000	0.0	405
7/1/14-15	0	1.000	0.0	405
7/1/15-16	0	1.002	0.0	409
7/1/16-17	0	1.013	0.0	407
<b>Total</b>	<b>3</b>		<b>3.0</b>	<b>8,202</b>

7/1/18-19

<i>Exposures Per Large Loss { Weighted Average of All Years }</i>	2,734
<i>Exposure</i>	425
<i>Forecast Number of Large Losses</i>	0.16

Column (B): Exhibit II  
Column (C): Appendix A3  
Column (D) = (B) \* (C)  
Column (E): Exhibit IV

**Calculation of Forecast Losses**

	<u>7/1/16-17</u>	<u>7/1/17-18</u>	<u>7/1/18-19</u>	<u>7/1/19-20</u>
(1) Forecast Losses less than \$50,000: { Exhibit IV }			\$53,000	
(2) Expected Number of Losses over \$50,000: { Exhibit V }			0.16	
(3) Expected Severity of Losses over \$50,000 Limited to \$250,000: { Derived from VA Association of Counties Large Loss Experience }			\$133,000	

(4) Forecast Losses Limited to \$250,000: { Line(1) + Line(2) * Line(3) for 7/1/18-19; Line(5) * Line(6) for other forecast periods }	\$67,000	\$71,000	\$74,000	\$76,000
(5) Forecast Exposure { Exhibit I }	407	418	425	425
(6) Forecast Loss Rate (per vehicle) { Line(4) / Line(5) for 7/1/18-19; 7/1/18-19 rate adjusted for trend for 7/1/16-17, 7/1/17-18 and 7/1/19-20 }	\$165	\$169	\$174	\$179

**Aggregate Loss Distribution  
For Forecast Periods**

(A) <i>Probability That Losses Will Be Less Than Or Equal to Column (B)</i>	(B) <i>Estimated 7/1/18-19 Ultimate Limited Losses</i>	(C) <i>Estimated 7/1/19-20 Ultimate Limited Losses</i>	(D) <i>Probability That Losses Will Be Greater Than Column (B)</i>
50%	\$49,000	\$50,000	50%
55%	\$54,000	\$55,000	45%
60%	\$61,000	\$63,000	40%
65%	\$68,000	\$70,000	35%
70%	\$78,000	\$80,000	30%
75%	\$90,000	\$92,000	25%
80%	\$107,000	\$110,000	20%
85%	\$129,000	\$132,000	15%
90%	\$166,000	\$170,000	10%
95%	\$242,000	\$249,000	5%
<i>Expected Losses</i>			
68%	\$74,000	\$76,000	32%
<i>Discounted at 2.5%</i>			
	\$70,000	\$72,000	

- Based on Lognormal Distribution for Small Losses,  
Inverse Weibull Distribution for Large Loss Severity  
and Poisson Distribution for Large Loss Frequency

**Estimation of Limited Ultimate Losses  
Using Loss Development Method**

Reported Method							
(A) Accident Period	(B) Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Reported Develop. Factor	(F) Ultimate on Small Claims	(G) Provision for Large Claims	(H) Estimated Ultimate Losses
7/1/94-95	\$3,353	\$0	\$3,353	1.000	\$3,400	\$0	\$3,000
7/1/95-96	\$18,395	\$0	\$18,395	1.000	\$18,400	\$0	\$18,000
7/1/96-97	\$13,214	\$0	\$13,214	1.000	\$13,200	\$0	\$13,000
7/1/97-98	\$19,700	\$0	\$19,700	1.000	\$19,700	\$0	\$20,000
7/1/98-99	\$11,376	\$0	\$11,376	1.000	\$11,400	\$0	\$11,000
7/1/99-00	\$15,316	\$0	\$15,316	1.000	\$15,300	\$0	\$15,000
7/1/00-01	\$32,819	\$0	\$32,819	1.000	\$32,800	\$0	\$33,000
7/1/01-02	\$116,482	\$0	\$116,482	1.000	\$116,500	\$0	\$117,000
7/1/02-03	\$17,543	\$0	\$17,543	1.000	\$17,500	\$0	\$18,000
7/1/03-04	\$35,067	\$0	\$35,067	1.000	\$35,100	\$0	\$35,000
7/1/04-05	\$123,899	\$0	\$123,899	1.000	\$123,900	\$0	\$124,000
7/1/05-06	\$42,764	\$0	\$42,764	1.000	\$42,800	\$0	\$43,000
7/1/06-07	\$66,223	\$0	\$66,223	1.000	\$66,200	\$0	\$66,000
7/1/07-08	\$23,803	\$0	\$23,803	1.000	\$23,800	\$0	\$24,000
7/1/08-09	\$26,281	\$0	\$26,281	1.000	\$26,300	\$0	\$26,000
7/1/09-10	\$30,280	\$0	\$30,280	1.000	\$30,300	\$0	\$30,000
7/1/10-11	\$4,321	\$0	\$4,321	1.000	\$4,300	\$0	\$4,000
7/1/11-12	\$45,045	\$0	\$45,045	1.000	\$45,000	\$0	\$45,000
7/1/12-13	\$87,990	\$0	\$87,990	1.013	\$89,100	\$0	\$89,000
7/1/13-14	\$27,294	\$0	\$27,294	1.033	\$28,200	\$0	\$28,000
7/1/14-15	\$17,861	\$0	\$17,861	1.085	\$19,400	\$0	\$19,000
7/1/15-16	\$46,689	\$0	\$46,689	1.226	\$57,300	\$0	\$57,000
7/1/16-17	\$25,478	\$0	\$25,478	1.619	\$41,300	\$0	\$41,000
Total	\$851,000	\$0	\$851,195		\$881,200	\$0	\$879,000

Paid Method							
(I) Accident Period	(J) Paid Losses	(K) Paid on Large Claims	(L) Paid on Small Claims	(M) Paid Develop. Factor	(N) Ultimate on Small Claims	(O) Provision for Large Claims	(P) Estimated Ultimate Losses
7/1/94-95	\$3,353	\$0	\$3,353	1.000	\$3,400	\$0	\$3,000
7/1/95-96	\$18,395	\$0	\$18,395	1.000	\$18,400	\$0	\$18,000
7/1/96-97	\$13,214	\$0	\$13,214	1.000	\$13,200	\$0	\$13,000
7/1/97-98	\$19,700	\$0	\$19,700	1.000	\$19,700	\$0	\$20,000
7/1/98-99	\$11,376	\$0	\$11,376	1.000	\$11,400	\$0	\$11,000
7/1/99-00	\$15,316	\$0	\$15,316	1.000	\$15,300	\$0	\$15,000
7/1/00-01	\$32,819	\$0	\$32,819	1.000	\$32,800	\$0	\$33,000
7/1/01-02	\$116,482	\$0	\$116,482	1.000	\$116,500	\$0	\$117,000
7/1/02-03	\$17,543	\$0	\$17,543	1.000	\$17,500	\$0	\$18,000
7/1/03-04	\$35,067	\$0	\$35,067	1.000	\$35,100	\$0	\$35,000
7/1/04-05	\$123,899	\$0	\$123,899	1.000	\$123,900	\$0	\$124,000
7/1/05-06	\$42,764	\$0	\$42,764	1.000	\$42,800	\$0	\$43,000
7/1/06-07	\$66,223	\$0	\$66,223	1.000	\$66,200	\$0	\$66,000
7/1/07-08	\$23,803	\$0	\$23,803	1.000	\$23,800	\$0	\$24,000
7/1/08-09	\$26,281	\$0	\$26,281	1.000	\$26,300	\$0	\$26,000
7/1/09-10	\$30,280	\$0	\$30,280	1.000	\$30,300	\$0	\$30,000
7/1/10-11	\$4,321	\$0	\$4,321	1.000	\$4,300	\$0	\$4,000
7/1/11-12	\$45,045	\$0	\$45,045	1.000	\$45,000	\$0	\$45,000
7/1/12-13	\$61,905	\$0	\$61,905	1.033	\$63,900	\$0	\$64,000
7/1/13-14	\$27,294	\$0	\$27,294	1.071	\$29,200	\$0	\$29,000
7/1/14-15	\$17,861	\$0	\$17,861	1.169	\$20,900	\$0	\$21,000
7/1/15-16	\$46,689	\$0	\$46,689	1.453	\$67,900	\$0	\$68,000
7/1/16-17	\$25,478	\$0	\$25,478	2.421	\$61,700	\$0	\$62,000
Total	\$825,000	\$0	\$825,110		\$889,500	\$0	\$889,000

Columns (B), (J): Exhibit I  
Columns (C), (K): Exhibit II  
Column (D) = (B) - (C)  
Columns (E), (M): Appendix A  
Column (F) = (D) x (E)

Columns (G), (O) = Claim count in (C) x CCDF x Specific Retention  
Column (H) = (F) + (G)  
Column (L) = (J) - (K)  
Column (N) = (L) x (M)  
Column (P) = (N) + (O)

**Estimation of Limited Ultimate Losses  
Using the Bornhuetter-Ferguson Method**

Reported Method						
(A)	(B)	(C)	(D)	(E)	(F)	(G)
Accident Period	Previous Estimate or Forecast Losses	Reported LDF	Estimated Percent Unreported	Estimated IBNR Losses	Reported Losses as of 12/31/2017	Estimated Ultimate Losses
7/1/94-95	\$3,353	1.000	0%	\$0	\$3,353	\$3,000
7/1/95-96	\$18,395	1.000	0%	\$0	\$18,395	\$18,000
7/1/96-97	\$13,214	1.000	0%	\$0	\$13,214	\$13,000
7/1/97-98	\$19,700	1.000	0%	\$0	\$19,700	\$20,000
7/1/98-99	\$11,376	1.000	0%	\$0	\$11,376	\$11,000
7/1/99-00	\$15,316	1.000	0%	\$0	\$15,316	\$15,000
7/1/00-01	\$32,819	1.000	0%	\$0	\$32,819	\$33,000
7/1/01-02	\$116,482	1.000	0%	\$0	\$116,482	\$116,000
7/1/02-03	\$17,543	1.000	0%	\$0	\$17,543	\$18,000
7/1/03-04	\$35,067	1.000	0%	\$0	\$35,067	\$35,000
7/1/04-05	\$123,899	1.000	0%	\$0	\$123,899	\$124,000
7/1/05-06	\$42,764	1.000	0%	\$0	\$42,764	\$43,000
7/1/06-07	\$66,223	1.000	0%	\$0	\$66,223	\$66,000
7/1/07-08	\$23,803	1.000	0%	\$0	\$23,803	\$24,000
7/1/08-09	\$26,281	1.000	0%	\$0	\$26,281	\$26,000
7/1/09-10	\$30,280	1.000	0%	\$0	\$30,280	\$30,000
7/1/10-11	\$4,321	1.000	0%	\$0	\$4,321	\$4,000
7/1/11-12	\$45,045	1.000	0%	\$0	\$45,045	\$45,000
7/1/12-13	\$74,000	1.013	1%	\$900	\$87,990	\$89,000
7/1/13-14	\$44,000	1.033	3%	\$1,400	\$27,294	\$29,000
7/1/14-15	\$61,000	1.085	8%	\$4,800	\$17,861	\$23,000
7/1/15-16	\$63,000	1.226	18%	\$11,600	\$46,689	\$58,000
7/1/16-17	\$67,000	1.619	38%	\$25,600	\$25,478	\$51,000
7/1/17-18	\$71,000	4.658	79%	\$55,800	\$11,929	\$68,000
Total	\$1,026,000			\$100,000	\$863,124	\$962,000

Paid Method						
(H)	(I)	(J)	(K)	(L)	(M)	(N)
Accident Period	Previous Estimate or Forecast Losses	Paid LDF	Estimated Percent Unpaid	Estimated Unpaid Losses	Paid Losses as of 12/31/2017	Estimated Ultimate Losses
7/1/94-95	\$3,353	1.000	0%	\$0	\$3,353	\$3,000
7/1/95-96	\$18,395	1.000	0%	\$0	\$18,395	\$18,000
7/1/96-97	\$13,214	1.000	0%	\$0	\$13,214	\$13,000
7/1/97-98	\$19,700	1.000	0%	\$0	\$19,700	\$20,000
7/1/98-99	\$11,376	1.000	0%	\$0	\$11,376	\$11,000
7/1/99-00	\$15,316	1.000	0%	\$0	\$15,316	\$15,000
7/1/00-01	\$32,819	1.000	0%	\$0	\$32,819	\$33,000
7/1/01-02	\$116,482	1.000	0%	\$0	\$116,482	\$116,000
7/1/02-03	\$17,543	1.000	0%	\$0	\$17,543	\$18,000
7/1/03-04	\$35,067	1.000	0%	\$0	\$35,067	\$35,000
7/1/04-05	\$123,899	1.000	0%	\$0	\$123,899	\$124,000
7/1/05-06	\$42,764	1.000	0%	\$0	\$42,764	\$43,000
7/1/06-07	\$66,223	1.000	0%	\$0	\$66,223	\$66,000
7/1/07-08	\$23,803	1.000	0%	\$0	\$23,803	\$24,000
7/1/08-09	\$26,281	1.000	0%	\$0	\$26,281	\$26,000
7/1/09-10	\$30,280	1.000	0%	\$0	\$30,280	\$30,000
7/1/10-11	\$4,321	1.000	0%	\$0	\$4,321	\$4,000
7/1/11-12	\$45,045	1.000	0%	\$0	\$45,045	\$45,000
7/1/12-13	\$74,000	1.033	3%	\$2,400	\$61,905	\$64,000
7/1/13-14	\$44,000	1.071	7%	\$2,900	\$27,294	\$30,000
7/1/14-15	\$61,000	1.169	14%	\$8,800	\$17,861	\$27,000
7/1/15-16	\$63,000	1.453	31%	\$19,700	\$46,689	\$66,000
7/1/16-17	\$67,000	2.421	59%	\$39,300	\$25,478	\$65,000
7/1/17-18	\$71,000	9.621	90%	\$63,600	\$7,647	\$71,000
Total	\$1,026,000			\$137,000	\$832,758	\$967,000

Columns (B), (I): Prior analysis; Exhibit VI for 2016-17 and 2017-18  
Columns (C), (J): Appendix A  
Column (D) =  $[1 - 1 / (C)]$   
Columns (E) = (B) x (D)  
Column (F), (M): Exhibit I

Column (G) = (E) + (F)  
Column (K) =  $[1 - 1 / (J)]$   
Column (L) = (I) x (K)  
Column (N) = (L) + (M)



***Summary and Selection of Limited Ultimate Losses***

(A) <i>Accident Period</i>	(B) <i>Prior Estimate or Forecast</i>	(C) <i>Reported Loss Development Method</i>	(D) <i>Paid Loss Development Method</i>	(E) <i>Reported Bornhuetter- Ferguson Method</i>	(F) <i>Paid Bornhuetter- Ferguson Method</i>	(G) <i>Selected Ultimate Losses</i>
7/1/94-95	\$3,353	\$3,000	\$3,000	\$3,000	\$3,000	<b>\$3,353</b>
7/1/95-96	\$18,395	\$18,000	\$18,000	\$18,000	\$18,000	<b>\$18,395</b>
7/1/96-97	\$13,214	\$13,000	\$13,000	\$13,000	\$13,000	<b>\$13,214</b>
7/1/97-98	\$19,700	\$20,000	\$20,000	\$20,000	\$20,000	<b>\$19,700</b>
7/1/98-99	\$11,376	\$11,000	\$11,000	\$11,000	\$11,000	<b>\$11,376</b>
7/1/99-00	\$15,316	\$15,000	\$15,000	\$15,000	\$15,000	<b>\$15,316</b>
7/1/00-01	\$32,819	\$33,000	\$33,000	\$33,000	\$33,000	<b>\$32,819</b>
7/1/01-02	\$116,482	\$117,000	\$117,000	\$116,000	\$116,000	<b>\$116,482</b>
7/1/02-03	\$17,543	\$18,000	\$18,000	\$18,000	\$18,000	<b>\$17,543</b>
7/1/03-04	\$35,067	\$35,000	\$35,000	\$35,000	\$35,000	<b>\$35,067</b>
7/1/04-05	\$123,899	\$124,000	\$124,000	\$124,000	\$124,000	<b>\$123,899</b>
7/1/05-06	\$42,764	\$43,000	\$43,000	\$43,000	\$43,000	<b>\$42,764</b>
7/1/06-07	\$66,223	\$66,000	\$66,000	\$66,000	\$66,000	<b>\$66,223</b>
7/1/07-08	\$23,803	\$24,000	\$24,000	\$24,000	\$24,000	<b>\$23,803</b>
7/1/08-09	\$26,281	\$26,000	\$26,000	\$26,000	\$26,000	<b>\$26,281</b>
7/1/09-10	\$30,280	\$30,000	\$30,000	\$30,000	\$30,000	<b>\$30,280</b>
7/1/10-11	\$4,321	\$4,000	\$4,000	\$4,000	\$4,000	<b>\$4,321</b>
7/1/11-12	\$45,045	\$45,000	\$45,000	\$45,000	\$45,000	<b>\$45,045</b>
7/1/12-13	\$74,000	\$89,000	\$64,000	\$89,000	\$64,000	<b>\$89,000</b>
7/1/13-14	\$44,000	\$28,000	\$29,000	\$29,000	\$30,000	<b>\$27,294</b>
7/1/14-15	\$61,000	\$19,000	\$21,000	\$23,000	\$27,000	<b>\$17,861</b>
7/1/15-16	\$63,000	\$57,000	\$68,000	\$58,000	\$66,000	<b>\$58,000</b>
7/1/16-17	\$67,000	\$41,000	\$62,000	\$51,000	\$65,000	<b>\$51,000</b>
7/1/17-18	\$71,000	--	--	\$68,000	\$71,000	<b>\$71,000</b>
<b>Total</b>	<b>\$1,026,000</b>	<b>\$879,000</b>	<b>\$889,000</b>	<b>\$962,000</b>	<b>\$967,000</b>	<b>\$960,000</b>

Column (B): Prior analysis as of 12/31/2015; Exhibit VI for 2016-17 and 2017-18

Columns (C), (D): Exhibit VIII

Columns (E), (F): Exhibit IX

Column (G): Limited reported losses for 94-95 through 11-12 and 13-14 through 14-15

Column (C) for 12-13

Column (E) for 15-16 and 16-17

Column (B) for 17-18

**Estimated Ultimate Reported Claims  
and Claim Frequencies**

(A)	(B)	(C)	(D)	(E)	(F)
Accident Period	Number of Claims	Claim Development Factor	Estimated Ultimate Claims	Exposure	Claim Frequency*
7/1/94-95	4	1.000	4.0	326	1.2
7/1/95-96	16	1.000	16.0	327	4.9
7/1/96-97	7	1.000	7.0	328	2.1
7/1/97-98	10	1.000	10.0	329	3.0
7/1/98-99	7	1.000	7.0	330	2.1
7/1/99-00	14	1.000	14.0	321	4.4
7/1/00-01	23	1.000	23.0	335	6.9
7/1/01-02	18	1.000	18.0	343	5.2
7/1/02-03	18	1.000	18.0	347	5.2
7/1/03-04	22	1.000	22.0	351	6.3
7/1/04-05	11	1.000	11.0	314	3.5
7/1/05-06	17	1.000	17.0	319	5.3
7/1/06-07	14	1.000	14.0	337	4.2
7/1/07-08	17	1.000	17.0	352	4.8
7/1/08-09	25	1.000	25.0	359	7.0
7/1/09-10	9	1.000	9.0	398	2.3
7/1/10-11	10	1.000	10.0	383	2.6
7/1/11-12	18	1.000	18.0	393	4.6
7/1/12-13	10	1.000	10.0	384	2.6
7/1/13-14	12	1.000	12.0	405	3.0
7/1/14-15	9	1.000	9.0	405	2.2
7/1/15-16	23	1.002	23.0	409	5.6
7/1/16-17	26	1.013	26.3	407	6.5
<b>Total</b>	<b>340</b>		<b>340.4</b>	<b>8,202</b>	<b>4.2</b>

	<u>7/1/17-18</u>	<u>7/1/18-19</u>
(1) Selected Claim Frequency { Weighted Average of All Years }	4.2	4.2
(2) Projected Exposure { Exhibit I }	418	425
(3) Forecast Ultimate Claims: { Line (1) x Line (2) / 100 }	17.3	17.6
(4) Estimated claims unreported { (1 - 1 / CCDF) x (3) }	9.5	
(5) Reported claims { Exhibit I }	13	
(6) Estimate of Ultimate Claims { (4) + (5) or (3) }	22.5	17.6

\* Shown as claims per 100 vehicles

Columns (B), (E): Exhibit I

Column (C): Appendix A3

Column (D) = (B) \* (C)

Column (F) = (D) / (E) \* 100

***Estimation of Claim Severities***

(A)	(B)	(C)	(D)	(E)	(F)
<i>Accident Period</i>	<i>Estimated Ultimate Claims</i>	<i>Selected Estimated Ultimate Losses</i>	<i>Estimated Ultimate Severity</i>	<i>Exposure</i>	<i>Cost per Vehicle</i>
7/1/94-95	4.0	\$3,353	\$800	326	\$10
7/1/95-96	16.0	\$18,395	\$1,100	327	\$56
7/1/96-97	7.0	\$13,214	\$1,900	328	\$40
7/1/97-98	10.0	\$19,700	\$2,000	329	\$60
7/1/98-99	7.0	\$11,376	\$1,600	330	\$34
7/1/99-00	14.0	\$15,316	\$1,100	321	\$48
7/1/00-01	23.0	\$32,819	\$1,400	335	\$98
7/1/01-02	18.0	\$116,482	\$6,500	343	\$340
7/1/02-03	18.0	\$17,543	\$1,000	347	\$51
7/1/03-04	22.0	\$35,067	\$1,600	351	\$100
7/1/04-05	11.0	\$123,899	\$11,300	314	\$395
7/1/05-06	17.0	\$42,764	\$2,500	319	\$134
7/1/06-07	14.0	\$66,223	\$4,700	337	\$197
7/1/07-08	17.0	\$23,803	\$1,400	352	\$68
7/1/08-09	25.0	\$26,281	\$1,100	359	\$73
7/1/09-10	9.0	\$30,280	\$3,400	398	\$76
7/1/10-11	10.0	\$4,321	\$400	383	\$11
7/1/11-12	18.0	\$45,045	\$2,500	393	\$115
7/1/12-13	10.0	\$89,000	\$8,900	384	\$232
7/1/13-14	12.0	\$27,294	\$2,300	405	\$67
7/1/14-15	9.0	\$17,861	\$2,000	405	\$44
7/1/15-16	23.0	\$58,000	\$2,500	409	\$142
7/1/16-17	26.3	\$51,000	\$1,900	407	\$125
7/1/17-18	22.5	\$71,000	\$3,200	418	\$170
7/1/18-19	17.6	\$74,000	\$4,200	425	\$174
<b>Total</b>	<b>380.5</b>	<b>\$1,034,000</b>	<b>\$2,700</b>	<b>9,045</b>	<b>\$114</b>

Columns (B), (E): Exhibit XI, page 1  
Column (C): Exhibit X; Exhibit VI for the forecast period  
Column (D) = (C) / (B)  
Column (E) = Exhibit I  
Column (F) = (C) / (E)

**Calculation of Required Reserves  
As of December 31, 2017**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Accident Period	Selected Ultimate Losses	Limited Paid Losses	Limited Reported Losses	Case Reserves	IBNR Reserves	Total Required Reserves	Discount Factor at 2.5%	Total Discounted Reserves at 2.5%
7/1/94-95	\$3,353	\$3,353	\$3,353	\$0	\$0	\$0	1.000	\$0
7/1/95-96	\$18,395	\$18,395	\$18,395	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$13,214	\$13,214	\$13,214	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$19,700	\$19,700	\$19,700	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$11,376	\$11,376	\$11,376	\$0	\$0	\$0	1.000	\$0
7/1/99-00	\$15,316	\$15,316	\$15,316	\$0	\$0	\$0	1.000	\$0
7/1/00-01	\$32,819	\$32,819	\$32,819	\$0	\$0	\$0	1.000	\$0
7/1/01-02	\$116,482	\$116,482	\$116,482	\$0	\$0	\$0	1.000	\$0
7/1/02-03	\$17,543	\$17,543	\$17,543	\$0	\$0	\$0	1.000	\$0
7/1/03-04	\$35,067	\$35,067	\$35,067	\$0	\$0	\$0	1.000	\$0
7/1/04-05	\$123,899	\$123,899	\$123,899	\$0	\$0	\$0	1.000	\$0
7/1/05-06	\$42,764	\$42,764	\$42,764	\$0	\$0	\$0	1.000	\$0
7/1/06-07	\$66,223	\$66,223	\$66,223	\$0	\$0	\$0	1.000	\$0
7/1/07-08	\$23,803	\$23,803	\$23,803	\$0	\$0	\$0	1.000	\$0
7/1/08-09	\$26,281	\$26,281	\$26,281	\$0	\$0	\$0	1.000	\$0
7/1/09-10	\$30,280	\$30,280	\$30,280	\$0	\$0	\$0	1.000	\$0
7/1/10-11	\$4,321	\$4,321	\$4,321	\$0	\$0	\$0	1.000	\$0
7/1/11-12	\$45,045	\$45,045	\$45,045	\$0	\$0	\$0	1.000	\$0
7/1/12-13	\$89,000	\$61,905	\$87,990	\$26,085	\$1,000	\$27,000	0.988	\$26,700
7/1/13-14	\$27,294	\$27,294	\$27,294	\$0	\$0	\$0	0.976	\$0
7/1/14-15	\$17,861	\$17,861	\$17,861	\$0	\$0	\$0	0.972	\$0
7/1/15-16	\$58,000	\$46,689	\$46,689	\$0	\$11,000	\$11,000	0.969	\$10,700
7/1/16-17	\$51,000	\$25,478	\$25,478	\$0	\$26,000	\$26,000	0.965	\$25,100
7/1-12/31/17	\$36,000	\$7,647	\$11,929	\$4,282	\$24,000	\$28,000	0.958	\$26,800
<b>Total</b>	<b>\$925,000</b>	<b>\$832,758</b>	<b>\$863,124</b>	<b>\$30,366</b>	<b>\$62,000</b>	<b>\$92,000</b>		<b>\$89,000</b>
1/1-6/30/18	\$35,000							

Column (B): Exhibit X; prorated for 7/1/17-18

Columns (C), (D): Exhibit IX

Column (E) = (D) - (C)

Column (F) = (B) - (D)

Column (G) = (E) + (F)

Column (H): Appendix D

Column (I) = (G) \* (H)

***Estimated Outstanding Losses  
At Various Confidence Levels  
As of December 31, 2017***

<i>Confidence Level</i>	<i>(A) Estimated Ultimate Losses</i>	<i>(B) Limited Paid Losses</i>	<i>(C) Limited Reported Losses</i>	<i>(D) Case Reserves</i>	<i>(E) Estimated Unreported Losses</i>	<i>(F) Estimated Outstanding Losses</i>	<i>(G) Discount Factor at 2.5%</i>	<i>(H) Discounted Outstanding Losses</i>
50%	\$923,000	\$832,758	\$863,124	\$30,366	\$59,900	\$90,200	0.967	\$87,300
55%	\$926,000	\$832,758	\$863,124	\$30,366	\$62,900	\$93,200	0.967	\$90,200
60%	\$928,000	\$832,758	\$863,124	\$30,366	\$64,900	\$95,200	0.967	\$92,100
65%	\$932,000	\$832,758	\$863,124	\$30,366	\$68,900	\$99,200	0.967	\$96,000
70%	\$935,000	\$832,758	\$863,124	\$30,366	\$71,900	\$102,200	0.967	\$98,900
75%	\$939,000	\$832,758	\$863,124	\$30,366	\$75,900	\$106,200	0.967	\$102,700
80%	\$943,000	\$832,758	\$863,124	\$30,366	\$79,900	\$110,200	0.967	\$106,600
85%	\$948,000	\$832,758	\$863,124	\$30,366	\$84,900	\$115,200	0.967	\$111,400
90%	\$956,000	\$832,758	\$863,124	\$30,366	\$92,900	\$123,200	0.967	\$119,200
95%	\$968,000	\$832,758	\$863,124	\$30,366	\$104,900	\$135,200	0.967	\$130,800

*Column (A): Based on Lognormal Fit to Historical Development Experience of Virginia Association of Counties*

*Columns (B), (C): Exhibit XII, page 1*

*Column (D) = (C) - (B)*

*Column (E) = (A) - (C)*

*Column (F) = (A) - (B) = (D) + (E)*

*Column (G): Average Discount from Exhibit XII, page 1*

*Column (H) = (F) \* (G)*

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 1/1-6/30/18	Paid During 2018-19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28
7/1/94-95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/95-96	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/01-02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/02-03	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/03-04	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/04-05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/06-07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/07-08	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/08-09	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/09-10	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/10-11	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/11-12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/12-13	\$27,000	\$27,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/13-14	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/14-15	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/15-16	\$11,000	\$3,400	\$4,100	\$1,800	\$1,600	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/16-17	\$26,000	\$6,500	\$10,000	\$5,200	\$2,300	\$2,000	\$0	\$0	\$0	\$0	\$0	\$0
7/1-12/31/17	\$28,000	\$5,100	\$9,100	\$7,100	\$3,600	\$1,600	\$1,400	\$0	\$0	\$0	\$0	\$0
Subtotal	\$92,000	\$42,000	\$23,200	\$14,100	\$7,500	\$3,600	\$1,400	\$0	\$0	\$0	\$0	\$0
1/1-6/30/18	\$35,000	\$6,000	\$11,300	\$8,800	\$4,600	\$2,000	\$1,800	\$0	\$0	\$0	\$0	\$0
7/1/18-19	\$76,000	--	\$20,400	\$22,100	\$17,200	\$8,900	\$4,000	\$3,500	\$0	\$0	\$0	\$0
Total	\$203,000	\$48,000	\$54,900	\$45,000	\$29,300	\$14,500	\$7,200	\$3,500	\$0	\$0	\$0	\$0

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A2 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 12/31/17)]\}$ .

**Projected Payment Pattern  
At Various Confidence Levels  
for Accident Periods 94-95 through 18-19**

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
					Projected Limited		
Aggregate Percentile	Limited Ultimate Losses	Limited Outstanding & Forecast Losses	Limited Paid Losses as of 12/31/2017	Projected Paid Losses as of 6/30/2018	Outstanding & Forecast Losses as of 6/30/2018	Projected Paid Losses as of 6/30/2019	Projected Outstanding Losses as of 6/30/2019
50%	\$1,011,000	\$178,000	\$832,758	\$875,000	\$136,000	\$923,200	\$87,800
55%	\$1,019,000	\$186,000	\$832,758	\$877,000	\$142,000	\$927,300	\$91,700
60%	\$1,028,000	\$195,000	\$832,758	\$879,000	\$149,000	\$931,800	\$96,200
65%	\$1,038,000	\$205,000	\$832,758	\$881,000	\$157,000	\$936,600	\$101,400
70%	\$1,048,000	\$215,000	\$832,758	\$884,000	\$164,000	\$942,100	\$105,900
75%	\$1,061,000	\$228,000	\$832,758	\$887,000	\$174,000	\$948,600	\$112,400
80%	\$1,078,000	\$245,000	\$832,758	\$891,000	\$187,000	\$957,200	\$120,800
85%	\$1,100,000	\$267,000	\$832,758	\$896,000	\$204,000	\$968,300	\$131,700
90%	\$1,133,000	\$300,000	\$832,758	\$904,000	\$229,000	\$985,100	\$147,900
95%	\$1,204,000	\$371,000	\$832,758	\$920,000	\$284,000	\$1,020,600	\$183,400
<i>Expected</i>	\$1,034,000	\$203,000	\$832,758	\$881,000	\$153,000	\$936,000	\$98,000

Column (A): Percentile estimates are based on a lognormal distribution.

Column (B) = (C) - (A)

Column (C): Exhibit XII, page 2

Column (D) = { (% of outstanding as of 12/31/17 expected to be paid during 1/1-6/30/18 from Exhibit XIII, page 1) \* (B) } + (C)

Column (E) = (A) - (D)

Column (F) = { (% of outstanding as of 6/30/18 expected to be paid during 2018-19 from Exhibit XIII, page 1) \* (E) } + (D)

Column (G) = (A) - (F)

Comparison of Results with Report Valued as of December 31, 2015

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Reported Losses 12/31/2015	Expected Reported Losses 12/31/2017	Actual Reported Losses 12/31/2017	Percent Difference	Estimated Ultimate Losses 12/31/2015	Estimated Ultimate Losses 12/31/2017	Percent Difference
7/1/94-95	\$3,353	\$3,353	\$3,353	0%	\$3,353	\$3,353	0%
7/1/95-96	\$18,395	\$18,395	\$18,395	0%	\$18,395	\$18,395	0%
7/1/96-97	\$13,214	\$13,214	\$13,214	0%	\$13,214	\$13,214	0%
7/1/97-98	\$19,700	\$19,700	\$19,700	0%	\$19,700	\$19,700	0%
7/1/98-99	\$11,376	\$11,376	\$11,376	0%	\$11,376	\$11,376	0%
7/1/99-00	\$15,316	\$15,316	\$15,316	0%	\$15,316	\$15,316	0%
7/1/00-01	\$32,819	\$32,819	\$32,819	0%	\$32,819	\$32,819	0%
7/1/01-02	\$116,482	\$116,482	\$116,482	0%	\$116,482	\$116,482	0%
7/1/02-03	\$17,543	\$17,543	\$17,543	0%	\$17,543	\$17,543	0%
7/1/03-04	\$35,067	\$35,067	\$35,067	0%	\$35,067	\$35,067	0%
7/1/04-05	\$123,899	\$123,899	\$123,899	0%	\$123,899	\$123,899	0%
7/1/05-06	\$42,764	\$42,764	\$42,764	0%	\$42,764	\$42,764	0%
7/1/06-07	\$66,223	\$66,223	\$66,223	0%	\$66,223	\$66,223	0%
7/1/07-08	\$23,803	\$23,803	\$23,803	0%	\$23,803	\$23,803	0%
7/1/08-09	\$26,281	\$26,281	\$26,281	0%	\$26,281	\$26,281	0%
7/1/09-10	\$30,280	\$30,280	\$30,280	0%	\$30,280	\$30,280	0%
7/1/10-11	\$4,321	\$4,321	\$4,321	0%	\$4,321	\$4,321	0%
7/1/11-12	\$45,045	\$45,045	\$45,045	0%	\$45,045	\$45,045	0%
7/1/12-13	\$70,088	\$73,274	\$87,990	20%	\$74,000	\$89,000	20%
7/1/13-14	\$27,294	\$41,156	\$27,294	-34%	\$44,000	\$27,294	-38%
7/1/14-15	\$17,861	\$53,186	\$17,861	-66%	\$61,000	\$17,861	-71%
7/1/15-16	\$22,278	\$53,426	\$46,689	-13%	\$63,000	\$58,000	-8%
7/1/16-17		\$36,060	\$25,478	-29%	\$65,000	\$51,000	-22%
7/1/17-18		\$11,496	\$11,929	4%	\$73,000	\$71,000	-3%
Total	\$783,403	\$914,482	\$863,124	-6%	\$1,026,000	\$960,000	-6%

Variance from Expected (\$51,358)

Change in Ultimates (\$66,000)

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Paid Losses 12/31/2015	Expected Paid Losses 12/31/2017	Actual Paid Losses 12/31/2017	Percent Difference	Estimated Ultimate Losses 12/31/2015	Estimated Ultimate Losses 12/31/2017	Percent Difference
7/1/94-95	\$3,353	\$3,353	\$3,353	0%	\$3,353	\$3,353	0%
7/1/95-96	\$18,395	\$18,395	\$18,395	0%	\$18,395	\$18,395	0%
7/1/96-97	\$13,214	\$13,214	\$13,214	0%	\$13,214	\$13,214	0%
7/1/97-98	\$19,700	\$19,700	\$19,700	0%	\$19,700	\$19,700	0%
7/1/98-99	\$11,376	\$11,376	\$11,376	0%	\$11,376	\$11,376	0%
7/1/99-00	\$15,316	\$15,316	\$15,316	0%	\$15,316	\$15,316	0%
7/1/00-01	\$32,819	\$32,819	\$32,819	0%	\$32,819	\$32,819	0%
7/1/01-02	\$116,482	\$116,482	\$116,482	0%	\$116,482	\$116,482	0%
7/1/02-03	\$17,543	\$17,543	\$17,543	0%	\$17,543	\$17,543	0%
7/1/03-04	\$35,067	\$35,067	\$35,067	0%	\$35,067	\$35,067	0%
7/1/04-05	\$123,899	\$123,899	\$123,899	0%	\$123,899	\$123,899	0%
7/1/05-06	\$42,764	\$42,764	\$42,764	0%	\$42,764	\$42,764	0%
7/1/06-07	\$66,223	\$66,223	\$66,223	0%	\$66,223	\$66,223	0%
7/1/07-08	\$23,803	\$23,803	\$23,803	0%	\$23,803	\$23,803	0%
7/1/08-09	\$26,281	\$26,281	\$26,281	0%	\$26,281	\$26,281	0%
7/1/09-10	\$30,280	\$30,280	\$30,280	0%	\$30,280	\$30,280	0%
7/1/10-11	\$4,321	\$4,321	\$4,321	0%	\$4,321	\$4,321	0%
7/1/11-12	\$45,045	\$45,045	\$45,045	0%	\$45,045	\$45,045	0%
7/1/12-13	\$59,390	\$70,298	\$61,905	-12%	\$74,000	\$89,000	20%
7/1/13-14	\$27,294	\$40,216	\$27,294	-32%	\$44,000	\$27,294	-38%
7/1/14-15	\$17,861	\$50,839	\$17,861	-65%	\$61,000	\$17,861	-71%
7/1/15-16	\$22,278	\$49,715	\$46,689	-6%	\$63,000	\$58,000	-8%
7/1/16-17		\$26,791	\$25,478	-5%	\$65,000	\$51,000	-22%
7/1/17-18		\$6,531	\$7,647	17%	\$73,000	\$71,000	-3%
Total	\$772,705	\$890,273	\$832,758	-6%	\$1,026,000	\$960,000	-6%

Columns (B), (F): From previous actuarial report

Column (C): Derived using LDF's from previous actuarial report

Column (D): Exhibit I, limited to retention

Column (E) = [(D) / (C)] - 1

Column (G): Exhibit V

Column (H) = [(G) / (F)] - 1



***Funding at the Expected Level***

(1) <i>Estimated Outstanding Losses as of 12/31/17</i> <i>{ Exhibit XII-1 }</i>	\$92,000
(2) <i>Forecast Losses for 1/1-6/30/18</i> <i>{ Exhibit XII-1 }</i>	\$35,000
<hr/>	
<b>(3) <i>Required Funding as of 12/31/17</i></b> <b><i>{ (1) + (2) }</i></b>	<b>\$127,000</b>
(4) <i>Projected Payments during 1/1-6/30/18</i> <i>{ Exhibit XIII-1 }</i>	\$48,000
(5) <i>Estimated Outstanding Losses as of 6/30/18</i> <i>{ (3) – (4) }</i>	\$79,000
(6) <i>Forecast Losses for 7/1/18-19</i> <i>{ Exhibit VI }</i>	\$74,000
<hr/>	
<b>(7) <i>Required Funding as of 6/30/18</i></b> <b><i>{ (5) + (6) }</i></b>	<b>\$153,000</b>
(8) <i>Projected Payments during 7/1/18-19</i> <i>{ Exhibit XIII-1 }</i>	\$55,000
(9) <i>Estimated Outstanding Losses as of 6/30/19</i> <i>{ (7) – (8) }</i>	\$98,000
(10) <i>Forecast Losses for 7/1/19-20</i> <i>{ Exhibit VI }</i>	\$76,000
<hr/>	
<b>(11) <i>Required Funding as of 6/30/19</i></b> <b><i>{ (9) + (10) }</i></b>	<b>\$174,000</b>

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## Exhibits: General Liability

The “Analysis” section of this report presents a discussion of the following exhibits:

Exhibit I	Summary of Experience
Exhibit II	Summary of Claims Over \$30,000
Exhibit III	Estimation of Ultimate Small Losses at 7/1/18-19 Cost Level
Exhibit IV	Calculation of Forecast Small Losses
Exhibit V	OMITTED
Exhibit VI	Calculation of Forecast Losses
Exhibit VII	Forecast Losses at Various Confidence Levels
Exhibit VIII	Estimation of Ultimate Losses: Loss Development Methods
Exhibit IX	Estimation of Ultimate Losses: Bornhuetter/Ferguson Methods
Exhibit X	Selection of Ultimate Limited Loss Estimates
Exhibit XI	Estimated Ultimate Claims Estimation of Claim Severities
Exhibit XII	Calculation of Required Reserves Estimated Outstanding Losses at Various Confidence Levels
Exhibit XIII	Projection of Loss Payments Over the Next Ten Years Projected Payment Pattern at Various Confidence Levels
Exhibit XIV	Comparison of Results: Current to Prior Estimates
Exhibit XV	Required Funding

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**Summary of Experience\***

(A)		(B)	(C)	(D)	(E)	(F)	(G) Net Operating Expenditures (thousands)+
Period Begin	End	Evaluation Date	Maturity (months)	Reported Claims	Paid Losses	Reported Losses	
7/1/1994	6/30/1995	12/31/2017	282	11	\$1,216	\$1,216	\$22,956
7/1/1995	6/30/1996	12/31/2017	270	12	\$70	\$70	\$23,160
7/1/1996	6/30/1997	12/31/2017	258	10	\$1,745	\$1,745	\$23,718
7/1/1997	6/30/1998	12/31/2017	246	32	\$5,850	\$5,850	\$25,535
7/1/1998	6/30/1999	12/31/2017	234	17	\$36,007	\$36,007	\$25,360
7/1/1999	6/30/2000	12/31/2017	222	17	\$28,350	\$28,350	\$30,033
7/1/2000	6/30/2001	12/31/2017	210	10	\$3,429	\$3,429	\$31,910
7/1/2001	6/30/2002	12/31/2017	198	9	\$3,276	\$3,276	\$33,165
7/1/2002	6/30/2003	12/31/2017	186	20	\$23,269	\$23,269	\$33,608
7/1/2003	6/30/2004	12/31/2017	174	17	\$9,501	\$9,501	\$34,610
7/1/2004	6/30/2005	12/31/2017	162	8	\$298	\$298	\$30,210
7/1/2005	6/30/2006	12/31/2017	150	7	\$0	\$0	\$31,399
7/1/2006	6/30/2007	12/31/2017	138	5	\$1,417	\$1,417	\$31,742
7/1/2007	6/30/2008	12/31/2017	126	5	\$15,813	\$15,813	\$32,862
7/1/2008	6/30/2009	12/31/2017	114	10	\$17,156	\$17,156	\$33,188
7/1/2009	6/30/2010	12/31/2017	102	4	\$544	\$544	\$34,685
7/1/2010	6/30/2011	12/31/2017	90	6	\$1,380	\$1,380	\$36,492
7/1/2011	6/30/2012	12/31/2017	78	1	\$103	\$103	\$36,858
7/1/2012	6/30/2013	12/31/2017	66	0	\$0	\$0	\$35,117
7/1/2013	6/30/2014	12/31/2017	54	3	\$5,858	\$5,858	\$39,599
7/1/2014	6/30/2015	12/31/2017	42	3	\$50	\$50	\$41,462
7/1/2015	6/30/2016	12/31/2017	30	14	\$7,129	\$7,129	\$42,695
7/1/2016	6/30/2017	12/31/2017	18	16	\$28,813	\$46,425	\$43,983
7/1/2017	6/30/2018	12/31/2017	6	10	\$1,109	\$1,109	\$43,983
7/1/2018	6/30/2019						\$44,862
7/1/2019	6/30/2020						\$45,760
Total				247	\$192,382	\$209,994	\$888,951

\* Loss and exposure information supplied by VACO

+ Estimated for 2017-18 through 2019-20

**Summary of Claims over \$30,000**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
<i>Claim Number</i>	<i>Accident Date</i>	<i>Paid Losses</i>	<i>Reported Losses</i>	<i>Historical Retention</i>	<i>Severity Development Factor</i>	<i>Developed Losses</i>	<i>Trend Factor to 7/1/18-19</i>	<i>Trended Developed Losses</i>
771998000655	10/19/1998	\$30,448	\$30,448	\$250,000	1.000	\$30,448	1.947	\$59,293
772017184570	1/24/2017	\$25,544	\$35,000	\$250,000	2.062	\$72,176	1.046	\$75,523

Columns (A) through (E): Provided by VACO

Column (F) = RLDF/CCDF

Column (G) = (D) \* (F)

Column (H): Appendix B

Column (I) = (G) \* (H)

**Estimation of Ultimate Limited Losses Less Than \$50,000  
At the 2018-19 Loss Level  
Using Loss Development Method**

Reported Method						
(A) Accident Period	(B) Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Trend Factor to 7/1/18-19	(F) Reported Develop. Factor	(G) Ultimate on Small Claims
7/1/94-95	\$1,216	\$0	\$1,216	2.254	1.000	\$2,700
7/1/95-96	\$70	\$0	\$70	2.179	1.000	\$200
7/1/96-97	\$1,745	\$0	\$1,745	2.100	1.000	\$3,700
7/1/97-98	\$5,850	\$0	\$5,850	2.023	1.000	\$11,800
7/1/98-99	\$36,007	\$30,448	\$5,559	1.947	1.000	\$10,800
7/1/99-00	\$28,350	\$0	\$28,350	1.864	1.000	\$52,800
7/1/00-01	\$3,429	\$0	\$3,429	1.799	1.000	\$6,200
7/1/01-02	\$3,276	\$0	\$3,276	1.735	1.000	\$5,700
7/1/02-03	\$23,269	\$0	\$23,269	1.665	1.000	\$38,700
7/1/03-04	\$9,501	\$0	\$9,501	1.596	1.000	\$15,200
7/1/04-05	\$298	\$0	\$298	1.521	1.000	\$500
7/1/05-06	\$0	\$0	\$0	1.453	1.000	\$0
7/1/06-07	\$1,417	\$0	\$1,417	1.392	1.000	\$2,000
7/1/07-08	\$15,813	\$0	\$15,813	1.337	1.000	\$21,100
7/1/08-09	\$17,156	\$0	\$17,156	1.299	1.000	\$22,300
7/1/09-10	\$544	\$0	\$544	1.270	1.000	\$700
7/1/10-11	\$1,380	\$0	\$1,380	1.232	1.000	\$1,700
7/1/11-12	\$103	\$0	\$103	1.192	1.000	\$100
7/1/12-13	\$0	\$0	\$0	1.159	1.103	\$0
7/1/13-14	\$5,858	\$0	\$5,858	1.129	1.163	\$7,700
7/1/14-15	\$50	\$0	\$50	1.098	1.278	\$100
7/1/15-16	\$7,129	\$0	\$7,129	1.070	1.527	\$11,600
7/1/16-17	\$46,425	\$35,000	\$11,425	1.046	2.177	\$26,000
Total	\$208,885	\$65,448	\$143,437			\$241,600

Paid Method						
(H) Accident Period	(I) Paid Losses	(J) Paid on Large Claims	(K) Paid on Small Claims	(L) Trend Factor to 7/1/18-19	(M) Paid Develop. Factor	(N) Ultimate on Small Claims
7/1/94-95	\$1,216	\$0	\$1,216	2.254	1.000	\$2,700
7/1/95-96	\$70	\$0	\$70	2.179	1.000	\$200
7/1/96-97	\$1,745	\$0	\$1,745	2.100	1.000	\$3,700
7/1/97-98	\$5,850	\$0	\$5,850	2.023	1.000	\$11,800
7/1/98-99	\$36,007	\$30,448	\$5,559	1.947	1.000	\$10,800
7/1/99-00	\$28,350	\$0	\$28,350	1.864	1.000	\$52,800
7/1/00-01	\$3,429	\$0	\$3,429	1.799	1.000	\$6,200
7/1/01-02	\$3,276	\$0	\$3,276	1.735	1.000	\$5,700
7/1/02-03	\$23,269	\$0	\$23,269	1.665	1.000	\$38,700
7/1/03-04	\$9,501	\$0	\$9,501	1.596	1.000	\$15,200
7/1/04-05	\$298	\$0	\$298	1.521	1.000	\$500
7/1/05-06	\$0	\$0	\$0	1.453	1.000	\$0
7/1/06-07	\$1,417	\$0	\$1,417	1.392	1.000	\$2,000
7/1/07-08	\$15,813	\$0	\$15,813	1.337	1.000	\$21,100
7/1/08-09	\$17,156	\$0	\$17,156	1.299	1.000	\$22,300
7/1/09-10	\$544	\$0	\$544	1.270	1.000	\$700
7/1/10-11	\$1,380	\$0	\$1,380	1.232	1.000	\$1,700
7/1/11-12	\$103	\$0	\$103	1.192	1.000	\$100
7/1/12-13	\$0	\$0	\$0	1.159	1.129	\$0
7/1/13-14	\$5,858	\$0	\$5,858	1.129	1.209	\$8,000
7/1/14-15	\$50	\$0	\$50	1.098	1.375	\$100
7/1/15-16	\$7,129	\$0	\$7,129	1.070	1.787	\$13,600
7/1/16-17	\$28,813	\$25,544	\$3,269	1.046	3.180	\$10,900
Total	\$191,273	\$55,992	\$135,282			\$228,800

Columns (B), (I): Exhibit I  
Columns (C), (J): Exhibit II  
Column (D) = (B) - (C)  
Columns (E), (L): Appendix B  
Column (F): Appendix A1

Column (G) = (D) \* (E) \* (F)  
Column (K) = (I) - (J)  
Column (M): Appendix A2  
Column (N) = (K) \* (L) \* (M)

**Calculation of Forecast Losses Less Than \$50,000**

(A) Accident Period	(B) Trended Ultimate Small Losses	(C) Net Operating Expenditures (thousands)	(D) Trend Factor 7/1/18-19	(E) Trended Exposure	(F) Loss Rate
7/1/94-95	\$2,700	\$22,956	1.680	\$38,566	\$0.07
7/1/95-96	\$200	\$23,160	1.633	\$37,814	\$0.01
7/1/96-97	\$3,700	\$23,718	1.591	\$37,737	\$0.10
7/1/97-98	\$11,800	\$25,535	1.561	\$39,862	\$0.30
7/1/98-99	\$10,800	\$25,360	1.532	\$38,856	\$0.28
7/1/99-00	\$52,800	\$30,033	1.491	\$44,766	\$1.18
7/1/00-01	\$6,200	\$31,910	1.446	\$46,134	\$0.13
7/1/01-02	\$5,700	\$33,165	1.415	\$46,914	\$0.12
7/1/02-03	\$38,700	\$33,608	1.388	\$46,639	\$0.83
7/1/03-04	\$15,200	\$34,610	1.354	\$46,871	\$0.32
7/1/04-05	\$500	\$30,210	1.314	\$39,709	\$0.01
7/1/05-06	\$0	\$31,399	1.272	\$39,952	\$0.00
7/1/06-07	\$2,000	\$31,742	1.235	\$39,202	\$0.05
7/1/07-08	\$21,100	\$32,862	1.195	\$39,269	\$0.54
7/1/08-09	\$22,300	\$33,188	1.175	\$38,995	\$0.57
7/1/09-10	\$700	\$34,685	1.167	\$40,490	\$0.02
7/1/10-11	\$1,700	\$36,492	1.140	\$41,600	\$0.04
7/1/11-12	\$100	\$36,858	1.111	\$40,954	\$0.00
7/1/12-13	\$0	\$35,117	1.092	\$38,336	\$0.00
7/1/13-14	\$7,900	\$39,599	1.075	\$42,575	\$0.19
7/1/14-15	\$100	\$41,462	1.066	\$44,202	\$0.00
7/1/15-16	\$12,600	\$42,695	1.059	\$45,202	\$0.28
7/1/16-17	\$18,500	\$43,983	1.041	\$45,787	\$0.40
Total	\$235,300	\$754,346		\$960,432	\$0.24

7/1/18-19

Selected Loss Rate for 2011-12:  
{ Wtd Avg of 08-09 through 16-17 }

\$0.17

Forecast Exposure:  
{ Exhibit I }

\$44,862

**Forecast Small Losses**  
{ Line (1) x Line (2) }

**\$7,600**

Column (B): Average of (G) and (N), Exhibit III

Column (C): Exhibit I

Column (D): Appendix C

Column (E) = (C) \* (D)

Column (F) = (B) / (E)

**Calculation of Forecast Losses**

	<u>7/1/16-17</u>	<u>7/1/17-18</u>	<u>7/1/18-19</u>	<u>7/1/19-20</u>
(1) Forecast Losses less than \$50,000: { Exhibit IV }			\$7,600	
(2) Expected Number of Losses over \$50,000: { Derived from VA Association of Counties Large Loss Experience }			0.06	
(3) Expected Severity of Losses over \$50,000 Limited to \$250,000: { Derived from VA Association of Counties Large Loss Experience }			\$125,000	
(4) Forecast Losses Limited to \$250,000: { Line(1) + Line(2) * Line(3) for 7/1/18-19; Line(5) * Line(6) for other forecast periods }	\$14,600	\$14,700	\$15,000	\$15,300
(5) Forecast Exposure { Exhibit I }	\$43,983	\$43,983	\$44,862	\$45,760
(6) Forecast Loss Rate (per \$1,000 NOE) { Line(4) / Line(5) for 7/1/18-19; 7/1/18-19 rate adjusted for trend for 7/1/16-17, 7/1/17-18 and 7/1/19-20 }	\$0.33	\$0.33	\$0.33	\$0.34

**Aggregate Loss Distribution  
For Forecast Periods**

(A) <i>Probability That Losses Will Be Less Than Or Equal to Column (B)</i>	(B) <i>Estimated 7/1/18-19 Ultimate Limited Losses</i>	(C) <i>Estimated 7/1/19-20 Ultimate Limited Losses</i>	(D) <i>Probability That Losses Will Be Greater Than Column (B)</i>
50%	\$2,000	\$2,000	50%
55%	\$2,000	\$2,000	45%
60%	\$3,000	\$3,000	40%
65%	\$3,000	\$3,000	35%
70%	\$5,000	\$5,000	30%
75%	\$6,000	\$6,000	25%
80%	\$9,000	\$9,000	20%
85%	\$16,000	\$16,000	15%
90%	\$33,000	\$34,000	10%
95%	\$90,000	\$92,000	5%
<i>Expected Losses</i>			
85%	\$15,000	\$15,300	15%
<i>Discounted at 2.5%</i>			
	\$14,100	\$14,300	

- Based on Lognormal Distribution for Small Losses,  
Inverse Weibull Distribution for Large Loss Severity  
and Poisson Distribution for Large Loss Frequency



**Estimation of Limited Ultimate Losses  
Using Loss Development Method**

<i>Reported Method</i>							
(A) Accident Period	(B) Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Reported Develop. Factor	(F) Ultimate on Small Claims	(G) Provision for Large Claims	(H) Estimated Ultimate Losses
7/1/94-95	\$1,216	\$0	\$1,216	1.000	\$1,200	\$0	\$1,200
7/1/95-96	\$70	\$0	\$70	1.000	\$100	\$0	\$100
7/1/96-97	\$1,745	\$0	\$1,745	1.000	\$1,700	\$0	\$1,700
7/1/97-98	\$5,850	\$0	\$5,850	1.000	\$5,900	\$0	\$5,900
7/1/98-99	\$36,007	\$0	\$36,007	1.000	\$36,000	\$0	\$36,000
7/1/99-00	\$28,350	\$0	\$28,350	1.000	\$28,300	\$0	\$28,300
7/1/00-01	\$3,429	\$0	\$3,429	1.000	\$3,400	\$0	\$3,400
7/1/01-02	\$3,276	\$0	\$3,276	1.000	\$3,300	\$0	\$3,300
7/1/02-03	\$23,269	\$0	\$23,269	1.000	\$23,300	\$0	\$23,300
7/1/03-04	\$9,501	\$0	\$9,501	1.000	\$9,500	\$0	\$9,500
7/1/04-05	\$298	\$0	\$298	1.000	\$300	\$0	\$300
7/1/05-06	\$0	\$0	\$0	1.000	\$0	\$0	\$0
7/1/06-07	\$1,417	\$0	\$1,417	1.000	\$1,400	\$0	\$1,400
7/1/07-08	\$15,813	\$0	\$15,813	1.000	\$15,800	\$0	\$15,800
7/1/08-09	\$17,156	\$0	\$17,156	1.000	\$17,200	\$0	\$17,200
7/1/09-10	\$544	\$0	\$544	1.000	\$500	\$0	\$500
7/1/10-11	\$1,380	\$0	\$1,380	1.000	\$1,400	\$0	\$1,400
7/1/11-12	\$103	\$0	\$103	1.000	\$100	\$0	\$100
7/1/12-13	\$0	\$0	\$0	1.103	\$0	\$0	\$0
7/1/13-14	\$5,858	\$0	\$5,858	1.163	\$6,800	\$0	\$6,800
7/1/14-15	\$50	\$0	\$50	1.278	\$100	\$0	\$100
7/1/15-16	\$7,129	\$0	\$7,129	1.527	\$10,900	\$0	\$10,900
7/1/16-17	\$46,425	\$0	\$46,425	2.177	\$101,100	\$0	\$101,100
Total	\$208,885	\$0	\$208,885		\$268,300	\$0	\$268,300

<i>Paid Method</i>							
(I) Accident Period	(J) Paid Losses	(K) Paid on Large Claims	(L) Paid on Small Claims	(M) Paid Develop. Factor	(N) Ultimate on Small Claims	(O) Provision for Large Claims	(P) Estimated Ultimate Losses
7/1/94-95	\$1,216	\$0	\$1,216	1.000	\$1,200	\$0	\$1,200
7/1/95-96	\$70	\$0	\$70	1.000	\$100	\$0	\$100
7/1/96-97	\$1,745	\$0	\$1,745	1.000	\$1,700	\$0	\$1,700
7/1/97-98	\$5,850	\$0	\$5,850	1.000	\$5,900	\$0	\$5,900
7/1/98-99	\$36,007	\$0	\$36,007	1.000	\$36,000	\$0	\$36,000
7/1/99-00	\$28,350	\$0	\$28,350	1.000	\$28,300	\$0	\$28,300
7/1/00-01	\$3,429	\$0	\$3,429	1.000	\$3,400	\$0	\$3,400
7/1/01-02	\$3,276	\$0	\$3,276	1.000	\$3,300	\$0	\$3,300
7/1/02-03	\$23,269	\$0	\$23,269	1.000	\$23,300	\$0	\$23,300
7/1/03-04	\$9,501	\$0	\$9,501	1.000	\$9,500	\$0	\$9,500
7/1/04-05	\$298	\$0	\$298	1.000	\$300	\$0	\$300
7/1/05-06	\$0	\$0	\$0	1.000	\$0	\$0	\$0
7/1/06-07	\$1,417	\$0	\$1,417	1.000	\$1,400	\$0	\$1,400
7/1/07-08	\$15,813	\$0	\$15,813	1.000	\$15,800	\$0	\$15,800
7/1/08-09	\$17,156	\$0	\$17,156	1.000	\$17,200	\$0	\$17,200
7/1/09-10	\$544	\$0	\$544	1.000	\$500	\$0	\$500
7/1/10-11	\$1,380	\$0	\$1,380	1.000	\$1,400	\$0	\$1,400
7/1/11-12	\$103	\$0	\$103	1.000	\$100	\$0	\$100
7/1/12-13	\$0	\$0	\$0	1.129	\$0	\$0	\$0
7/1/13-14	\$5,858	\$0	\$5,858	1.209	\$7,100	\$0	\$7,100
7/1/14-15	\$50	\$0	\$50	1.375	\$100	\$0	\$100
7/1/15-16	\$7,129	\$0	\$7,129	1.787	\$12,700	\$0	\$12,700
7/1/16-17	\$28,813	\$0	\$28,813	3.180	\$91,600	\$0	\$91,600
Total	\$191,273	\$0	\$191,273		\$260,900	\$0	\$260,900

Columns (B), (J): Exhibit I  
Columns (C), (K): Exhibit II  
Column (D) = (B) - (C)  
Columns (E), (M): Appendix A  
Column (F) = (D) x (E)

Columns (G), (O) = Claim count in (C) x CCDF x Specific Retention  
Column (H) = (F) + (G)  
Column (L) = (J) - (K)  
Column (N) = (L) x (M)  
Column (P) = (N) + (O)

**Estimation of Limited Ultimate Losses  
Using the Bornhuetter-Ferguson Method**

Reported Method						
(A)	(B)	(C)	(D)	(E)	(F)	(G)
Accident Period	Previous Estimate or Forecast Losses	Reported LDF	Estimated Percent Unreported	Estimated IBNR Losses	Reported Losses as of 12/31/2017	Estimated Ultimate Losses
7/1/94-95	\$1,216	1.000	0%	\$0	\$1,216	\$1,200
7/1/95-96	\$70	1.000	0%	\$0	\$70	\$100
7/1/96-97	\$1,745	1.000	0%	\$0	\$1,745	\$1,700
7/1/97-98	\$5,850	1.000	0%	\$0	\$5,850	\$5,900
7/1/98-99	\$36,007	1.000	0%	\$0	\$36,007	\$36,000
7/1/99-00	\$28,350	1.000	0%	\$0	\$28,350	\$28,300
7/1/00-01	\$3,429	1.000	0%	\$0	\$3,429	\$3,400
7/1/01-02	\$3,276	1.000	0%	\$0	\$3,276	\$3,300
7/1/02-03	\$23,269	1.000	0%	\$0	\$23,269	\$23,300
7/1/03-04	\$9,501	1.000	0%	\$0	\$9,501	\$9,500
7/1/04-05	\$298	1.000	0%	\$0	\$298	\$300
7/1/05-06	\$0	1.000	0%	\$0	\$0	\$0
7/1/06-07	\$1,417	1.000	0%	\$0	\$1,417	\$1,400
7/1/07-08	\$15,813	1.000	0%	\$0	\$15,813	\$15,800
7/1/08-09	\$17,156	1.000	0%	\$0	\$17,156	\$17,200
7/1/09-10	\$544	1.000	0%	\$0	\$544	\$500
7/1/10-11	\$1,380	1.000	0%	\$0	\$1,380	\$1,400
7/1/11-12	\$103	1.000	0%	\$0	\$103	\$100
7/1/12-13	\$1,000	1.103	9%	\$100	\$0	\$100
7/1/13-14	\$11,000	1.163	14%	\$1,500	\$5,858	\$7,400
7/1/14-15	\$8,000	1.278	22%	\$1,700	\$50	\$1,800
7/1/15-16	\$19,000	1.527	34%	\$6,600	\$7,129	\$13,700
7/1/16-17	\$14,600	2.177	54%	\$7,900	\$46,425	\$54,300
7/1/17-18	\$14,700	7.067	86%	\$12,600	\$1,109	\$13,700
Total	\$218,000			\$30,000	\$209,994	\$240,400

Paid Method						
(H)	(I)	(J)	(K)	(L)	(M)	(N)
Accident Period	Previous Estimate or Forecast Losses	Paid LDF	Estimated Percent Unpaid	Estimated Unpaid Losses	Paid Losses as of 12/31/2017	Estimated Ultimate Losses
7/1/94-95	\$1,216	1.000	0%	\$0	\$1,216	\$1,200
7/1/95-96	\$70	1.000	0%	\$0	\$70	\$100
7/1/96-97	\$1,745	1.000	0%	\$0	\$1,745	\$1,700
7/1/97-98	\$5,850	1.000	0%	\$0	\$5,850	\$5,900
7/1/98-99	\$36,007	1.000	0%	\$0	\$36,007	\$36,000
7/1/99-00	\$28,350	1.000	0%	\$0	\$28,350	\$28,300
7/1/00-01	\$3,429	1.000	0%	\$0	\$3,429	\$3,400
7/1/01-02	\$3,276	1.000	0%	\$0	\$3,276	\$3,300
7/1/02-03	\$23,269	1.000	0%	\$0	\$23,269	\$23,300
7/1/03-04	\$9,501	1.000	0%	\$0	\$9,501	\$9,500
7/1/04-05	\$298	1.000	0%	\$0	\$298	\$300
7/1/05-06	\$0	1.000	0%	\$0	\$0	\$0
7/1/06-07	\$1,417	1.000	0%	\$0	\$1,417	\$1,400
7/1/07-08	\$15,813	1.000	0%	\$0	\$15,813	\$15,800
7/1/08-09	\$17,156	1.000	0%	\$0	\$17,156	\$17,200
7/1/09-10	\$544	1.000	0%	\$0	\$544	\$500
7/1/10-11	\$1,380	1.000	0%	\$0	\$1,380	\$1,400
7/1/11-12	\$103	1.000	0%	\$0	\$103	\$100
7/1/12-13	\$1,000	1.129	11%	\$100	\$0	\$100
7/1/13-14	\$11,000	1.209	17%	\$1,900	\$5,858	\$7,800
7/1/14-15	\$8,000	1.375	27%	\$2,200	\$50	\$2,300
7/1/15-16	\$19,000	1.787	44%	\$8,400	\$7,129	\$15,500
7/1/16-17	\$14,600	3.180	69%	\$10,000	\$28,813	\$38,800
7/1/17-18	\$14,700	15.364	93%	\$13,700	\$1,109	\$14,800
Total	\$218,000			\$36,000	\$192,382	\$228,700

Columns (B), (I): Prior analysis; Exhibit VI for 2016-17 and 2017-18  
Columns (C), (J): Appendix A  
Column (D) =  $[1 - 1 / (C)]$   
Columns (E) = (B) x (D)  
Column (F), (M): Exhibit I

Column (G) = (E) + (F)  
Column (K) =  $[1 - 1 / (J)]$   
Column (L) = (I) x (K)  
Column (N) = (L) + (M)

**Summary and Selection of Limited Ultimate Losses**

(A) <i>Accident Period</i>	(B) <i>Prior Estimate or Forecast</i>	(C) <i>Reported Loss Development Method</i>	(D) <i>Paid Loss Development Method</i>	(E) <i>Reported Bornhuetter- Ferguson Method</i>	(F) <i>Paid Bornhuetter- Ferguson Method</i>	(G) <i>Selected Ultimate Losses</i>
7/1/94-95	\$1,216	\$1,200	\$1,200	\$1,200	\$1,200	<b>\$1,216</b>
7/1/95-96	\$70	\$100	\$100	\$100	\$100	<b>\$70</b>
7/1/96-97	\$1,745	\$1,700	\$1,700	\$1,700	\$1,700	<b>\$1,745</b>
7/1/97-98	\$5,850	\$5,900	\$5,900	\$5,900	\$5,900	<b>\$5,850</b>
7/1/98-99	\$36,007	\$36,000	\$36,000	\$36,000	\$36,000	<b>\$36,007</b>
7/1/99-00	\$28,350	\$28,300	\$28,300	\$28,300	\$28,300	<b>\$28,350</b>
7/1/00-01	\$3,429	\$3,400	\$3,400	\$3,400	\$3,400	<b>\$3,429</b>
7/1/01-02	\$3,276	\$3,300	\$3,300	\$3,300	\$3,300	<b>\$3,276</b>
7/1/02-03	\$23,269	\$23,300	\$23,300	\$23,300	\$23,300	<b>\$23,269</b>
7/1/03-04	\$9,501	\$9,500	\$9,500	\$9,500	\$9,500	<b>\$9,501</b>
7/1/04-05	\$298	\$300	\$300	\$300	\$300	<b>\$298</b>
7/1/05-06	\$0	\$0	\$0	\$0	\$0	<b>\$0</b>
7/1/06-07	\$1,417	\$1,400	\$1,400	\$1,400	\$1,400	<b>\$1,417</b>
7/1/07-08	\$15,813	\$15,800	\$15,800	\$15,800	\$15,800	<b>\$15,813</b>
7/1/08-09	\$17,156	\$17,200	\$17,200	\$17,200	\$17,200	<b>\$17,156</b>
7/1/09-10	\$544	\$500	\$500	\$500	\$500	<b>\$544</b>
7/1/10-11	\$1,380	\$1,400	\$1,400	\$1,400	\$1,400	<b>\$1,380</b>
7/1/11-12	\$103	\$100	\$100	\$100	\$100	<b>\$103</b>
7/1/12-13	\$1,000	\$0	\$0	\$100	\$100	<b>\$0</b>
7/1/13-14	\$11,000	\$6,800	\$7,100	\$7,400	\$7,800	<b>\$5,858</b>
7/1/14-15	\$8,000	\$100	\$100	\$1,800	\$2,300	<b>\$50</b>
7/1/15-16	\$19,000	\$10,900	\$12,700	\$13,700	\$15,500	<b>\$13,700</b>
7/1/16-17	\$14,600	\$101,100	\$91,600	\$54,300	\$38,800	<b>\$54,300</b>
7/1/17-18	\$14,700	--	--	\$13,700	\$14,800	<b>\$13,700</b>
<b>Total</b>	<b>\$217,700</b>	<b>\$268,300</b>	<b>\$260,900</b>	<b>\$240,400</b>	<b>\$228,700</b>	<b>\$237,000</b>

Column (B): Prior analysis as of 12/31/2015; Exhibit VI for 2016-17 and 2017-18

Columns (C), (D): Exhibit VIII

Columns (E), (F): Exhibit IX

Column (G): Limited reported losses for 94-95 through 14-15

Column (E) for 15-16 and 16-17

Column (B) for 17-18

**Estimated Ultimate Reported Claims  
and Claim Frequencies**

(A)	(B)	(C)	(D)	(E)	(F)
Accident Period	Number of Claims	Claim Development Factor	Estimated Ultimate Claims	Trended Exposure (thousands)	Claim Frequency*
7/1/94-95	11	1.000	11.0	\$38,566	0.29
7/1/95-96	12	1.000	12.0	\$37,814	0.32
7/1/96-97	10	1.000	10.0	\$37,737	0.26
7/1/97-98	32	1.000	32.0	\$39,862	0.80
7/1/98-99	17	1.000	17.0	\$38,856	0.44
7/1/99-00	17	1.000	17.0	\$44,766	0.38
7/1/00-01	10	1.000	10.0	\$46,134	0.22
7/1/01-02	9	1.000	9.0	\$46,914	0.19
7/1/02-03	20	1.000	20.0	\$46,639	0.43
7/1/03-04	17	1.000	17.0	\$46,871	0.36
7/1/04-05	8	1.000	8.0	\$39,709	0.20
7/1/05-06	7	1.000	7.0	\$39,952	0.18
7/1/06-07	5	1.000	5.0	\$39,202	0.13
7/1/07-08	5	1.000	5.0	\$39,269	0.13
7/1/08-09	10	1.000	10.0	\$38,995	0.26
7/1/09-10	4	1.000	4.0	\$40,490	0.10
7/1/10-11	6	1.000	6.0	\$41,600	0.14
7/1/11-12	1	1.000	1.0	\$40,954	0.02
7/1/12-13	0	1.000	0.0	\$38,336	0.00
7/1/13-14	3	1.000	3.0	\$42,575	0.07
7/1/14-15	3	1.006	3.0	\$44,202	0.07
7/1/15-16	14	1.015	14.2	\$45,202	0.31
7/1/16-17	16	1.056	16.9	\$45,787	0.37
<b>Total</b>	<b>237</b>		<b>238.1</b>	<b>\$960,432</b>	<b>0.25</b>

	<u>7/1/17-18</u>	<u>7/1/18-19</u>
(1) Selected Frequency: { Wtd Avg of latest six periods }	0.15	0.15
(2) Exposure (thousands): { Exhibit I }	\$43,983	\$44,862
(3) Forecast Ultimate Claims: { (Line (1) x Line (2)) / 1,000 }	6.7	6.7
(4) Estimated claims unreported { (1 - 1 / CCDF) x (3) }	4.2	
(5) Reported claims { Exhibit I }	10	
(6) Estimate of Ultimate Claims { (4) + (5) or (3) }	14.2	6.7

\*Shown as claims per million of exposure

Column (B): Exhibit I  
Column (C): Appendix A3  
Column (D) = (B) \* (C)  
Column (E): Exhibit IV  
Column (F) = (D) / (E) \* 1,000

**Estimation of Claim Severities**

(A)	(B)	(C)	(D)	(E)	(F)
Accident Period	Estimated Ultimate Claims	Selected Estimated Ultimate Losses	Estimated Ultimate Severity	Exposure (Ten Thousands)	Estimated Cost per \$10K NOE
7/1/94-95	11.0	\$1,216	\$100	\$2,296	\$0.53
7/1/95-96	12.0	\$70	\$0	\$2,316	\$0.03
7/1/96-97	10.0	\$1,745	\$200	\$2,372	\$0.74
7/1/97-98	32.0	\$5,850	\$200	\$2,554	\$2.29
7/1/98-99	17.0	\$36,007	\$2,100	\$2,536	\$14.20
7/1/99-00	17.0	\$28,350	\$1,700	\$3,003	\$9.44
7/1/00-01	10.0	\$3,429	\$300	\$3,191	\$1.07
7/1/01-02	9.0	\$3,276	\$400	\$3,316	\$0.99
7/1/02-03	20.0	\$23,269	\$1,200	\$3,361	\$6.92
7/1/03-04	17.0	\$9,501	\$600	\$3,461	\$2.75
7/1/04-05	8.0	\$298	\$0	\$3,021	\$0.10
7/1/05-06	7.0	\$0	\$0	\$3,140	\$0.00
7/1/06-07	5.0	\$1,417	\$300	\$3,174	\$0.45
7/1/07-08	5.0	\$15,813	\$3,200	\$3,286	\$4.81
7/1/08-09	10.0	\$17,156	\$1,700	\$3,319	\$5.17
7/1/09-10	4.0	\$544	\$100	\$3,469	\$0.16
7/1/10-11	6.0	\$1,380	\$200	\$3,649	\$0.38
7/1/11-12	1.0	\$103	\$100	\$3,686	\$0.03
7/1/12-13	0.0	\$0	\$0	\$3,512	\$0.00
7/1/13-14	3.0	\$5,858	\$2,000	\$3,960	\$1.48
7/1/14-15	3.0	\$50	\$0	\$4,146	\$0.01
7/1/15-16	14.2	\$13,700	\$1,000	\$4,270	\$3.21
7/1/16-17	16.9	\$54,300	\$3,200	\$4,398	\$12.35
7/1/17-18	14.2	\$13,700	\$1,000	\$4,398	\$3.11
7/1/18-19	6.7	\$15,000	\$2,300	\$4,486	\$3.34
Total	258.9	\$252,000	\$1,000	\$84,319	\$2.99

Column (B): Exhibit XI, page 1

Column (C): Exhibit X; Exhibit VI for the forecast period

Column (D) = (C) / (B)

Column (E): Exhibit I

Column (F) = (C) / (E)

**Calculation of Required Reserves  
As of December 31, 2017**

(A) Accident Period	(B) Selected Ultimate Losses	(C) Limited Paid Losses	(D) Limited Reported Losses	(E) Case Reserves	(F) IBNR Reserves	(G) Total Required Reserves	(H) Discount Factor at 2.5%	(I) Total Discounted Reserves at 2.5%
7/1/94-95	\$1,216	\$1,216	\$1,216	\$0	\$0	\$0	1.000	\$0
7/1/95-96	\$70	\$70	\$70	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$1,745	\$1,745	\$1,745	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$5,850	\$5,850	\$5,850	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$36,007	\$36,007	\$36,007	\$0	\$0	\$0	1.000	\$0
7/1/99-00	\$28,350	\$28,350	\$28,350	\$0	\$0	\$0	1.000	\$0
7/1/00-01	\$3,429	\$3,429	\$3,429	\$0	\$0	\$0	1.000	\$0
7/1/01-02	\$3,276	\$3,276	\$3,276	\$0	\$0	\$0	1.000	\$0
7/1/02-03	\$23,269	\$23,269	\$23,269	\$0	\$0	\$0	1.000	\$0
7/1/03-04	\$9,501	\$9,501	\$9,501	\$0	\$0	\$0	1.000	\$0
7/1/04-05	\$298	\$298	\$298	\$0	\$0	\$0	1.000	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	1.000	\$0
7/1/06-07	\$1,417	\$1,417	\$1,417	\$0	\$0	\$0	1.000	\$0
7/1/07-08	\$15,813	\$15,813	\$15,813	\$0	\$0	\$0	1.000	\$0
7/1/08-09	\$17,156	\$17,156	\$17,156	\$0	\$0	\$0	1.000	\$0
7/1/09-10	\$544	\$544	\$544	\$0	\$0	\$0	1.000	\$0
7/1/10-11	\$1,380	\$1,380	\$1,380	\$0	\$0	\$0	1.000	\$0
7/1/11-12	\$103	\$103	\$103	\$0	\$0	\$0	1.000	\$0
7/1/12-13	\$0	\$0	\$0	\$0	\$0	\$0	0.988	\$0
7/1/13-14	\$5,858	\$5,858	\$5,858	\$0	\$0	\$0	0.972	\$0
7/1/14-15	\$50	\$50	\$50	\$0	\$0	\$0	0.963	\$0
7/1/15-16	\$13,700	\$7,129	\$7,129	\$0	\$6,600	\$6,600	0.958	\$6,300
7/1/16-17	\$54,300	\$28,813	\$46,425	\$17,612	\$7,900	\$25,500	0.953	\$24,300
7/1-12/31/17	\$6,900	\$1,109	\$1,109	\$0	\$5,800	\$5,800	0.945	\$5,500
<b>Total</b>	<b>\$230,200</b>	<b>\$192,382</b>	<b>\$209,994</b>	<b>\$17,612</b>	<b>\$20,300</b>	<b>\$37,900</b>		<b>\$36,100</b>
1/1-6/30/18	\$6,800							

Column (B): Exhibit X; prorated for 7/1/17-18

Columns (C), (D): Exhibit IX

Column (E) = (D) - (C)

Column (F) = (B) - (D)

Column (G) = (E) + (F)

Column (H): Appendix D

Column (I) = (G) \* (H)

***Estimated Outstanding Losses  
At Various Confidence Levels  
As of December 31, 2017***

<i>Confidence Level</i>	<i>(A) Estimated Ultimate Losses</i>	<i>(B) Limited Paid Losses</i>	<i>(C) Limited Reported Losses</i>	<i>(D) Case Reserves</i>	<i>(E) Estimated Unreported Losses</i>	<i>(F) Estimated Outstanding Losses</i>	<i>(G) Discount Factor at 2.5%</i>	<i>(H) Discounted Outstanding Losses</i>
50%	\$225,000	\$192,382	\$209,994	\$17,612	\$15,000	\$32,600	0.953	\$31,100
55%	\$228,000	\$192,382	\$209,994	\$17,612	\$18,000	\$35,600	0.953	\$33,900
60%	\$231,000	\$192,382	\$209,994	\$17,612	\$21,000	\$38,600	0.953	\$36,800
65%	\$235,000	\$192,382	\$209,994	\$17,612	\$25,000	\$42,600	0.953	\$40,600
70%	\$239,000	\$192,382	\$209,994	\$17,612	\$29,000	\$46,600	0.953	\$44,400
75%	\$244,000	\$192,382	\$209,994	\$17,612	\$34,000	\$51,600	0.953	\$49,100
80%	\$250,000	\$192,382	\$209,994	\$17,612	\$40,000	\$57,600	0.953	\$54,900
85%	\$258,000	\$192,382	\$209,994	\$17,612	\$48,000	\$65,600	0.953	\$62,500
90%	\$268,000	\$192,382	\$209,994	\$17,612	\$58,000	\$75,600	0.953	\$72,000
95%	\$286,000	\$192,382	\$209,994	\$17,612	\$76,000	\$93,600	0.953	\$89,200

*Column (A): Based on Lognormal Fit to Historical Development Experience of Virginia Association of Counties, Appendix E-2*

*Columns (B), (C): Exhibit XII, page 1*

*Column (D) = (C) - (B)*

*Column (E) = (A) - (C)*

*Column (F) = (A) - (B) = (D) + (E)*

*Column (G): Average Discount from Exhibit XII, page 1*

*Column (H) = (F) \* (G)*

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 1/1-6/30/18	Paid During 2018-19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28
7/1/94-95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/95-96	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/01-02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/02-03	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/03-04	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/04-05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/06-07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/07-08	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/08-09	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/09-10	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/10-11	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/11-12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/12-13	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/13-14	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/14-15	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/15-16	\$6,600	\$1,400	\$2,000	\$1,100	\$2,100	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/16-17	\$25,500	\$4,800	\$7,800	\$4,900	\$2,800	\$5,200	\$0	\$0	\$0	\$0	\$0	\$0
7/1-12/31/17	\$5,800	\$700	\$1,600	\$1,300	\$800	\$500	\$900	\$0	\$0	\$0	\$0	\$0
Subtotal	\$37,900	\$6,900	\$11,400	\$7,300	\$5,700	\$5,700	\$900	\$0	\$0	\$0	\$0	\$0
1/1-6/30/18	\$6,800	\$900	\$1,900	\$1,500	\$900	\$600	\$1,000	\$0	\$0	\$0	\$0	\$0
7/1/18-19	\$15,300	--	\$2,800	\$4,000	\$3,200	\$2,000	\$1,200	\$2,100	\$0	\$0	\$0	\$0
Total	\$60,000	\$7,800	\$16,100	\$12,800	\$9,800	\$8,300	\$3,100	\$2,100	\$0	\$0	\$0	\$0

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A2 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 12/31/17)]\}$ .



**Projected Payment Pattern  
At Various Confidence Levels  
for Accident Periods 94-95 through 18-19**

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
					Projected Limited		
Aggregate Percentile	Limited Ultimate Losses	Limited Outstanding & Forecast Losses	Limited Paid Losses as of 12/31/2017	Projected Paid Losses as of 6/30/2018	Outstanding & Forecast Losses as of 6/30/2018	Projected Paid Losses as of 6/30/2019	Projected Outstanding Losses as of 6/30/2019
50%	\$240,000	\$48,000	\$192,382	\$199,000	\$41,000	\$211,600	\$28,400
55%	\$245,000	\$53,000	\$192,382	\$199,000	\$46,000	\$213,200	\$31,800
60%	\$249,000	\$57,000	\$192,382	\$200,000	\$49,000	\$215,100	\$33,900
65%	\$255,000	\$63,000	\$192,382	\$201,000	\$54,000	\$217,700	\$37,300
70%	\$260,000	\$68,000	\$192,382	\$201,000	\$59,000	\$219,200	\$40,800
75%	\$267,000	\$75,000	\$192,382	\$202,000	\$65,000	\$222,000	\$45,000
80%	\$274,000	\$82,000	\$192,382	\$203,000	\$71,000	\$224,900	\$49,100
85%	\$285,000	\$93,000	\$192,382	\$204,000	\$81,000	\$229,000	\$56,000
90%	\$302,000	\$110,000	\$192,382	\$207,000	\$95,000	\$236,300	\$65,700
95%	\$332,000	\$140,000	\$192,382	\$211,000	\$121,000	\$248,300	\$83,700
<i>Expected</i>	\$252,000	\$60,000	\$192,382	\$200,000	\$52,000	\$216,000	\$36,000

Column (A): Percentile estimates are based on a lognormal distribution.

Column (B) = (C) - (A)

Column (C): Exhibit XII, page 2

Column (D) = { (% of outstanding as of 12/31/17 expected to be paid during 1/1-6/30/18 from Exhibit XIII, page 1) \* (B) } + (C)

Column (E) = (A) - (D)

Column (F) = { (% of outstanding as of 6/30/18 expected to be paid during 2018-19 from Exhibit XIII, page 1) \* (E) } + (D)

Column (G) = (A) - (F)

Comparison of Results with Report Valued as of December 31, 2015

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Reported Losses 12/31/2015	Expected Reported Losses 12/31/2017	Actual Reported Losses 12/31/2017	Percent Difference	Estimated Ultimate Losses 12/31/2015	Estimated Ultimate Losses 12/31/2017	Percent Difference
7/1/94-95	\$1,216	\$1,216	\$1,216	0%	\$1,216	\$1,216	0%
7/1/95-96	\$70	\$70	\$70	0%	\$70	\$70	0%
7/1/96-97	\$1,745	\$1,745	\$1,745	0%	\$1,745	\$1,745	0%
7/1/97-98	\$5,850	\$5,850	\$5,850	0%	\$5,850	\$5,850	0%
7/1/98-99	\$36,007	\$36,007	\$36,007	0%	\$36,007	\$36,007	0%
7/1/99-00	\$28,350	\$28,350	\$28,350	0%	\$28,350	\$28,350	0%
7/1/00-01	\$3,429	\$3,429	\$3,429	0%	\$3,429	\$3,429	0%
7/1/01-02	\$3,276	\$3,276	\$3,276	0%	\$3,276	\$3,276	0%
7/1/02-03	\$23,269	\$23,269	\$23,269	0%	\$23,269	\$23,269	0%
7/1/03-04	\$9,501	\$9,501	\$9,501	0%	\$9,501	\$9,501	0%
7/1/04-05	\$298	\$298	\$298	0%	\$298	\$298	0%
7/1/05-06	\$0	\$0	\$0	0%	\$0	\$0	0%
7/1/06-07	\$1,417	\$1,417	\$1,417	0%	\$1,417	\$1,417	0%
7/1/07-08	\$15,813	\$15,813	\$15,813	0%	\$15,813	\$15,813	0%
7/1/08-09	\$17,156	\$17,156	\$17,156	0%	\$17,156	\$17,156	0%
7/1/09-10	\$544	\$544	\$544	0%	\$544	\$544	0%
7/1/10-11	\$1,380	\$1,380	\$1,380	0%	\$1,380	\$1,380	0%
7/1/11-12	\$103	\$103	\$103	0%	\$103	\$103	0%
7/1/12-13	\$0	\$596	\$0	-100%	\$1,000	\$0	-100%
7/1/13-14	\$5,858	\$9,122	\$5,858	-36%	\$11,000	\$5,858	-47%
7/1/14-15	\$50	\$5,271	\$50	-99%	\$8,000	\$50	-99%
7/1/15-16	\$9,079	\$15,632	\$7,129	-54%	\$19,000	\$13,700	-28%
7/1/16-17		\$6,465	\$46,425	618%	\$12,900	\$54,300	321%
7/1/17-18		\$1,839	\$1,109	-40%	\$12,700	\$13,700	8%
Total	\$164,410	\$188,349	\$209,994	11%	\$214,000	\$237,000	11%

Variance from Expected

\$21,645

Change in Ultimates

\$23,000

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Paid Losses 12/31/2015	Expected Paid Losses 12/31/2017	Actual Paid Losses 12/31/2017	Percent Difference	Estimated Ultimate Losses 12/31/2015	Estimated Ultimate Losses 12/31/2017	Percent Difference
7/1/94-95	\$1,216	\$1,216	\$1,216	0%	\$1,216	\$1,216	0%
7/1/95-96	\$70	\$70	\$70	0%	\$70	\$70	0%
7/1/96-97	\$1,745	\$1,745	\$1,745	0%	\$1,745	\$1,745	0%
7/1/97-98	\$5,850	\$5,850	\$5,850	0%	\$5,850	\$5,850	0%
7/1/98-99	\$36,007	\$36,007	\$36,007	0%	\$36,007	\$36,007	0%
7/1/99-00	\$28,350	\$28,350	\$28,350	0%	\$28,350	\$28,350	0%
7/1/00-01	\$3,429	\$3,429	\$3,429	0%	\$3,429	\$3,429	0%
7/1/01-02	\$3,276	\$3,276	\$3,276	0%	\$3,276	\$3,276	0%
7/1/02-03	\$23,269	\$23,269	\$23,269	0%	\$23,269	\$23,269	0%
7/1/03-04	\$9,501	\$9,501	\$9,501	0%	\$9,501	\$9,501	0%
7/1/04-05	\$298	\$298	\$298	0%	\$298	\$298	0%
7/1/05-06	\$0	\$0	\$0	0%	\$0	\$0	0%
7/1/06-07	\$1,417	\$1,417	\$1,417	0%	\$1,417	\$1,417	0%
7/1/07-08	\$15,813	\$15,813	\$15,813	0%	\$15,813	\$15,813	0%
7/1/08-09	\$17,156	\$17,156	\$17,156	0%	\$17,156	\$17,156	0%
7/1/09-10	\$544	\$544	\$544	0%	\$544	\$544	0%
7/1/10-11	\$1,380	\$1,380	\$1,380	0%	\$1,380	\$1,380	0%
7/1/11-12	\$103	\$103	\$103	0%	\$103	\$103	0%
7/1/12-13	\$0	\$641	\$0	-100%	\$1,000	\$0	-100%
7/1/13-14	\$5,858	\$9,243	\$5,858	-37%	\$11,000	\$5,858	-47%
7/1/14-15	\$50	\$5,109	\$50	-99%	\$8,000	\$50	-99%
7/1/15-16	\$6,579	\$13,312	\$7,129	-46%	\$19,000	\$13,700	-28%
7/1/16-17		\$4,095	\$28,813	604%	\$12,900	\$54,300	321%
7/1/17-18		\$866	\$1,109	28%	\$12,700	\$13,700	8%
Total	\$161,910	\$182,691	\$192,382	5%	\$214,000	\$237,000	11%

Columns (B), (F): From previous actuarial report

Column (C): Derived using LDF's from previous actuarial report

Column (D): Exhibit I, limited to retention

Column (E) = [(D) / (C)] - 1

Column (G): Exhibit V

Column (H) = [(G) / (F)] - 1

***Funding at the Expected Level***

(1) <i>Estimated Outstanding Losses as of 12/31/17</i> <i>{ Exhibit XII-1 }</i>	\$37,900
(2) <i>Forecast Losses for 1/1-6/30/18</i> <i>{ Exhibit XII-1 }</i>	\$6,800
<hr/>	
<b>(3) <i>Required Funding as of 12/31/17</i></b> <b><i>{ (1) + (2) }</i></b>	<b>\$44,700</b>
(4) <i>Projected Payments during 1/1-6/30/18</i> <i>{ Exhibit XIII-1 }</i>	\$7,800
(5) <i>Estimated Outstanding Losses as of 6/30/18</i> <i>{ (3) – (4) }</i>	\$36,900
(6) <i>Forecast Losses for 7/1/18-19</i> <i>{ Exhibit VI }</i>	\$15,000
<hr/>	
<b>(7) <i>Required Funding as of 6/30/18</i></b> <b><i>{ (5) + (6) }</i></b>	<b>\$51,900</b>
(8) <i>Projected Payments during 7/1/18-19</i> <i>{ Exhibit XIII-1 }</i>	\$16,100
(9) <i>Estimated Outstanding Losses as of 6/30/19</i> <i>{ (7) – (8) }</i>	\$35,800
(10) <i>Forecast Losses for 7/1/19-20</i> <i>{ Exhibit VI }</i>	\$15,300
<hr/>	
<b>(11) <i>Required Funding as of 6/30/19</i></b> <b><i>{ (9) + (10) }</i></b>	<b>\$51,100</b>

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## Appendices

Appendix A	Loss Development Factors
Appendix B	Claims Cost Trend Factors
Appendix C	Exposure Trend Factors
Appendix D	Calculation of Discount Factors

**Roanoke County**  
Workers Compensation  
Combined Experience for County and School Board\*

**Appendix A1**

**Reported Loss Development**

Accident Period	12	24	36	48	60	72	Gross Reported Losses as of (months)										120	132	144	156	168	180
							84	96	108													
7/1/96-97		\$391,619	\$479,281	\$537,354	\$891,594	\$984,421	\$937,377	\$937,377	\$987,377	\$995,610	\$995,276	\$995,276	\$995,276	\$992,791	\$1,014,504							
7/1/97-98	\$178,355	\$369,414	\$361,358	\$366,052	\$376,196	\$384,177	\$385,718	\$423,499	\$431,707	\$421,053	\$373,354	\$373,354	\$367,535	\$361,716	\$361,716							
7/1/98-99	\$251,274	\$293,511	\$322,136	\$381,950	\$386,474	\$332,336	\$339,838	\$439,796	\$423,663	\$472,490	\$472,490	\$491,285	\$560,647	\$535,716	\$510,784							
7/1/99-00	\$456,512	\$472,597	\$645,257	\$579,065	\$595,694	\$648,217	\$654,537	\$654,749	\$683,192	\$693,126	\$705,129	\$759,241	\$741,899	\$724,556	\$745,770							
7/1/00-01	\$562,554	\$596,006	\$639,157	\$381,479	\$401,133	\$363,871	\$363,781	\$367,001	\$367,001	\$367,001	\$406,638	\$386,819	\$367,001	\$367,001	\$367,001							
7/1/01-02	\$821,345	\$770,966	\$878,953	\$863,677	\$851,895	\$862,878	\$898,139	\$961,748	\$967,083	\$948,009	\$980,115	\$1,012,221	\$1,013,569	\$1,015,072	\$988,840							
7/1/02-03	\$385,934	\$462,770	\$456,767	\$506,971	\$539,944	\$543,920	\$533,249	\$532,801	\$533,477	\$535,250	\$537,022	\$540,425	\$545,529	\$614,436	\$614,436							
7/1/03-04	\$336,277	\$498,535	\$574,468	\$559,821	\$597,779	\$588,154	\$636,900	\$637,701	\$666,162	\$694,622	\$808,347	\$818,840	\$858,918									
7/1/04-05	\$305,338	\$457,455	\$529,557	\$546,401	\$514,586	\$471,847	\$475,615	\$507,449	\$539,284	\$545,097	\$550,491	\$530,235	\$575,235									
7/1/05-06	\$471,382	\$692,734	\$801,879	\$801,370	\$791,870	\$763,614	\$763,815	\$753,292	\$753,538	\$757,809	\$803,477	\$803,892										
7/1/06-07	\$465,228	\$672,559	\$636,436	\$719,044	\$695,799	\$697,188	\$709,934	\$791,296	\$893,409	\$933,951	\$989,384											
7/1/07-08	\$793,678	\$813,941	\$1,020,141	\$1,105,670	\$1,049,629	\$1,010,938	\$1,001,820	\$1,005,949	\$1,068,398	\$1,066,549												
7/1/08-09	\$309,982	\$804,301	\$870,982	\$823,819	\$832,494	\$868,082	\$998,647	\$947,745	\$975,850													
7/1/09-10	\$441,280	\$596,072	\$875,536	\$870,279	\$881,845	\$895,337	\$1,268,822	\$1,268,822														
7/1/10-11	\$660,825	\$900,594	\$1,526,519	\$1,889,607	\$1,957,049	\$2,208,710	\$2,254,412															
7/1/11-12	\$240,987	\$530,151	\$569,171	\$606,015	\$615,112	\$672,877																
7/1/12-13	\$415,587	\$523,968	\$677,852	\$780,191	\$860,055																	
7/1/13-14	\$537,650	\$906,246	\$1,101,686	\$1,134,454																		
7/1/14-15	\$484,074	\$951,574	\$1,013,337																			
7/1/15-16	\$523,561	\$542,777																				
7/1/16-17	\$713,411																					

Accident Period	12:24	24:36	36:48	48:60	60:72	72:84	84:96	96:108	108:120	120:132	132:144	144:156	156:168	168:180	180:Ult
7/1/96-97		1.224	1.121	1.659	1.104	0.952	1.000	1.053	1.008	1.000	1.000	1.000	0.998	1.022	
7/1/97-98	2.071	0.978	1.013	1.028	1.021	1.004	1.098	1.019	0.975	0.887	1.000	0.984	0.984	1.000	
7/1/98-99	1.168	1.098	1.186	1.012	0.860	1.023	1.294	0.963	1.115	1.000	1.040	1.141	0.956	0.953	
7/1/99-00	1.035	1.365	0.897	1.029	1.088	1.010	1.000	1.043	1.015	1.017	1.077	0.977	0.977	1.029	
7/1/00-01	1.059	1.072	0.597	1.052	0.907	1.000	1.009	1.000	1.000	1.108	0.951	0.949	1.000	1.000	
7/1/01-02	0.939	1.140	0.983	0.986	1.013	1.041	1.071	1.006	0.980	1.034	1.033	1.001	1.001	0.974	
7/1/02-03	1.199	0.987	1.110	1.065	1.007	0.980	0.999	1.001	1.003	1.003	1.006	1.009	1.126	1.000	
7/1/03-04	1.483	1.152	0.975	1.068	0.984	1.083	1.001	1.045	1.043	1.164	1.013	1.049	1.000		
7/1/04-05	1.498	1.158	1.032	0.942	0.917	1.008	1.067	1.063	1.011	1.010	0.963	1.085			
7/1/05-06	1.470	1.158	0.999	0.988	0.964	1.000	0.986	1.000	1.006	1.060	1.001				
7/1/06-07	1.446	0.946	1.130	0.968	1.002	1.018	1.115	1.129	1.045	1.059					
7/1/07-08	1.026	1.253	1.084	0.949	0.963	0.991	1.004	1.062	0.998						
7/1/08-09	2.595	1.083	0.946	1.011	1.043	1.150	0.949	1.030							
7/1/09-10	1.351	1.469	0.994	1.013	1.015	1.417	1.000								
7/1/10-11	1.363	1.695	1.238	1.036	1.129	1.021									
7/1/11-12	2.200	1.074	1.065	1.015	1.094										
7/1/12-13	1.261	1.294	1.151	1.102											
7/1/13-14	1.686	1.216	1.030												
7/1/14-15	1.966	1.065													
7/1/15-16	1.037														
Average	1.466	1.180	1.031	1.054	1.007	1.047	1.042	1.032	1.017	1.031	1.008	1.022	1.005	0.997	
Wtd. Avg.	1.372	1.194	1.037	1.042	1.027	1.052	1.026	1.037	1.014	1.035	1.012	1.020	1.004	0.998	
Avg. Latest 5	1.630	1.269	1.095	1.035	1.049	1.120	1.011	1.057	1.021	1.059	1.003	1.019	1.021	0.991	
Wtd. Avg. Latest 5	1.569	1.282	1.112	1.036	1.060	1.097	1.005	1.056	1.020	1.064	1.007	1.022	1.015	0.991	
VACO	1.531	1.170	1.079	1.044	1.027	1.018	1.025	1.013	1.009	1.007	1.005	1.003	1.002	1.002	1.004
Prior	1.512	1.206	1.058	1.030	1.023	1.020	1.014	1.011	1.008	1.007	1.007	1.005	1.002	1.002	1.003
Selected	1.512	1.206	1.058	1.030	1.025	1.020	1.014	1.011	1.008	1.007	1.007	1.005	1.002	1.002	1.003

Cumulative Factor	12:ult	24:ult	36:ult	48:ult	60:ult	72:ult	84:ult	96:ult	108:ult	120:ult	132:ult	144:ult	156:ult	168:ult	180:Ult
	2.201	1.456	1.207	1.141	1.108	1.081	1.060	1.045	1.034	1.026	1.018	1.012	1.007	1.005	1.003

\* School Board losses were as of 5/31/05 in the 2005 analysis

***Estimation of Cumulative Reported Loss Development Factors  
Using "The Method of Least Squares"  
Workers Compensation***

**Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)**

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X' $LN(1/(X+C))$	Y' $LN(Y-1)$	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	2.201	-2.9437	0.1833	8.665	0.0336	-0.5395	354	1.004
24	1.456	-3.4335	-0.7852	11.789	0.6165	2.6960	342	1.004
36	1.207	-3.7609	-1.5728	14.144	2.4737	5.9151	330	1.004
48	1.141	-4.0071	-1.9605	16.057	3.8434	7.8557	318	1.005
60	1.108	-4.2045	-2.2265	17.678	4.9575	9.3615	306	1.005
72	1.081	-4.3693	-2.5106	19.091	6.3032	10.9695	294	1.005
84	1.060	-4.5107	-2.8136	20.346	7.9161	12.6912	282	1.006
96	1.045	-4.6346	-3.0967	21.479	9.5894	14.3519	270	1.006
108	1.034	-4.7448	-3.3884	22.513	11.4813	16.0773	258	1.007
120	1.026	-4.8441	-3.6668	23.465	13.4454	17.7623	246	1.008
							234	1.008
							222	1.009
							210	1.010
							198	1.011
							186	1.013
							174	1.014
							162	1.017
							150	1.019
							138	1.022
							126	1.026
							114	1.032
							102	1.039
							90	1.049
							78	1.063
							66	1.085
							54	1.120
							42	1.185
							30	1.320
							18	1.687
							6	5.284
Sum		-41.4531	-21.8378	175.2278	60.6601	97.1408		
Average		-4.1453	-2.1838	17.5	6.0660	9.7141		

N =	10		
A =	3.661E+02		
B =	1.951	R^2 =	0.99509
C =	7		

\* Appendix A1

**Roanoke County**  
Workers Compensation  
Combined Experience for County and School Board\*

**Appendix A3**

***Paid Loss Development***

<i>Accident Period</i>	12	24	36	48	60	72	<i>Gross Paid Losses as of (months)</i>								
							84	96	108	120	132	144	156	168	180
7/1/96-97		\$301,493	\$401,657	\$458,782	\$616,631	\$686,635	\$772,779	\$797,776	\$824,695	\$846,088	\$871,085	\$917,232	\$971,077	\$980,691	\$990,305
7/1/97-98	\$80,084	\$215,592	\$317,065	\$328,379	\$332,568	\$345,369	\$350,868	\$363,112	\$371,053	\$372,910	\$373,354	\$373,354	\$367,535	\$361,716	\$361,716
7/1/98-99	\$114,134	\$210,693	\$257,038	\$277,403	\$299,572	\$319,178	\$329,461	\$433,040	\$396,366	\$408,694	\$421,923	\$433,319	\$444,715	\$453,818	\$462,920
7/1/99-00	\$151,117	\$299,234	\$323,588	\$459,479	\$494,100	\$525,881	\$532,954	\$565,068	\$575,672	\$651,017	\$666,314	\$681,611	\$702,875	\$724,139	\$745,631
7/1/00-01	\$126,266	\$167,694	\$252,401	\$283,113	\$313,127	\$313,698	\$317,365	\$323,251	\$327,364	\$332,422	\$337,480	\$343,283	\$349,086	\$352,871	\$356,056
7/1/01-02	\$197,503	\$639,170	\$724,256	\$742,498	\$746,596	\$763,886	\$793,389	\$860,360	\$878,364	\$898,927	\$909,566	\$920,206	\$924,183	\$927,447	\$933,275
7/1/02-03	\$161,268	\$321,666	\$395,462	\$491,459	\$507,841	\$517,986	\$523,379	\$526,694	\$530,029	\$533,526	\$537,022	\$540,425	\$545,515	\$567,835	\$576,215
7/1/03-04	\$185,211	\$410,637	\$478,986	\$511,613	\$529,197	\$537,615	\$548,283	\$567,319	\$596,521	\$625,722	\$651,354	\$784,165	\$811,743	\$814,970	
7/1/04-05	\$222,501	\$380,203	\$417,035	\$434,221	\$446,417	\$459,273	\$469,296	\$480,195	\$491,093	\$505,990	\$511,764	\$524,243	\$529,325		
7/1/05-06	\$278,823	\$543,464	\$606,056	\$618,708	\$646,943	\$667,044	\$685,059	\$699,186	\$712,742	\$731,913	\$765,383	\$771,403			
7/1/06-07	\$168,902	\$287,571	\$330,500	\$409,330	\$427,981	\$469,403	\$524,061	\$597,589	\$724,740	\$792,609	\$820,107				
7/1/07-08	\$360,909	\$698,063	\$764,823	\$860,320	\$876,657	\$897,844	\$912,375	\$918,106	\$934,569	\$928,201					
7/1/08-09	\$219,242	\$498,944	\$570,611	\$606,511	\$613,428	\$637,490	\$698,276	\$776,157	\$794,830						
7/1/09-10	\$315,096	\$557,148	\$699,820	\$770,577	\$829,431	\$876,579	\$996,073	\$1,250,646							
7/1/10-11	\$382,581	\$742,117	\$1,355,826	\$1,672,469	\$1,824,614	\$2,106,606	\$2,144,885								
7/1/11-12	\$161,217	\$325,779	\$442,039	\$500,632	\$587,090	\$605,268									
7/1/12-13	\$222,231	\$502,772	\$628,810	\$749,561	\$767,988										
7/1/13-14	\$368,648	\$763,504	\$995,143	\$1,056,329											
7/1/14-15	\$305,085	\$887,204	\$946,564												
7/1/15-16	\$471,117	\$512,546													
7/1/16-17	\$517,973														

<i>Accident Period</i>	12:24	24:36	36:48	48:60	60:72	72:84	<i>Age-to-Age Factors</i>								
							84:96	96:108	108:120	120:132	132:144	144:156	156:168	168:180	180:Ult
7/1/96-97		1.332	1.142	1.344	1.114	1.125	1.032	1.034	1.026	1.030	1.053	1.059	1.010	1.010	
7/1/97-98	2.692	1.471	1.036	1.013	1.038	1.016	1.035	1.022	1.005	1.001	1.000	0.984	0.984	1.000	
7/1/98-99	1.846	1.220	1.079	1.080	1.065	1.032	1.314	0.915	1.031	1.032	1.027	1.026	1.020	1.020	
7/1/99-00	1.980	1.081	1.420	1.075	1.064	1.013	1.060	1.019	1.131	1.023	1.031	1.031	1.030	1.030	
7/1/00-01	1.328	1.505	1.122	1.106	1.002	1.012	1.019	1.013	1.015	1.015	1.017	1.017	1.011	1.009	
7/1/01-02	3.236	1.133	1.025	1.006	1.023	1.039	1.084	1.021	1.023	1.012	1.012	1.004	1.004	1.006	
7/1/02-03	1.995	1.229	1.243	1.033	1.020	1.010	1.006	1.006	1.007	1.007	1.006	1.009	1.041	1.015	
7/1/03-04	2.217	1.166	1.068	1.034	1.016	1.020	1.035	1.051	1.049	1.041	1.204	1.035	1.004		
7/1/04-05	1.709	1.097	1.041	1.028	1.029	1.022	1.023	1.023	1.030	1.011	1.024	1.010			
7/1/05-06	1.949	1.115	1.021	1.046	1.031	1.027	1.021	1.019	1.027	1.046	1.008				
7/1/06-07	1.703	1.149	1.239	1.046	1.097	1.116	1.140	1.213	1.094	1.035					
7/1/07-08	1.934	1.096	1.125	1.019	1.024	1.016	1.006	1.018	0.993						
7/1/08-09	2.276	1.144	1.063	1.011	1.039	1.095	1.112	1.024							
7/1/09-10	1.768	1.256	1.101	1.076	1.057	1.136	1.256								
7/1/10-11	1.940	1.827	1.234	1.091	1.155	1.018									
7/1/11-12	2.021	1.357	1.133	1.173	1.031										
7/1/12-13	2.262	1.251	1.192	1.025											
7/1/13-14	2.071	1.303	1.061												
7/1/14-15	2.908	1.067													
7/1/15-16	1.088														
Average	2.049	1.253	1.130	1.071	1.050	1.047	1.082	1.029	1.036	1.023	1.037	1.020	1.013	1.013	
Wtd. Avg.	1.996	1.246	1.128	1.067	1.063	1.047	1.083	1.032	1.036	1.025	1.040	1.023	1.013	1.013	
Avg. Latest 5	2.070	1.361	1.144	1.075	1.061	1.076	1.107	1.059	1.039	1.028	1.051	1.015	1.018	1.016	
Wtd. Avg. Latest 5	1.958	1.356	1.152	1.075	1.083	1.058	1.112	1.054	1.036	1.030	1.049	1.015	1.016	1.016	
VACO	2.229	1.237	1.103	1.057	1.036	1.025	1.040	1.022	1.017	1.012	1.009	1.007	1.005	1.004	1.012
Prior	2.065	1.266	1.129	1.056	1.045	1.036	1.031	1.024	1.025	1.019	1.015	1.013	1.008	1.005	1.006
Selected	2.065	1.260	1.129	1.062	1.045	1.036	1.031	1.025	1.024	1.021	1.015	1.013	1.008	1.005	1.006
Cumulative Factor	12:ult	24:ult	36:ult	48:ult	60:ult	72:ult	84:ult	96:ult	108:ult	120:ult	132:ult	144:ult	156:ult	168:ult	180:ult
	3.909	1.893	1.503	1.332	1.254	1.200	1.158	1.123	1.096	1.070	1.049	1.033	1.019	1.011	1.006

\* School Board losses were as of 5/31/05 in the 2005 analysis

**Estimation of Cumulative Paid Loss Development Factors  
Using "The Method of Least Squares"  
Workers Compensation**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X' LN(1/(X+C))	Y' LN(Y-1)	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	3.909	-2.4886	1.0678	6.193	1.1402	-2.6573	354	1.016
24	1.893	-3.1799	-0.1131	10.112	0.0128	0.3597	342	1.017
36	1.503	-3.5847	-0.6871	12.850	0.4722	2.4632	330	1.018
48	1.332	-3.8721	-1.1038	14.993	1.2184	4.2740	318	1.019
60	1.254	-4.0951	-1.3699	16.770	1.8766	5.6097	306	1.020
72	1.200	-4.2773	-1.6093	18.295	2.5899	6.8835	294	1.021
84	1.158	-4.4313	-1.8462	19.637	3.4086	8.1813	282	1.022
96	1.123	-4.5648	-2.0931	20.837	4.3809	9.5545	270	1.024
108	1.096	-4.6825	-2.3426	21.926	5.4879	10.9694	258	1.026
120	1.070	-4.7879	-2.6527	22.924	7.0370	12.7009	246	1.028
							234	1.030
							222	1.032
							210	1.035
							198	1.039
							186	1.043
							174	1.047
							162	1.053
							150	1.059
							138	1.067
							126	1.077
							114	1.090
							102	1.107
							90	1.129
							78	1.161
							66	1.208
							54	1.282
							42	1.415
							30	1.694
							18	2.514
							6	10.716
Sum		-39.9642	-12.7501	164.5370	27.6243	58.3389		
Average		-3.9964	-1.2750	16.5	2.7624	5.8339		

N =	10		
A =	1.269E+02		
B =	1.531	R^2 =	0.99446
C =	0		

\* Appendix A3



**Roanoke County**  
Workers Compensation  
Combined Experience for County and School Board\*

Appendix A5

**Claim Count Development**

Accident Period	Claims reported as of (months):+ 12 24 36 48 60 72 84 96 108 120 132 144											
7/1/96-97		223	225	225	225	225	225	225	225	226	226	226
7/1/97-98	383	414	414	414	414	414	414	414	229	229	229	229
7/1/98-99	415	429	429	429	429	429	429	201	201	201	201	201
7/1/99-00	443	473	473	473	473	473	250	250	250	250	250	250
7/1/00-01	364	378	378	378	378	175	175	175	175	175	175	175
7/1/01-02	402	412	412	412	220	220	220	220	220	220	220	220
7/1/02-03	453	467	467	195	195	195	195	195	195	195	195	195
7/1/03-04	479	492	220	220	220	220	220	220	220	220	220	220
7/1/04-05	375	196	196	196	196	196	196	196	196	196	196	196
7/1/05-06	172	176	177	177	177	177	177	177	177	177	177	177
7/1/06-07	181	179	182	181	181	181	181	181	181	180	180	
7/1/07-08	210	214	216	216	216	216	216	216	217	217		
7/1/08-09	168	176	176	176	176	176	176	176	176			
7/1/09-10	167	173	173	173	173	173	173	173				
7/1/10-11	172	178	180	180	181	181	181					
7/1/11-12	180	186	186	186	186	186						
7/1/12-13	202	203	203	203	203							
7/1/13-14	195	205	205	205								
7/1/14-15	202	203	203									
7/1/15-16	180	180										
7/1/16-17	171											

Accident Period	Age-to-Age Factors 12:24 24:36 36:48 48:60 60:72 72:84 84:96 96:108 108:120 120:132 132:144 144:ult											
7/1/96-97		1.009	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.000	1.000	
7/1/97-98	1.081	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/98-99	1.034	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/99-00	1.068	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/00-01	1.038	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/01-02	1.025	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/02-03	1.031	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/03-04	1.027	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/04-05	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/05-06	0.989	1.017	0.995	1.000	1.000	1.000	1.000	1.000	0.994	1.000	1.000	
7/1/06-07	1.019	1.009	1.000	1.000	1.000	1.000	1.000	1.005	1.000			
7/1/07-08	1.048	1.000	1.000	1.000	1.000	1.000	1.000	1.000				
7/1/08-09	1.036	1.000	1.000	1.000	1.000	1.000	1.000					
7/1/09-10	1.035	1.011	1.000	1.006	1.000	1.000						
7/1/10-11	1.033	1.000	1.000	1.000	1.000							
7/1/11-12	1.005	1.000	1.000	1.000								
7/1/12-13	1.051	1.000	1.000									
7/1/13-14	1.005	1.000										
7/1/14-15	1.000											
7/1/15-16												
Average	1.030	1.003	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Wtd. Avg.	1.018	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Avg Latest 5	1.019	1.002	1.000	1.001	1.000	1.000	1.000	1.001	0.999	1.000	1.000	
VACO	1.042	1.002	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Prior	1.033	1.004	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Selected	1.030	1.003	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Cumulative Factor	12:ult 1.034	24:ult 1.003	36:ult 1.000	48:ult 1.000	60:ult 1.000	72:ult 1.000	84:ult 1.000	96:ult 1.000	108:ult 1.000	120:ult 1.000	132:ult 1.000	144:ult 1.000

\* School Board losses were as of 5/31/05 in the 2005 analysis

+ Beginning 7/1/05, record-only claims no longer included in claim counts

**Estimation of Cumulative Claim Count Development Factors  
Using "The Method of Least Squares"  
Workers Compensation**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X' LN(1/(X+C))	Y' LN(Y-1)	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	1.034	-2.4849	-3.3883	6.175	11.4806	8.4196	354	1.000
24	1.003	-3.1781	-5.7369	10.100	32.9125	18.2323	342	1.000
							330	1.000
							318	1.000
							306	1.000
							294	1.000
							282	1.000
							270	1.000
							258	1.000
							246	1.000
							234	1.000
							222	1.000
							210	1.000
							198	1.000
							186	1.000
							174	1.000
							162	1.000
							150	1.000
							138	1.000
							126	1.000
							114	1.000
							102	1.000
							90	1.000
							78	1.000
							66	1.000
							54	1.000
							42	1.000
							30	1.002
							18	1.009
							6	2.179
Sum		-5.6630	-9.1252	16.3	44.3931	26.6519		
Average		-2.8315	-4.5626	8.1	22.1966	13.3260		

N =	2		
A =	1.532E+02		
B =	3.388	R^2 =	1.00000
C =	0		

\* Appendix A5

**U.S. Claims Cost Index  
Adjusted to Remove Effects of California Trend**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Year	Workers Compensation Economic Index	Social Index	Composite Economic & Social Index	Annual Percent Increase	Accident Period	Interpolated Index	Trend Factor to 7/1/18-19
1989	49.3	1.000	49.3	--	7/1/88-89	49.3	3.019
1990	52.9	1.000	52.9	7.3%	7/1/89-90	51.1	2.913
1991	55.8	1.000	55.8	5.6%	7/1/90-91	54.3	2.737
1992	58.8	1.000	58.8	5.4%	7/1/91-92	57.3	2.596
1993	61.7	1.000	61.7	4.9%	7/1/92-93	60.2	2.469
1994	63.3	1.000	63.3	2.6%	7/1/93-94	62.5	2.381
1995	64.3	1.000	64.3	1.7%	7/1/94-95	63.8	2.331
1996	66.7	1.000	66.7	3.7%	7/1/95-96	65.5	2.269
1997	69.3	1.000	69.3	3.8%	7/1/96-97	68.0	2.186
1998	72.2	1.000	72.2	4.2%	7/1/97-98	70.8	2.102
1999	75.0	1.000	75.0	3.8%	7/1/98-99	73.6	2.020
2000	78.7	1.000	78.7	5.0%	7/1/99-00	76.9	1.935
2001	81.6	1.000	81.6	3.6%	7/1/00-01	80.2	1.856
2002	85.8	1.000	85.8	5.2%	7/1/01-02	83.7	1.777
2003	90.3	1.000	90.3	5.2%	7/1/02-03	88.0	1.689
2004	95.2	1.000	95.2	5.5%	7/1/03-04	92.8	1.603
2005	100.0	1.000	100.0	5.0%	7/1/04-05	97.6	1.524
2006	104.8	1.000	104.8	4.8%	7/1/05-06	102.4	1.452
2007	106.8	1.000	106.8	1.8%	7/1/06-07	105.8	1.406
2008	110.0	1.000	110.0	3.0%	7/1/07-08	108.4	1.372
2009	110.0	1.000	110.0	0.0%	7/1/08-09	110.0	1.352
2010	114.6	1.000	114.6	4.2%	7/1/09-10	112.3	1.324
2011	118.4	1.000	118.4	3.3%	7/1/10-11	116.5	1.276
2012	122.2	1.000	122.2	3.2%	7/1/11-12	120.3	1.236
2013	125.1	1.000	125.1	2.3%	7/1/12-13	123.6	1.203
2014	129.6	1.000	129.6	3.6%	7/1/13-14	127.3	1.168
2015	133.5	1.000	133.5	3.0%	7/1/14-15	131.5	1.131
2016*	137.7	1.000	137.7	3.1%	7/1/15-16	135.6	1.097
2017**	142.0	1.000	142.0	3.1%	7/1/16-17	139.8	1.064
2018**	146.4	1.000	146.4	3.1%	7/1/17-18	144.2	1.031
2019**	151.0	1.000	151.0	3.1%	7/1/18-19	148.7	1.000
2020**	155.8	1.000	155.8	3.1%	7/1/19-20	153.4	0.970

\* 2016 numbers are preliminary

\*\* Future trend estimated using latest year

Column (B): Willis Towers Watson Claim Cost Index, September 2016  
Jeremy P. Pecora and Emily M. Thompson  
2002-2008 adjusted to remove effects of changes in California cost trends

Column (C): No Social Inflation assumed

Column (D) = (B) x (C)

Column (E) = [(D) / (D, prior)] - 1

Column (G): Linear interpolation of column (D)

Column (H) = [(G), forecast period] / [(G), current period]

**Derivation of Exposure Trend Factors  
Employment Compensation Index**

(A)	(B)	(C)	(D)	(E)	(F)
Year	ECI Index	Annual Percent Increase	Accident Period	Interpolated Index	Trend Factor to 7/1/18-19
1996	74.3				
1997	76.8	3.4%	7/1/96-97	75.5	1.764
1998	79.7	3.8%	7/1/97-98	78.3	1.703
1999	82.4	3.4%	7/1/98-99	81.1	1.643
2000	85.7	3.9%	7/1/99-00	84.1	1.585
2001	88.8	3.6%	7/1/00-01	87.2	1.527
2002	91.7	3.2%	7/1/01-02	90.2	1.477
2003	94.3	2.9%	7/1/02-03	93.0	1.433
2004	96.7	2.5%	7/1/03-04	95.5	1.395
2005	99.1	2.5%	7/1/04-05	97.9	1.361
2006	102.0	3.0%	7/1/05-06	100.5	1.325
2007	105.5	3.4%	7/1/06-07	103.8	1.284
2008	108.7	3.1%	7/1/07-08	107.1	1.244
2009	110.6	1.7%	7/1/08-09	109.7	1.215
2010	112.3	1.6%	7/1/09-10	111.5	1.195
2011	114.1	1.6%	7/1/10-11	113.2	1.177
2012	116.0	1.7%	7/1/11-12	115.0	1.158
2013	118.0	1.7%	7/1/12-13	117.0	1.139
2014	120.2	1.9%	7/1/13-14	119.1	1.119
2015	122.9	2.2%	7/1/14-15	121.5	1.096
2016	125.7	2.3%	7/1/15-16	124.3	1.072
2017	128.8	2.5%	7/1/16-17	127.2	1.047
2018*	131.7	2.3%	7/1/17-18	130.2	1.023
2019*	134.7	2.3%	7/1/18-19	133.2	1.000
2020*	137.8	2.3%	7/1/19-20	136.3	0.978

\* Estimated at 2.3%

Column (B): U. S. Department of Labor, Bureau of Statistics, [bls.gov](http://bls.gov)

Wages and Salary Cost Index for All Civilian Workers, Not Seasonably Adjusted

Column (C) =  $[(B) / (B, \text{prior})] - 1$

Column (E): Values interpolated from index in (B)

Column (F) =  $(E, \text{Forecast period}) / (E)$

**Derivation of Discount Factors**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Maturity in Years at 12/31/2017	Cumulative Paid Loss Develop. Factor	% Losses Paid 12/31/2017	Midpoint Upcoming Period	% Losses Paid Upcoming Period	Column(F) Discounted 2.5%	Discount Factor at 2.5%
7/1/88-89	29.5	1.000	100.0%				1.000
7/1/89-90	28.5	1.000	100.0%				1.000
7/1/90-91	27.5	1.000	100.0%				1.000
7/1/91-92	26.5	1.000	100.0%				1.000
7/1/92-93	25.5	1.000	100.0%				1.000
7/1/93-94	24.5	1.000	100.0%				1.000
7/1/94-95	23.5	1.000	100.0%				1.000
7/1/95-96	22.5	1.000	100.0%				1.000
7/1/96-97	21.5	1.000	100.0%				1.000
7/1/97-98	20.5	1.000	100.0%				1.000
7/1/98-99	19.5	1.030	97.1%	20.0	2.9%	0.018	0.988
7/1/99-00	18.5	1.032	96.9%	19.0	0.2%	0.001	0.965
7/1/00-01	17.5	1.035	96.6%	18.0	0.3%	0.002	0.945
7/1/01-02	16.5	1.039	96.3%	17.0	0.3%	0.002	0.928
7/1/02-03	15.5	1.043	95.9%	16.0	0.4%	0.002	0.913
7/1/03-04	14.5	1.047	95.5%	15.0	0.4%	0.003	0.899
7/1/04-05	13.5	1.053	95.0%	14.0	0.5%	0.003	0.888
7/1/05-06	12.5	1.059	94.4%	13.0	0.6%	0.004	0.879
7/1/06-07	11.5	1.067	93.7%	12.0	0.7%	0.005	0.873
7/1/07-08	10.5	1.077	92.8%	11.0	0.9%	0.007	0.868
7/1/08-09	9.5	1.090	91.7%	10.0	1.1%	0.009	0.865
7/1/09-10	8.5	1.107	90.4%	9.0	1.4%	0.011	0.865
7/1/10-11	7.5	1.129	88.6%	8.0	1.8%	0.015	0.866
7/1/11-12	6.5	1.161	86.1%	7.0	2.4%	0.020	0.870
7/1/12-13	5.5	1.208	82.8%	6.0	3.3%	0.029	0.876
7/1/13-14	4.5	1.282	78.0%	5.0	4.8%	0.043	0.884
7/1/14-15	3.5	1.415	70.7%	4.0	7.3%	0.066	0.893
7/1/15-16	2.5	1.694	59.0%	3.0	11.6%	0.108	0.905
7/1/16-17	1.5	2.514	39.8%	2.0	19.3%	0.183	0.916
7/1/17-18	0.5	10.716	9.3%	1.0	30.4%	0.297	0.925
7/1/18-19	0.0			0.5	9.3%	0.092	0.921

Column (C): Appendix A2

Column (D) = 1 / (C)

Column (E) = [ (B), current line + (B), previous line] / 2

Column (F) = (D), previous line - (D), current line

Column (G) = (F) x [ 1 + Interest Rate ]<sup>-(E)</sup>

Column (H) = [1 + Interest Rate]<sup>-(B)</sup> / [1 - (D)] x [Downward Sum, (G)]

**Analysis of Historical Loss Patterns  
Variation in Reported Loss Development  
Workers Compensation**

Accident Period	12:24	24:36	36:48	48:60	60:72	72:84	Natural Log of Age-to-Age Factors								
							84:96	96:108	108:120	120:132	132:144	144:156	156:168	168:180	180:Ult
7/1/96-97		1.2238	1.1212	1.6592	1.1041	0.9522	1.0000	1.0533	1.0083	0.9997	1.0000	1.0000	0.9975	1.0219	
7/1/97-98	2.0712	0.9782	1.0130	1.0277	1.0212	1.0040	1.0979	1.0194	0.9753	0.8867	1.0000	0.9844	0.9842	1.0000	
7/1/98-99	1.1681	1.0975	1.1857	1.0118	0.8599	1.0226	1.2941	0.9633	1.1152	1.0000	1.0398	1.1412	0.9555	0.9535	
7/1/99-00	1.0352	1.3653	0.8974	1.0287	1.0882	1.0098	1.0003	1.0434	1.0145	1.0173	1.0767	0.9772	0.9766	1.0293	
7/1/00-01	1.0595	1.0724	0.5968	1.0515	0.9071	0.9998	1.0089	1.0000	1.0000	1.1080	0.9513	0.9488	1.0000	1.0000	
7/1/01-02	0.9387	1.1401	0.9826	0.9864	1.0129	1.0409	1.0708	1.0055	0.9803	1.0339	1.0328	1.0013	1.0015	0.9742	
7/1/02-03	1.1991	0.9870	1.1099	1.0650	1.0074	0.9804	0.9992	1.0013	1.0033	1.0033	1.0063	1.0094	1.1263	1.0000	
7/1/03-04	1.4825	1.1523	0.9745	1.0678	0.9839	1.0829	1.0013	1.0446	1.0427	1.1637	1.0130	1.0489	1.0000		
7/1/04-05	1.4982	1.1576	1.0318	0.9418	0.9169	1.0080	1.0669	1.0627	1.0108	1.0099	0.9632	1.0849			
7/1/05-06	1.4696	1.1576	0.9994	0.9881	0.9643	1.0003	0.9862	1.0003	1.0057	1.0603	1.0005				
7/1/06-07	1.4457	0.9463	1.1298	0.9677	1.0020	1.0183	1.1146	1.1290	1.0454	1.0594					
7/1/07-08	1.0255	1.2533	1.0838	0.9493	0.9631	0.9910	1.0041	1.0621	0.9983						
7/1/08-09	2.5947	1.0829	0.9459	1.0105	1.0427	1.1504	0.9490	1.0297							
7/1/09-10	1.3508	1.4688	0.9940	1.0133	1.0153	1.4171	1.0000								
7/1/10-11	1.3628	1.6950	1.2379	1.0357	1.1286	1.0207									
7/1/11-12	2.1999	1.0736	1.0647	1.0150	1.0939										
7/1/12-13	1.2608	1.2937	1.1510	1.1024											
7/1/13-14	1.6856	1.2157	1.0297												
7/1/14-15	1.9658	1.0649													
7/1/15-16	1.0367														
Variance	0.2062	0.0329	0.0195	0.0261	0.0056	0.0126	0.0074	0.0017	0.0014	0.0049	0.0013	0.0036	0.0026	0.0007	
Sum	0.3266	0.1204	0.0875	0.0680	0.0419	0.0363	0.0237	0.0163	0.0146	0.0132	0.0082	0.0069	0.0033	0.0007	
Sigma	0.5715	0.3470	0.2958	0.2608	0.2048	0.1906	0.1539	0.1276	0.1207	0.1148	0.0907	0.0832	0.0577	0.0500	

**Estimation of Cumulative Reported Loss Development Factors  
Using "The Method of Least Squares"**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	2.003	-6.1060	0.0028	37.283	0.0000	-0.0171	282	1.000
24	1.402	-6.1324	-0.9116	37.606	0.8310	5.5901	270	1.000
36	1.220	-6.1581	-1.5164	37.922	2.2994	9.3379	258	1.000
48	1.037	-6.1832	-3.2927	38.232	10.8417	20.3592	246	1.000
60	1.017	-6.2076	-4.0853	38.535	16.6897	25.3601	234	1.000
72	1.006	-6.2315	-5.0532	38.832	25.5352	31.4894	222	1.000
84	1.003	-6.2548	-5.8081	39.123	33.7345	36.3290	210	1.000
96	1.002	-6.2776	-6.2141	39.409	38.6151	39.0099	198	1.000
							186	1.000
							174	1.000
							162	1.000
							150	1.000
							138	1.000
							126	1.000
							114	1.000
							102	1.000
							90	1.000
							78	1.000
							66	1.013
							54	1.033
							42	1.085
							30	1.226
							18	1.619
							6	4.658
Sum		-49.5513	-26.8786	306.9411	128.5467	167.4586		
Average		-6.1939	-3.3598	38.3676	16.0683	20.9323		

N =	8		
A =	2.680E+102		
B =	38.620	R^2 =	0.98463
C =	437		

\* Based on Virginia Association of Counties Experience

**Estimation of Cumulative Paid Loss Development Factors  
Using "The Method of Least Squares"**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	3.492	-4.1611	0.9131	17.315	0.8337	-3.7993	282	1.000
24	1.718	-4.3326	-0.3307	18.771	0.1094	1.4327	270	1.000
36	1.362	-4.4789	-1.0157	20.061	1.0317	4.5493	258	1.000
48	1.131	-4.6066	-2.0304	21.221	4.1224	9.3531	246	1.000
60	1.067	-4.7198	-2.6979	22.276	7.2787	12.7335	234	1.000
72	1.012	-4.8214	-4.4479	23.246	19.7840	21.4453	222	1.000
84	1.009	-4.9137	-4.7304	24.144	22.3767	23.2437	210	1.000
96	1.006	-4.9982	-5.0813	24.982	25.8198	25.3973	198	1.000
108	1.005	-5.0761	-5.4021	25.766	29.1829	27.4215	186	1.000
120	1.003	-5.1483	-5.9907	26.505	35.8881	30.8418	174	1.000
							162	1.000
							150	1.000
							138	1.000
							126	1.000
							114	1.000
							102	1.000
							90	1.000
							78	1.000
							66	1.033
							54	1.071
							42	1.169
							30	1.453
							18	2.421
							6	9.621
Sum		-47.2566	-30.8140	224.2872	146.4273	152.6188		
Average		-4.7257	-3.0814	22.4287	14.6427	15.2619		

N =	10		
A =	3.158E+13		
B =	7.230	R^2 =	0.98342
C =	52		

\* Based on Virginia Association of Counties Experience



**Estimation of Cumulative Claim Count Development Factors  
Using "The Method of Least Squares"**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	1.051	-3.3837	-2.9664	11.449	8.7997	10.0374	282	1.000
24	1.004	-3.7252	-5.4342	13.877	29.5303	20.2433	270	1.000
36	1.001	-3.9793	-7.2703	15.835	52.8574	28.9306	258	1.000
							246	1.000
							234	1.000
							222	1.000
							210	1.000
							198	1.000
							186	1.000
							174	1.000
							162	1.000
							150	1.000
							138	1.000
							126	1.000
							114	1.000
							102	1.000
							90	1.000
							78	1.000
							66	1.000
							54	1.000
							42	1.000
							30	1.002
							18	1.013
							6	2.211
Sum		-11.0881	-15.6709	41.1607	91.1875	59.2113		
Average		-3.6960	-5.2236	13.7202	30.3958	19.7371		

N =	3		
A =	2.139E+09		
B =	7.226	R^2 =	1.00000
C =	17		

\* Based on Virginia Association of Counties Experience

**U.S. Claims Cost Index  
Automobile Liability**

(A) Year	(B) Auto Bodily Injury Economic Index	(C) Auto Property Damage Economic Index	(D) Combined Economic Index	(E) Social Index	(F) Composite Economic & Social Index	(G) Annual Percent Increase	(H) Accident Period	(I) Interpolated Index	(J) Trend Factor to 7/1/18-19
1994	61.4	66.8	63.6	1.000	63.6		7/1/93-94	63.6	2.489
1995	64.4	69.3	66.4	1.000	66.4	4.4%	7/1/94-95	65.0	2.436
1996	66.9	71.9	68.9	1.000	68.9	3.9%	7/1/95-96	67.6	2.340
1997	69.5	74.4	71.5	1.000	71.5	3.7%	7/1/96-97	70.2	2.255
1998	72.2	76.9	74.1	1.000	74.1	3.7%	7/1/97-98	72.8	2.174
1999	75.5	79.5	77.1	1.000	77.1	4.0%	7/1/98-99	75.6	2.093
2000	79.7	82.7	80.9	1.000	80.9	4.9%	7/1/99-00	79.0	2.003
2001	83.2	85.2	84.0	1.000	84.0	3.9%	7/1/00-01	82.5	1.919
2002	87.5	88.9	88.1	1.000	88.1	4.8%	7/1/01-02	86.1	1.839
2003	91.4	91.7	91.5	1.000	91.5	3.9%	7/1/02-03	89.8	1.763
2004	95.9	95.1	95.6	1.000	95.6	4.5%	7/1/03-04	93.5	1.692
2005	100.0	100.0	100.0	1.000	100.0	4.6%	7/1/04-05	97.8	1.618
2006	104.9	103.6	104.3	1.000	104.3	4.3%	7/1/05-06	102.2	1.549
2007	110.6	107.2	109.3	1.000	109.3	4.7%	7/1/06-07	106.8	1.482
2008	115.7	110.7	113.7	1.000	113.7	4.1%	7/1/07-08	111.5	1.420
2009	119.3	118.9	119.1	1.000	119.1	4.8%	7/1/08-09	116.4	1.359
2010	124.1	122.0	123.2	1.000	123.2	3.4%	7/1/09-10	121.2	1.306
2011	129.7	125.7	128.1	1.000	128.1	3.9%	7/1/10-11	125.7	1.259
2012	134.8	128.2	132.1	1.000	132.1	3.2%	7/1/11-12	130.1	1.216
2013	138.4	130.6	135.3	1.000	135.3	2.4%	7/1/12-13	133.7	1.183
2014	143.3	134.1	139.6	1.000	139.6	3.1%	7/1/13-14	137.5	1.151
2015	148.0	137.2	143.7	1.000	143.7	3.0%	7/1/14-15	141.6	1.117
2016*	152.7	140.2	147.7	1.000	147.7	2.8%	7/1/15-16	145.7	1.086
2017**	157.6	143.2	151.8	1.000	151.8	2.8%	7/1/16-17	149.8	1.057
2018**	162.6	146.2	156.1	1.000	156.1	2.8%	7/1/17-18	154.0	1.028
2019**	167.8	149.4	160.4	1.000	160.4	2.8%	7/1/18-19	158.3	1.000
2020**	173.2	152.6	164.9	1.000	164.9	2.8%	7/1/19-20	162.7	0.973

Columns (B), (C): Willis Towers Watson Claim Cost Index, September 2016

Jeremy P. Pecora and Emily M. Thompson

\* 2016 numbers are preliminary

\*\* Future trend estimated based on latest year

Column (D) = 60/40 weighting of BI and PD

Column (E): No Social Inflation assumed

Column (F) = (D) x (E)

Column (G) = [(F) / (F, prior)] - 1

Column (I): Linear interpolation of column (F)

Column (J) = [(I), forecast period] / [(I), current period]

***Exposure Trend Factors  
Automobile Liability***

*No Trend Necessary for Number of Vehicles*

**Derivation of Discount Factors**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Maturity in Years at 12/31/2017	Cumulative Paid Loss Develop. Factor	% Losses Paid 12/31/2017	Midpoint Upcoming Period	% Losses Paid Upcoming Period	Column (F) Discounted 2.5%	Discount Factor at 2.5%
7/1/94-95	23.50	1.000	100.0%				1.000
7/1/95-96	22.50	1.000	100.0%				1.000
7/1/96-97	21.50	1.000	100.0%				1.000
7/1/97-98	20.50	1.000	100.0%				1.000
7/1/98-99	19.50	1.000	100.0%				1.000
7/1/99-00	18.50	1.000	100.0%				1.000
7/1/00-01	17.50	1.000	100.0%				1.000
7/1/01-02	16.50	1.000	100.0%				1.000
7/1/02-03	15.50	1.000	100.0%				1.000
7/1/03-04	14.50	1.000	100.0%				1.000
7/1/04-05	13.50	1.000	100.0%				1.000
7/1/05-06	12.50	1.000	100.0%				1.000
7/1/06-07	11.50	1.000	100.0%				1.000
7/1/07-08	10.50	1.000	100.0%				1.000
7/1/08-09	9.50	1.000	100.0%				1.000
7/1/09-10	8.50	1.000	100.0%				1.000
7/1/10-11	7.50	1.000	100.0%				1.000
7/1/11-12	6.50	1.000	100.0%				1.000
7/1/12-13	5.50	1.033	96.8%	6.0	3.18%	0.0274	0.988
7/1/13-14	4.50	1.071	93.4%	5.0	3.46%	0.0306	0.976
7/1/14-15	3.50	1.169	85.5%	4.0	7.83%	0.0709	0.972
7/1/15-16	2.50	1.453	68.8%	3.0	16.73%	0.1553	0.969
7/1/16-17	1.50	2.421	41.3%	2.0	27.49%	0.2617	0.965
7/1/17-18	0.50	9.621	10.4%	1.0	30.91%	0.3016	0.958
7/1/18-19	0.00			0.5	10.39%	0.1027	0.950

Column (C): Appendix A2

Column (D) =  $1 / (C)$

Column (E) =  $[(B), \text{current line} + (B), \text{previous line}] / 2$

Column (F) =  $(D), \text{previous line} - (D), \text{current line}$

Column (G) =  $(F) \times [1 + \text{Interest Rate}]^{-(E)}$

Column (H) =  $[1 + \text{Interest Rate}]^{(B)} / [1 - (D)] \times [\text{Downward Sum}, (G)]$

**Estimation of Cumulative Reported Loss Development Factors  
Using "The Method of Least Squares"**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	<b>2.902</b>	-3.5671	0.6429	12.724	0.4133	-2.2932	<b>282</b>	<b>1.000</b>
24	<b>1.820</b>	-3.8589	-0.1985	14.891	0.0394	0.7659	<b>270</b>	<b>1.000</b>
36	<b>1.353</b>	-4.0845	-1.0408	16.684	1.0833	4.2513	<b>258</b>	<b>1.000</b>
48	<b>1.208</b>	-4.2685	-1.5682	18.220	2.4593	6.6939	<b>246</b>	<b>1.000</b>
60	<b>1.134</b>	-4.4238	-2.0103	19.570	4.0414	8.8933	<b>234</b>	<b>1.000</b>
72	<b>1.084</b>	-4.5582	-2.4822	20.778	6.1614	11.3145	<b>222</b>	<b>1.000</b>
							<b>210</b>	<b>1.000</b>
							<b>198</b>	<b>1.000</b>
							<b>186</b>	<b>1.000</b>
							<b>174</b>	<b>1.000</b>
							<b>162</b>	<b>1.000</b>
							<b>150</b>	<b>1.000</b>
							<b>138</b>	<b>1.000</b>
							<b>126</b>	<b>1.000</b>
							<b>114</b>	<b>1.000</b>
							<b>102</b>	<b>1.000</b>
							<b>90</b>	<b>1.000</b>
							<b>78</b>	<b>1.000</b>
							<b>66</b>	<b>1.103</b>
							<b>54</b>	<b>1.163</b>
							<b>42</b>	<b>1.278</b>
							<b>30</b>	<b>1.527</b>
							<b>18</b>	<b>2.177</b>
							<b>6</b>	<b>7.067</b>
Sum		-24.7612	-6.6572	102.8673	14.1981	29.6257		
Average		-4.1269	-1.1095	17.1445	2.3663	4.9376		

N =	6		
A =	1.518E+05		
B =	3.160	R^2 =	0.99849
C =	23		

\* Based on Virginia Association of Counties Experience

**Estimation of Cumulative Paid Loss Development Factors  
Using "The Method of Least Squares"**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	5.297	-3.0357	1.4578	9.215	2.1252	-4.4254	282	1.000
24	2.403	-3.4909	0.3388	12.186	0.1148	-1.1826	270	1.000
36	1.466	-3.8025	-0.7640	14.459	0.5837	2.9052	258	1.000
48	1.267	-4.0398	-1.3207	16.320	1.7443	5.3355	246	1.000
60	1.181	-4.2314	-1.7102	17.905	2.9248	7.2365	234	1.000
72	1.102	-4.3922	-2.2874	19.291	5.2321	10.0465	222	1.000
							210	1.000
							198	1.000
							186	1.000
							174	1.000
							162	1.000
							150	1.000
							138	1.000
							126	1.000
							114	1.000
							102	1.000
							90	1.000
							78	1.000
							66	1.129
							54	1.209
							42	1.375
							30	1.787
							18	3.180
							6	15.364
Sum		-22.9924	-4.2857	89.3766	12.7249	19.9157		
Average		-3.8321	-0.7143	14.8961	2.1208	3.3193		

N =	6		
A =	1.880E+04		
B =	2.755	R^2 =	0.99551
C =	9		

\* Based on Virginia Association of Counties Experience

**Estimation of Cumulative Claim Count Development Factors  
Using "The Method of Least Squares"**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	1.165	-2.4582	-1.7993	6.043	3.2376	4.4231	282	1.000
24	1.026	-3.1648	-3.6401	10.016	13.2500	11.5201	270	1.000
36	1.008	-3.5747	-4.8477	12.778	23.5004	17.3291	258	1.000
48	1.004	-3.8646	-5.5315	14.935	30.5977	21.3771	246	1.000
60	1.003	-4.0891	-5.7911	16.720	33.5366	23.6801	234	1.000
72	1.002	-4.2723	-6.2073	18.252	38.5303	26.5192	222	1.000
84	1.001	-4.4270	-7.2654	19.599	52.7865	32.1644	210	1.000
							198	1.000
							186	1.000
							174	1.000
							162	1.000
							150	1.000
							138	1.000
							126	1.000
							114	1.000
							102	1.000
							90	1.000
							78	1.000
							66	1.000
							54	1.000
							42	1.006
							30	1.015
							18	1.056
							6	2.685
Sum		-25.8507	-35.0824	98.3438	195.4390	137.0130		
Average		-3.6930	-5.0118	14.0491	27.9199	19.5733		

N =	7		
A =	9.495E+01		
B =	2.590	R^2 =	0.98450
C =	0		

\* Based on Virginia Association of Counties Experience

**U.S. Claims Cost Index  
General Liability**

(A)	(B) Other Bodily Injury Economic Index	(C) Other Property Damage Economic Index	(D) Combined Economic Index	(E) Social Index	(F) Composite Economic & Social Index	(G) Annual Percent Increase	(H) Accident Period	(I) Interpolated Index	(J) Trend Factor to 7/1/18-19
Year									
1994	61.4	68.2	64.8	1.000	64.8	4.5%	7/1/93-94	64.8	2.291
1995	63.8	70.1	66.9	1.000	66.9	3.3%	7/1/94-95	65.9	2.254
1996	66.2	72.4	69.3	1.000	69.3	3.6%	7/1/95-96	68.1	2.179
1997	68.9	75.3	72.1	1.000	72.1	4.0%	7/1/96-97	70.7	2.100
1998	71.6	77.7	74.7	1.000	74.7	3.6%	7/1/97-98	73.4	2.023
1999	75.1	80.5	77.8	1.000	77.8	4.2%	7/1/98-99	76.3	1.947
2000	79.0	84.0	81.5	1.000	81.5	4.8%	7/1/99-00	79.7	1.864
2001	82.8	84.3	83.6	1.000	83.6	2.6%	7/1/00-01	82.5	1.799
2002	87.9	87.3	87.6	1.000	87.6	4.8%	7/1/01-02	85.6	1.735
2003	92.0	89.6	90.8	1.000	90.8	3.7%	7/1/02-03	89.2	1.665
2004	96.1	94.5	95.3	1.000	95.3	3.7%	7/1/03-04	93.0	1.596
2005	100.0	100.0	100.0	1.000	100.0	4.3%	7/1/04-05	97.6	1.521
2006	104.1	104.6	104.4	1.000	104.4	4.3%	7/1/05-06	102.2	1.453
2007	109.6	108.4	109.0	1.000	109.0	4.5%	7/1/06-07	106.7	1.392
2008	114.7	111.6	113.2	1.000	113.2	3.8%	7/1/07-08	111.1	1.337
2009	118.3	112.7	115.5	1.000	115.5	2.1%	7/1/08-09	114.3	1.299
2010	122.4	114.2	118.3	1.000	118.3	2.4%	7/1/09-10	116.9	1.270
2011	127.6	117.7	122.7	1.000	122.7	3.7%	7/1/10-11	120.5	1.232
2012	131.1	122.0	126.6	1.000	126.6	3.2%	7/1/11-12	124.6	1.192
2013	134.8	124.7	129.8	1.000	129.8	2.5%	7/1/12-13	128.2	1.159
2014	137.8	128.9	133.4	1.000	133.4	2.8%	7/1/13-14	131.6	1.129
2015	145.5	128.9	137.2	1.000	137.2	2.9%	7/1/14-15	135.3	1.098
2016*	149.9	130.7	140.3	1.000	140.3	2.3%	7/1/15-16	138.8	1.070
2017**	154.5	132.5	143.5	1.000	143.5	2.3%	7/1/16-17	141.9	1.046
2018**	159.2	134.4	146.8	1.000	146.8	2.3%	7/1/17-18	145.2	1.023
2019**	164.1	136.3	150.2	1.000	150.2	2.3%	7/1/18-19	148.5	1.000
2020**	169.1	138.2	153.7	1.000	153.7	2.3%	7/1/19-20	151.9	0.977

Columns (B), (C): Willis Towers Watson Claim Cost Index, September 2016

Jeremy P. Pecora and Emily M. Thompson

\* 2016 numbers are preliminary

\*\* Future trend estimated based on latest year

Column (D) = Average of (B) and (C)

Column (E): No Social Inflation assumed

Column (F) = (D) x (E)

Column (G) = [(F) / (F, prior)] - 1

Column (I): Linear interpolation of column (F)

Column (J) = [(I), forecast period] / [(I), current period]



**Derivation of Consumer Price Index  
Exposure Trend Factors**

(A) Year	(B) CPI Index	(C) Annual Percent Increase	(D) Accident Period	(E) Interpolated Index	(F) Trend Factor 7/1/18-19
1994	148.2				
1995	152.4	2.8%	7/1/94-95	150.3	1.680
1996	156.9	3.0%	7/1/95-96	154.7	1.633
1997	160.5	2.3%	7/1/96-97	158.7	1.591
1998	163.0	1.6%	7/1/97-98	161.8	1.561
1999	166.6	2.2%	7/1/98-99	164.8	1.532
2000	172.2	3.4%	7/1/99-00	169.4	1.491
2001	177.1	2.8%	7/1/00-01	174.7	1.446
2002	179.9	1.6%	7/1/01-02	178.5	1.415
2003	184.0	2.3%	7/1/02-03	182.0	1.388
2004	188.9	2.7%	7/1/03-04	186.5	1.354
2005	195.3	3.4%	7/1/04-05	192.1	1.314
2006	201.6	3.2%	7/1/05-06	198.5	1.272
2007	207.3	2.8%	7/1/06-07	204.5	1.235
2008	215.3	3.9%	7/1/07-08	211.3	1.195
2009	214.5	-0.4%	7/1/08-09	214.9	1.175
2010	218.1	1.7%	7/1/09-10	216.3	1.167
2011	224.9	3.1%	7/1/10-11	221.5	1.140
2012	229.6	2.1%	7/1/11-12	227.3	1.111
2013	233.0	1.5%	7/1/12-13	231.3	1.092
2014	236.7	1.6%	7/1/13-14	234.9	1.075
2015	237.0	0.1%	7/1/14-15	236.9	1.066
2016	240.0	1.3%	7/1/15-16	238.5	1.059
2017	245.1	2.1%	7/1/16-17	242.6	1.041
2018*	250.0	2.0%	7/1/17-18	247.6	1.020
2019*	255.0	2.0%	7/1/18-19	252.5	1.000
2020*	260.1	2.0%	7/1/19-20	257.6	0.980

\* Forecast at 2.0% annual increase

Column (B): based on data from the U. S. Department of Labor, Bureau of Statistics

Column (C) =  $[(B) / (B, \text{prior})] - 1$

Column (E): Values interpolated from index in (B)

Column (F) =  $(E, \text{Forecast period}) / (E)$

**Derivation of Discount Factors**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Maturity in Years at 12/31/2017	Cumulative Paid Loss Develop. Factor	% Losses Paid 12/31/2017	Midpoint Upcoming Period	% Losses Paid Upcoming Period	Column(F) Discounted 2.5%	Discount Factor at 2.5%
7/1/94-95	23.50	1.000	100.0%				1.000
7/1/95-96	22.50	1.000	100.0%				1.000
7/1/96-97	21.50	1.000	100.0%				1.000
7/1/97-98	20.50	1.000	100.0%				1.000
7/1/98-99	19.50	1.000	100.0%				1.000
7/1/99-00	18.50	1.000	100.0%				1.000
7/1/00-01	17.50	1.000	100.0%				1.000
7/1/01-02	16.50	1.000	100.0%				1.000
7/1/02-03	15.50	1.000	100.0%				1.000
7/1/03-04	14.50	1.000	100.0%				1.000
7/1/04-05	13.50	1.000	100.0%				1.000
7/1/05-06	12.50	1.000	100.0%				1.000
7/1/06-07	11.50	1.000	100.0%				1.000
7/1/07-08	10.50	1.000	100.0%				1.000
7/1/08-09	9.50	1.000	100.0%				1.000
7/1/09-10	8.50	1.000	100.0%				1.000
7/1/10-11	7.50	1.000	100.0%				1.000
7/1/11-12	6.50	1.000	100.0%				1.000
7/1/12-13	5.50	1.129	88.5%	6.0	11.45%	0.0987	0.988
7/1/13-14	4.50	1.209	82.7%	5.0	5.85%	0.0517	0.972
7/1/14-15	3.50	1.375	72.7%	4.0	9.96%	0.0903	0.963
7/1/15-16	2.50	1.787	56.0%	3.0	16.78%	0.1558	0.958
7/1/16-17	1.50	3.180	31.4%	2.0	24.51%	0.2332	0.953
7/1/17-18	0.50	15.364	6.5%	1.0	24.94%	0.2433	0.945
7/1/18-19	0.00			0.5	6.51%	0.0643	0.937

Column (C): Appendix A2

Column (D) =  $1 / (C)$

Column (E) =  $[(B), \text{current line} + (B), \text{previous line}] / 2$

Column (F) =  $(D), \text{previous line} - (D), \text{current line}$

Column (G) =  $(F) \times [1 + \text{Interest Rate}]^{-(E)}$

Column (H) =  $[1 + \text{Interest Rate}]^{(B)} / [1 - (D)] \times [\text{Downward Sum}, (G)]$



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# **Estimate of Ultimate and Outstanding Losses**

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County of Roanoke School Board

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May 28, 2019

Based on data evaluated as of March 31, 2019

# Estimate of Ultimate and Outstanding Losses

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County of Roanoke School Board

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May 28, 2019

Based on data evaluated as of March 31, 2019

*Prepared by Elly Fell and:*

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*Mary Frances Miller, FCAS, MAAA, CPCU, ARe, AIM*

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*Jack Pipa, ACAS, MAAA*

*Select Actuarial Services  
28 White Bridge Road, Suite 205  
Nashville, TN 37205  
(615) 269-4469 ext 110  
(615) 269-4878 (fax)*

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## Executive Summary

The purpose of this report is to provide the School Board of the County of Roanoke, Virginia, with an evaluation of the liabilities associated with its retained workers compensation exposures. The specific objectives are (a) to determine required reserves for historical accident periods as of March 31, 2019, using data evaluated as of March 31, 2019, (b) to project ultimate liabilities for the forecast periods 7/1/19-20 and 7/1/20-21, (c) to estimate required funding as of March 31, 2019, and to project funding requirements through the 2020/21 year; and (d) to provide estimated cash flow requirements for prior incurred claims and projected future claims by fiscal year.

Key assumptions in this analysis include the use of:

- 1) Historical reporting and payment patterns of the combined experience of the County and School Board, supplemented by those of the Virginia Association of Counties, to estimate ultimate workers compensation losses for past accident years;
- 2) External economic indices to estimate trends;
- 3) Use of various statistical distributions to model the loss generating process and to measure the variability in the loss estimates; and
- 4) A 2.5% rate of return in discounting outstanding losses.

Table 1 following this Executive Summary displays the estimated ultimate limited losses, the limited reported and paid losses, and the case reserves, along with discounted and undiscounted estimated outstanding losses, for accident periods from July 1, 1992, through March 31, 2019, as of March 31, 2019. Table 2 shows projected loss payments during the remainder of the 2018/19 year and the following ten fiscal years. Table 3 shows the required fund balance if funding at the expected level with an additional \$250,000 risk margin.

The graph following this Executive Summary illustrates the results of this analysis. Estimated ultimate losses for each policy period are shown, divided into paid losses, adjusters' reserves on known claims (case reserves) and unreported (IBNR) losses. Also shown are the forecasts for

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the remaining three months of 2018/19 and the 2019/20 and 2020/21 years. Payroll is displayed as a line scaled on the right side of the graph.

Throughout the analysis we have estimated ultimate losses using data as of March 31, 2019. Unless otherwise specified, "losses" includes allocated expenses but not unallocated claims handling charges throughout this report.

## Results of the Analysis

In total, reported losses for accident periods through 2018/19 have developed \$120,000 lower than projected since the prior study as of December 31, 2016. For the older periods, the greatest deviation from expected was observed for the 2003/04 and 2006/07 accident years. Claim #WC077C014971 from the 2003/04 accident year increased by \$35,000 since the previous evaluation. From the 2006/07 accident year, claim #WC077C022074 re-opened with reported losses increasing \$202,000. The higher than expected development driven by these two claims was offset by overall favorable experience for the more recent accident years. An exception to the favorable experience in recent years is claim #WC077C144455, occurring in 2015/16, which had reported losses increase by \$198,000 since December 31, 2016. Reported losses for most other recent accident years came in below projections. For the 1996/97 through 2018/19 years combined, estimated ultimate losses have been adjusted downward by \$77,000.

Estimated total required reserves for all periods as of March 31, 2019, (92/93 through 18/19) are \$732,000. Discounting the outstanding liabilities at 2.5% reduces the expected outstanding losses to \$664,000.

We project that the School Board will incur about 87 claims during the 2019/20 year, at an average cost of \$4,800, resulting in total losses of about \$416,000 for the year. The projected cost per \$100 payroll for 2019/20 is \$0.43.

It must be understood that the evaluation of ultimate levels of past liabilities requires estimation of future transactions. In projecting future loss emergence, we have assumed that historical patterns, with specific adjustments as noted, are predictive of future loss emergence. We have not anticipated any extraordinary changes to the legal, social, and economic environment that might affect the cost and frequency of all claims, again except as noted. Actual results may differ significantly from the estimates provided in this analysis.

**Calculation of Required Reserves  
As of March 31, 2019**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Accident Period	Selected Ultimate Losses	Limited Paid Losses	Limited Reported Losses	Case Reserves	IBNR Reserves	Total Required Reserves	Discount Factor at 2.5%	Total Discounted Reserves at 2.5%
7/1/92-93	--	\$304,020	\$304,020	\$0	\$0	\$0	1.000	\$0
7/1/93-94	--	\$2,499	\$2,499	\$0	\$0	\$0	1.000	\$0
7/1/94-95	--	\$4,025	\$4,025	\$0	\$0	\$0	1.000	\$0
7/1/95-96	--	\$250,000	\$250,000	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$477,879	\$477,879	\$477,879	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$184,764	\$184,764	\$184,764	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$178,018	\$178,018	\$178,018	\$0	\$0	\$0	1.000	\$0
7/1/99-00	\$165,594	\$165,594	\$165,594	\$0	\$0	\$0	0.988	\$0
7/1/00-01	\$43,290	\$43,290	\$43,290	\$0	\$0	\$0	0.966	\$0
7/1/01-02	\$93,990	\$93,990	\$93,990	\$0	\$0	\$0	0.946	\$0
7/1/02-03	\$310,984	\$310,984	\$310,984	\$0	\$0	\$0	0.929	\$0
7/1/03-04	\$388,000	\$375,431	\$384,555	\$9,124	\$3,000	\$12,000	0.914	\$11,000
7/1/04-05	\$173,970	\$173,970	\$173,970	\$0	\$0	\$0	0.902	\$0
7/1/05-06	\$177,537	\$177,537	\$177,537	\$0	\$0	\$0	0.892	\$0
7/1/06-07	\$455,093	\$455,093	\$455,093	\$0	\$0	\$0	0.884	\$0
7/1/07-08	\$221,834	\$221,834	\$221,834	\$0	\$0	\$0	0.878	\$0
7/1/08-09	\$156,000	\$150,318	\$152,136	\$1,818	\$4,000	\$6,000	0.874	\$5,000
7/1/09-10	\$593,000	\$587,481	\$587,481	\$0	\$6,000	\$6,000	0.872	\$5,000
7/1/10-11	\$458,000	\$440,397	\$440,397	\$0	\$18,000	\$18,000	0.872	\$16,000
7/1/11-12	\$245,000	\$226,762	\$233,380	\$6,618	\$12,000	\$19,000	0.874	\$17,000
7/1/12-13	\$187,000	\$174,947	\$174,947	\$0	\$12,000	\$12,000	0.877	\$11,000
7/1/13-14	\$481,000	\$439,601	\$439,601	\$0	\$41,000	\$41,000	0.882	\$36,000
7/1/14-15	\$246,000	\$212,147	\$212,147	\$0	\$34,000	\$34,000	0.889	\$30,000
7/1/15-16	\$443,000	\$385,154	\$386,035	\$881	\$57,000	\$58,000	0.897	\$52,000
7/1/16-17	\$308,000	\$184,261	\$210,448	\$26,187	\$98,000	\$124,000	0.906	\$112,000
7/1/17-18	\$340,000	\$166,615	\$186,043	\$19,428	\$154,000	\$173,000	0.914	\$158,000
7/1/18-3/31/19	\$258,000	\$28,868	\$77,545	\$48,678	\$180,000	\$229,000	0.921	\$211,000
<b>Total</b>	<b>\$6,586,000</b>	<b>\$6,415,477</b>	<b>\$6,528,211</b>	<b>\$112,734</b>	<b>\$619,000</b>	<b>\$732,000</b>		<b>\$664,000</b>
96-97 through 3/31/19	\$6,586,000	\$5,854,933	\$5,967,668	\$112,734	\$619,000	\$732,000		\$664,000
3/31-6/30/19	\$86,000							

Column (B): Exhibit X; prorated for 7/1/18-19  
Columns (C), (D): Exhibit I, limited to retention  
Column (E) = (D) - (C)  
Column (F) = (B) - (D); judgmentally selected for 92-93 through 95/96  
Column (G) = (E) + (F)  
Column (H): Appendix D  
Column (I) = (G) \* (H)



**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 3/31-6/30/19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28	Paid During 2028-29
7/1/95-96	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/01-02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/02-03	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/03-04	\$12,000	\$300	\$1,100	\$1,000	\$800	\$700	\$600	\$600	\$500	\$400	\$400	\$400
7/1/04-05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/06-07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/07-08	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/08-09	\$6,000	\$200	\$800	\$600	\$500	\$400	\$400	\$300	\$300	\$200	\$200	\$200
7/1/09-10	\$6,000	\$200	\$800	\$600	\$500	\$400	\$400	\$300	\$300	\$200	\$200	\$200
7/1/10-11	\$18,000	\$800	\$2,600	\$2,000	\$1,600	\$1,300	\$1,100	\$900	\$800	\$700	\$600	\$500
7/1/11-12	\$19,000	\$900	\$3,000	\$2,300	\$1,800	\$1,400	\$1,200	\$1,000	\$800	\$700	\$600	\$500
7/1/12-13	\$12,000	\$600	\$2,000	\$1,500	\$1,200	\$900	\$700	\$600	\$500	\$400	\$400	\$300
7/1/13-14	\$41,000	\$2,300	\$7,600	\$5,600	\$4,200	\$3,200	\$2,500	\$2,000	\$1,600	\$1,400	\$1,100	\$1,000
7/1/14-15	\$34,000	\$2,200	\$6,900	\$4,900	\$3,600	\$2,700	\$2,100	\$1,600	\$1,300	\$1,100	\$900	\$700
7/1/15-16	\$58,000	\$4,100	\$13,000	\$8,900	\$6,300	\$4,600	\$3,500	\$2,700	\$2,100	\$1,700	\$1,400	\$1,100
7/1/16-17	\$124,000	\$9,800	\$30,400	\$20,100	\$13,800	\$9,800	\$7,200	\$5,400	\$4,200	\$3,300	\$2,600	\$2,100
7/1/17-18	\$173,000	\$14,400	\$45,600	\$29,900	\$19,900	\$13,700	\$9,700	\$7,100	\$5,300	\$4,100	\$3,200	\$2,600
7/1/18-3/31/19	\$229,000	\$24,800	\$59,700	\$41,500	\$27,300	\$18,200	\$12,500	\$8,900	\$6,500	\$4,900	\$3,800	\$3,000
Subtotal	\$732,000	\$61,000	\$174,000	\$119,000	\$82,000	\$57,000	\$42,000	\$31,000	\$24,000	\$19,000	\$15,000	\$13,000
3/31-6/30/19	\$86,000	\$9,000	\$22,000	\$16,000	\$10,000	\$7,000	\$5,000	\$3,000	\$2,000	\$2,000	\$1,000	\$1,000
7/1/19-20	\$416,000	--	\$111,000	\$89,000	\$62,000	\$41,000	\$27,000	\$19,000	\$13,000	\$10,000	\$7,000	\$6,000
Total	\$1,234,000	\$70,000	\$307,000	\$224,000	\$154,000	\$105,000	\$74,000	\$53,000	\$39,000	\$31,000	\$23,000	\$20,000

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

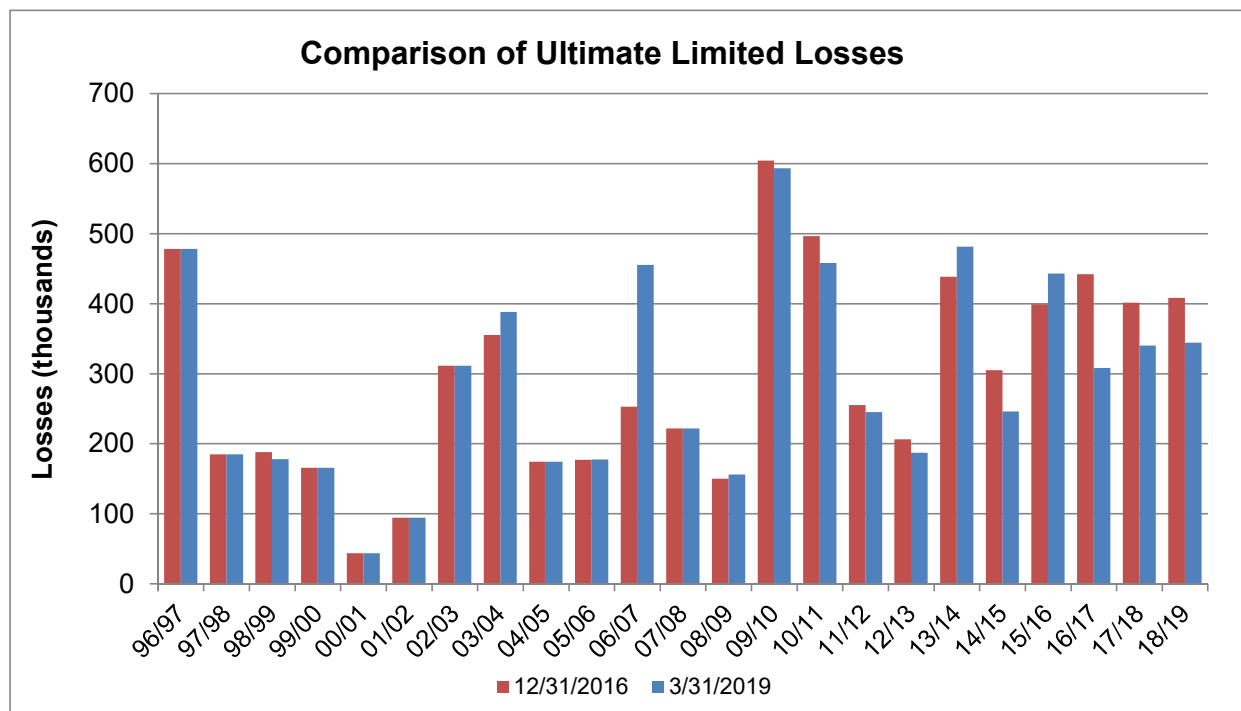
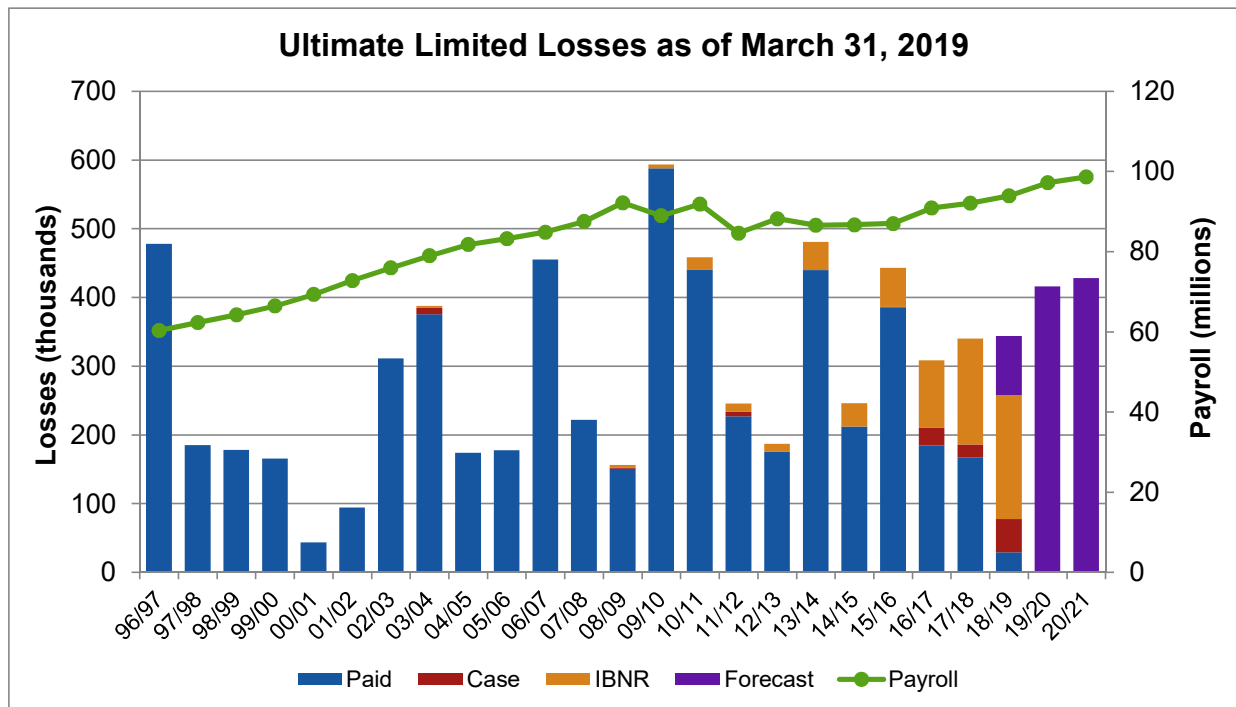
Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A4 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 03/31/19)]\}$ .

Amount paid equals the percent of outstanding or expected paid times the estimated outstanding losses or expected incurred.

***Funding at the Expected Level  
With An Additional \$250,000 Risk Margin***

(1) Estimated Outstanding Losses as of 3/31/19 { Exhibit XII-1 }	\$732,000
(2) Forecast Losses for 3/31-6/30/19 { Exhibit XII-1 }	\$86,000
(3) Additional Risk Margin { Provided by Roanoke Co. Schools }	\$250,000
<hr/>	
<b>(4) Required Funding as of 3/31/19 { (1) + (2) + (3) }</b>	<b>\$1,068,000</b>
(5) Projected Payments during 3/31-6/30/19 { Exhibit XIII-1 }	\$70,000
(6) Estimated Outstanding Losses as of 6/30/19 { (1) + (2) – (5) }	\$748,000
(7) Forecast Losses for 7/1/19-20 { Exhibit VI }	\$416,000
(8) Additional Risk Margin { Provided by Roanoke Co. Schools }	\$250,000
<hr/>	
<b>(9) Required Funding as of 6/30/19 { (6) + (7) + (8) }</b>	<b>\$1,414,000</b>
(10) Projected Payments during 7/1/19-20 { Exhibit XIII-1 }	\$307,000
(11) Estimated Outstanding Losses as of 6/30/20 { (6) + (7) – (10) }	\$857,000
(12) Forecast Losses for 7/1/20-21 { Exhibit VI }	\$428,000
(13) Additional Risk Margin { Provided by Roanoke Co. Schools }	\$250,000
<hr/>	
<b>(14) Required Funding as of 6/30/20 { (11) + (12) + (13) }</b>	<b>\$1,535,000</b>

**Composition of Ultimate and Outstanding Losses**  
**Accident Periods Beginning July 1, 1996, through June 30, 2021**



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## Introduction

Select Actuarial Services has prepared this report for the School Board of Roanoke County, Virginia (hereinafter referred to as “the School Board”) at the request of Ms. Susan Peterson, Director of Finance for Roanoke County Schools. The specific objectives of this report are (a) to determine required reserves for historical accident periods as of March 31, 2019, using data evaluated as of March 31, 2019, (b) to project ultimate liabilities for the forecast periods 7/1/19-20 and 7/1/20-21, (c) to estimate required funding as of March 31, 2019, and to project funding requirements through the 2020/21 year; and (d) to provide estimated cash flow requirements for prior incurred claims and projected future claims by fiscal year.

This report is an actuarial analysis of data, conditions, and practices communicated as of May 20, 2019, to Select Actuarial Services as described in the section entitled “Considerations.” While Select Actuarial Services believes these communications to be reliable, it has not attempted to audit the information and cannot guarantee the accuracy of any information supplied. However, the data have been reviewed for reasonableness and consistency through comparison with the prior analysis. The estimates in this report are based upon appropriate actuarial assumptions and procedures described in the section of this report entitled “Analysis.” Select Actuarial Services assumes no responsibility for any loss or damage that might arise from the use of or reliance upon this report other than for the purposes set forth herein.

This report was prepared for the use of and is only to be relied upon by the School Board and the County of Roanoke County. This report also may be provided to the School Board's auditors, insurance brokers, and risk manager. No portion of the report may be provided to any other party without Select Actuarial Services' prior written consent. In the event such consent is provided, the report must be provided in its entirety. We recommend that any such party have its own actuary review this report to ensure that the party understands the assumptions and uncertainties inherent in our estimates.

Mary Frances Miller is a Fellow of the Casualty Actuarial Society and Jack Pipa is an Associate of the Casualty Actuarial Society. Both actuaries are Members of the American Academy of Actuaries and meet the

Qualification Standards of the American Academy of Actuaries to render actuarial opinions for property/casualty reserves. This report is prepared in accordance with Actuarial Standard of Practice No. 43, *Property/Casualty Unpaid Claim Estimates* and No. 53, *Estimating Future Costs for Prospective Property/Casualty Risk Transfer and Risk Retention*.

## Section 3

### Considerations

Appropriate actuarial methods for performing a reserve evaluation and forecast can only be identified in light of the coverage involved, claims information available, and other considerations. Key considerations motivating the selection of techniques employed in this analysis are set forth below.

#### School Board Self-Insurance Program

The School Board has retained risk for its workers compensation exposures since July 1, 1990, with per occurrence retentions as shown in Table C-1. Five claims have exceeded the School Board's retention: one 1992/93 claim, one 1995/96 claim, one 1996/97 claim, one 2009/10 claim, and one 2015/16 claim.

**Table C-1**

Accident Year	All Time per Accident Retention
7/1/90 – 92	\$200,000
7/1/92 – 94	\$225,000
7/1/94 – 01	\$250,000
7/1/01 – 03	\$300,000
7/1/03 - 05	\$350,000
7/1/05 – 11	\$400,000
7/1/11 – 13	\$450,000
7/1/13 – 15	\$500,000
7/1/15 – present	\$200,000

## Available Data

Loss information was provided by Mr. Chris Carey, VACO Risk Management Programs, Inc. Workers compensation claims were administered by Trigon Administrators, Inc., through December 31, 1997, for claims incurred through June 30, 1996. Landin, Inc., began administering claims on July 1, 1996, for claims incurred after that date, and took over administration of prior claims on January 1, 1998. Claims for the 99/00 year were administered by Zurich while claims occurring during the 00/01 year were administered by ERC. Midwest administered claims for the accident years 01/02 through 03/04 until ERC once again administered claims for the 04/05 year. July 1, 2005, and subsequent claims have been handled by the Virginia Association of Counties, and the Virginia Association of Counties now administers all open claims for the prior periods. Loss data included reported and paid losses on an individual claim basis evaluated as of June 30, 2018, and March 31, 2019. For the 1992/93 through 1995/96 years, data were only available for claims that were open when the Virginia Association of Counties took over claim administration.

Exposure information in the form of payroll was provided by Ms. Courtney Deeds, Roanoke County Public Schools.

## Development

Development is defined as the change over time in certain quantities pertaining to a given set of incidents. As claims for a given program year are reported, adjusted, litigated, and ultimately paid out, the number of claims, along with the paid losses and case reserves on those claims, will change.

Ideally, a client's own development patterns should be utilized in order to reflect its unique claims reporting procedures, claims administration arrangements, and settlement philosophy. Because the historical losses are available at multiple evaluation dates, it was possible to analyze Roanoke County's own development experience. County and School Board workers compensation losses have been combined in order to increase the volume of data upon which development selections are made. To improve the stability of the estimates, factors based on Virginia Association of Counties statistics are also given weight in the selection of development factors. The selected development patterns are shown in Appendix A.

## Trends and External Influences

Trends are defined as changes over time in underlying claims costs. Trend factors are used to adjust losses and payrolls from past years to the level at which they would have been, had they occurred during a future period. This is vital since historical losses may have occurred in a different environment in terms of both monetary inflation and benefit levels. In this analysis, trends have been measured by examining changes in the Employment Cost Index for civilian workers as compiled by the U.S. Department of Labor and U.S. Claims Cost Indices as compiled by Jeremy P. Pecora, FCAS, and published by Willis Towers Watson.

## Loss Models

Statistical distributions are often used by the insurance industry to model the loss generating process. In this analysis, the lognormal probability distribution has been used to model limited ultimate losses. This technique allows for the projection of ultimate losses at various confidence levels or percentiles. The variation estimated in this modeling technique is the variation inherent in the historical experience; it does not include potential variation due to unanticipated changes in the environment or to misestimation of parameters.

For the period beginning July 1, 2019, aggregate small losses for the forecast period are modeled by the lognormal probability distribution. Large claim frequencies are modeled by a Poisson distribution. The inverse Weibull distribution is used to model large claim severities.

## Actuarial Central Estimate

The estimates of ultimate losses at the “expected” or “selected” level in this analysis are actuarial central estimates - estimates that represent an expected value over the range of reasonably possible outcomes. Such range of reasonably possible outcomes may not include all conceivable outcomes. For example, it would not include conceivable extreme events where the contribution of such events to an expected value estimate is not reliably measurable.

## Subrogation and Recoveries

Subrogation and recoveries are reflected in the primary loss reports. Recoveries were infrequent, and did not provide a basis for estimating potential recoveries over and above those reflected in the loss runs. Accordingly, no explicit reductions for collateral sources have been incorporated into the estimates.



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## Analysis

Actuarial procedures employed to project ultimate and outstanding losses consist of a number of steps, and can be summarized as follows:

- Combined County and School Board paid and reported loss development patterns for workers compensation are analyzed and supplemented by Virginia Association of Counties experience to estimate future development on past accident periods through March 31, 2019.
- Losses for past years are adjusted by trend factors and related to the level of their underlying exposures to derive ultimate adjusted pure premiums.
- The historical pure premiums are used to determine a forecast pure premium and forecast ultimate losses for the upcoming periods.
- Paid losses are deducted from ultimate losses to derive estimated outstanding losses, which are then discounted to reflect anticipated investment income.

Exhibits representing the various steps in the process are explained in this section of the report.

### Exhibit I

Exhibit I displays a summary of the historical reported claims information as of the most recent evaluation date. Paid losses, reported losses, claim counts, and exposures (payroll) are displayed for each accident year.

### Exhibit II

Exhibit II-A displays a listing of claims which exceed \$50,000. Exhibit II-B calculates paid and reported losses with individual occurrences limited to the applicable retention.

## Exhibit III

Exhibit III shows the estimation of ultimate losses less than \$100,000 trended to the 2019/20 accident year level. Historical losses are developed to ultimate using the loss development factors derived in Appendix A. Losses in Exhibit III are also trended to reflect the increase in claim costs to the mid-point of the forecast year. Appendix B presents the derivation of trend factors utilized in this analysis.

## Exhibit IV

In Exhibit IV, adjusted ultimate losses less than \$100,000 from prior years are restated on a common basis: that is, per adjusted unit exposure, or as pure premiums. These pure premiums provide a basis of comparison across accident years since all experience has been adjusted to an ultimate, common inflationary, per exposure level. Then a pure premium that best represents the 2019/20 forecast year is selected. This selected pure premium is multiplied by the forecast period's exposures to derive an estimate of the projected ultimate losses less than \$100,000 for the 2019/20 accident year.

## Exhibit V

This exhibit summarizes the calculation of the expected number of large claims for each of the forecast periods. The numbers of claims exceeding \$100,000 are developed to ultimate and related to the applicable level of exposure to derive frequency rates. A frequency rate based on the observed historical frequencies is selected and applied to the projected exposure for 2019/20 to derive the forecast number of large claims.

## Exhibit VI

On this exhibit the forecast number of large claims is multiplied by the large claims severity to determine the forecast losses for claims over \$100,000 limited to the forecast per occurrence retention level. The large claim severity is based on fitting the claims in Exhibit II to a loss severity distribution. The large claim forecast is then combined with the forecast losses for claims less than \$100,000 from Exhibit IV to determine the ground-up loss forecast for 2019/20. The resulting 2019/20 loss rate is adjusted for trend to the level of the 2017/18, 2018/19, and 2020/21 years and multiplied by appropriate exposures to obtain estimates of ultimate forecast losses for those years as well.

## Exhibit VII

The distribution given on this exhibit provides a measure of the variability or risk underlying the forecasts. The results displayed are derived based on statistical modeling of each of the components of the loss forecast. Suitable distributions were selected as best fits, and these distributions were then combined to derive the forecast losses at various percentiles or confidence levels. The variation estimated in this modeling technique is the variation inherent in the historical experience; it does not include potential variation due to unanticipated changes in the environment or to misestimation of parameters.

## Exhibit VIII

Exhibit VIII shows the estimation of ultimate losses using the loss development methods. Losses are projected by accident year by using both reported and paid loss development methods, taking per occurrence retentions into account.

The methods are based on reported and paid losses as of March 31, 2019, and the development factors derived in Appendix A. Large losses are first deducted from the total. The result is then developed to ultimate and a provision for the large losses is added back to this ultimate.

## Exhibit IX

Exhibit IX estimates ultimate losses using the paid and reported Bornhuetter/Ferguson techniques. These methods, also referred to as the estimated unpaid and estimated unreported methods, combine the prior estimate of ultimate losses for each year with current paid and reported losses to produce a blended estimate which places less emphasis on the most recent changes in the loss data.

## Exhibit X

In Exhibit X, the results of the various techniques for estimating ultimate losses are summarized, and selections are made based upon the consistency of the results with one another and with losses reported to date.

## Exhibit XI

Claim frequencies, shown in Exhibit XI, Page 1, are calculated by developing reported claims to ultimate and relating them to their underlying exposures.

Average claim size is shown in Exhibit XI, Page 2. This is the ratio of selected ultimate losses and ultimate claim counts. Cost per \$100 payroll is also shown.

## Exhibit XII

Outstanding losses as of March 31, 2019, are estimated in Exhibit XII, Page 1. Outstanding losses are the difference between estimated ultimate losses and losses paid for each period. Similarly, unreported (IBNR) losses are the difference between estimated ultimate losses and losses reported to date. The estimated outstanding losses are also provided on a discounted basis at a rate of 2.5% using discount factors derived in Appendix D. This exhibit also shows the limited data available for the 1992/93 through 1995/96 periods. All claims are closed in these years and we have not provided any IBNR for claims occurring in periods 1995/96 and prior.

Page 2 shows estimated outstanding losses at various percentiles of the aggregate distribution for accident periods 1996/97 through March 31, 2019. The aggregate distribution of these years is based on the observed variation in prior years' development for combined County and School Board workers compensation.

## Exhibit XIII

Page 1 projects loss payments during the remainder of the 2018/19 year and the following ten fiscal years. Projected payments are based on the outstanding and forecast losses as of March 31, 2019, along with the paid loss development patterns used throughout the analysis.

Page 2 shows projected paid losses at different percentiles of the aggregate distribution for accident years 1996/97 through 2019/20.

## Exhibit XIV

Exhibit XIV compares the results of this analysis with those of the previous analysis, as of December 31, 2016. Using loss and development information available as of the previous report's evaluation, the expected paid and reported losses as of the latest evaluation are calculated. These estimated amounts are compared to the actual paid and reported losses as of the latest evaluation, to determine if the loss experience has developed as expected. Also included on this exhibit is a comparison of the ultimate losses for each analysis.

## Exhibit XV

Exhibit XV shows the required funding as of March 31, 2019, June 30, 2019, and June 30, 2020, if funding is set at the expected level. Required funding is based on the estimated outstanding and forecast losses, the estimated payments over the next 15 months, and the desired risk margin.

## Section 5

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### **Exhibits: Workers Compensation - Schools**

The “Analysis” section of this report presents a discussion of the following exhibits:

Exhibit I	Summary of Experience
Exhibit II	Summary of Claims Over \$50,000
Exhibit III	Estimation of Ultimate Small Losses at 7/1/19-20 Cost Level
Exhibit IV	Calculation of Forecast Small Losses
Exhibit V	Calculation of Forecast Number of Large Losses
Exhibit VI	Calculation of Forecast Losses
Exhibit VII	Forecast Losses at Various Confidence Levels
Exhibit VIII	Estimation of Ultimate Losses: Loss Development Methods
Exhibit IX	Estimation of Ultimate Losses: Bornhuetter/Ferguson Methods
Exhibit X	Selection of Ultimate Limited Loss Estimates
Exhibit XI	Estimated Ultimate Claims Estimation of Claim Severities
Exhibit XII	Calculation of Required Reserves Estimated Outstanding Losses at Various Confidence Levels
Exhibit XIII	Projection of Loss Payments Over the Next Ten Years Projected Payment Pattern at Various Confidence Levels
Exhibit XIV	Comparison of Results: Current to Prior Estimates
Exhibit XV	Required Funding

**Summary of Experience\***

(A) Period Begin End		(B) Evaluation Date	(C) Maturity (months)	(D) Reported Claims	(E) Gross Paid Losses	(F) Collections	(G) Net Paid Losses	(H) Net Reported Losses	(I) Exposure (Payroll - Thousands)**
7/1/1992	6/30/1993	3/31/2019	321	3	\$318,237	\$0	\$318,237	\$318,237	
7/1/1993	6/30/1994	3/31/2019	309	3	\$2,499	\$0	\$2,499	\$2,499	
7/1/1994	6/30/1995	3/31/2019	297	3	\$4,025	\$0	\$4,025	\$4,025	
7/1/1995	6/30/1996	3/31/2019	285	3	\$299,678	\$0	\$299,678	\$299,678	
7/1/1996	6/30/1997	3/31/2019	273	92	\$508,849	\$0	\$508,849	\$508,849	\$60,323
7/1/1997	6/30/1998	3/31/2019	261	106	\$184,764	\$0	\$184,764	\$184,764	\$62,310
7/1/1998	6/30/1999	3/31/2019	249	79	\$178,521	\$503	\$178,018	\$178,018	\$64,210
7/1/1999	6/30/2000	3/31/2019	237	82	\$165,594	\$0	\$165,594	\$165,594	\$66,464
7/1/2000	6/30/2001	3/31/2019	225	54	\$43,290	\$0	\$43,290	\$43,290	\$69,320
7/1/2001	6/30/2002	3/31/2019	213	61	\$93,990	\$0	\$93,990	\$93,990	\$72,786
7/1/2002	6/30/2003	3/31/2019	201	82	\$310,984	\$0	\$310,984	\$310,984	\$75,938
7/1/2003	6/30/2004	3/31/2019	189	92	\$375,431	\$0	\$375,431	\$384,555	\$78,977
7/1/2004	6/30/2005	3/31/2019	177	88	\$173,970	\$0	\$173,970	\$173,970	\$81,784
7/1/2005	6/30/2006	3/31/2019	165	74	\$181,521	\$3,984	\$177,537	\$177,537	\$83,214
7/1/2006	6/30/2007	3/31/2019	153	78	\$456,775	\$1,682	\$455,093	\$455,093	\$84,840
7/1/2007	6/30/2008	3/31/2019	141	96	\$221,909	\$75	\$221,834	\$221,834	\$87,505
7/1/2008	6/30/2009	3/31/2019	129	73	\$157,877	\$7,559	\$150,318	\$152,136	\$92,179
7/1/2009	6/30/2010	3/31/2019	117	68	\$907,176	\$660	\$906,516	\$906,516	\$88,971
7/1/2010	6/30/2011	3/31/2019	105	67	\$442,245	\$1,848	\$440,397	\$440,397	\$91,871
7/1/2011	6/30/2012	3/31/2019	93	84	\$229,847	\$3,085	\$226,762	\$233,380	\$84,608
7/1/2012	6/30/2013	3/31/2019	81	87	\$177,812	\$2,865	\$174,947	\$174,947	\$88,204
7/1/2013	6/30/2014	3/31/2019	69	97	\$441,357	\$1,756	\$439,601	\$439,601	\$86,549
7/1/2014	6/30/2015	3/31/2019	57	80	\$214,426	\$2,279	\$212,147	\$212,147	\$86,678
7/1/2015	6/30/2016	3/31/2019	45	90	\$483,227	\$2,099	\$481,128	\$512,203	\$86,981
7/1/2016	6/30/2017	3/31/2019	33	79	\$185,209	\$948	\$184,261	\$210,448	\$90,847
7/1/2017	6/30/2018	3/31/2019	21	81	\$167,665	\$1,051	\$166,615	\$186,043	\$92,067
7/1/2018	6/30/2019	3/31/2019	9	61	\$28,868	\$0	\$28,868	\$77,545	\$93,908
7/1/2019	6/30/2020	3/31/2019							\$97,195
7/1/2020	6/30/2021	3/31/2019							\$98,653
Total				1,863	\$6,955,745	\$30,394	\$6,925,351	\$7,068,281	\$2,066,381

\* Loss and exposure information supplied by Roanoke County; loss data incomplete for 1995/96 and prior

\*\* Projected for 2018/19, 2019/20 and 2020/21

**Summary of Claims over \$50,000**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Claim Number	Accident Date	Net Paid Losses	Net Reported Losses	Historical Retention	Severity Development Factor	Developed Losses	Trend Factor to 7/1/19-20	Trended Developed Losses
224-34-4712	4/7/1993	\$78,873	\$78,873	\$225,000	1.002	\$79,050	2.750	\$217,410
226-66-5445	4/29/1993	\$239,217	\$239,217	\$225,000	1.002	\$239,754	2.750	\$659,393
WC077C014754	9/27/1995	\$299,678	\$299,678	\$250,000	1.003	\$300,610	2.528	\$759,830
231-78-4016	4/7/1997	\$280,970	\$280,970	\$250,000	1.003	\$281,952	2.435	\$686,691
228-86-1302	4/10/1997	\$143,373	\$143,373	\$250,000	1.003	\$143,874	2.435	\$350,403
364-60-6818	11/13/1997	\$57,896	\$57,896	\$250,000	1.004	\$58,124	2.341	\$136,072
WC077C014482	3/29/1999	\$127,712	\$127,712	\$250,000	1.004	\$128,283	2.251	\$288,711
229-54-7525	11/13/1999	\$69,636	\$69,636	\$250,000	1.005	\$69,992	2.155	\$150,852
WC077C014287	2/20/2003	\$196,741	\$196,741	\$300,000	1.008	\$198,290	1.882	\$373,129
WC077C014971	11/7/2003	\$246,853	\$255,977	\$350,000	1.009	\$258,342	1.786	\$461,427
WC077C014924	2/11/2004	\$62,403	\$62,403	\$350,000	1.009	\$62,980	1.786	\$112,488
WC077C014280	7/19/2004	\$122,073	\$122,073	\$350,000	1.011	\$123,408	1.697	\$209,439
WC077C022074	1/16/2007	\$357,453	\$357,453	\$400,000	1.016	\$363,097	1.566	\$568,573
WC077C026726	9/28/2007	\$64,365	\$64,365	\$400,000	1.019	\$65,609	1.529	\$100,294
WC077C041986	12/3/2009	\$719,035	\$719,035	\$400,000	1.030	\$740,812	1.387	\$1,027,309
WC077C047054	8/3/2010	\$126,090	\$126,090	\$400,000	1.039	\$131,004	1.336	\$175,019
WC077C050369	12/26/2010	\$110,582	\$110,582	\$400,000	1.039	\$114,892	1.336	\$153,493
WC077C062028	5/2/2012	\$52,303	\$52,303	\$450,000	1.051	\$54,987	1.294	\$71,150
WC077C069777	4/12/2013	\$71,465	\$71,465	\$450,000	1.069	\$76,431	1.259	\$96,238
WC077C088093	11/15/2013	\$80,120	\$80,120	\$500,000	1.097	\$87,911	1.223	\$107,497
WC077C100234	1/13/2014	\$82,398	\$82,398	\$500,000	1.097	\$90,409	1.223	\$110,552
WC077C101043	2/11/2014	\$60,210	\$60,210	\$500,000	1.097	\$66,064	1.223	\$80,783
WC077C101991	3/5/2014	\$51,216	\$51,216	\$500,000	1.097	\$56,195	1.223	\$68,716
WC077C107274	7/9/2014	\$56,012	\$56,012	\$500,000	1.142	\$63,958	1.184	\$75,709
WC077C118761	1/9/2015	\$59,717	\$59,717	\$500,000	1.142	\$68,189	1.184	\$80,718
WC077C144455	8/11/2015	\$295,974	\$326,169	\$200,000	1.218	\$397,434	1.140	\$452,962
WC077C163686	8/19/2016	\$71,443	\$71,443	\$200,000	1.361	\$97,250	1.095	\$106,518
WC077C190216	6/5/2017	\$23,963	\$50,150	\$200,000	1.361	\$68,265	1.095	\$74,771
WC077C198480	10/31/2017	\$64,138	\$75,150	\$200,000	1.656	\$124,429	1.063	\$132,295

Columns (A) through (E): Provided by Roanoke County  
Column (F) = RLDF/CCDF  
Column (G) = (D) \* (F)  
Column (H): Appendix B  
Column (I) = (G) \* (H)



**Limited Paid and Reported Losses\***  
**As of March 31, 2019**

(A) Accident Period	(B) Per Occurrence Occurrence Retention	(C) Net Paid Losses	(D) Net Reported Losses	(E) Excess Paid Losses	(F) Excess Reported Losses	(G) Limited Paid Losses	(H) Limited Reported Losses
7/1/92-93	\$225,000	\$318,237	\$318,237	\$14,217	\$14,217	\$304,020	\$304,020
7/1/93-94	\$225,000	\$2,499	\$2,499	\$0	\$0	\$2,499	\$2,499
7/1/94-95	\$250,000	\$4,025	\$4,025	\$0	\$0	\$4,025	\$4,025
7/1/95-96	\$250,000	\$299,678	\$299,678	\$49,678	\$49,678	\$250,000	\$250,000
7/1/96-97	\$250,000	\$508,849	\$508,849	\$30,970	\$30,970	\$477,879	\$477,879
7/1/97-98	\$250,000	\$184,764	\$184,764	\$0	\$0	\$184,764	\$184,764
7/1/98-99	\$250,000	\$178,018	\$178,018	\$0	\$0	\$178,018	\$178,018
7/1/99-00	\$250,000	\$165,594	\$165,594	\$0	\$0	\$165,594	\$165,594
7/1/00-01	\$250,000	\$43,290	\$43,290	\$0	\$0	\$43,290	\$43,290
7/1/01-02	\$300,000	\$93,990	\$93,990	\$0	\$0	\$93,990	\$93,990
7/1/02-03	\$300,000	\$310,984	\$310,984	\$0	\$0	\$310,984	\$310,984
7/1/03-04	\$350,000	\$375,431	\$384,555	\$0	\$0	\$375,431	\$384,555
7/1/04-05	\$350,000	\$173,970	\$173,970	\$0	\$0	\$173,970	\$173,970
7/1/05-06	\$400,000	\$177,537	\$177,537	\$0	\$0	\$177,537	\$177,537
7/1/06-07	\$400,000	\$455,093	\$455,093	\$0	\$0	\$455,093	\$455,093
7/1/07-08	\$400,000	\$221,834	\$221,834	\$0	\$0	\$221,834	\$221,834
7/1/08-09	\$400,000	\$150,318	\$152,136	\$0	\$0	\$150,318	\$152,136
7/1/09-10	\$400,000	\$906,516	\$906,516	\$319,035	\$319,035	\$587,481	\$587,481
7/1/10-11	\$400,000	\$440,397	\$440,397	\$0	\$0	\$440,397	\$440,397
7/1/11-12	\$450,000	\$226,762	\$233,380	\$0	\$0	\$226,762	\$233,380
7/1/12-13	\$450,000	\$174,947	\$174,947	\$0	\$0	\$174,947	\$174,947
7/1/13-14	\$500,000	\$439,601	\$439,601	\$0	\$0	\$439,601	\$439,601
7/1/14-15	\$500,000	\$212,147	\$212,147	\$0	\$0	\$212,147	\$212,147
7/1/15-16	\$200,000	\$481,128	\$512,203	\$95,974	\$126,169	\$385,154	\$386,035
7/1/16-17	\$200,000	\$184,261	\$210,448	\$0	\$0	\$184,261	\$210,448
7/1/17-18	\$200,000	\$166,615	\$186,043	\$0	\$0	\$166,615	\$186,043
7/1/18-19	\$200,000	\$28,868	\$77,545	\$0	\$0	\$28,868	\$77,545
Total	\$8,600,000	\$6,925,351	\$7,068,281	\$509,874	\$540,069	\$6,415,477	\$6,528,211

\* Loss data incomplete for 1995/96 and prior

Column (B): Provided by Roanoke County

Columns (C), (D): Exhibit I

Columns (E), (F): Calculated from Exhibit II-A

Column (G) = (C) - (E)

Column (H) = (D) - (F)

**Estimation of Ultimate Losses Less Than \$100,000  
At the 2019-20 Loss Level**

(A) Accident Period	(B) Net Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Reported Develop. Factor	(F) Trend Factor to 7/1/19-20	(G) Ultimate on Small Claims
7/1/96-97	\$508,849	\$424,343	\$84,506	1.003	2.435	\$207,000
7/1/97-98	\$184,764	\$57,896	\$126,868	1.004	2.341	\$298,000
7/1/98-99	\$178,018	\$127,712	\$50,306	1.004	2.251	\$114,000
7/1/99-00	\$165,594	\$69,636	\$95,958	1.005	2.155	\$208,000
7/1/00-01	\$43,290	\$0	\$43,290	1.006	2.067	\$90,000
7/1/01-02	\$93,990	\$0	\$93,990	1.007	1.980	\$187,000
7/1/02-03	\$310,984	\$196,741	\$114,243	1.008	1.882	\$217,000
7/1/03-04	\$384,555	\$318,380	\$66,175	1.009	1.786	\$119,000
7/1/04-05	\$173,970	\$122,073	\$51,897	1.011	1.697	\$89,000
7/1/05-06	\$177,537	\$0	\$177,537	1.013	1.618	\$291,000
7/1/06-07	\$455,093	\$357,453	\$97,639	1.016	1.566	\$155,000
7/1/07-08	\$221,834	\$64,365	\$157,469	1.019	1.529	\$245,000
7/1/08-09	\$152,136	\$0	\$152,136	1.024	1.460	\$227,000
7/1/09-10	\$906,516	\$719,035	\$187,481	1.030	1.387	\$268,000
7/1/10-11	\$440,397	\$236,672	\$203,725	1.039	1.336	\$283,000
7/1/11-12	\$233,380	\$0	\$233,380	1.051	1.294	\$317,000
7/1/12-13	\$174,947	\$0	\$174,947	1.070	1.259	\$236,000
7/1/13-14	\$439,601	\$162,518	\$277,083	1.097	1.223	\$372,000
7/1/14-15	\$212,147	\$0	\$212,147	1.142	1.184	\$287,000
7/1/15-16	\$512,203	\$326,169	\$186,035	1.219	1.140	\$258,000
7/1/16-17	\$210,448	\$71,443	\$139,005	1.363	1.095	\$207,000
7/1/17-18	\$186,043	\$75,150	\$110,893	1.664	1.063	\$196,000
Total	\$6,366,296	\$3,329,587	\$3,036,709			\$4,871,000

(H) Accident Period	(I) Net Paid Losses	(J) Paid on Large Claims	(K) Paid on Small Claims	(L) Paid Develop. Factor	(M) Trend Factor to 7/1/19-20	(N) Ultimate on Small Claims
7/1/96-97	\$508,849	\$424,343	\$84,506	1.020	2.435	\$210,000
7/1/97-98	\$184,764	\$57,896	\$126,868	1.021	2.341	\$303,000
7/1/98-99	\$178,018	\$127,712	\$50,306	1.023	2.251	\$116,000
7/1/99-00	\$165,594	\$69,636	\$95,958	1.025	2.155	\$212,000
7/1/00-01	\$43,290	\$0	\$43,290	1.028	2.067	\$92,000
7/1/01-02	\$93,990	\$0	\$93,990	1.031	1.980	\$192,000
7/1/02-03	\$310,984	\$196,741	\$114,243	1.034	1.882	\$222,000
7/1/03-04	\$375,431	\$309,256	\$66,175	1.038	1.786	\$123,000
7/1/04-05	\$173,970	\$122,073	\$51,897	1.042	1.697	\$92,000
7/1/05-06	\$177,537	\$0	\$177,537	1.047	1.618	\$301,000
7/1/06-07	\$455,093	\$357,453	\$97,639	1.054	1.566	\$161,000
7/1/07-08	\$221,834	\$64,365	\$157,469	1.062	1.529	\$256,000
7/1/08-09	\$150,318	\$0	\$150,318	1.072	1.460	\$235,000
7/1/09-10	\$906,516	\$719,035	\$187,481	1.086	1.387	\$282,000
7/1/10-11	\$440,397	\$236,672	\$203,725	1.103	1.336	\$300,000
7/1/11-12	\$226,762	\$0	\$226,762	1.126	1.294	\$330,000
7/1/12-13	\$174,947	\$0	\$174,947	1.159	1.259	\$255,000
7/1/13-14	\$439,601	\$162,518	\$277,083	1.207	1.223	\$409,000
7/1/14-15	\$212,147	\$0	\$212,147	1.284	1.184	\$322,000
7/1/15-16	\$481,128	\$295,974	\$185,154	1.415	1.140	\$299,000
7/1/16-17	\$184,261	\$71,443	\$112,818	1.674	1.095	\$207,000
7/1/17-18	\$166,615	\$64,138	\$102,477	2.314	1.063	\$252,000
Total	\$6,272,045	\$3,279,256	\$2,992,789			\$5,171,000

Columns (B), (I): Exhibit I  
Columns (C), (J): Exhibit II-A  
Column (D) = (B) - (C)  
Column (E): Appendix A2  
Columns (F), (M): Appendix B

Column (G) = (D) \* (E) \* (F)  
Column (K) = (I) - (J)  
Column (L): Appendix A4  
Column (N) = (K) \* (L) \* (M)

**Calculation of Forecast Losses Less Than \$100,000**

(A)	(B)	(C)	(D)	(E)	(F)
<i>Accident Period</i>	<i>Trended Ultimate Losses</i>	<i>Exposure (Thousands)</i>	<i>Exposure Trend Factors</i>	<i>Trended Exposures</i>	<i>Pure Premium</i>
7/1/01-02	\$190,000	\$72,786	1.464	\$106,547	\$1.78
7/1/02-03	\$220,000	\$75,938	1.422	\$108,007	\$2.04
7/1/03-04	\$121,000	\$78,977	1.389	\$109,687	\$1.10
7/1/04-05	\$91,000	\$81,784	1.357	\$110,976	\$0.82
7/1/05-06	\$296,000	\$83,214	1.318	\$109,706	\$2.70
7/1/06-07	\$158,000	\$84,840	1.274	\$108,115	\$1.46
7/1/07-08	\$251,000	\$87,505	1.231	\$107,745	\$2.33
7/1/08-09	\$231,000	\$92,179	1.197	\$110,313	\$2.09
7/1/09-10	\$275,000	\$88,971	1.175	\$104,510	\$2.63
7/1/10-11	\$292,000	\$91,871	1.161	\$106,626	\$2.74
7/1/11-12	\$324,000	\$84,608	1.148	\$97,151	\$3.34
7/1/12-13	\$246,000	\$88,204	1.136	\$100,235	\$2.45
7/1/13-14	\$391,000	\$86,549	1.123	\$97,164	\$4.02
7/1/14-15	\$305,000	\$86,678	1.104	\$95,732	\$3.19
7/1/15-16	\$279,000	\$86,981	1.084	\$94,303	\$2.96
7/1/16-17	\$207,000	\$90,847	1.063	\$96,564	\$2.14
7/1/17-18	\$224,000	\$92,067	1.041	\$95,837	\$2.34
<i>Total</i>	\$4,101,000	\$1,453,999		\$1,759,219	\$2.33

7/1/19-20

*Selected Pure Premium* \$2.85  
{ Wtd Avg of 12-13 through 17-18 }

*Forecast Exposure* \$97,195

*Forecast Small Losses* \$277,000

*Column (B) = Average of (G) and (N) from Exhibit III*

*Column (C): Exhibit I*

*Column (D): Appendix C*

*Column (E) = (C) x (D)*

*Column (F) = (B) / (E)*

**Roanoke County School Board**  
Workers Compensation

**Exhibit V**

***Forecast Number of Large Losses Over \$100,000***

(A)	(B)	(C)	(D)	(E)	(F)
<i>Accident Period</i>	<i>Number of Claims</i>	<i>Claim Development Factor</i>	<i>Estimated Ultimate Claims</i>	<i>Trended Exposure</i>	<i>Frequency</i>
7/1/01-02	0	1.000	0.0	\$106,547	0.000
7/1/02-03	1	1.000	1.0	\$108,007	0.009
7/1/03-04	2	1.000	2.0	\$109,687	0.018
7/1/04-05	1	1.000	1.0	\$110,976	0.009
7/1/05-06	0	1.000	0.0	\$109,706	0.000
7/1/06-07	1	1.000	1.0	\$108,115	0.009
7/1/07-08	1	1.000	1.0	\$107,745	0.009
7/1/08-09	0	1.000	0.0	\$110,313	0.000
7/1/09-10	1	1.000	1.0	\$104,510	0.010
7/1/10-11	2	1.000	2.0	\$106,626	0.019
7/1/11-12	0	1.000	0.0	\$97,151	0.000
7/1/12-13	0	1.000	0.0	\$100,235	0.000
7/1/13-14	2	1.000	2.0	\$97,164	0.021
7/1/14-15	0	1.000	0.0	\$95,732	0.000
7/1/15-16	1	1.000	1.0	\$94,303	0.011
7/1/16-17	1	1.001	1.0	\$96,564	0.010
7/1/17-18	1	1.005	1.0	\$95,837	0.010
<i>Total</i>	14		14.0	\$1,759,219	0.008

7/1/19-20

*Selected Frequency  
{ Wtd Avg of All Years }*

0.008

*Exposure*

\$97,195

*Forecast Number of Large Losses*

0.8

*Column (B): Claims from Exhibit II-A*

*Column (C): Appendix A6*

*Column (D) = (B) \* (C)*

*Column (E): Exhibit IV*

*Column (F) = (D) / (E) \* 1,000*

**Calculation of Forecast Losses for 2017-18 through 2020-21**

	<u>7/1/17-18</u>	<u>7/1/18-19</u>	<u>7/1/19-20</u>	<u>7/1/20-21</u>
(1) Forecast Losses less than \$100,000: { Exhibit IV }			\$277,000	
(2) Expected Number of Losses over \$100,000: { Exhibit V }			0.77	
(3) Expected Severity of Losses over \$100,000 Limited to \$200,000: { Derived from Losses in Exhibit II-A }			\$180,000	
(4) Forecast Losses Limited to \$200,000: { Line(1) + Line(2) * Line(3) for 7/1/19-20; Line(5) * Line(6) for 7/1/17-18, 7/1/18-19, and 7/1/20-21 }	\$386,000	\$397,000	\$416,000	\$428,000
(5) Forecast Exposure { Exhibit I }	\$92,067	\$93,908	\$97,195	\$98,653
(6) Forecast Loss Rate { Line(4) / Line(5) for 7/1/19-20; 7/1/19-20 rate adjusted for trend for 7/1/17-18, 7/1/18-19, and 7/1/20-21 }	\$4.19	\$4.23	\$4.28	\$4.33

***Aggregate Loss Distribution  
For the Forecast Accident Period***

<i>(A) Probability That Losses Will Be Less Than Or Equal to Column (B)</i>	<i>(B) Estimated 7/1/19-20 Ultimate Limited Losses</i>	<i>(C) Probability That Losses Will Be Greater Than Column (B)</i>
50%	\$388,000	50%
55%	\$412,000	45%
60%	\$440,000	40%
65%	\$467,000	35%
70%	\$500,000	30%
75%	\$534,000	25%
80%	\$577,000	20%
85%	\$626,000	15%
90%	\$694,000	10%
95%	\$795,000	5%
56%	\$416,000	44%
<i>Discounted at 2.5%</i>		
\$383,000		

- Based on Lognormal Distribution for Small Losses,  
Inverse Weibull Distribution for Large Loss Severity  
and Poisson Distribution for Large Loss Frequency

**Estimation of Limited Ultimate Losses  
Using Loss Development Method**

(A) Accident Period	(B) Net Reported Losses	(C) Reported on Large Claims	(D) Reported on Small Claims	(E) Reported Develop. Factor	(F) Ultimate on Small Claims	(G) Provision for Large Claims	(H) Estimated Ultimate Losses
7/1/96-97	\$508,849	\$280,970	\$227,879	1.003	\$229,000	\$250,000	\$479,000
7/1/97-98	\$184,764	\$0	\$184,764	1.004	\$185,000	\$0	\$185,000
7/1/98-99	\$178,018	\$0	\$178,018	1.004	\$179,000	\$0	\$179,000
7/1/99-00	\$165,594	\$0	\$165,594	1.005	\$166,000	\$0	\$166,000
7/1/00-01	\$43,290	\$0	\$43,290	1.006	\$44,000	\$0	\$44,000
7/1/01-02	\$93,990	\$0	\$93,990	1.007	\$95,000	\$0	\$95,000
7/1/02-03	\$310,984	\$0	\$310,984	1.008	\$313,000	\$0	\$313,000
7/1/03-04	\$384,555	\$0	\$384,555	1.009	\$388,000	\$0	\$388,000
7/1/04-05	\$173,970	\$0	\$173,970	1.011	\$176,000	\$0	\$176,000
7/1/05-06	\$177,537	\$0	\$177,537	1.013	\$180,000	\$0	\$180,000
7/1/06-07	\$455,093	\$0	\$455,093	1.016	\$462,000	\$0	\$462,000
7/1/07-08	\$221,834	\$0	\$221,834	1.019	\$226,000	\$0	\$226,000
7/1/08-09	\$152,136	\$0	\$152,136	1.024	\$156,000	\$0	\$156,000
7/1/09-10	\$906,516	\$719,035	\$187,481	1.030	\$193,000	\$400,005	\$593,000
7/1/10-11	\$440,397	\$0	\$440,397	1.039	\$458,000	\$0	\$458,000
7/1/11-12	\$233,380	\$0	\$233,380	1.051	\$245,000	\$0	\$245,000
7/1/12-13	\$174,947	\$0	\$174,947	1.070	\$187,000	\$0	\$187,000
7/1/13-14	\$439,601	\$0	\$439,601	1.097	\$482,000	\$0	\$482,000
7/1/14-15	\$212,147	\$0	\$212,147	1.142	\$242,000	\$0	\$242,000
7/1/15-16	\$512,203	\$326,169	\$186,035	1.219	\$227,000	\$200,072	\$427,000
7/1/16-17	\$210,448	\$0	\$210,448	1.363	\$287,000	\$0	\$287,000
7/1/17-18	\$186,043	\$0	\$186,043	1.664	\$310,000	\$0	\$310,000
Total	\$6,366,296	\$1,326,174	\$5,040,122		\$5,430,000	\$850,078	\$6,280,000

(I) Accident Period	(J) Net Paid Losses	(K) Paid on Large Claims	(L) Paid on Small Claims	(M) Paid Develop. Factor	(N) Ultimate on Small Claims	(O) Provision for Large Claims	(P) Estimated Ultimate Losses
7/1/96-97	\$508,849	\$280,970	\$227,879	1.020	\$232,000	\$250,000	\$482,000
7/1/97-98	\$184,764	\$0	\$184,764	1.021	\$189,000	\$0	\$189,000
7/1/98-99	\$178,018	\$0	\$178,018	1.023	\$182,000	\$0	\$182,000
7/1/99-00	\$165,594	\$0	\$165,594	1.025	\$170,000	\$0	\$170,000
7/1/00-01	\$43,290	\$0	\$43,290	1.028	\$44,000	\$0	\$44,000
7/1/01-02	\$93,990	\$0	\$93,990	1.031	\$97,000	\$0	\$97,000
7/1/02-03	\$310,984	\$0	\$310,984	1.034	\$321,000	\$0	\$321,000
7/1/03-04	\$375,431	\$0	\$375,431	1.038	\$390,000	\$0	\$390,000
7/1/04-05	\$173,970	\$0	\$173,970	1.042	\$181,000	\$0	\$181,000
7/1/05-06	\$177,537	\$0	\$177,537	1.047	\$186,000	\$0	\$186,000
7/1/06-07	\$455,093	\$0	\$455,093	1.054	\$480,000	\$0	\$480,000
7/1/07-08	\$221,834	\$0	\$221,834	1.062	\$236,000	\$0	\$236,000
7/1/08-09	\$150,318	\$0	\$150,318	1.072	\$161,000	\$0	\$161,000
7/1/09-10	\$906,516	\$719,035	\$187,481	1.086	\$204,000	\$400,005	\$604,000
7/1/10-11	\$440,397	\$0	\$440,397	1.103	\$486,000	\$0	\$486,000
7/1/11-12	\$226,762	\$0	\$226,762	1.126	\$255,000	\$0	\$255,000
7/1/12-13	\$174,947	\$0	\$174,947	1.159	\$203,000	\$0	\$203,000
7/1/13-14	\$439,601	\$0	\$439,601	1.207	\$531,000	\$0	\$531,000
7/1/14-15	\$212,147	\$0	\$212,147	1.284	\$272,000	\$0	\$272,000
7/1/15-16	\$481,128	\$295,974	\$185,154	1.415	\$262,000	\$200,072	\$462,000
7/1/16-17	\$184,261	\$0	\$184,261	1.674	\$308,000	\$0	\$308,000
7/1/17-18	\$166,615	\$0	\$166,615	2.314	\$385,000	\$0	\$385,000
Total	\$6,272,045	\$1,295,979	\$4,976,066		\$5,775,000	\$850,078	\$6,625,000

Columns (B), (J): Exhibit I  
Columns (C), (K): Exhibit II-A  
Column (D) = (B) - (C)  
Column (E): Appendix A2  
Column (F) = (D) x (E)  
Columns (G), (O): Claim count in (C) x CCDF x Specific Retention

Column (H) = (F) + (G)  
Column (L) = (J) - (K)  
Column (M): Appendix A4  
Column (N) = (L) x (M)  
Column (P) = (N) + (O)

**Estimation of Limited Ultimate Losses  
Using the Bornhuetter-Ferguson Method**

(A)	(B)	(C)	(D)	(E)	(F)	(G)
Accident Period	Previous Estimate or Forecast Losses	Reported LDF	Estimated Percent Unreported	Estimated IBNR Losses	Limited Reported Losses as of 3/31/2019	Estimated Ultimate Losses
7/1/96-97	\$477,879	1.003	0%	\$2,000	\$477,879	\$480,000
7/1/97-98	\$184,764	1.004	0%	\$1,000	\$184,764	\$186,000
7/1/98-99	\$188,000	1.004	0%	\$1,000	\$178,018	\$179,000
7/1/99-00	\$165,594	1.005	1%	\$1,000	\$165,594	\$167,000
7/1/00-01	\$43,290	1.006	1%	\$0	\$43,290	\$43,000
7/1/01-02	\$93,990	1.007	1%	\$1,000	\$93,990	\$95,000
7/1/02-03	\$310,984	1.008	1%	\$2,000	\$310,984	\$313,000
7/1/03-04	\$355,000	1.009	1%	\$3,000	\$384,555	\$388,000
7/1/04-05	\$173,970	1.011	1%	\$2,000	\$173,970	\$176,000
7/1/05-06	\$176,983	1.013	1%	\$2,000	\$177,537	\$180,000
7/1/06-07	\$252,595	1.016	2%	\$4,000	\$455,093	\$459,000
7/1/07-08	\$221,834	1.019	2%	\$4,000	\$221,834	\$226,000
7/1/08-09	\$150,040	1.024	2%	\$4,000	\$152,136	\$156,000
7/1/09-10	\$604,000	1.030	3%	\$18,000	\$587,481	\$605,000
7/1/10-11	\$496,000	1.039	4%	\$19,000	\$440,397	\$459,000
7/1/11-12	\$255,000	1.051	5%	\$12,000	\$233,380	\$245,000
7/1/12-13	\$206,000	1.070	7%	\$13,000	\$174,947	\$188,000
7/1/13-14	\$438,000	1.097	9%	\$39,000	\$439,601	\$479,000
7/1/14-15	\$305,000	1.142	12%	\$38,000	\$212,147	\$250,000
7/1/15-16	\$399,000	1.219	18%	\$72,000	\$386,035	\$458,000
7/1/16-17	\$442,000	1.363	27%	\$118,000	\$210,448	\$328,000
7/1/17-18	\$386,000	1.664	40%	\$154,000	\$186,043	\$340,000
7/1/18-19	\$397,000	3.033	67%	\$266,000	\$77,545	\$344,000
Total	\$6,723,000			\$776,000	\$5,967,668	\$6,744,000

(H)	(I)	(J)	(K)	(L)	(M)	(N)
Accident Period	Previous Estimate or Forecast Losses	Paid LDF	Estimated Percent Unpaid	Estimated Unpaid Losses	Limited Paid Losses as of 3/31/2019	Estimated Ultimate Losses
7/1/96-97	\$477,879	1.020	2%	\$9,000	\$477,879	\$487,000
7/1/97-98	\$184,764	1.021	2%	\$4,000	\$184,764	\$189,000
7/1/98-99	\$188,000	1.023	2%	\$4,000	\$178,018	\$182,000
7/1/99-00	\$165,594	1.025	2%	\$4,000	\$165,594	\$170,000
7/1/00-01	\$43,290	1.028	3%	\$1,000	\$43,290	\$44,000
7/1/01-02	\$93,990	1.031	3%	\$3,000	\$93,990	\$97,000
7/1/02-03	\$310,984	1.034	3%	\$10,000	\$310,984	\$321,000
7/1/03-04	\$355,000	1.038	4%	\$13,000	\$375,431	\$388,000
7/1/04-05	\$173,970	1.042	4%	\$7,000	\$173,970	\$181,000
7/1/05-06	\$176,983	1.047	5%	\$8,000	\$177,537	\$186,000
7/1/06-07	\$252,595	1.054	5%	\$13,000	\$455,093	\$468,000
7/1/07-08	\$221,834	1.062	6%	\$13,000	\$221,834	\$235,000
7/1/08-09	\$150,040	1.072	7%	\$10,000	\$150,318	\$160,000
7/1/09-10	\$604,000	1.086	8%	\$48,000	\$587,481	\$635,000
7/1/10-11	\$496,000	1.103	9%	\$46,000	\$440,397	\$486,000
7/1/11-12	\$255,000	1.126	11%	\$29,000	\$226,762	\$256,000
7/1/12-13	\$206,000	1.159	14%	\$28,000	\$174,947	\$203,000
7/1/13-14	\$438,000	1.207	17%	\$75,000	\$439,601	\$515,000
7/1/14-15	\$305,000	1.284	22%	\$67,000	\$212,147	\$279,000
7/1/15-16	\$399,000	1.415	29%	\$117,000	\$385,154	\$502,000
7/1/16-17	\$442,000	1.674	40%	\$178,000	\$184,261	\$362,000
7/1/17-18	\$386,000	2.314	57%	\$219,000	\$166,615	\$386,000
7/1/18-19	\$397,000	5.664	82%	\$327,000	\$28,868	\$356,000
Total	\$6,723,000			\$1,233,000	\$5,854,933	\$7,088,000

Columns (B), (I): Prior analysis; Exhibit VI for 17-18 and 18-19  
Column (C): Appendix A2  
Column (D) =  $[1 - 1 / (C)]$   
Column (E) = (B) x (D)  
Columns (F), (M): Exhibit II-B

Column (G) = (E) + (F)  
Column (J): Appendix A4  
Column (K) =  $[1 - 1 / (J)]$   
Column (L) = (I) x (K)  
Column (N) = (L) + (M)



**Summary and Selection of Limited Ultimate Losses**

(A)	(B)	(C)	(D)	(E)	(F)	(G)
<i>Accident Period</i>	<i>Prior Estimate or Forecast</i>	<i>Reported Loss Development Method</i>	<i>Paid Loss Development Method</i>	<i>Reported Bornhuetter- Ferguson Method</i>	<i>Paid Bornhuetter- Ferguson Method</i>	<i>Selected Ultimate Losses</i>
7/1/96-97	\$477,879	\$479,000	\$482,000	\$480,000	\$487,000	<b>\$477,879</b>
7/1/97-98	\$184,764	\$185,000	\$189,000	\$186,000	\$189,000	<b>\$184,764</b>
7/1/98-99	\$188,000	\$179,000	\$182,000	\$179,000	\$182,000	<b>\$178,018</b>
7/1/99-00	\$165,594	\$166,000	\$170,000	\$167,000	\$170,000	<b>\$165,594</b>
7/1/00-01	\$43,290	\$44,000	\$44,000	\$43,000	\$44,000	<b>\$43,290</b>
7/1/01-02	\$93,990	\$95,000	\$97,000	\$95,000	\$97,000	<b>\$93,990</b>
7/1/02-03	\$310,984	\$313,000	\$321,000	\$313,000	\$321,000	<b>\$310,984</b>
7/1/03-04	\$355,000	\$388,000	\$390,000	\$388,000	\$388,000	<b>\$388,000</b>
7/1/04-05	\$173,970	\$176,000	\$181,000	\$176,000	\$181,000	<b>\$173,970</b>
7/1/05-06	\$176,983	\$180,000	\$186,000	\$180,000	\$186,000	<b>\$177,537</b>
7/1/06-07	\$252,595	\$462,000	\$480,000	\$459,000	\$468,000	<b>\$455,093</b>
7/1/07-08	\$221,834	\$226,000	\$236,000	\$226,000	\$235,000	<b>\$221,834</b>
7/1/08-09	\$150,040	\$156,000	\$161,000	\$156,000	\$160,000	<b>\$156,000</b>
7/1/09-10	\$604,000	\$593,000	\$604,000	\$605,000	\$635,000	<b>\$593,000</b>
7/1/10-11	\$496,000	\$458,000	\$486,000	\$459,000	\$486,000	<b>\$458,000</b>
7/1/11-12	\$255,000	\$245,000	\$255,000	\$245,000	\$256,000	<b>\$245,000</b>
7/1/12-13	\$206,000	\$187,000	\$203,000	\$188,000	\$203,000	<b>\$187,000</b>
7/1/13-14	\$438,000	\$482,000	\$531,000	\$479,000	\$515,000	<b>\$481,000</b>
7/1/14-15	\$305,000	\$242,000	\$272,000	\$250,000	\$279,000	<b>\$246,000</b>
7/1/15-16	\$399,000	\$427,000	\$462,000	\$458,000	\$502,000	<b>\$443,000</b>
7/1/16-17	\$442,000	\$287,000	\$308,000	\$328,000	\$362,000	<b>\$308,000</b>
7/1/17-18	\$386,000	\$310,000	\$385,000	\$340,000	\$386,000	<b>\$340,000</b>
7/1/18-19	\$397,000	--	--	\$344,000	\$356,000	<b>\$344,000</b>
<b>Total</b>	<b>\$6,722,923</b>	<b>\$6,280,000</b>	<b>\$6,625,000</b>	<b>\$6,744,000</b>	<b>\$7,088,000</b>	<b>\$6,672,000</b>

Column (B): Prior analysis as of 12/31/2016; Exhibit VI for 17-18 and 18-19

Columns (C), (D): Exhibit VIII

Columns (E), (F): Exhibit IX

Column (G): Limited reported losses for 96-97 through 07-08, excluding 03-04

Column (C) for 03-04 and 08-09 through 12-13

Average of Columns (C) and (E) for 13-14 through 16-17

Column (E) for 17-18 and 18-19

**Estimated Ultimate Reported Claims  
and Claim Frequencies**

(A)	(B)	(C)	(D)	(E)	(F)
Accident Period	Number of Claims	Claim Development Factor	Estimated Ultimate Claims	Trended Exposure (thousands)	Claim Frequency*
7/1/01-02	61	1.000	61.0	\$106,547	0.6
7/1/02-03	82	1.000	82.0	\$108,007	0.8
7/1/03-04	92	1.000	92.0	\$109,687	0.8
7/1/04-05	88	1.000	88.0	\$110,976	0.8
7/1/05-06	74	1.000	74.0	\$109,706	0.7
7/1/06-07	78	1.000	78.0	\$108,115	0.7
7/1/07-08	96	1.000	96.0	\$107,745	0.9
7/1/08-09	73	1.000	73.0	\$110,313	0.7
7/1/09-10	68	1.000	68.0	\$104,510	0.7
7/1/10-11	67	1.000	67.0	\$106,626	0.6
7/1/11-12	84	1.000	84.0	\$97,151	0.9
7/1/12-13	87	1.000	87.0	\$100,235	0.9
7/1/13-14	97	1.000	97.0	\$97,164	1.0
7/1/14-15	80	1.000	80.0	\$95,732	0.8
7/1/15-16	90	1.000	90.0	\$94,303	1.0
7/1/16-17	79	1.001	79.1	\$96,564	0.8
7/1/17-18	81	1.005	81.4	\$95,837	0.8
Total	1,377		1,377.5	\$1,759,219	0.8

	<u>7/1/18-19</u>	<u>7/1/19-20</u>	<u>7/1/20-21</u>
(1) Selected Claim Frequency { Average of 13-14 through 17-18 }	0.9	0.9	0.9
(2) Projected Exposure { Exhibit I }	\$93,908	\$97,195	\$98,653
(3) Estimated Ultimate Reported Claims: { Line (1) x Line (2) / 1,000 }	85.4	86.6	86.2
(4) Estimated claims unreported { (1 - 1 / CCDF) x (3) }	24.7		
(5) Reported claims { Exhibit I }	61		
(6) Estimate of Ultimate Claims { (4) + (5) or (3) }	85.7	86.6	86.2

\*Shown as claims per million of exposure, record only claims omitted

Column (B): Exhibit I  
Column (C): Appendix A6  
Column (D) = (B) \* (C)  
Column (E) = Exhibit IV  
Column (F) = (D) / (E) \* 1,000

***Estimation of Claim Severities***

(A)	(B)	(C)	(D)	(E)	(F)
<i>Accident Period</i>	<i>Estimated Ultimate Claims</i>	<i>Selected Estimated Ultimate Losses</i>	<i>Estimated Ultimate Severity</i>	<i>Exposure (Hundreds)</i>	<i>Cost per \$100 Payroll</i>
7/1/96-97	92.0	\$477,879	\$5,200	\$603,228	\$0.79
7/1/97-98	106.0	\$184,764	\$1,700	\$623,098	\$0.30
7/1/98-99	79.0	\$178,018	\$2,300	\$642,097	\$0.28
7/1/99-00	82.0	\$165,594	\$2,000	\$664,645	\$0.25
7/1/00-01	54.0	\$43,290	\$800	\$693,198	\$0.06
7/1/01-02	61.0	\$93,990	\$1,500	\$727,858	\$0.13
7/1/02-03	82.0	\$310,984	\$3,800	\$759,385	\$0.41
7/1/03-04	92.0	\$388,000	\$4,200	\$789,767	\$0.49
7/1/04-05	88.0	\$173,970	\$2,000	\$817,839	\$0.21
7/1/05-06	74.0	\$177,537	\$2,400	\$832,145	\$0.21
7/1/06-07	78.0	\$455,093	\$5,800	\$848,397	\$0.54
7/1/07-08	96.0	\$221,834	\$2,300	\$875,052	\$0.25
7/1/08-09	73.0	\$156,000	\$2,100	\$921,786	\$0.17
7/1/09-10	68.0	\$593,000	\$8,700	\$889,708	\$0.67
7/1/10-11	67.0	\$458,000	\$6,800	\$918,714	\$0.50
7/1/11-12	84.0	\$245,000	\$2,900	\$846,084	\$0.29
7/1/12-13	87.0	\$187,000	\$2,100	\$882,041	\$0.21
7/1/13-14	97.0	\$481,000	\$5,000	\$865,495	\$0.56
7/1/14-15	80.0	\$246,000	\$3,100	\$866,778	\$0.28
7/1/15-16	90.0	\$443,000	\$4,900	\$869,806	\$0.51
7/1/16-17	79.1	\$308,000	\$3,900	\$908,469	\$0.34
7/1/17-18	81.4	\$340,000	\$4,200	\$920,667	\$0.37
7/1/18-19	85.7	\$344,000	\$4,000	\$939,080	\$0.37
7/1/19-20	86.6	\$416,000	\$4,800	\$971,948	\$0.43
7/1/20-21	86.2	\$428,000	\$5,000	\$986,527	\$0.43
<i>Total</i>	2,049.1	\$7,516,000	\$3,700	\$20,663,809	\$0.36

*Columns (B): Exhibit XI, page 1*

*Column (C): Exhibit X; Exhibit VI for the forecast periods*

*Column (D) = (C) / (B)*

*Column (E): Exhibit I*

*Column (F) = (C) / (E)*

**Calculation of Required Reserves  
As of March 31, 2019**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Accident Period	Selected Ultimate Losses	Limited Paid Losses	Limited Reported Losses	Case Reserves	IBNR Reserves	Total Required Reserves	Discount Factor at 2.5%	Total Discounted Reserves at 2.5%
7/1/92-93	--	\$304,020	\$304,020	\$0	\$0	\$0	1.000	\$0
7/1/93-94	--	\$2,499	\$2,499	\$0	\$0	\$0	1.000	\$0
7/1/94-95	--	\$4,025	\$4,025	\$0	\$0	\$0	1.000	\$0
7/1/95-96	--	\$250,000	\$250,000	\$0	\$0	\$0	1.000	\$0
7/1/96-97	\$477,879	\$477,879	\$477,879	\$0	\$0	\$0	1.000	\$0
7/1/97-98	\$184,764	\$184,764	\$184,764	\$0	\$0	\$0	1.000	\$0
7/1/98-99	\$178,018	\$178,018	\$178,018	\$0	\$0	\$0	1.000	\$0
7/1/99-00	\$165,594	\$165,594	\$165,594	\$0	\$0	\$0	0.988	\$0
7/1/00-01	\$43,290	\$43,290	\$43,290	\$0	\$0	\$0	0.966	\$0
7/1/01-02	\$93,990	\$93,990	\$93,990	\$0	\$0	\$0	0.946	\$0
7/1/02-03	\$310,984	\$310,984	\$310,984	\$0	\$0	\$0	0.929	\$0
7/1/03-04	\$388,000	\$375,431	\$384,555	\$9,124	\$3,000	\$12,000	0.914	\$11,000
7/1/04-05	\$173,970	\$173,970	\$173,970	\$0	\$0	\$0	0.902	\$0
7/1/05-06	\$177,537	\$177,537	\$177,537	\$0	\$0	\$0	0.892	\$0
7/1/06-07	\$455,093	\$455,093	\$455,093	\$0	\$0	\$0	0.884	\$0
7/1/07-08	\$221,834	\$221,834	\$221,834	\$0	\$0	\$0	0.878	\$0
7/1/08-09	\$156,000	\$150,318	\$152,136	\$1,818	\$4,000	\$6,000	0.874	\$5,000
7/1/09-10	\$593,000	\$587,481	\$587,481	\$0	\$6,000	\$6,000	0.872	\$5,000
7/1/10-11	\$458,000	\$440,397	\$440,397	\$0	\$18,000	\$18,000	0.872	\$16,000
7/1/11-12	\$245,000	\$226,762	\$233,380	\$6,618	\$12,000	\$19,000	0.874	\$17,000
7/1/12-13	\$187,000	\$174,947	\$174,947	\$0	\$12,000	\$12,000	0.877	\$11,000
7/1/13-14	\$481,000	\$439,601	\$439,601	\$0	\$41,000	\$41,000	0.882	\$36,000
7/1/14-15	\$246,000	\$212,147	\$212,147	\$0	\$34,000	\$34,000	0.889	\$30,000
7/1/15-16	\$443,000	\$385,154	\$386,035	\$881	\$57,000	\$58,000	0.897	\$52,000
7/1/16-17	\$308,000	\$184,261	\$210,448	\$26,187	\$98,000	\$124,000	0.906	\$112,000
7/1/17-18	\$340,000	\$166,615	\$186,043	\$19,428	\$154,000	\$173,000	0.914	\$158,000
7/1/18-3/31/19	\$258,000	\$28,868	\$77,545	\$48,678	\$180,000	\$229,000	0.921	\$211,000
Total	\$6,586,000	\$6,415,477	\$6,528,211	\$112,734	\$619,000	\$732,000		\$664,000
96-97 through 3/31/19	\$6,586,000	\$5,854,933	\$5,967,668	\$112,734	\$619,000	\$732,000		\$664,000
3/31-6/30/19	\$86,000							

Column (B): Exhibit X; prorated for 7/1/18-19  
Columns (C), (D): Exhibit I, limited to retention  
Column (E) = (D) - (C)  
Column (F) = (B) - (D); judgmentally selected for 92-93 through 95/96  
Column (G) = (E) + (F)  
Column (H): Appendix D  
Column (I) = (G) \* (H)

**Estimated Outstanding Losses  
At Various Confidence Levels  
As of March 31, 2019  
for Accident Periods 96-97 through 18-19**

Confidence Level	(A) Estimated Ultimate Losses	(B) Limited Paid Losses	(C) Limited Reported Losses	(D) Case Reserves	(E) Estimated Unreported Losses	(F) Estimated Outstanding Losses	(G) Discount Factor at 2.5%	(H) Discounted Outstanding Losses
50%	\$6,567,000	\$5,854,933	\$5,967,668	\$112,734	\$599,000	\$712,000	0.907	\$646,000
55%	\$6,601,000	\$5,854,933	\$5,967,668	\$112,734	\$633,000	\$746,000	0.907	\$677,000
60%	\$6,634,000	\$5,854,933	\$5,967,668	\$112,734	\$666,000	\$779,000	0.907	\$707,000
65%	\$6,669,000	\$5,854,933	\$5,967,668	\$112,734	\$701,000	\$814,000	0.907	\$738,000
70%	\$6,707,000	\$5,854,933	\$5,967,668	\$112,734	\$739,000	\$852,000	0.907	\$773,000
75%	\$6,749,000	\$5,854,933	\$5,967,668	\$112,734	\$781,000	\$894,000	0.907	\$811,000
80%	\$6,795,000	\$5,854,933	\$5,967,668	\$112,734	\$827,000	\$940,000	0.907	\$853,000
85%	\$6,852,000	\$5,854,933	\$5,967,668	\$112,734	\$884,000	\$997,000	0.907	\$904,000
90%	\$6,926,000	\$5,854,933	\$5,967,668	\$112,734	\$958,000	\$1,071,000	0.907	\$972,000
95%	\$7,036,000	\$5,854,933	\$5,967,668	\$112,734	\$1,068,000	\$1,181,000	0.907	\$1,071,000
Expected	\$6,586,000	\$5,854,933	\$5,967,668	\$112,734	\$619,000	\$732,000	0.907	\$664,000

Column (A): Based on Lognormal Fit to Historical Development Experience

Columns (B), (C): Exhibit XII, page 1

Column (D) = (C) - (B)

Column (E) = (A) - (C)

Column (F) = (A) - (B) = (D) + (E)

Column (G): Average Discount from Exhibit XII, page 1

Column (H) = (F) \* (G)

**Projection of Loss Payout  
For the Next Ten Fiscal Years**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
Accident Year	Outstanding Losses or Expected Incurred	Paid During 3/31-6/30/19	Paid During 2019-20	Paid During 2020-21	Paid During 2021-22	Paid During 2022-23	Paid During 2023-24	Paid During 2024-25	Paid During 2025-26	Paid During 2026-27	Paid During 2027-28	Paid During 2028-29
7/1/95-96	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/96-97	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/97-98	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/98-99	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/99-00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/00-01	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/01-02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/02-03	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/03-04	\$12,000	\$300	\$1,100	\$1,000	\$800	\$700	\$600	\$600	\$500	\$400	\$400	\$400
7/1/04-05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/05-06	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/06-07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/07-08	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
7/1/08-09	\$6,000	\$200	\$800	\$600	\$500	\$400	\$400	\$300	\$300	\$200	\$200	\$200
7/1/09-10	\$6,000	\$200	\$800	\$600	\$500	\$400	\$400	\$300	\$300	\$200	\$200	\$200
7/1/10-11	\$18,000	\$800	\$2,600	\$2,000	\$1,600	\$1,300	\$1,100	\$900	\$800	\$700	\$600	\$500
7/1/11-12	\$19,000	\$900	\$3,000	\$2,300	\$1,800	\$1,400	\$1,200	\$1,000	\$800	\$700	\$600	\$500
7/1/12-13	\$12,000	\$600	\$2,000	\$1,500	\$1,200	\$900	\$700	\$600	\$500	\$400	\$400	\$300
7/1/13-14	\$41,000	\$2,300	\$7,600	\$5,600	\$4,200	\$3,200	\$2,500	\$2,000	\$1,600	\$1,400	\$1,100	\$1,000
7/1/14-15	\$34,000	\$2,200	\$6,900	\$4,900	\$3,600	\$2,700	\$2,100	\$1,600	\$1,300	\$1,100	\$900	\$700
7/1/15-16	\$58,000	\$4,100	\$13,000	\$8,900	\$6,300	\$4,600	\$3,500	\$2,700	\$2,100	\$1,700	\$1,400	\$1,100
7/1/16-17	\$124,000	\$9,800	\$30,400	\$20,100	\$13,800	\$9,800	\$7,200	\$5,400	\$4,200	\$3,300	\$2,600	\$2,100
7/1/17-18	\$173,000	\$14,400	\$45,600	\$29,900	\$19,900	\$13,700	\$9,700	\$7,100	\$5,300	\$4,100	\$3,200	\$2,600
7/1/18-3/31/19	\$229,000	\$24,800	\$59,700	\$41,500	\$27,300	\$18,200	\$12,500	\$8,900	\$6,500	\$4,900	\$3,800	\$3,000
Subtotal	\$732,000	\$61,000	\$174,000	\$119,000	\$82,000	\$57,000	\$42,000	\$31,000	\$24,000	\$19,000	\$15,000	\$13,000
3/31-6/30/19	\$86,000	\$9,000	\$22,000	\$16,000	\$10,000	\$7,000	\$5,000	\$3,000	\$2,000	\$2,000	\$1,000	\$1,000
7/1/19-20	\$416,000	--	\$111,000	\$89,000	\$62,000	\$41,000	\$27,000	\$19,000	\$13,000	\$10,000	\$7,000	\$6,000
Total	\$1,234,000	\$70,000	\$307,000	\$224,000	\$154,000	\$105,000	\$74,000	\$53,000	\$39,000	\$31,000	\$23,000	\$20,000

Outstanding losses or expected incurred are derived in Exhibit XII, page 1 and Exhibit VI

Percent of outstanding losses or expected incurred paid during a given period is based on the paid loss development patterns given in Appendix A4 and the formula  $\{[1 / PLDF(t+1)] - [1 / PLDF(t)]\} / \{1 - [1 / PLDF(@ 03/31/19)]\}$ .

Amount paid equals the percent of outstanding or expected paid times the estimated outstanding losses or expected incurred.

**Projected Payment Pattern  
At Various Confidence Levels  
for Accident Periods 96-97 through 19-20**

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
	Limited Ultimate Losses	Limited Outstanding & Forecast Losses	Limited Paid Losses as of 3/31/2019	Projected Paid Losses as of 6/30/2019	Projected Limited Outstanding & Forecast Losses as of 6/30/2019	Projected Paid Losses as of 6/30/2020	Projected Outstanding Losses as of 6/30/2020
Aggregate Percentile							
50%	\$7,045,000	\$1,190,000	\$5,854,933	\$5,922,000	\$1,123,000	\$6,218,000	\$827,000
55%	\$7,091,000	\$1,236,000	\$5,854,933	\$5,925,000	\$1,166,000	\$6,233,000	\$858,000
60%	\$7,141,000	\$1,286,000	\$5,854,933	\$5,928,000	\$1,213,000	\$6,248,000	\$893,000
65%	\$7,191,000	\$1,336,000	\$5,854,933	\$5,931,000	\$1,260,000	\$6,263,000	\$928,000
70%	\$7,243,000	\$1,388,000	\$5,854,933	\$5,934,000	\$1,309,000	\$6,279,000	\$964,000
75%	\$7,308,000	\$1,453,000	\$5,854,933	\$5,937,000	\$1,371,000	\$6,299,000	\$1,009,000
80%	\$7,379,000	\$1,524,000	\$5,854,933	\$5,941,000	\$1,438,000	\$6,320,000	\$1,059,000
85%	\$7,467,000	\$1,612,000	\$5,854,933	\$5,946,000	\$1,521,000	\$6,347,000	\$1,120,000
90%	\$7,580,000	\$1,725,000	\$5,854,933	\$5,953,000	\$1,627,000	\$6,382,000	\$1,198,000
95%	\$7,785,000	\$1,930,000	\$5,854,933	\$5,964,000	\$1,821,000	\$6,444,000	\$1,341,000
Expected	\$7,088,000	\$1,234,000	\$5,854,933	\$5,925,000	\$1,163,000	\$6,232,000	\$856,000

Column (A): Percentile estimates are based on a lognormal distribution.

Column (B) = (C) - (A)

Column (C): Exhibit XII, page 2

Column (D) = { (% of outstanding as of 3/31/19 expected to be paid during 3/31-6/30/19 from Exhibit XIII, page 1) \* (B) } + (C)

Column (E) = (A) - (D)

Column (F) = { (% of outstanding as of 6/30/19 expected to be paid during 2019-20 from Exhibit XIII, page 1) \* (E) } + (D)

Column (G) = (A) - (F)

Comparison of Results with Report Valued as of December 31, 2016

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Reported Losses 12/31/2016	Expected Reported Losses 3/31/2019	Actual Reported Losses 3/31/2019	Percent Difference	Estimated Ultimate Losses 12/31/2016	Estimated Ultimate Losses 3/31/2019	Percent Difference
7/1/96-97	\$477,879	\$477,879	\$477,879	0%	\$477,879	\$477,879	0%
7/1/97-98	\$184,764	\$184,764	\$184,764	0%	\$184,764	\$184,764	0%
7/1/98-99	\$186,421	\$186,719	\$178,018	-5%	\$188,000	\$178,018	-5%
7/1/99-00	\$165,594	\$165,594	\$165,594	0%	\$165,594	\$165,594	0%
7/1/00-01	\$43,290	\$43,290	\$43,290	0%	\$43,290	\$43,290	0%
7/1/01-02	\$93,990	\$93,990	\$93,990	0%	\$93,990	\$93,990	0%
7/1/02-03	\$310,984	\$310,984	\$310,984	0%	\$310,984	\$310,984	0%
7/1/03-04	\$349,287	\$350,668	\$384,555	10%	\$355,000	\$388,000	9%
7/1/04-05	\$173,970	\$173,970	\$173,970	0%	\$173,970	\$173,970	0%
7/1/05-06	\$176,983	\$176,983	\$177,537	0%	\$176,983	\$177,537	0%
7/1/06-07	\$252,595	\$252,595	\$455,093	80%	\$252,595	\$455,093	80%
7/1/07-08	\$221,834	\$221,834	\$221,834	0%	\$221,834	\$221,834	0%
7/1/08-09	\$150,040	\$150,040	\$152,136	1%	\$150,040	\$156,000	4%
7/1/09-10	\$587,481	\$593,464	\$587,481	-1%	\$604,000	\$593,000	-2%
7/1/10-11	\$452,249	\$469,488	\$440,397	-6%	\$496,000	\$458,000	-8%
7/1/11-12	\$222,419	\$236,477	\$233,380	-1%	\$255,000	\$245,000	-4%
7/1/12-13	\$174,990	\$189,740	\$174,947	-8%	\$206,000	\$187,000	-9%
7/1/13-14	\$378,955	\$410,112	\$439,601	7%	\$438,000	\$481,000	10%
7/1/14-15	\$215,938	\$268,296	\$212,147	-21%	\$305,000	\$246,000	-19%
7/1/15-16	\$247,224	\$346,274	\$386,035	11%	\$399,000	\$443,000	11%
7/1/16-17	\$176,987	\$372,165	\$210,448	-43%	\$442,000	\$308,000	-30%
7/1/17-18		\$259,000	\$186,043	-28%	\$401,000	\$340,000	-15%
7/1/18-19		\$153,000	\$77,545	-49%	\$408,000	\$344,000	-16%
Total	\$5,243,874	\$6,087,327	\$5,967,668	-2%	\$6,749,000	\$6,672,000	-1%
Variance from Expected			(\$119,659)	Change in Ultimates			(\$77,000)

(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
Accident Period	Paid Losses 12/31/2016	Expected Paid Losses 3/31/2019	Actual Paid Losses 3/31/2019	Percent Difference	Estimated Ultimate Losses 12/31/2016	Estimated Ultimate Losses 3/31/2019	Percent Difference
7/1/96-97	\$477,879	\$477,879	\$477,879	0%	\$477,879	\$477,879	0%
7/1/97-98	\$184,764	\$184,764	\$184,764	0%	\$184,764	\$184,764	0%
7/1/98-99	\$177,212	\$178,903	\$178,018	0%	\$188,000	\$178,018	-5%
7/1/99-00	\$165,594	\$165,594	\$165,594	0%	\$165,594	\$165,594	0%
7/1/00-01	\$43,290	\$43,290	\$43,290	0%	\$43,290	\$43,290	0%
7/1/01-02	\$93,990	\$93,990	\$93,990	0%	\$93,990	\$93,990	0%
7/1/02-03	\$310,984	\$310,984	\$310,984	0%	\$310,984	\$310,984	0%
7/1/03-04	\$336,472	\$340,210	\$375,431	10%	\$355,000	\$388,000	9%
7/1/04-05	\$173,970	\$173,970	\$173,970	0%	\$173,970	\$173,970	0%
7/1/05-06	\$176,983	\$176,983	\$177,537	0%	\$176,983	\$177,537	0%
7/1/06-07	\$252,595	\$252,595	\$455,093	80%	\$252,595	\$455,093	80%
7/1/07-08	\$221,834	\$221,834	\$221,834	0%	\$221,834	\$221,834	0%
7/1/08-09	\$150,040	\$150,040	\$150,318	0%	\$150,040	\$156,000	4%
7/1/09-10	\$587,481	\$592,514	\$587,481	-1%	\$604,000	\$593,000	-2%
7/1/10-11	\$440,397	\$458,862	\$440,397	-4%	\$496,000	\$458,000	-8%
7/1/11-12	\$222,419	\$234,289	\$226,762	-3%	\$255,000	\$245,000	-4%
7/1/12-13	\$174,947	\$187,442	\$174,947	-7%	\$206,000	\$187,000	-9%
7/1/13-14	\$345,804	\$387,023	\$439,601	14%	\$438,000	\$481,000	10%
7/1/14-15	\$206,679	\$255,685	\$212,147	-17%	\$305,000	\$246,000	-19%
7/1/15-16	\$209,715	\$314,179	\$385,154	23%	\$399,000	\$443,000	11%
7/1/16-17	\$30,246	\$273,129	\$184,261	-33%	\$442,000	\$308,000	-30%
7/1/17-18		\$183,000	\$166,615	-9%	\$401,000	\$340,000	-15%
7/1/18-19		\$76,000	\$28,868	-62%	\$408,000	\$344,000	-16%
Total	\$4,983,296	\$5,733,159	\$5,854,933	2%	\$6,748,923	\$6,672,000	-1%

Columns (B), (F), (J), (N): From previous actuarial report as of 12/31/16

Column (C): Derived from (B) and (F) using Reported LDF's from previous actuarial report

Columns (D), (L): Exhibit I, limited to retention

Column (E) = [(D) / (C)] - 1

Columns (G), (O): Exhibit X

Column (H) = [(G) / (F)] - 1

Column (K): Derived from (J) and (N) using Paid LDF's from previous actuarial report

Column (M) = [(L) / (K)] - 1

Column (P) = [(O) / (N)] - 1



***Funding at the Expected Level  
With An Additional \$250,000 Risk Margin***

(1) Estimated Outstanding Losses as of 3/31/19 { Exhibit XII-1 }	\$732,000
(2) Forecast Losses for 3/31-6/30/19 { Exhibit XII-1 }	\$86,000
(3) Additional Risk Margin { Provided by Roanoke Co. Schools }	\$250,000
<hr/>	
<b>(4) Required Funding as of 3/31/19 { (1) + (2) + (3) }</b>	<b>\$1,068,000</b>
(5) Projected Payments during 3/31-6/30/19 { Exhibit XIII-1 }	\$70,000
(6) Estimated Outstanding Losses as of 6/30/19 { (1) + (2) – (5) }	\$748,000
(7) Forecast Losses for 7/1/19-20 { Exhibit VI }	\$416,000
(8) Additional Risk Margin { Provided by Roanoke Co. Schools }	\$250,000
<hr/>	
<b>(9) Required Funding as of 6/30/19 { (6) + (7) + (8) }</b>	<b>\$1,414,000</b>
(10) Projected Payments during 7/1/19-20 { Exhibit XIII-1 }	\$307,000
(11) Estimated Outstanding Losses as of 6/30/20 { (6) + (7) – (10) }	\$857,000
(12) Forecast Losses for 7/1/20-21 { Exhibit VI }	\$428,000
(13) Additional Risk Margin { Provided by Roanoke Co. Schools }	\$250,000
<hr/>	
<b>(14) Required Funding as of 6/30/20 { (11) + (12) + (13) }</b>	<b>\$1,535,000</b>

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## Appendices

Appendix A	Loss Development Factors
Appendix B	Claims Cost Trend Factors
Appendix C	Exposure Trend Factors
Appendix D	Calculation of Discount Factors
Appendix E	Lognormal Parameters for Loss Distributions For Historical Accident Periods

**Roanoke County School Board**  
Workers Compensation  
Combined Experience for County and School Board\*

Appendix A1

**Reported Loss Development**

Accident Period	Gross Reported Losses as of (months):														
	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180
7/1/96-97		\$391,619	\$479,281	\$537,354	\$891,594	\$984,421	\$937,377	\$937,377	\$987,377	\$995,610	\$995,276	\$995,276	\$995,276	\$992,791	\$1,014,504
7/1/97-98	\$178,355	\$369,414	\$361,358	\$366,052	\$376,196	\$384,177	\$385,718	\$423,499	\$431,707	\$421,053	\$373,354	\$373,354	\$367,535	\$361,716	\$361,716
7/1/98-99	\$251,274	\$293,511	\$322,136	\$381,950	\$386,474	\$332,336	\$339,838	\$439,796	\$423,663	\$472,490	\$472,490	\$491,285	\$560,647	\$535,716	\$510,784
7/1/99-00	\$456,512	\$472,597	\$645,257	\$579,065	\$595,694	\$648,217	\$654,537	\$654,749	\$683,192	\$693,126	\$705,129	\$759,241	\$741,899	\$724,556	\$745,770
7/1/00-01	\$562,554	\$596,006	\$639,157	\$381,479	\$401,133	\$363,871	\$363,781	\$367,001	\$367,001	\$367,001	\$406,638	\$386,819	\$367,001	\$367,001	\$367,001
7/1/01-02	\$821,345	\$770,966	\$878,953	\$863,677	\$851,895	\$862,878	\$898,139	\$961,748	\$967,083	\$948,009	\$980,115	\$1,012,221	\$1,013,569	\$1,015,072	\$988,840
7/1/02-03	\$385,934	\$462,770	\$456,767	\$506,971	\$539,944	\$543,920	\$533,249	\$532,801	\$533,477	\$535,250	\$537,022	\$540,425	\$545,529	\$614,436	\$614,436
7/1/03-04	\$336,277	\$498,535	\$574,468	\$559,821	\$597,779	\$588,154	\$636,900	\$637,701	\$666,162	\$694,622	\$808,347	\$818,840	\$858,918	\$858,918	\$874,055
7/1/04-05	\$305,338	\$457,455	\$529,557	\$546,401	\$514,586	\$471,847	\$475,615	\$507,449	\$539,284	\$545,097	\$550,491	\$530,235	\$575,235	\$577,556	
7/1/05-06	\$471,382	\$692,734	\$801,879	\$801,370	\$791,870	\$763,614	\$763,815	\$753,292	\$753,538	\$757,809	\$803,477	\$803,892	\$804,540		
7/1/06-07	\$465,228	\$672,559	\$636,436	\$719,044	\$695,799	\$697,188	\$709,934	\$791,296	\$893,409	\$933,951	\$989,384	\$1,138,159			
7/1/07-08	\$793,678	\$813,941	\$1,020,141	\$1,105,670	\$1,049,629	\$1,010,938	\$1,001,820	\$1,005,949	\$1,068,398	\$1,066,549	\$1,069,253				
7/1/08-09	\$309,982	\$804,301	\$870,982	\$823,819	\$832,494	\$868,082	\$998,647	\$947,745	\$975,850	\$890,806					
7/1/09-10	\$441,280	\$596,072	\$875,536	\$870,279	\$881,845	\$895,337	\$1,268,822	\$1,268,822	\$1,254,052						
7/1/10-11	\$660,825	\$900,594	\$1,526,519	\$1,889,607	\$1,957,049	\$2,208,710	\$2,254,412	\$2,361,699							
7/1/11-12	\$240,987	\$530,151	\$569,171	\$606,015	\$615,112	\$672,877	\$725,035								
7/1/12-13	\$415,587	\$523,968	\$677,852	\$780,191	\$860,055	\$920,942									
7/1/13-14	\$537,650	\$906,246	\$1,101,686	\$1,134,454	\$1,191,860										
7/1/14-15	\$484,074	\$951,574	\$1,013,337	\$1,050,317											
7/1/15-16	\$523,561	\$542,777	\$800,027												
7/1/16-17	\$713,411	\$785,771													
7/1/17-18	\$251,598														

Accident Period	Age-to-Age Factors:														
	12:24	24:36	36:48	48:60	60:72	72:84	84:96	96:108	108:120	120:132	132:144	144:156	156:168	168:180	180:Ult
7/1/96-97		1.224	1.121	1.659	1.104	0.952	1.000	1.053	1.008	1.000	1.000	1.000	0.998	1.022	
7/1/97-98	2.071	0.978	1.013	1.028	1.021	1.004	1.098	1.019	0.975	0.887	1.000	0.984	0.984	1.000	
7/1/98-99	1.168	1.098	1.186	1.012	0.860	1.023	1.294	0.963	1.115	1.000	1.040	1.141	0.956	0.953	
7/1/99-00	1.035	1.365	0.897	1.029	1.088	1.010	1.000	1.043	1.015	1.017	1.077	0.977	0.977	1.029	
7/1/00-01	1.059	1.072	0.597	1.052	0.907	1.000	1.009	1.000	1.000	1.108	0.951	0.949	1.000	1.000	
7/1/01-02	0.939	1.140	0.983	0.986	1.013	1.041	1.071	1.006	0.980	1.034	1.033	1.001	1.001	0.974	
7/1/02-03	1.199	0.987	1.110	1.065	1.007	0.980	0.999	1.001	1.003	1.003	1.006	1.009	1.126	1.000	
7/1/03-04	1.483	1.152	0.975	1.068	0.984	1.083	1.001	1.045	1.043	1.164	1.013	1.049	1.000	1.018	
7/1/04-05	1.498	1.158	1.032	0.942	0.917	1.008	1.067	1.063	1.011	1.010	0.963	1.085	1.004		
7/1/05-06	1.470	1.158	0.999	0.988	0.964	1.000	0.986	1.000	1.006	1.060	1.001	1.001			
7/1/06-07	1.446	0.946	1.130	0.968	1.002	1.018	1.115	1.129	1.045	1.059	1.150				
7/1/07-08	1.026	1.253	1.084	0.949	0.963	0.991	1.004	1.062	0.998	1.003					
7/1/08-09	2.595	1.083	0.946	1.011	1.043	1.150	0.949	1.030	0.913						
7/1/09-10	1.351	1.469	0.994	1.013	1.015	1.417	1.000	0.988							
7/1/10-11	1.363	1.695	1.238	1.036	1.129	1.021	1.048								
7/1/11-12	2.200	1.074	1.065	1.015	1.094	1.078									
7/1/12-13	1.261	1.294	1.151	1.102	1.071										
7/1/13-14	1.686	1.216	1.030	1.051											
7/1/14-15	1.966	1.065	1.036												
7/1/15-16	1.037	1.474													
7/1/16-17	1.101														
Average	1.448	1.195	1.031	1.054	1.011	1.048	1.043	1.029	1.009	1.029	1.021	1.020	1.005	1.000	
Avg. Latest 5	1.410	1.224	1.104	1.043	1.070	1.131	1.023	1.042	0.995	1.059	1.027	1.029	1.026	1.004	
Wtd. Avg. Latest 5	1.387	1.205	1.117	1.043	1.081	1.105	1.023	1.037	0.991	1.056	1.039	1.025	1.022	1.003	
Wtd. Avg.	1.351	1.207	1.037	1.043	1.029	1.053	1.030	1.031	1.003	1.031	1.030	1.018	1.004	1.001	
VACO	1.535	1.168	1.078	1.044	1.027	1.018	1.021	1.019	1.013	1.008	1.005	1.003	1.002	1.001	1.002
Prior	1.512	1.206	1.058	1.030	1.025	1.020	1.014	1.011	1.008	1.007	1.007	1.005	1.002	1.002	1.003
Selected	1.461	1.224	1.058	1.036	1.035	1.034	1.023	1.011	1.008	1.007	1.007	1.005	1.003	1.002	1.003
Cumulative Factor	12:ult	24:ult	36:ult	48:ult	60:ult	72:ult	84:ult	96:ult	108:ult	120:ult	132:ult	144:ult	156:ult	168:ult	180:Ult
	2.247	1.538	1.256	1.187	1.145	1.107	1.070	1.046	1.035	1.026	1.019	1.012	1.008	1.005	1.003

\* School Board losses were as of 5/31/05 in the 2005 analysis

**Estimation of Cumulative Reported Loss Development Factors  
Using "The Method of Least Squares"  
Workers Compensation**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X' LN(1/(X+C))	Y' LN(Y-1)	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	2.247	-3.8159	0.2209	14.561	0.0488	-0.8428	321	1.002
24	1.538	-4.0503	-0.6195	16.405	0.3838	2.5092	309	1.002
36	1.256	-4.2401	-1.3613	17.979	1.8531	5.7719	297	1.003
48	1.187	-4.3996	-1.6768	19.356	2.8118	7.3773	285	1.003
60	1.145	-4.5371	-1.9285	20.585	3.7191	8.7497	273	1.003
72	1.107	-4.6579	-2.2393	21.696	5.0146	10.4307	261	1.004
84	1.070	-4.7657	-2.6610	22.712	7.0807	12.6814	249	1.004
96	1.046	-4.8630	-3.0775	23.649	9.4711	14.9661	237	1.005
108	1.035	-4.9517	-3.3631	24.519	11.3105	16.6532	225	1.006
120	1.026	-5.0332	-3.6338	25.333	13.2044	18.2894	213	1.007
							201	1.008
							189	1.009
							177	1.011
							165	1.013
							153	1.016
							141	1.019
							129	1.024
							117	1.030
							105	1.039
							93	1.051
							81	1.070
							69	1.097
							57	1.142
							45	1.219
							33	1.363
							21	1.664
							9	3.033
Sum		-45.3145	-20.3400	206.7951	54.8979	96.5861		
Average		-4.5314	-2.0340	20.7	5.4898	9.6586		

N =	10		
A =	1.232E+05		
B =	3.036	R^2 =	0.99115
C =	33		

\* From combined experience of County and School Board

**Roanoke County School Board**  
Workers Compensation  
Combined Experience for County and School Board\*

**Appendix A3**

***Paid Loss Development***

Accident Period	12	24	36	48	60	72	Gross Paid Losses as of (months):								
							84	96	108	120	132	144	156	168	180
7/1/96-97		\$301,493	\$401,657	\$458,782	\$616,631	\$686,635	\$772,779	\$797,776	\$824,695	\$846,088	\$871,085	\$917,232	\$971,077	\$980,691	\$990,305
7/1/97-98	\$80,084	\$215,592	\$317,065	\$328,379	\$332,568	\$345,369	\$350,868	\$363,112	\$371,053	\$372,910	\$373,354	\$373,354	\$367,535	\$361,716	\$361,716
7/1/98-99	\$114,134	\$210,693	\$257,038	\$277,403	\$299,572	\$319,178	\$329,461	\$433,040	\$396,366	\$408,694	\$421,923	\$433,319	\$444,715	\$453,818	\$462,920
7/1/99-00	\$151,117	\$299,234	\$323,588	\$459,479	\$494,100	\$525,881	\$532,954	\$565,068	\$575,672	\$651,017	\$666,314	\$681,611	\$702,875	\$724,139	\$745,631
7/1/00-01	\$126,266	\$167,694	\$252,401	\$283,113	\$313,127	\$313,698	\$317,365	\$323,251	\$327,364	\$332,422	\$337,480	\$343,283	\$349,086	\$352,871	\$356,056
7/1/01-02	\$197,503	\$639,170	\$724,256	\$742,498	\$746,596	\$763,886	\$793,389	\$860,360	\$878,364	\$898,927	\$909,566	\$920,206	\$924,183	\$927,447	\$933,275
7/1/02-03	\$161,268	\$321,666	\$395,462	\$491,459	\$507,841	\$517,986	\$523,379	\$526,694	\$530,029	\$533,526	\$537,022	\$540,425	\$545,515	\$567,835	\$576,215
7/1/03-04	\$185,211	\$410,637	\$478,986	\$511,613	\$529,197	\$537,615	\$548,283	\$567,319	\$596,521	\$625,722	\$651,354	\$784,165	\$811,743	\$814,970	\$846,416
7/1/04-05	\$222,501	\$380,203	\$417,035	\$434,221	\$446,417	\$459,273	\$469,296	\$480,195	\$491,093	\$505,990	\$511,764	\$524,243	\$529,325	\$543,024	
7/1/05-06	\$278,823	\$543,464	\$606,056	\$618,708	\$646,943	\$667,044	\$685,059	\$699,186	\$712,742	\$731,913	\$765,383	\$771,403	\$787,818		
7/1/06-07	\$168,902	\$287,571	\$330,500	\$409,330	\$427,981	\$469,403	\$524,061	\$597,589	\$724,740	\$792,609	\$820,107	\$998,425			
7/1/07-08	\$360,909	\$698,063	\$764,823	\$860,320	\$876,657	\$897,844	\$912,375	\$918,106	\$934,569	\$928,201	\$939,269				
7/1/08-09	\$219,242	\$498,944	\$570,611	\$606,511	\$613,428	\$637,490	\$698,276	\$776,157	\$794,830	\$844,026					
7/1/09-10	\$315,096	\$557,148	\$699,820	\$770,577	\$829,431	\$876,579	\$996,073	\$1,250,646	\$1,254,052						
7/1/10-11	\$382,581	\$742,117	\$1,355,826	\$1,672,469	\$1,824,614	\$2,106,606	\$2,144,885	\$2,276,905							
7/1/11-12	\$161,217	\$325,779	\$442,039	\$500,632	\$587,090	\$605,268	\$698,862								
7/1/12-13	\$222,231	\$502,772	\$628,810	\$749,561	\$767,988	\$868,795									
7/1/13-14	\$368,648	\$763,504	\$995,143	\$1,056,329	\$1,131,783										
7/1/14-15	\$305,085	\$887,204	\$946,564	\$1,046,180											
7/1/15-16	\$471,117	\$512,546	\$708,855												
7/1/16-17	\$517,973	\$743,783													
7/1/17-18	\$127,414														

Accident Period	12:24	24:36	36:48	48:60	60:72	72:84	Age-to-Age Factors:								
							84:96	96:108	108:120	120:132	132:144	144:156	156:168	168:180	180:Ult
7/1/96-97		1.332	1.142	1.344	1.114	1.125	1.032	1.034	1.026	1.030	1.053	1.059	1.010	1.010	
7/1/97-98	2.692	1.471	1.036	1.013	1.038	1.016	1.035	1.022	1.005	1.001	1.000	0.984	0.984	1.000	
7/1/98-99	1.846	1.220	1.079	1.080	1.065	1.032	1.314	0.915	1.031	1.032	1.027	1.026	1.020	1.020	
7/1/99-00	1.980	1.081	1.420	1.075	1.064	1.013	1.060	1.019	1.131	1.023	1.023	1.031	1.030	1.030	
7/1/00-01	1.328	1.505	1.122	1.106	1.002	1.012	1.019	1.013	1.015	1.015	1.017	1.017	1.011	1.009	
7/1/01-02	3.236	1.133	1.025	1.006	1.023	1.039	1.084	1.021	1.023	1.012	1.012	1.004	1.004	1.006	
7/1/02-03	1.995	1.229	1.243	1.033	1.020	1.010	1.006	1.006	1.007	1.007	1.006	1.009	1.041	1.015	
7/1/03-04	2.217	1.166	1.068	1.034	1.016	1.020	1.035	1.051	1.049	1.041	1.204	1.035	1.004	1.039	
7/1/04-05	1.709	1.097	1.041	1.028	1.029	1.022	1.023	1.023	1.030	1.011	1.024	1.010	1.026		
7/1/05-06	1.949	1.115	1.021	1.046	1.031	1.027	1.021	1.019	1.027	1.046	1.008	1.021			
7/1/06-07	1.703	1.149	1.239	1.046	1.097	1.116	1.140	1.213	1.094	1.035	1.217				
7/1/07-08	1.934	1.096	1.125	1.019	1.024	1.016	1.006	1.018	0.993	1.012					
7/1/08-09	2.276	1.144	1.063	1.011	1.039	1.095	1.112	1.024	1.062						
7/1/09-10	1.768	1.256	1.101	1.076	1.057	1.136	1.256	1.003							
7/1/10-11	1.940	1.827	1.234	1.091	1.155	1.018	1.062								
7/1/11-12	2.021	1.357	1.133	1.173	1.031	1.155									
7/1/12-13	2.262	1.251	1.192	1.025	1.131										
7/1/13-14	2.071	1.303	1.061	1.071											
7/1/14-15	2.908	1.067	1.105												
7/1/15-16	1.088	1.383													
7/1/16-17	1.436														
Average	2.018	1.259	1.129	1.071	1.055	1.053	1.080	1.027	1.038	1.022	1.054	1.020	1.014	1.016	
Avg. Latest 5	1.953	1.272	1.145	1.087	1.083	1.084	1.115	1.055	1.041	1.029	1.092	1.016	1.017	1.020	
Wtd. Avg. Latest 5	1.809	1.244	1.150	1.082	1.102	1.064	1.103	1.042	1.040	1.029	1.101	1.016	1.015	1.021	
Wtd. Avg.	1.938	1.254	1.126	1.068	1.068	1.053	1.079	1.028	1.038	1.023	1.062	1.023	1.014	1.017	
VACO	2.205	1.236	1.103	1.058	1.037	1.025	1.034	1.029	1.020	1.014	1.010	1.007	1.005	1.003	1.008
Prior	2.065	1.260	1.129	1.062	1.045	1.036	1.031	1.025	1.024	1.021	1.015	1.013	1.008	1.005	1.006
Selected	2.001	1.266	1.126	1.068	1.062	1.045	1.034	1.025	1.024	1.021	1.015	1.013	1.008	1.005	1.006
Cumulative Factor	12:ult	24:ult	36:ult	48:ult	60:ult	72:ult	84:ult	96:ult	108:ult	120:ult	132:ult	144:ult	156:ult	168:ult	180:Ult
	3.920	1.959	1.548	1.375	1.288	1.213	1.161	1.123	1.096	1.070	1.049	1.033	1.019	1.011	1.006

\* School Board losses were as of 5/31/05 in the 2005 analysis

**Estimation of Cumulative Paid Loss Development Factors  
Using "The Method of Least Squares"  
Workers Compensation**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X'	Y'	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	3.920	-2.8527	1.0717	8.138	1.1486	-3.0572	321	1.015
24	1.959	-3.3787	-0.0420	11.416	0.0018	0.1418	309	1.016
36	1.548	-3.7217	-0.6020	13.851	0.3624	2.2404	297	1.017
48	1.375	-3.9766	-0.9807	15.813	0.9618	3.8999	285	1.018
60	1.288	-4.1795	-1.2454	17.468	1.5510	5.2051	273	1.020
72	1.213	-4.3481	-1.5456	18.906	2.3890	6.7206	261	1.021
84	1.161	-4.4924	-1.8245	20.181	3.3287	8.1963	249	1.023
96	1.123	-4.6184	-2.0931	21.330	4.3809	9.6667	237	1.025
108	1.096	-4.7303	-2.3426	22.376	5.4879	11.0814	225	1.028
120	1.070	-4.8310	-2.6527	23.338	7.0370	12.8153	213	1.031
							201	1.034
							189	1.038
							177	1.042
							165	1.047
							153	1.054
							141	1.062
							129	1.072
							117	1.086
							105	1.103
							93	1.126
							81	1.159
							69	1.207
							57	1.284
							45	1.415
							33	1.674
							21	2.314
							9	5.664
Sum		-41.1294	-12.2569	172.8181	26.6490	56.9102		
Average		-4.1129	-1.2257	17.3	2.6649	5.6910		

N =	10		
A =	4.400E+02		
B =	1.778	R^2 =	0.99378
C =	5		

\* From combined experience of County and School Board

**Roanoke County School Board**  
Workers Compensation  
Combined Experience for County and School Board\*

Appendix A5

**Claim Count Development**

Accident Period	Claims reported as of (months):+											
	12	24	36	48	60	72	84	96	108	120	132	144
7/1/96-97		223	225	225	225	225	225	225	225	226	226	226
7/1/97-98	383	414	414	414	414	414	414	414	229	229	229	229
7/1/98-99	415	429	429	429	429	429	429	201	201	201	201	201
7/1/99-00	443	473	473	473	473	473	250	250	250	250	250	250
7/1/00-01	364	378	378	378	378	175	175	175	175	175	175	175
7/1/01-02	402	412	412	412	220	220	220	220	220	220	220	220
7/1/02-03	453	467	467	195	195	195	195	195	195	195	195	195
7/1/03-04	479	492	220	220	220	220	220	220	220	220	220	220
7/1/04-05	375	196	196	196	196	196	196	196	196	196	196	196
7/1/05-06	172	176	177	177	177	177	177	177	177	177	177	177
7/1/06-07	181	179	182	181	181	181	181	181	181	180	180	180
7/1/07-08	210	214	216	216	216	216	216	216	217	217	217	
7/1/08-09	168	176	176	176	176	176	176	176	176	176		
7/1/09-10	167	173	173	173	173	173	173	173	173			
7/1/10-11	172	178	180	180	181	181	181	181				
7/1/11-12	180	186	186	186	186	186	186					
7/1/12-13	202	203	203	203	203	203						
7/1/13-14	195	205	206	205	205							
7/1/14-15	202	203	203	203								
7/1/15-16	180	180	180									
7/1/16-17	171	176										
7/1/17-18	186											

Accident Period	Age-to-Age Factors:											
	12:24	24:36	36:48	48:60	60:72	72:84	84:96	96:108	108:120	120:132	132:144	144:ult
7/1/96-97		1.009	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.000	1.000	
7/1/97-98	1.081	1.000	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	
7/1/98-99	1.034	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	
7/1/99-00	1.068	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	
7/1/00-01	1.038	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	
7/1/01-02	1.025	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/02-03	1.031	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/03-04	1.027		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/04-05		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/05-06	1.023	1.006	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
7/1/06-07	0.989	1.017	0.995	1.000	1.000	1.000	1.000	1.000	0.994	1.000	1.000	
7/1/07-08	1.019	1.009	1.000	1.000	1.000	1.000	1.000	1.005	1.000	1.000		
7/1/08-09	1.048	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000			
7/1/09-10	1.036	1.000	1.000	1.000	1.000	1.000		1.000				
7/1/10-11	1.035	1.011	1.000	1.006	1.000	1.000	1.000					
7/1/11-12	1.033	1.000	1.000	1.000	1.000	1.000						
7/1/12-13	1.005	1.000	1.000	1.000	1.000							
7/1/13-14	1.051	1.005	0.995	1.000								
7/1/14-15	1.005	1.000	1.000									
7/1/15-16	1.000	1.000										
7/1/16-17	1.029											
Average	1.030	1.003	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Avg Latest 5	1.018	1.001	0.999	1.001	1.000	1.000	1.000	1.001	0.999	1.000	1.000	
Wtd. Avg.	1.015	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
VACO	1.041	1.002	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Prior	1.030	1.003	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Selected	1.030	1.003	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Cumulative Factor	12:ult	24:ult	36:ult	48:ult	60:ult	72:ult	84:ult	96:ult	108:ult	120:ult	132:ult	144:ult
	1.034	1.003	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

\* School Board losses were as of 5/31/05 in the 2005 analysis

+ Beginning 7/1/05, record-only claims no longer included in claim counts

**Estimation of Cumulative Claim Count Development Factors  
Using "The Method of Least Squares"  
Workers Compensation**

Curve :  $Y = A(1/(X+C))^B + 1$  (Modified Inverse Power Curve)

Months of Maturity X	Cumulative Factors Y*	Transformed Values for Regression					Fitted Values	
		X' LN(1/(X+C))	Y' LN(Y-1)	(X')^2	(Y')^2	X' x Y'	X	Cumulative Factor Y
12	<b>1.034</b>	-2.4849	-3.3937	6.175	11.5174	8.4331	<b>321</b>	<b>1.000</b>
24	<b>1.003</b>	-3.1781	-5.7735	10.100	33.3332	18.3485	<b>309</b>	<b>1.000</b>
							<b>297</b>	<b>1.000</b>
							<b>285</b>	<b>1.000</b>
							<b>273</b>	<b>1.000</b>
							<b>261</b>	<b>1.000</b>
							<b>249</b>	<b>1.000</b>
							<b>237</b>	<b>1.000</b>
							<b>225</b>	<b>1.000</b>
							<b>213</b>	<b>1.000</b>
							<b>201</b>	<b>1.000</b>
							<b>189</b>	<b>1.000</b>
							<b>177</b>	<b>1.000</b>
							<b>165</b>	<b>1.000</b>
							<b>153</b>	<b>1.000</b>
							<b>141</b>	<b>1.000</b>
							<b>129</b>	<b>1.000</b>
							<b>117</b>	<b>1.000</b>
							<b>105</b>	<b>1.000</b>
							<b>93</b>	<b>1.000</b>
							<b>81</b>	<b>1.000</b>
							<b>69</b>	<b>1.000</b>
							<b>57</b>	<b>1.000</b>
							<b>45</b>	<b>1.000</b>
							<b>33</b>	<b>1.001</b>
							<b>21</b>	<b>1.005</b>
							<b>9</b>	<b>1.406</b>
Sum		-5.6630	-9.1672	16.2748	44.8506	26.7816		
Average		-2.8315	-4.5836	8.1	22.4253	13.3908		

N =	2		
A =	1.703E+02		
B =	3.433	R^2 =	1.00000
C =	0		

\* From combined experience of County and School Board



**U.S. Claims Cost Index  
Adjusted to Remove Effects of California Trend**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Year	Workers Compensation Economic Index	Social Index	Composite Economic & Social Index	Annual Percent Increase	Accident Period	Interpolated Index	Trend Factor to 7/1/19-20
1992	58.8	1.000	58.8				
1993	61.7	1.000	61.7	4.9%	7/1/92-93	60.2	2.750
1994	63.3	1.000	63.3	2.6%	7/1/93-94	62.5	2.652
1995	64.3	1.000	64.3	1.7%	7/1/94-95	63.8	2.596
1996	66.7	1.000	66.7	3.7%	7/1/95-96	65.5	2.528
1997	69.3	1.000	69.3	3.8%	7/1/96-97	68.0	2.435
1998	72.2	1.000	72.2	4.2%	7/1/97-98	70.8	2.341
1999	75.0	1.000	75.0	3.8%	7/1/98-99	73.6	2.251
2000	78.7	1.000	78.7	5.0%	7/1/99-00	76.9	2.155
2001	81.6	1.000	81.6	3.6%	7/1/00-01	80.2	2.067
2002	85.8	1.000	85.8	5.2%	7/1/01-02	83.7	1.980
2003	90.3	1.000	90.3	5.2%	7/1/02-03	88.0	1.882
2004	95.2	1.000	95.2	5.5%	7/1/03-04	92.8	1.786
2005	100.0	1.000	100.0	5.0%	7/1/04-05	97.6	1.697
2006	104.8	1.000	104.8	4.8%	7/1/05-06	102.4	1.618
2007	106.8	1.000	106.8	1.8%	7/1/06-07	105.8	1.566
2008	110.0	1.000	110.0	3.0%	7/1/07-08	108.4	1.529
2009	116.9	1.000	116.9	6.3%	7/1/08-09	113.5	1.460
2010	122.0	1.000	122.0	4.3%	7/1/09-10	119.5	1.387
2011	126.0	1.000	126.0	3.3%	7/1/10-11	124.0	1.336
2012	130.1	1.000	130.1	3.2%	7/1/11-12	128.0	1.294
2013	133.1	1.000	133.1	2.3%	7/1/12-13	131.6	1.259
2014	137.9	1.000	137.9	3.6%	7/1/13-14	135.5	1.223
2015	142.0	1.000	142.0	3.0%	7/1/14-15	140.0	1.184
2016	148.7	1.000	148.7	4.7%	7/1/15-16	145.4	1.140
2017	153.8	1.000	153.8	3.5%	7/1/16-17	151.3	1.095
2018*	157.8	1.000	157.8	2.6%	7/1/17-18	155.8	1.063
2019**	163.0	1.000	163.0	3.3%	7/1/18-19	160.4	1.033
2020**	168.3	1.000	168.3	3.3%	7/1/19-20	165.7	1.000

\* 2018 numbers are preliminary

\*\* Future trend estimated based on 2013-2018

Column (B): Willis Towers Watson Claim Cost Index, November 2018

Jeremy P. Pecora and Emily M. Thompson

2002-2008 adjusted to remove effects of changes in California cost trends

Column (C): No Social Inflation assumed

Column (D) = (B) x (C)

Column (E) = [(D) / (D, prior)] - 1

Column (G): Linear interpolation of column (D)

Column (H) = [(G), forecast period] / [(G), current period]

**Derivation of Exposure Trend Factors**  
**Employment Compensation Index**  
**State and Local Government Workers**

(A)	(B)	(C)	(D)	(E)	(F)
Year	ECI Index	Annual Percent Increase	Accident Period	Interpolated Index	Trend Factor to 7/1/19-20
2001	88.9				
2002	91.7	3.2%	7/1/01-02	90.3	1.464
2003	94.2	2.7%	7/1/02-03	92.9	1.422
2004	96.2	2.1%	7/1/03-04	95.2	1.389
2005	98.6	2.6%	7/1/04-05	97.4	1.357
2006	101.9	3.3%	7/1/05-06	100.2	1.318
2007	105.6	3.6%	7/1/06-07	103.7	1.274
2008	109.1	3.4%	7/1/07-08	107.3	1.231
2009	111.8	2.4%	7/1/08-09	110.4	1.197
2010	113.3	1.3%	7/1/09-10	112.5	1.175
2011	114.5	1.1%	7/1/10-11	113.9	1.161
2012	115.7	1.1%	7/1/11-12	115.1	1.148
2013	116.9	1.0%	7/1/12-13	116.3	1.136
2014	118.6	1.4%	7/1/13-14	117.7	1.123
2015	120.8	1.9%	7/1/14-15	119.7	1.104
2016	123.0	1.9%	7/1/15-16	121.9	1.084
2017	125.6	2.1%	7/1/16-17	124.3	1.063
2018	128.3	2.1%	7/1/17-18	127.0	1.041
2019*	130.8	2.0%	7/1/18-19	129.6	1.020
2020*	133.5	2.0%	7/1/19-20	132.1	1.000

\* Estimated at 2.0%

Column (B): U. S. Department of Labor, Bureau of Statistics, bls.gov  
Wages and Salary Cost for State and Local Government Workers

Column (C) =  $[(B) / (B, \text{prior})] - 1$

Column (E): Values interpolated from index in (B)

Column (F) =  $(E, \text{Forecast period}) / (E)$

**Derivation of Discount Factors**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Maturity in Years at 3/31/2019	Cumulative Paid Loss Develop. Factor	% Losses Paid 3/31/2019	Midpoint Upcoming Period	% Losses Paid Upcoming Period	Column(F) Discounted 2.5%	Discount Factor at 2.5%
7/1/92-93	26.75	1.000	100.0%				1.000
7/1/93-94	25.75	1.000	100.0%				1.000
7/1/94-95	24.75	1.000	100.0%				1.000
7/1/95-96	23.75	1.000	100.0%				1.000
7/1/96-97	22.75	1.000	100.0%				1.000
7/1/97-98	21.75	1.000	100.0%				1.000
7/1/98-99	20.75	1.000	100.0%				1.000
7/1/99-00	19.75	1.025	97.5%	20.25	2.5%	0.015	0.988
7/1/00-01	18.75	1.028	97.3%	19.25	0.2%	0.001	0.966
7/1/01-02	17.75	1.031	97.0%	18.25	0.3%	0.002	0.946
7/1/02-03	16.75	1.034	96.7%	17.25	0.3%	0.002	0.929
7/1/03-04	15.75	1.038	96.4%	16.25	0.4%	0.002	0.914
7/1/04-05	14.75	1.042	96.0%	15.25	0.4%	0.003	0.902
7/1/05-06	13.75	1.047	95.5%	14.25	0.5%	0.003	0.892
7/1/06-07	12.75	1.054	94.9%	13.25	0.6%	0.004	0.884
7/1/07-08	11.75	1.062	94.1%	12.25	0.7%	0.005	0.878
7/1/08-09	10.75	1.072	93.2%	11.25	0.9%	0.007	0.874
7/1/09-10	9.75	1.086	92.1%	10.25	1.1%	0.009	0.872
7/1/10-11	8.75	1.103	90.7%	9.25	1.4%	0.011	0.872
7/1/11-12	7.75	1.126	88.8%	8.25	1.9%	0.015	0.874
7/1/12-13	6.75	1.159	86.3%	7.25	2.5%	0.021	0.877
7/1/13-14	5.75	1.207	82.8%	6.25	3.5%	0.030	0.882
7/1/14-15	4.75	1.284	77.9%	5.25	4.9%	0.043	0.889
7/1/15-16	3.75	1.415	70.7%	4.25	7.2%	0.065	0.897
7/1/16-17	2.75	1.674	59.7%	3.25	10.9%	0.101	0.906
7/1/17-18	1.75	2.314	43.2%	2.25	16.5%	0.156	0.914
7/1/18-19	0.75	5.664	17.7%	1.25	25.6%	0.248	0.921

Column (C): Appendix A2

Column (D) = 1 / (C)

Column (E) = [ (B), current line + (B), previous line ] / 2

Column (F) = (D), previous line - (D), current line

Column (G) = (F) x [ 1 + Interest Rate ]<sup>n</sup> - (E)

Column (H) = [ 1 + Interest Rate ]<sup>n</sup> (B) / [ 1 - (D) ] x [ Downward Sum, (G) ]

**Derivation of Discount Factors**

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Accident Period	Maturity in Years at 7/1/2019	Cumulative Paid Loss Develop. Factor	% Losses Paid 7/1/2019	Midpoint Upcoming Period	% Losses Paid Upcoming Period	Column(F) Discounted 2.5%	Discount Factor at 2.5%
	27	1.000	100.0%				
	26	1.000	100.0%				
	25	1.000	100.0%				
	24	1.000	100.0%				
	23	1.000	100.0%				
	22	1.000	100.0%				
	21	1.000	100.0%				
	20	1.025	97.6%	20.5	2.4%	0.015	
	19	1.027	97.4%	19.5	0.2%	0.001	
	18	1.030	97.1%	18.5	0.3%	0.002	
	17	1.033	96.8%	17.5	0.3%	0.002	
	16	1.037	96.5%	16.5	0.3%	0.002	
	15	1.041	96.1%	15.5	0.4%	0.003	
	14	1.046	95.6%	14.5	0.5%	0.003	
	13	1.052	95.0%	13.5	0.6%	0.004	
	12	1.060	94.3%	12.5	0.7%	0.005	
	11	1.070	93.5%	11.5	0.8%	0.006	
	10	1.082	92.4%	10.5	1.1%	0.008	
	9	1.098	91.1%	9.5	1.4%	0.011	
	8	1.120	89.3%	8.5	1.8%	0.014	
	7	1.150	87.0%	7.5	2.3%	0.019	
	6	1.193	83.8%	6.5	3.2%	0.027	
	5	1.261	79.3%	5.5	4.5%	0.039	
	4	1.374	72.8%	4.5	6.5%	0.059	
	3	1.589	62.9%	3.5	9.8%	0.090	
	2	2.083	48.0%	2.5	14.9%	0.140	
	1	3.759	26.6%	1.5	21.4%	0.206	
7/1/19-20	0		0.0%	0.5	26.6%	0.263	<b>0.920</b>

Column (C): Appendix A2

Column (D) = 1 / (C)

Column (E) = [ (B), current line + (B), previous line] / 2

Column (F) = (D), previous line - (D), current line

Column (G) = (F) x [ 1 + Interest Rate ]<sup>n</sup> - (E) ]

Column (H) = [1 + Interest Rate]<sup>n</sup>(B) / [1 - (D)] x [Downward Sum, (G)]

**Estimation of Lognormal Parameters for Aggregate Distribution  
of Losses in Historical Accident Years  
Workers Compensation**

Accident Year	Natural Log of Age-to-Age Factors														
	12:24	24:36	36:48	48:60	60:72	72:84	84:96	96:108	108:120	120:132	132:144	144:156	156:168	168:180	180:Ult
7/1/96-97		0.202	0.114	0.506	0.099	-0.049	0.000	0.052	0.008	0.000	0.000	0.000	-0.003	0.022	
7/1/97-98	0.728	-0.022	0.013	0.027	0.021	0.004	0.093	0.019	-0.025	-0.120	0.000	-0.016	-0.016	0.000	
7/1/98-99	0.155	0.093	0.170	0.012	-0.151	0.022	0.258	-0.037	0.109	0.000	0.039	0.132	-0.045	-0.048	
7/1/99-00	0.035	0.311	-0.108	0.028	0.084	0.010	0.000	0.043	0.014	0.017	0.074	-0.023	-0.024	0.029	
7/1/00-01	0.058	0.070	-0.516	0.050	-0.097	0.000	0.009	0.000	0.000	0.103	-0.050	-0.053	0.000	0.000	
7/1/01-02	-0.063	0.131	-0.018	-0.014	0.013	0.040	0.068	0.006	-0.020	0.033	0.032	0.001	0.001	-0.026	
7/1/02-03	0.182	-0.013	0.104	0.063	0.007	-0.020	-0.001	0.001	0.003	0.003	0.006	0.009	0.119	0.000	
7/1/03-04	0.394	0.142	-0.026	0.066	-0.016	0.080	0.001	0.044	0.042	0.152	0.013	0.048	0.000	0.017	
7/1/04-05	0.404	0.146	0.031	-0.060	-0.087	0.008	0.065	0.061	0.011	0.010	-0.037	0.081	0.004		
7/1/05-06	0.385	0.146	-0.001	-0.012	-0.036	0.000	-0.014	0.000	0.006	0.059	0.001	0.001			
7/1/06-07	0.369	-0.055	0.122	-0.033	0.002	0.018	0.108	0.121	0.044	0.058	0.140				
7/1/07-08	0.025	0.226	0.081	-0.052	-0.038	-0.009	0.004	0.060	-0.002	0.003					
7/1/08-09	0.953	0.080	-0.056	0.010	0.042	0.140	-0.052	0.029	-0.091						
7/1/09-10	0.301	0.384	-0.006	0.013	0.015	0.349	0.000	-0.012							
7/1/10-11	0.310	0.528	0.213	0.035	0.121	0.020	0.046								
7/1/11-12	0.788	0.071	0.063	0.015	0.090	0.075									
7/1/12-13	0.232	0.257	0.141	0.097	0.068										
7/1/13-14	0.522	0.195	0.029	0.049											
7/1/14-15	0.676	0.063	0.036												
7/1/15-16	0.036	0.388													
7/1/16-17	0.097														
Variance	0.0811	0.0223	0.0234	0.0150	0.0055	0.0086	0.0056	0.0016	0.0021	0.0044	0.0027	0.0030	0.0021	0.0007	
Sigma	0.4219	0.3112	0.2731	0.2262	0.1903	0.1751	0.1485	0.1283	0.1220	0.1133	0.0921	0.0757	0.0526	0.0255	

Accident Year	Selected Ultimate	Maturity	Selected Sigma	Selected Mu
7/1/96-97	\$477,879	273	0.0113	13.0770
7/1/97-98	\$184,764	261	0.0133	12.1267
7/1/98-99	\$178,018	249	0.0156	12.0895
7/1/99-00	\$165,594	237	0.0184	12.0171
7/1/00-01	\$43,290	225	0.0216	10.6754
7/1/01-02	\$93,990	213	0.0255	11.4506
7/1/02-03	\$310,984	201	0.0299	12.6470
7/1/03-04	\$388,000	189	0.0352	12.8681
7/1/04-05	\$173,970	177	0.0414	12.0658
7/1/05-06	\$177,537	165	0.0488	12.0857
7/1/06-07	\$455,093	153	0.0574	13.0266
7/1/07-08	\$221,834	141	0.0675	12.3074
7/1/08-09	\$156,000	129	0.0794	11.9545
7/1/09-10	\$593,000	117	0.0934	13.2886
7/1/10-11	\$458,000	105	0.1099	13.0286
7/1/11-12	\$245,000	93	0.1293	12.4007
7/1/12-13	\$187,000	81	0.1521	12.1273
7/1/13-14	\$481,000	69	0.1790	13.0676
7/1/14-15	\$246,000	57	0.1993	12.3932
7/1/15-16	\$443,000	45	0.2380	12.9730
7/1/16-17	\$308,000	33	0.2827	12.5979
7/1/17-18	\$340,000	21	0.3391	12.6792
7/1/18-3/31/19	\$258,000	9	0.4558	12.3568