

RULES – IMPLEMENTATION

AUGUST 7, 2018

COMMERCIAL AUTOMOBILE

LI-CA-2018-181

## TENNESSEE REVISION OF COMMERCIAL AUTO LIABILITY INCREASED LIMIT AND DEDUCTIBLE DISCOUNT FACTORS TO BE IMPLEMENTED

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### KEY MESSAGE

The revised increased limit factors represent a **-3.9%** change from the increased limit factors currently in effect.

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### BACKGROUND

In circular [LI-CA-2017-271](#), we provided you with information about the Commercial Auto liability increased limit experience review.

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### ISO ACTION

We are implementing CA-2018-IALL1, which revises the increased limit and deductible discount factors for all Commercial Automobile Liability tables.

Refer to the attached explanatory material for complete details about the filing.

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### IMPORTANT NOTE ON RISK LOAD REFLECTION

The indicated increased limit factors in this document incorporate a procedure for reflecting the increased risk or variation in experience associated with higher limit policies in the increased limits ratemaking process. For all General Liability and Commercial Automobile Liability tables combined, this procedure generates increased limit factors that are on average 6.0% higher than the factors would be excluding any reflection of risk. The indicated Commercial Automobile increased limit factors in this state group are on average 4.8% higher than such factors would be excluding any reflection of risk.

The inclusion of risk load in increased limit factors may have implications on basic limit loss cost multipliers. Specifically, assuming industrywide averages and the ISO increased limit factors in this document, the inclusion of risk load may result in additional revenue of 4.8% for this Commercial Automobile Liability state group. All sources of revenue, including the revenue resulting from the risk load in these increased limit factors, should be kept in mind when determining loss cost multipliers.

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### EFFECTIVE DATE

The ISO revision is subject to the following rule of application:

These changes are applicable to all policies written on or after February 1, 2019.

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## COMPANY ACTION

If you have authorized us to file on your behalf and decide:

- To use our revision and effective date, you are not required to file anything with the Insurance Department.
- To use our revision with a different effective date, to use our revision with modification, or to not use our revision, you must make an appropriate submission with the Insurance Department.

For guidance on submission requirements, consult the ISO State Filing Handbook.

WE WILL SUBMIT THIS REVISION TO THE INSURANCE DEPARTMENT ON JANUARY 3, 2019. IF STATE FILING REQUIREMENTS DICTATE THAT YOU MAKE A SUBMISSION WITH THE INSURANCE DEPARTMENT, DO NOT SUBMIT IT PRIOR TO THIS DATE.

In all correspondence with the Insurance Department on this revision, you should refer to ISO Filing Designation Number **CA-2018-IALL1**, NOT this circular number. Communications with the regulator concerning a filing affecting multiple lines of business (i.e., CL, PL, AL filing designation) should specify the line(s) of business that you are addressing.

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## RATING SOFTWARE IMPACT

No new attributes are being introduced with this revision.

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## POLICYHOLDER NOTIFICATION

If you decide to implement this revision, you should check all applicable laws for the state(s) to which this revision applies, to determine whether or not a specific policyholder notice requirement may apply. Please note that circular [LI-CL-2017-074](#) contains the ISO Guide To Renewals With Changed Conditions For Commercial Lines, which is available only as a guide to assist participating companies in complying with various conditional renewal statutes or regulations, for the major commercial lines of insurance serviced by ISO. The information in the Guide does not necessarily reflect all requirements or exceptions that may apply, and it is not intended as a substitute for your review of all applicable statutes and regulations concerning policyholder notification.

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## REVISION DISTRIBUTION

We will issue a Notice to Manualholders with an edition date of 2-19 (or the earliest possible subsequent date), along with any new and/or revised manual pages.

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## REFERENCE(S)

- [LI-CL-2017-074](#) (11/20/2017) Revised Lead Time Requirements Listing
- [LI-CA-2017-271](#) (08/31/2017) 2017 Commercial Automobile Liability Increased Limits Experience Level Indications Reviewed By Staff

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## ATTACHMENT(S)

Filing CA-2018-IALL1

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## ACKNOWLEDGMENT OF ACTUARIAL QUALIFICATIONS

The American Academy of Actuaries' "Qualifications Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States" requires that an actuary issuing a Statement of Actuarial Opinion should include an acknowledgment with the opinion that he/she has met the qualification standards of the AAA. ISO considers this rules document a Statement of Actuarial Opinion; therefore we are including the following acknowledgment:

I, David Terné, am a Managing Director of Actuarial Operations for ISO and I, James Davidson, am an Actuarial Director for Commercial Auto and Increased Limits for ISO. We are jointly responsible for the content of this Statement of Actuarial Opinion. We are both members of the American Academy of Actuaries and we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

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## DATA QUALITY

Statistical Plan data reported to ISO is first processed through a system of rigorous automated data verification processes so that only data that would be reliable is used. Subsequent to this initial data submission review, additional analyses involving more customized data reviews for this line were performed by staff. The ISO staff responsible for this increased limits review also reviewed the data for reasonableness, and removed or corrected certain data where appropriate.

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## CONTACT INFORMATION

If you have any questions concerning:

- The actuarial content of this circular, please contact:

Evan Spiegel  
Actuarial Operations  
(201) 469-2540  
[casualtyactuarial@verisk.com](mailto:casualtyactuarial@verisk.com)  
[Evan.Spiegel@verisk.com](mailto:Evan.Spiegel@verisk.com)

- The non-actuarial content of this circular, please contact:  
Vincent Barila  
Production Operations, Compliance and Product Services  
(201) 469-2751  
[casualtyactuarial@verisk.com](mailto:casualtyactuarial@verisk.com)  
[Vincent.Barila@verisk.com](mailto:Vincent.Barila@verisk.com)
- Other issues for this circular, please contact Customer Support:  
E-mail: [info@verisk.com](mailto:info@verisk.com)  
Phone: 800-888-4476

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY  
CA-2018-IALL1  
EXECUTIVE SUMMARY

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PURPOSE

This document:

- revises increased limit factors for all Commercial Automobile Liability tables. These increased limit factors represent a -3.9% change from the increased limit factors currently in effect.
  - provides the analyses used to derive these increased limit factors.
  - revises deductible discount factors for all Commercial Automobile Liability tables.
  - provides the analyses used to derive the deductible discount factors.
  - introduces a change in underlying increased limits state groups.
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DEFINITION OF  
INCREASED  
LIMIT FACTORS

We publish liability loss costs at the basic limit. The basic limit for Commercial Automobile Liability is \$100,000 per occurrence. The loss cost for a given policy limit is the product of the basic limit loss cost and the increased limit factor for that policy limit.

An increased limit factor is the ratio of two sums. The numerator is the cost to the insurer of writing a policy at the desired limit, including the average prospective indemnity, all loss adjustment expense and the risk load. The denominator is the sum of the same quantities at the basic limit. The average prospective indemnity reflects a per occurrence limit.

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DEFINITION OF  
DEDUCTIBLE  
DISCOUNT  
FACTORS

When a deductible applies, the insured receives a discount reflecting the reduced coverage. The amount of the discount is the basic limit/full coverage premium times the deductible discount factor. The deductible discount factor thus represents the ratio of total costs saved by the insurer to basic limit/full coverage premium. For Commercial Automobile, the base deductible is full coverage.

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INCREASED  
LIMITS TABLES

We group classifications with similar increased limits experience into increased limits tables. For Commercial Automobile Liability, the tables are: (1) Light and Medium Trucks, (2) Heavy Trucks and Truck-Tractors, (3) Extra Heavy Trucks and Truck-Tractors, (4) Zone-rated Trucks, Truck-Tractors and Trailers, and (5) All Other Risks.

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# INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

## INCREASED LIMIT FACTOR CHANGES

The statewide increased limit factor changes are:

<u>Table</u>	<u>Indicated Percent Change</u>	<u>Selected Percent Change</u>
Light and Medium	-5.1%	-5.1%
Heavy	-9.7%	-9.7%
Extra Heavy	1.1%	1.1%
Zone-rated	0.0%	0.0%
All Other	-2.3%	-2.3%
<b>TOTAL</b>	<b>-3.9%</b>	<b>-3.9%</b>

## INDICATED VERSUS SELECTED

Indicated changes are based on standard ISO methodology. To maintain consistency between successive policy limits within the Heavy and Extra Heavy tables, we judgmentally adjusted the indicated increased limit factors for the \$400,000 and \$750,000 policy limits for the Heavy table (from 1.38 to 1.37 and from 1.58 to 1.57, respectively) and the indicated increased limit factor for the \$500,000 policy limit for the Extra Heavy table (from 1.58 to 1.57). Otherwise, for each Commercial Automobile Liability table, the selected changes are the indicated changes.

## PRIOR ISO REVISIONS

The most recent Commercial Automobile Liability increased limit factor revisions are:

Filing CA-2017-IALL1

Date  
Implemented 2/1/2018

### Changes

Indicated	3.5%
Selected	3.5%
Implemented	3.5%

The most recent deductible discount factor revision is:

Filing CA-2003-RRU03

Date  
Implemented 2/1/2004

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### RISK LOAD PROCEDURE

The indicated increased limit factors in this document incorporate a procedure for reflecting the increased risk or variation in experience associated with higher limit policies in the increased limits ratemaking process. For all General Liability and Commercial Automobile Liability tables combined, this procedure generates increased limit factors that are on average 6.0% higher than the factors would be excluding any reflection of risk. The indicated Commercial Automobile increased limit factors in this state group are on average 4.8% higher than such factors would be excluding any reflection of risk.

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### HISTORICAL SOURCE DATA

For this document, we use the following data:

- Commercial Automobile Liability increased limits data by state group. We have adjusted the composition of the state groups. This state is part of State Group 2, which includes Arizona, Connecticut, Delaware, Idaho, Indiana, Iowa, Kansas, Nebraska, Tennessee, Washington and Wisconsin. We use multistate experience for certain calculations (including the determination of Zone-rated increased limit factors)
  - Experience for accident dates between July 1, 2008 and June 30, 2016, and average payment dates between July 1, 2011 and June 30, 2016
  - Experience for risks subject to Commercial Automobile Liability increased limits tables as reported to ISO under the Commercial Statistical Plan (CSP) - Full and Intermediate Levels and the Commercial Minimum Statistical Plan (CMSP) - Intermediate Level
  - Umbrella and excess experience for risks reported in the ISO Annual Call for Excess and Umbrella Policy Claims and risks reported to ISO under the CSP - Full and Intermediate Levels and CMSP - Intermediate Level (supplements primary data for pricing higher policy limits)
  - State group basic limit loss weights for the calculation of overall and by-table indicated changes
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### EFFECT ON MANUAL PAGES

Upon implementation of this filing, we will publish revised manual pages containing Commercial Automobile Liability increased limit factors and deductible discount factors. The manual rule exhibits are included in Section A of this document.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

COMPANY  
DECISION

We encourage each insurer to decide independently whether the judgments made and the procedures or data used by ISO in developing increased limit factors are appropriate. We have included within this document the information upon which ISO relied in order to enable companies to make such independent judgments.

The data underlying the enclosed material comes from all companies reporting to ISO. Therefore, the ISO statistical database is much bigger than any individual company's. A broader database enhances the validity of the ratemaking analysis. At the same time, an individual company may benefit from a comparison of its own experience to the aggregate ISO experience and may reach valid conclusions with respect to the manner in which its own costs can be expected to differ from ISO's projections based on the aggregate data.

Some calculations included in this document involve areas of ISO staff judgment. Each company should carefully review and evaluate its own experience in order to determine whether the increased limit factors developed by ISO are appropriate for its use.

This material has been developed exclusively by the staff of ISO.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

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COMMERCIAL AUTOMOBILE LIABILITY

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION A - SCOPE OF REVISION

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

**SUMMARY OF INCREASED LIMIT FACTOR CHANGES**

Changes By Table and in Total

The following shows the average effects of the filed changes for risks in each table:

<u>Table</u>	<u>Indicated Change</u>	<u>Selected Change</u>
Light and Medium	-5.1%	-5.1%
Heavy	-9.7%	-9.7%
Extra Heavy	1.1%	1.1%
Zone-rated	0.0%	0.0%
<u>All Other</u>	<u>-2.3%</u>	<u>-2.3%</u>
<b>TOTAL</b>	<b>-3.9%</b>	<b>-3.9%</b>

Comparison of Current and Revised Increased Limit Factors

The following compares the current and revised increased limit factors for a sample of policy limits:

<u>Table</u>	<u>Policy Limit (\$,000)</u>	(1) <u>Current Factor</u>	(2) <u>Revised Factor</u>	(3) <u>[(2)-(1)]/(1)</u> <u>Percent Change</u>
Light and Medium	300	1.31	1.28	-2.3%
	500	1.48	1.43	-3.4%
	1,000	1.74	1.65	-5.2%
	2,000	1.99	1.88	-5.5%
Heavy	300	1.36	1.29	-5.1%
	500	1.57	1.45	-7.6%
	1,000	1.85	1.67	-9.7%
	2,000	2.14	1.91	-10.7%
Extra Heavy	300	1.36	1.36	0.0%
	500	1.58	1.57	-0.6%
	1,000	1.91	1.93	1.0%
	2,000	2.26	2.31	2.2%
Zone-rated	300	1.37	1.37	0.0%
	500	1.59	1.59	0.0%
	1,000	1.92	1.92	0.0%
	2,000	2.25	2.25	0.0%
All Other	300	1.32	1.30	-1.5%
	500	1.49	1.46	-2.0%
	1,000	1.74	1.70	-2.3%
	2,000	1.99	1.94	-2.5%

Page A-4 displays the revised Commercial Automobile Liability increased limit factors as they will appear in the Commercial Lines Manual. The increased limit factors shown are the ratio of the sum of indemnity, ALAE, ULAE and risk load at each specific limit to the same sum evaluated at the basic limit (\$100,000). Therefore, the factor listed for the basic limit is 1.00.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

**SUMMARY OF DEDUCTIBLE DISCOUNT FACTOR CHANGES**

The following compares the current and revised deductible discount factors for a sample of deductible amounts:

Combined Single Limit Deductible				
		(1)	(2)	(3) [(2)-(1)]/(1)
<u>Table</u>	<u>Deductible Amount</u>	<u>Current Factor</u>	<u>Revised Factor</u>	<u>Percent Change</u>
Non-zone-rated	1,000	0.914	0.941	3.0%
	10,000	0.637	0.708	11.1%
	100,000	0.261	0.371	42.1%
Zone-rated	1,000	0.942	0.963	2.2%
	10,000	0.700	0.777	11.0%
	100,000	0.320	0.429	34.1%

  

Property Damage Deductible Only				
		(1)	(2)	(3) [(2)-(1)]/(1)
<u>Table</u>	<u>Deductible Amount</u>	<u>Current Factor</u>	<u>Revised Factor</u>	<u>Percent Change</u>
Non-zone-rated	1,000	0.922	0.945	2.5%
	10,000	0.727	0.762	4.8%
	100,000	0.671	0.692	3.1%
Zone-rated	1,000	0.947	0.966	2.0%
	10,000	0.767	0.818	6.6%
	100,000	0.693	0.716	3.3%

This section includes a reproduction of the deductible discount factor rule in the Commercial Lines Manual on page A-5. For more information on these factors, please refer to Section H.

# 100. INCREASED LIABILITY LIMITS

Paragraph B. is replaced by the following:

Combined Single Limit Of Liability (000's)	1.  Light And Medium Trucks	2.  Heavy Trucks And Truck- tractors	3.  Extra- heavy Trucks And Truck- tractors	4.  Trucks, Tractors, And Trailers Zone-rated	5.  All Other Risks
25	<del>0.690.68</del>	<del>0.690.68</del>	<del>0.670.66</del>	0.66	0.69
65	0.90	<del>0.900.89</del>	0.89	<del>0.880.89</del>	0.90
100	1.00	1.00	1.00	1.00	1.00
125	<del>1.051.06</del>	<del>1.051.06</del>	1.06	<del>1.071.06</del>	<del>1.051.06</del>
150	<del>1.101.11</del>	<del>1.101.12</del>	1.12	1.12	<del>1.101.11</del>
200	<del>1.171.19</del>	<del>1.181.21</del>	1.21	1.22	<del>1.181.19</del>
250	<del>1.231.26</del>	<del>1.241.29</del>	1.29	1.30	<del>1.241.26</del>
300	<del>1.281.31</del>	<del>1.291.36</del>	1.36	1.37	<del>1.301.32</del>
350	<del>1.321.36</del>	<del>1.331.42</del>	1.42	1.43	<del>1.351.37</del>
400	<del>1.361.41</del>	<del>1.371.47</del>	<del>1.471.48</del>	1.49	<del>1.391.42</del>
500	<del>1.431.48</del>	<del>1.451.57</del>	<del>1.571.58</del>	1.59	<del>1.461.49</del>
600	<del>1.491.55</del>	<del>1.501.64</del>	<del>1.671.66</del>	<del>1.671.68</del>	<del>1.521.56</del>
750	<del>1.561.63</del>	<del>1.571.73</del>	<del>1.781.77</del>	1.78	<del>1.601.64</del>
1,000	<del>1.651.74</del>	<del>1.671.85</del>	<del>1.931.91</del>	1.92	<del>1.701.74</del>
1,500	<del>1.791.89</del>	<del>1.812.02</del>	<del>2.152.11</del>	2.11	<del>1.831.89</del>
2,000	<del>1.881.99</del>	<del>1.912.14</del>	<del>2.312.26</del>	2.25	<del>1.941.99</del>
2,500	<del>1.962.07</del>	<del>1.992.23</del>	<del>2.432.37</del>	2.36	<del>2.022.07</del>
3,000	<del>2.022.15</del>	<del>2.062.31</del>	<del>2.532.47</del>	2.46	<del>2.082.14</del>
5,000	<del>2.222.36</del>	<del>2.272.56</del>	<del>2.862.77</del>	<del>2.752.76</del>	<del>2.292.36</del>
7,500	<del>2.392.55</del>	<del>2.472.79</del>	<del>3.163.04</del>	<del>3.023.04</del>	<del>2.482.55</del>
10,000	<del>2.542.71</del>	<del>2.642.98</del>	<del>3.403.27</del>	<del>3.253.28</del>	<del>2.632.71</del>

Table 100.B. Increased Liability Limits

## 98. DEDUCTIBLE INSURANCE

Paragraphs **A.1.** and **A.2.** are replaced by the following:

### **A. Liability Coverages**

1. Compute the premium by multiplying the full coverage \$100,000 bodily injury and property damage liability premium by the factor selected as follows:

<u>Deductible Amount</u>	<u>Combined Single Limit</u>		<u>Property Damage Per Accident</u>	
	<u>Non-zone Rated</u>	<u>Zone-rated</u>	<u>Non-zone Rated</u>	<u>Zone-rated</u>
\$ 250	0.984	0.990	0.985	0.991
500	0.969	0.981	0.970	0.982
1,000	0.941	0.963	0.945	0.966
2,500	0.874	0.917	0.884	0.925
5,000	0.797	0.857	0.822	0.875
10,000	0.708	0.777	0.762	0.818
20,000	0.613	0.687	0.722	0.770
25,000	0.581	0.656	0.714	0.758
50,000	0.475	0.549	0.698	0.731
75,000	0.414	0.480	0.694	0.721
100,000	0.371	0.429	0.692	0.716

**Table 98.A.1. Liability Deductible Factors**

2. The following example uses hypothetical loss costs and increased limits factors for a zone-rated risk for illustrative purposes only. You should determine from your individual companies what rates/loss costs and increased limits factors are actually in effect.

\$500,000 bodily injury and property damage liability limit with a \$1,000 zone-rated combined single limit deductible.

a. Premium for \$100,000 full coverage – \$2,000.

b. \$1,000 deductible factor – .963.

c. Premium for \$100,000 limit with a \$1,000 deductible – (\$2,000 x .963) = \$1,926.

d. Increased limit factor for \$500,000 limit – 1.53.

e. Increment factor over \$100,000 limit – .53.

f. Dollar increment amount – (\$2,000 x .53) = \$1,060.00.

g. Premium for \$500,000 bodily injury and property damage liability with a \$1,000 deductible – (\$1,926.00 plus \$1,060.00) = \$2,986.00.

h. For deductibles not shown, refer to company.

Paragraph **B.** is replaced by the following:

### **B. Physical Damage Coverages**

For deductibles not shown in the base loss costs, compute the premiums as follows. For stated amount rating, refer to Rule 101.

#### **1. Private Passenger Types, Trucks, Tractors And Trailers And All Autos Except Zone-rated Risks**

##### **a. Computation Procedures**

- (1) Determine the base loss cost.
- (2) Use Rule 101. to determine the factor for the age group of the auto being rated. For exposures rated on a stated amount basis, the ~~Ageage Groupgroup~~ factor is always 1.00.
- (3) Multiply the base loss cost by the ~~Ageage Groupgroup~~ factor.
- (4) Use Rule 101. to determine the factor for the original cost new of the auto being rated.
- (5) Subtract the applicable factor for the deductible desired from the ~~Originaloriginal Costcost Newnew~~ factor.
- (6) Multiply the result of Paragraph (3) by the result of Paragraph (5). Alternatively, the following equation will give the appropriate loss cost for every desired deductible:

Base loss cost x Age Group factor from Rule **101.** x (Original Cost New factor – deductible factor from Rule **98.**).

- (7) The rating procedures in Paragraph **a.** do not apply if the deductible factor is greater than the Original Cost New factor.

**b. Deductible Factors**

**(1) Comprehensive**

**(a) Private Passenger Types**

Deductible	Factor
\$ Full	-0.410
50	-0.340
100	-0.300
250	-0.160
500	0.000
1,000	0.160
2,000	0.370
3,000	0.480
5,000	0.650

**Table 98.B.1.b.(1)(a) Private Passenger Types Comprehensive Deductible Factors**

**(b) Trucks, Tractors And Trailers And All Autos Except Zone-rated Risks**

Deductible	Factor
\$ Full	-0.420
50	-0.340
100	-0.280
250	-0.130
500	0.000
1,000	0.110
2,000	0.260
3,000	0.310
5,000	0.390

**Table 98.B.1.b.(1)(b) Trucks, Tractors And Trailers And All Autos Except Zone-rated Risks Comprehensive Deductible Factors**

**(2) Collision**

**(a) Private Passenger Types**

Deductible	Factor
\$ 50	-0.130
100	-0.110
200	-0.080
250	-0.070
500	0.000
1,000	0.110
2,000	0.260
3,000	0.390
5,000	0.560

**Table 98.B.1.b.(2)(a) Private Passenger Types Collision Deductible Factors**

**(b) Trucks, Tractors And Trailers And All Autos Except Zone-rated Risks**

Deductible	Factor
\$ 50	-0.120



100	-0.110
250	-0.065
500	0.000
1,000	0.120
2,000	0.320
3,000	0.450
5,000	0.570

**Table 98.B.1.b.(2)(b) Trucks, Tractors And Trailers And All Autos Except Zone-rated Risks Collision Deductible Factors**

## 2. Zone-rated Risks

### a. Computation Procedures

- (1) Determine the base loss cost.
- (2) Use Rule **101.** to determine the factor for the age group of the auto being rated. For exposures rated on a stated amount basis, the Ageage Groupgroup factor is always 1.00.
- (3) Multiply the base loss cost by the Ageage Groupgroup factor.
- (4) Use Rule **101.** to determine the factor for the original cost new of the auto being rated.
- (5) Subtract the applicable factor for the deductible desired from the Originaloriginal Costcost Newnew factor.
- (6) Multiply the result of Paragraph (3) by the result of Paragraph (5). Alternatively, the following equation will give the appropriate loss cost for every desired deductible:  

$$\text{Base loss cost} \times \text{Age Group factor from Rule 101.} \times (\text{Original Cost New factor} - \text{deductible factor from Rule 98.})$$
- (7) The rating procedures in Paragraph a. do not apply if the deductible factor is greater than the Original Cost New factor.

### b. Deductible Factors

#### (1) Comprehensive

Deductible	Factor
\$ Full	-0.420
50	-0.340
100	-0.280
250	-0.130
500	0.000
1,000	0.110
2,000	0.260
3,000	0.310
5,000	0.390

**Table 98.B.2.b.(1) Zone-rated Risks Comprehensive Deductible Factors**

#### (2) Collision

Deductible	Factor
\$ 50	-0.120
100	-0.110
250	-0.065
500	0.000
1,000	0.120
2,000	0.320
3,000	0.450
5,000	0.570

**Table 98.B.2.b.(2) Zone-rated Risks Collision Deductible Factors**

### 3. Auto Dealers Blanket Collision

a. For \$500 deductible, multiply the \$250 deductible collision coverage premium by the following factor:

Factor
.65

**Table 98.B.3.a. Auto Dealers Blanket Collision Coverage – \$500 Deductible Factor**

b. For \$1,000 deductible, multiply the \$250 deductible collision coverage premium by the following factor:

Factor
.35

**Table 98.B.3.b. Auto Dealers Blanket Collision Coverage – \$1,000 Deductible Factor**

### 4. Auto Dealers And Garagekeepers Insurance Other Than Collision

Multiply the other than collision coverage premium by the following selected deductible options:

Coverage	Per Auto And Per Occurrence Deductible Options		
	\$100/500	\$250/1,000	\$500/2,500
Fire Only	N/A	N/A	N/A
Fire and Theft Only	1.00	0.90	0.75
Limited Specified Causes of Loss	1.00	0.90	0.75
Specified Causes of Loss	1.00	0.90	0.75
Comprehensive	1.00	0.90	0.75

**Table 98.B.4. Auto Dealers And Garagekeepers Insurance Other Than Collision Deductible Factors**

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION B - CALCULATION OF INCREASED LIMIT FACTORS

Overview of ISO Actuarial Procedures - Increased Limits .....	B2-B7
Calculation of Increased Limit Factors .....	B8-B12

# INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

## OVERVIEW OF ISO ACTUARIAL PROCEDURES - INCREASED LIMITS

### INTRODUCTION

This overview describes the methods we use to calculate increased limit factors. ISO defines an increased limit factor as the ratio of the expected cost (to the insurer) of a higher limit policy divided by the expected cost of a basic limit (\$100,000) policy. The cost components of the increased limit factor calculation are:

- Limited Average Severity (LAS)

The average indemnity per occurrence, limited to a given policy limit, at ultimate settlement value, and reflecting trend to the average accident date in the prospective experience period.

- Allocated Loss Adjustment Expense (ALAE)

The average claim settlement expense per occurrence for those expenses in the settlement process that can be assigned to an individual claim. The largest component of ALAE is legal defense costs.

- Unallocated Loss Adjustment Expense (ULAE)

The average claim settlement expense per occurrence for those expenses in the settlement process that cannot be assigned to an individual claim (e.g., the salaries of claims adjusters).

- Risk Load (RL)

A loading that varies by policy limit and reflects the greater risk of issuing higher limit policies. The ISO risk load model recognizes two kinds of risk:

Process Risk - the inherent variability of the insurance process, reflected in the difference between actual losses and expected losses.

Parameter Risk - the inherent variability of the estimation process, reflected in the difference between theoretical (true but unknown) expected losses and the estimated expected losses.

The ISO increased limit factor is the ratio of these costs at a specified limit divided by the corresponding costs at the basic limit. Given a basic limit  $b$ , the factor at occurrence policy limit  $PL$  is as follows:

$$ILF(PL) = \left[ \frac{LAS(PL) + ALAE(PL) + ULAE(PL) + RL(PL)}{LAS(b) + ALAE(b) + ULAE(b) + RL(b)} \right]$$

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# INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

## OVERVIEW OF ISO ACTUARIAL PROCEDURES - INCREASED LIMITS

INTRODUCTION (continued)	<p>Pages B-8 to B-12 show the indicated and selected increased limit factors for each of the increased limits tables from ISO's 2017 Commercial Automobile Liability increased limits review. Also shown are the underlying components of the calculation by limit. An overview of these four components of the increased limit factor calculation follows.</p> <hr/>
USE OF STATE GROUP DATA	<p>We calculate increased limit factors on a state group basis. In our latest review, we have revised the composition of the state groups. We modified the state groups through analysis of the empirical severity distributions for each increased limits table and jurisdiction within the review experience period, with the jurisdictions organized into distinct clusters based on the magnitude of their empirical increased limit factors. This state is part of State Group 2, which includes Arizona, Connecticut, Delaware, Idaho, Indiana, Iowa, Kansas, Nebraska, Tennessee, Washington and Wisconsin.</p> <p>As in the past, we determine indicated increased limit factors for Zone-rated Risks on a multistate basis, since those risks by their nature can lead to claims in any state. However, we use state group basic limit loss weights in calculating indicated Zone-rated percent changes compared to current factors, as with the other tables.</p> <p>We use multistate data in making our severity trend and unallocated loss adjustment expense factor selections.</p> <hr/>
INDEMNITY	<p>In this document, we use the term "indemnity" to mean the amount paid to the claimant (excluding all loss adjustment expense). Indemnity is subject to the policy limit. We construct an occurrence size distribution that describes the indemnity before the effect of policy limits. By using this distribution, we can calculate expected future indemnity for any given policy limit.</p> <hr/>
DATA FOR INDEMNITY ANALYSIS	<p>The limited average severity in this increased limits review is modeled using loss data reported to ISO under the Commercial Statistical Plan (CSP) - Full and Intermediate Levels and the Commercial Minimum Statistical Plan (CMSP) - Intermediate Level. The data includes paid (settled) occurrences on occurrence coverage policies with accident dates between July 1, 2008 and June 30, 2016, and "average payment dates" between July 1, 2011 and June 30, 2016. The data is evaluated as of September 30, 2016. We explain the concept of average payment date in the next subsection.</p> <p>For each occurrence, we determine the increased limits table, accident year, payment lag, indemnity amount, policy limit and any applicable attachment point.</p> <hr/>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - INCREASED LIMITS

PAYMENT LAG	<p>We consider an occurrence to be settled if it has no outstanding reserve. If there are multiple payments, we consider the payment date to be the dollar-weighted average of the dates of the individual payments.</p> <p>We use “payment lag” or “lag” to measure the amount of time between the accident and the payments made towards the loss settlement. A lag of 1 indicates that the average payment date is in the same accident year as the accident. A lag of 2 indicates that the average payment date falls in the following year, and so on.</p> <hr/>
COMPOSITE- RATED RISKS	<p>Insurers report composite-rated risk (CRR) data to ISO without detailed class information. This means we cannot use class to assign CRR data to a specific table. For each CRR occurrence we can make a Bayesian estimate of the probability it belongs in each table based on its known characteristics.</p> <p>We include CRR data in the analysis by assigning part of each such occurrence to the various tables using this Bayesian analysis. Thus, we might consider a single \$100,000 occurrence from a composite-rated risk to be really 1/3 of a “Light and Medium” occurrence, 1/2 of a “Heavy” occurrence, and 1/6 of an “All Other” occurrence. In each case, the amount of the (fractional) occurrence would remain \$100,000.</p> <hr/>
EXCESS AND UMBRELLA DATA	<p>We include additional data from the ISO Annual Call for Excess and Umbrella Policy Claims. This data enhances the credibility of our increased limit factors, but does not affect the lowest layers of the loss distribution.</p> <p>These excess and umbrella policies have attachment points that exclude smaller losses much the same way as a large deductible would. While we can reconstruct the full size of loss for those occurrences greater than the attachment point of their policy, occurrences below the attachment point are not reported under the call.</p> <p>We also include excess and umbrella data reported under the CSP - Full and Intermediate Levels and the CMSP - Intermediate Level in this review from the last several accident years for which we have data reported in sufficient detail.</p> <hr/>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - INCREASED LIMITS

INDEMNITY  
DEVELOPMENT

We fit paid settled loss data to derive our occurrence size distributions. By using losses settled at ultimate, it is not necessary to develop losses.

We combine data from different payment lags using a lag-weighting procedure. This procedure implicitly accounts for development as all possible payment lags are represented and given appropriate weight at the prospective average accident date.

For each occurrence in an accident year, there is a probability that the occurrence falls in a given payment lag. We assume that this probability (which may vary by table) is the same for all accident years. We refer to this probability as the “lag weight”.

Given the total number of occurrences for an accident year, the number falling into each payment lag follows a multinomial distribution. We use maximum likelihood estimation to calculate the lag weights from the observed average payment lags in the data. To enhance stability in the more mature lags, we apply certain constraints to the relationship between consecutive lag weights.

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INDEMNITY  
SEVERITY  
TREND

To bring different accident years to the same level, we project each occurrence from the average date of its accident year to April 1, 2019, one year beyond an assumed effective date of April 1, 2018 (date assumed for trending purposes). In this filing, we select an annual trend of +5.0% for each table based on our review of trend indications described in Section C.

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MIXED  
EXPONENTIAL  
MODEL

For each table, we fit a continuous distribution to the lag-weighted occurrence size distribution from the data. The resulting distribution produces the limited average severity component of the increased limit factor.

The fitting procedure uses a mixture of exponential distributions to model indemnity. ISO found that the mixed exponential distribution is flexible and simple to use and provides a good fit to empirical data over a wide range of loss sizes.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - INCREASED LIMITS

OVERVIEW OF  
MIXED  
EXPONENTIAL  
PROCESS

Section C describes the calculation of the limited average severities of indemnity in detail. The major steps in the calculation are:

1. Trend

Trending the indemnity amount of each occurrence to reflect the expected conditions during the period when the increased limit factors are assumed to be in effect.

2. Construction of the Empirical Survival Distributions

Using the trended data to calculate the empirical survival distributions by payment lag.

3. Payment Lag Process

Combining the empirical distributions for each payment lag to produce an overall empirical survival distribution for each table.

4. Tail of the Distribution

Smoothing the tail of the lag-weighted empirical survival distribution for each table.

5. Fitting a Mixed Exponential Distribution

Fitting a mixed exponential curve to the overall empirical survival distribution for each table.

6. Final Limited Average Severities

Using the fitted mixed exponential distribution to generate limited average severities.

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ALLOCATED  
LOSS  
ADJUSTMENT  
EXPENSE

We estimate allocated loss adjustment expense (ALAE) per occurrence as the product of two numbers. The first number is the ratio of ALAE to total limits (all limits combined) indemnity. The second number is the average (across all policy limits) limited average severity calculated from the indemnity severity model. We assume that ALAE per occurrence does not vary by policy limit. Section D contains a description of the estimation process.

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UNALLOCATED  
LOSS  
ADJUSTMENT  
EXPENSE

For each table, we calculate the unallocated loss adjustment expense (ULAE) for each limit as a percentage (9.25%) of the sum of the average severity and the ALAE at that limit. The selected percentage is based on multistate financial data reported to ISO. See Section E for the derivation of the selected ULAE percentage.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - INCREASED LIMITS

RISK LOAD

In order to properly reflect the greater risk associated with higher limit policies, we use a risk load procedure. The fundamental purpose of the risk load procedure is to make each policy limit being written equally attractive to insurers. The procedure accomplishes this by offsetting the greater risk associated with higher limit policies with an appropriate risk load provision that increases as the policy limit increases.

We calculate a risk load amount for each policy limit using the mathematical model described in Section F. This risk load amount reflects both process risk and parameter risk. Parameter risk reflects the uncertainty or variation of estimated expected results around the true expected results. Process risk reflects the uncertainty or variation of the actual results around the expected results.

For all General Liability and Commercial Automobile Liability lines combined, the risk load procedure produces increased limit factors that are on average 6.0% higher than such factors would be if calculated excluding risk load.

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SUMMARY

In summary, we calculate limited average severities from a continuous model of occurrence size. In this model, we fit mixed exponential distributions to trended lag-weighted occurrence size distributions by table.

We calculate allocated loss adjustment expense per occurrence that does not vary by policy limit. We calculate unallocated loss adjustment expense by limit as a percentage of the sum of the limited average severity and allocated loss adjustment expense. We calculate risk load amounts reflecting process and parameter risk.

Finally, we calculate the sum of the average severity, allocated loss adjustment expense, unallocated loss adjustment expense and risk load. The ratio of this sum at the limit desired to this sum at the basic limit is the per occurrence increased limit factor.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
**CALCULATION OF INCREASED LIMIT FACTORS**  
Based on Model Parameters

LIGHT AND MEDIUM TRUCKS

(1)	(2) <sup>a</sup>	(3)	(4)	(5)	(6)	(7) <sup>b</sup>	(8)
Policy	Limited					Indicated	Selected
Limit	Average	ALAE per	ULAE per	Process	Parameter	Limit	Limit
<u>(\$,000)</u>	<u>Severity</u>	<u>Occurrence</u>	<u>Occurrence</u>	<u>Risk Load</u>	<u>Risk Load</u>	<u>Factor</u>	<u>Factor</u>
100	9,754	989	994	80	79	1.00	<b>1.00</b>
250	12,089	989	1,210	215	98	1.23	<b>1.23</b>
300	12,588	989	1,256	263	102	1.28	<b>1.28</b>
400	13,396	989	1,331	362	109	1.36	<b>1.36</b>
500	14,036	989	1,390	462	114	1.43	<b>1.43</b>
750	15,204	989	1,498	715	124	1.56	<b>1.56</b>
1,000	16,008	989	1,572	959	131	1.65	<b>1.65</b>
1,500	17,054	989	1,669	1,410	140	1.79	<b>1.79</b>
2,000	17,723	989	1,731	1,816	146	1.88	<b>1.88</b>
2,500	18,203	989	1,775	2,193	151	1.96	<b>1.96</b>
3,000	18,573	989	1,809	2,548	154	2.02	<b>2.02</b>
5,000	19,508	989	1,896	3,824	162	2.22	<b>2.22</b>
7,500	20,155	989	1,956	5,215	168	2.39	<b>2.39</b>
10,000	20,568	989	1,994	6,473	172	2.54	<b>2.54</b>

<sup>a</sup> Reflects trend to an average loss date of April 1, 2019 and development to ultimate maturity. Calculated from a continuous indemnity model described in Section C.

<sup>b</sup> Derived by taking the ratio of columns [(2) + (3) + (4) + (5) + (6)] at the policy limit to columns [(2) + (3) + (4) + (5) + (6)] at the basic limit (\$100,000).

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
**CALCULATION OF INCREASED LIMIT FACTORS**  
Based on Model Parameters

HEAVY TRUCKS AND TRUCK-TRACTORS

(1)	(2) <sup>a</sup>	(3)	(4)	(5)	(6)	(7) <sup>b</sup>	(8) <sup>c</sup>
Policy	Limited					Indicated	Selected
Limit	Average	ALAE per	ULAE per	Process	Parameter	Limit	Limit
<u>(\$,000)</u>	<u>Severity</u>	<u>Occurrence</u>	<u>Occurrence</u>	<u>Risk Load</u>	<u>Risk Load</u>	<u>Factor</u>	<u>Factor</u>
100	9,968	1,223	1,035	83	75	1.00	<b>1.00</b>
250	12,509	1,223	1,270	230	94	1.24	<b>1.24</b>
300	13,046	1,223	1,320	281	98	1.29	<b>1.29</b>
400	13,918	1,223	1,401	388	104	1.38	<b>1.37</b>
500	14,610	1,223	1,465	496	110	1.45	<b>1.45</b>
750	15,857	1,223	1,580	765	119	1.58	<b>1.57</b>
1,000	16,696	1,223	1,658	1,020	126	1.67	<b>1.67</b>
1,500	17,789	1,223	1,759	1,491	134	1.81	<b>1.81</b>
2,000	18,507	1,223	1,825	1,928	139	1.91	<b>1.91</b>
2,500	19,036	1,223	1,874	2,343	143	1.99	<b>1.99</b>
3,000	19,450	1,223	1,912	2,741	146	2.06	<b>2.06</b>
5,000	20,524	1,223	2,012	4,208	155	2.27	<b>2.27</b>
7,500	21,297	1,223	2,083	5,874	161	2.47	<b>2.47</b>
10,000	21,806	1,223	2,130	7,423	164	2.64	<b>2.64</b>

<sup>a</sup> Reflects trend to an average loss date of April 1, 2019 and development to ultimate maturity. Calculated from a continuous indemnity model described in Section C.

<sup>b</sup> Derived by taking the ratio of columns [(2) + (3) + (4) + (5) + (6)] at the policy limit to columns [(2) + (3) + (4) + (5) + (6)] at the basic limit (\$100,000).

<sup>c</sup> Selected ILFs may include judgmental adjustments to maintain consistency between successive policy limits.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
**CALCULATION OF INCREASED LIMIT FACTORS**  
Based on Model Parameters

EXTRA HEAVY TRUCKS AND TRUCK-TRACTORS

(1)	(2) <sup>a</sup>	(3)	(4)	(5)	(6)	(7) <sup>b</sup>	(8) <sup>c</sup>
Policy	Limited					Indicated	Selected
Limit	Average	ALAE per	ULAE per	Process	Parameter	Limit	Limit
<u>(\$,000)</u>	<u>Severity</u>	<u>Occurrence</u>	<u>Occurrence</u>	<u>Risk Load</u>	<u>Risk Load</u>	<u>Factor</u>	<u>Factor</u>
100	12,857	2,101	1,384	118	146	1.00	<b>1.00</b>
250	16,948	2,101	1,762	358	192	1.29	<b>1.29</b>
300	17,902	2,101	1,850	450	203	1.36	<b>1.36</b>
400	19,523	2,101	2,000	647	221	1.47	<b>1.47</b>
500	20,869	2,101	2,125	859	237	1.58	<b>1.57</b>
750	23,428	2,101	2,361	1,412	266	1.78	<b>1.78</b>
1,000	25,224	2,101	2,528	1,959	286	1.93	<b>1.93</b>
1,500	27,573	2,101	2,745	2,970	313	2.15	<b>2.15</b>
2,000	29,078	2,101	2,884	3,885	331	2.31	<b>2.31</b>
2,500	30,167	2,101	2,985	4,740	343	2.43	<b>2.43</b>
3,000	31,014	2,101	3,063	5,554	353	2.53	<b>2.53</b>
5,000	33,192	2,101	3,265	8,525	378	2.86	<b>2.86</b>
7,500	34,718	2,101	3,406	11,812	396	3.16	<b>3.16</b>
10,000	35,709	2,101	3,497	14,825	407	3.40	<b>3.40</b>

<sup>a</sup> Reflects trend to an average loss date of April 1, 2019 and development to ultimate maturity. Calculated from a continuous indemnity model described in Section C.

<sup>b</sup> Derived by taking the ratio of columns [(2) + (3) + (4) + (5) + (6)] at the policy limit to columns [(2) + (3) + (4) + (5) + (6)] at the basic limit (\$100,000).

<sup>c</sup> Selected ILFs may include judgmental adjustments to maintain consistency between successive policy limits.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

MULTISTATE  
**CALCULATION OF INCREASED LIMIT FACTORS**  
Based on Model Parameters

ZONE-RATED RISKS

(1)	(2) <sup>a</sup>	(3)	(4)	(5)	(6)	(7) <sup>b</sup>	(8)
Policy	Limited					Indicated	Selected
Limit	Average	ALAE per	ULAE per	Process	Parameter	Limit	Limit
<u>(\$,000)</u>	<u>Severity</u>	<u>Occurrence</u>	<u>Occurrence</u>	<u>Risk Load</u>	<u>Risk Load</u>	<u>Factor</u>	<u>Factor</u>
100	15,088	3,292	1,700	148	207	1.00	<b>1.00</b>
250	20,307	3,292	2,183	453	280	1.30	<b>1.30</b>
300	21,500	3,292	2,293	568	296	1.37	<b>1.37</b>
400	23,498	3,292	2,478	811	324	1.49	<b>1.49</b>
500	25,120	3,292	2,628	1,066	346	1.59	<b>1.59</b>
750	28,090	3,292	2,903	1,707	388	1.78	<b>1.78</b>
1,000	30,095	3,292	3,088	2,317	416	1.92	<b>1.92</b>
1,500	32,672	3,292	3,327	3,426	453	2.11	<b>2.11</b>
2,000	34,332	3,292	3,480	4,436	477	2.25	<b>2.25</b>
2,500	35,542	3,292	3,592	5,386	494	2.36	<b>2.36</b>
3,000	36,483	3,292	3,679	6,290	507	2.46	<b>2.46</b>
5,000	38,892	3,292	3,902	9,577	541	2.75	<b>2.75</b>
7,500	40,589	3,292	4,059	13,232	565	3.02	<b>3.02</b>
10,000	41,693	3,292	4,161	16,587	581	3.25	<b>3.25</b>

<sup>a</sup> Reflects trend to an average loss date of April 1, 2019 and development to ultimate maturity. Calculated from a continuous indemnity model described in Section C.

<sup>b</sup> Derived by taking the ratio of columns [(2) + (3) + (4) + (5) + (6)] at the policy limit to columns [(2) + (3) + (4) + (5) + (6)] at the basic limit (\$100,000).

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
**CALCULATION OF INCREASED LIMIT FACTORS**  
Based on Model Parameters

ALL OTHER RISKS

(1)	(2) <sup>a</sup>	(3)	(4)	(5)	(6)	(7) <sup>b</sup>	(8)
Policy	Limited					Indicated	Selected
Limit	Average	ALAE per	ULAE per	Process	Parameter	Limit	Limit
<u>(\$,000)</u>	<u>Severity</u>	<u>Occurrence</u>	<u>Occurrence</u>	<u>Risk Load</u>	<u>Risk Load</u>	<u>Factor</u>	<u>Factor</u>
100	9,179	1,209	961	76	68	1.00	<b>1.00</b>
250	11,583	1,209	1,183	216	85	1.24	<b>1.24</b>
300	12,110	1,209	1,232	267	89	1.30	<b>1.30</b>
400	12,964	1,209	1,311	371	96	1.39	<b>1.39</b>
500	13,633	1,209	1,373	476	101	1.46	<b>1.46</b>
750	14,824	1,209	1,483	733	110	1.60	<b>1.60</b>
1,000	15,626	1,209	1,557	977	116	1.70	<b>1.70</b>
1,500	16,673	1,209	1,654	1,428	124	1.83	<b>1.83</b>
2,000	17,348	1,209	1,717	1,838	130	1.94	<b>1.94</b>
2,500	17,836	1,209	1,762	2,221	133	2.02	<b>2.02</b>
3,000	18,213	1,209	1,797	2,583	136	2.08	<b>2.08</b>
5,000	19,174	1,209	1,885	3,893	144	2.29	<b>2.29</b>
7,500	19,845	1,209	1,947	5,338	149	2.48	<b>2.48</b>
10,000	20,277	1,209	1,987	6,653	152	2.63	<b>2.63</b>

<sup>a</sup> Reflects trend to an average loss date of April 1, 2019 and development to ultimate maturity. Calculated from a continuous indemnity model described in Section C.

<sup>b</sup> Derived by taking the ratio of columns [(2) + (3) + (4) + (5) + (6)] at the policy limit to columns [(2) + (3) + (4) + (5) + (6)] at the basic limit (\$100,000).

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

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## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### OVERVIEW

In this document, we use the term “indemnity” to mean the amount paid to the claimant (excluding all loss adjustment expense). Indemnity is subject to policy limits. We construct an occurrence size distribution that describes the indemnity before the effect of policy limits. By using this distribution, we can calculate expected future indemnity under any given policy limit.

---

### USE OF STATE GROUP DATA

We calculate increased limit factors on a state group basis. In our latest review, we have revised the composition of the state groups. We modified the state groups through analysis of the empirical severity distributions for each increased limits table and jurisdiction within the review experience period, with the jurisdictions organized into distinct clusters based on the magnitude of their empirical increased limit factors. This state is part of State Group 2, which includes Arizona, Connecticut, Delaware, Idaho, Indiana, Iowa, Kansas, Nebraska, Tennessee, Washington and Wisconsin.

As in the past, we determine indicated increased limit factors for Zone-rated Risks on a multistate basis, since those risks by their nature can lead to claims in any state. However, we use state group basic limit loss weights in calculating indicated Zone-rated percent changes compared to current factors, as with the other tables.

We use multistate data in making our severity trend and unallocated loss adjustment expense factor selections.

---

### DATA FOR ESTIMATING INDEMNITY

The limited average severity in this increased limits review is modeled using loss data reported to ISO under the Commercial Statistical Plan (CSP) - Full and Intermediate Levels and the Commercial Minimum Statistical Plan (CMSP) - Intermediate Level. The data includes paid (settled) occurrences on occurrence coverage policies with accident dates between July 1, 2008 and June 30, 2016, and “average payment dates” between July 1, 2011 and June 30, 2016. The data is evaluated as of September 30, 2016.

We also include excess and umbrella data reported from the ISO Annual Call for Excess and Umbrella Policy Claims, the CSP - Full and Intermediate Levels and CMSP - Intermediate Level.

We consider an occurrence to be settled if it has no outstanding reserve. If there are multiple payments, we consider the payment date to be the dollar-weighted average of the dates of the individual payments.

For each occurrence, we determine the increased limits table, accident year, payment lag (described later), indemnity amount, policy limit and any applicable attachment point.

---

### MIXED EXPONENTIAL MODEL

For each table, we fit a continuous distribution to the lag-weighted occurrence size distribution from the data. The resulting distribution produces the limited average severity component of the increased limit factor.

Using a continuous distribution (such as the mixed exponential) offers several advantages over using a purely empirical fit, including:

---



## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### MIXED EXPONENTIAL MODEL (CONT'D)

- calculation of LAS for all possible limits,
- smoothing of data,
- simplified handling of trend, and
- calculation of higher moments used in risk load.

The fitting procedure uses a mixture of exponential distributions to model indemnity. ISO found that the mixed exponential distribution is flexible and simple to use and provides a good fit to empirical data over a wide range of loss sizes.

---

### OVERVIEW OF MIXED EXPONENTIAL PROCESS

The major steps in the calculation of the limited average severities of the indemnity are:

#### 1. Trend

Trending the indemnity amount of each occurrence to reflect the expected conditions during the period when the increased limit factors are assumed to be in effect.

#### 2. Construction of the Empirical Survival Distributions

Using the trended data to calculate the empirical survival distributions by payment lag.

#### 3. Payment Lag Process

Combining the empirical distributions for each payment lag to produce an overall empirical survival distribution for each increased limits table.

#### 4. Tail of the Distribution

Smoothing the tail of the lag-weighted empirical survival distributions for each table.

#### 5. Fitting a Mixed Exponential Distribution

Fitting a mixed exponential curve to the overall empirical survival distribution for each table.

#### 6. Final Limited Average Severities

Using the fitted mixed exponential distribution to generate limited average severities.

---

### INDEMNITY SEVERITY TREND

For a given payment lag, we expect severity to increase by the inflation rate from accident year to accident year.

If annual inflation is 4.0%, an injury that cost \$100,000 in 2017 would cost 1.04 x \$100,000 in 2018. The probability of that particular injury stays the same — only the nominal value of it changes.

To bring different accident years to the same level, we project each occurrence from the average date of its accident year to April 1, 2019, one year beyond an assumed effective date of April 1, 2018 (date assumed for trending purposes).

In this filing, we select an annual trend of +5.0% for each table. Our selection is based on a review of Commercial Automobile Liability paid trend indications shown on page C-14.

---

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### CONSTRUCTION OF THE EMPIRICAL SURVIVAL DISTRIBUTIONS

The construction of the empirical survival distributions is based on the Product-Limit Estimator described in Loss Models: From Data to Decisions<sup>1</sup>. First, paid (settled) occurrences are organized by accident year and payment lag and trended to the average accident date for which the loss distribution is desired.

Payment lags five and beyond generally have similar loss sizes and are combined to increase credibility. Other lags are handled individually. We define payment lag and explain the reasons for its use later in this section.

Next, a survival distribution is constructed for each payment lag using discrete loss size layers. The probability that an occurrence exceeds the upper bound of a discrete layer given that it exceeds the lower bound of the layer is known as the conditional survival probability (CSP). The ground-up survival distribution is generated by multiplying the successive CSPs of the discrete layers.

This procedure allows for the easy inclusion of censored losses as well as excess and umbrella data. Two conditions must be met in order for a particular occurrence to be used in the calculation of the conditional survival probability in a particular layer of loss. These conditions are:

- The policy limit (plus attachment point) must be greater than or equal to the upper bound of the layer of loss. This avoids a downward severity bias by excluding losses that are precluded by their policy limit from penetrating the upper bound of a layer of loss.
- Only those occurrences with attachment points less than or equal to the lower bound of the layer of loss are included. This condition is necessary to avoid an upward severity bias since loss information below the attachment point is unknown.

---

### ILLUSTRATION

An illustration should aid in the conceptual understanding of this construction.

Assume we have twelve occurrences, all for a single payment lag. We will calculate the empirical survival probabilities for three layers using combinations of conditional survival probabilities. The three layers used are \$10,000, \$20,000, and \$40,000 (in practice we begin with layers as small as \$10 - but larger layers better illustrate the handling of excess data and policy limits). The following two pages display sample calculations for these three layers. This example illustrates the treatment of excess data with attachment points.

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<sup>1</sup> Klugman, S. A., H.H. Panjer, and G. E. Willmot, *Loss Models: From Data to Decisions*, John Wiley and Sons, New York, 2004

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

Illustrative Data (Trended) for one Payment Lag

<u>Occurrence ID Number</u>	<u>Occurrence Size</u>	<u>Attachment Point</u>	<u>Policy Limit</u>	<u>Comment</u>
1	5,000	0	15,000	
2	5,000	0	15,000	
3	15,000	0	15,000	Censored Data
4	5,000	7,500	15,000	Excess Data
5	5,000	0	30,000	
6	15,000	0	30,000	
7	25,000	0	30,000	
8	10,000	15,000	30,000	Excess Data
9	15,000	0	100,000	
10	25,000	0	100,000	
11	30,000	0	100,000	
12	50,000	15,000	100,000	Excess Data

Where attachment point is non-zero, we define policy limit as the maximum payment.

Conditional Survival Probabilities

Condition:

$$\begin{array}{ll} \text{CSP}_{e_1}(10,000 | 0) = & \text{PL} + \text{AP} \geq 10,000 \\ \text{P}(X \geq 10,000 | X > 0) & \text{AP} = 0 \end{array}$$

$$\begin{array}{ll} \text{CSP}_{e_1}(20,000 | 10,000) = & \text{PL} + \text{AP} \geq 20,000 \\ \text{P}(X \geq 20,000 | X > 10,000) & \text{AP} \leq 10,000 \end{array}$$

$$\begin{array}{ll} \text{CSP}_{e_1}(40,000 | 20,000) = & \text{PL} + \text{AP} \geq 40,000 \\ \text{P}(X \geq 40,000 | X > 20,000) & \text{AP} \leq 20,000 \end{array}$$

where AP = attachment point, PL = policy limit, X= loss size,  $e_1$  = empirical lag 1

Calculation of Conditional Survival Probability at \$10,000

$$\begin{aligned} \text{CSP}_{e_1}(10,000 | 0) = \text{P}(X \geq 10,000 | X > 0) = & \text{number of occurrences with:} \\ & \text{occurrence size} + \text{AP} \geq 10,000, \\ & \text{policy limit} + \text{AP} \geq 10,000, \text{ and } \text{AP} = 0 \\ & \text{number of occurrences with:} \\ & \text{occurrence size} + \text{AP} \geq 0, \\ & \text{policy limit} + \text{AP} \geq 10,000, \text{ and } \text{AP} = 0 \\ = & \frac{6 \text{ (occurrences 3, 6, 7, 9, 10, 11)}}{9 \text{ (occurrences 1, 2, 3, 5, 6, 7, 9, 10, 11)}} \end{aligned}$$

Only occurrences with policy limit plus attachment point greater than or equal to 10,000 are used. Only occurrences with attachment point equal to zero are used.

# INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

## Calculation of Conditional Survival Probability at \$20,000

$$\begin{aligned} \text{CSP}_{\text{el}}(20,000 | 10,000) &= P(X \geq 20,000 | X > 10,000) = \text{number of occurrences with:} \\ &\quad \text{occurrence size} + \text{AP} \geq 20,000, \\ &\quad \text{policy limit} + \text{AP} \geq 20,000, \text{ and } \text{AP} \leq 10,000 \\ &\quad \text{number of occurrences with:} \\ &\quad \text{occurrence size} + \text{AP} \geq 10,000, \\ &\quad \text{policy limit} + \text{AP} \geq 20,000, \text{ and } \text{AP} \leq 10,000 \\ &= \frac{3 \text{ (occurrences 7, 10, 11)}}{6 \text{ (occurrences 4, 6, 7, 9, 10, 11)}} \end{aligned}$$

Only occurrences with policy limit plus attachment point greater than or equal to 20,000 are used. Only occurrences with attachment point less than or equal to 10,000 are used.

## Calculation of Conditional Survival Probability at \$40,000

$$\begin{aligned} \text{CSP}_{\text{el}}(40,000 | 20,000) &= P(X \geq 40,000 | X > 20,000) = \text{number of occurrences with:} \\ &\quad \text{occurrence size} + \text{AP} \geq 40,000, \\ &\quad \text{policy limit} + \text{AP} \geq 40,000, \text{ and } \text{AP} \leq 20,000 \\ &\quad \text{number of occurrences with:} \\ &\quad \text{occurrence size} + \text{AP} \geq 20,000, \\ &\quad \text{policy limit} + \text{AP} \geq 40,000, \text{ and } \text{AP} \leq 20,000 \\ &= \frac{1 \text{ (occurrence 12)}}{4 \text{ (occurrences 8, 10, 11, 12)}} \end{aligned}$$

Only occurrences with policy limit plus attachment point greater than or equal to 40,000 are used. Only occurrences with attachment point less than or equal to 20,000 are used.

## Calculation of Empirical Survival Distribution

The CSPs generate the following empirical survival probabilities:

$$\begin{aligned} S_{\text{el}}(10,000) &= P(X \geq 10,000) = \text{CSP}_{\text{el}}(10,000 | 0) = P(X \geq 10,000 | X > 0) \\ &= 6/9 \end{aligned}$$

$$\begin{aligned} S_{\text{el}}(20,000) &= P(X \geq 20,000) = \text{CSP}_{\text{el}}(10,000 | 0) * \text{CSP}_{\text{el}}(20,000 | 10,000) \\ &= P(X \geq 10,000 | X > 0) * P(X \geq 20,000 | X > 10,000) \\ &= 6/9 * 3/6 = 1/3 \end{aligned}$$

$$\begin{aligned} S_{\text{el}}(40,000) &= P(X \geq 40,000) = \text{CSP}_{\text{el}}(10,000 | 0) * \text{CSP}_{\text{el}}(20,000 | 10,000) * \text{CSP}_{\text{el}}(40,000 | 20,000) \\ &= P(X \geq 10,000 | X > 0) * P(X \geq 20,000 | X > 10,000) * P(X \geq 40,000 | X > 20,000) \\ &= 6/9 * 3/6 * 1/4 = 1/12 \end{aligned}$$

In practice, to generate the trended empirical loss distribution for each lag, we use sixty-eight discrete loss size layers to allow for a more refined selection of the tail-smoothing parameters (discussed later in this section).

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### USE OF PAYMENT LAG

Development for paid (settled) data has two aspects. One aspect is that many occurrences are paid within a short period of time after the accident occurs with a small number taking longer – sometimes much longer – to be paid. The second aspect is the tendency of larger occurrences to take longer to be paid.

To properly model an accident year at ultimate, we must include each payment lag with its appropriate weight. We do this by:

- accounting for the rate of payment using the probability-of-payment-lag model, and
- constructing severity distributions by payment lag.

Payment lags five and beyond generally have similar loss sizes and are combined to increase credibility.

---

### PAYMENT LAG PROCESS

A lag-weighting procedure combines the by-lag empirical loss distributions to generate an overall distribution. This procedure implicitly accounts for development, as all possible payment lags are represented and given weight at the prospective average accident date. We refer to the distribution of the overall survival probabilities by size of loss as the “empirical survival distribution function (SDF)”.

---

### PAYMENT LAG

Payment lag is the length of time between the date that an accident occurs and the date that the associated indemnity is paid. In the mixed exponential model, the average payment date is the dollar-weighted average of indemnity payments. ISO approximates payment lag based on the year in which an accident occurs and the year in which the occurrence is paid:

$$\text{Payment Lag} = (\text{Payment Year} - \text{Accident Year}) + 1$$

Payment lag can vary considerably by line of business and by type of claim. While most property claims are paid quickly, liability claims generally take longer to settle, particularly those involving protracted litigation. Among liability claims, there is considerable variation in payment lag.

---

### DIFFERENCES IN LOSS SIZE BY PAYMENT LAG

Loss experience generally shows that the average loss size tends to increase with development age. For example, the average loss size for occurrences paid in lag 4 will tend to be considerably higher than the average loss size for those paid in lag 1.

The mixed exponential methodology reflects this by fitting (the continuous mixed exponential distribution) to a lag-weighted empirical survival distribution. We do not directly fit to the severity distributions of individual lags.

---

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

PAYMENT LAG  
DISTRIBUTION

The payment lag distribution is modeled to avoid distortions that may otherwise result from:

- differing exposure amounts by accident year,
- an asymmetrical experience period with fewer than five accident years for lags five through eight, and
- a finite number of lags (no data for lags beyond eight).

The lag-weighting procedure implicitly accounts for ultimate development, as all possible payment lags are represented and given weight at the prospective average accident date.

The payment lag model uses three parameters (R1, R2, R3) to generate the weights given to the severity distribution associated with each payment lag. The parameters are represented as follows:

$$R1 = \frac{\text{expected percentage of occurrences paid in lag 2}}{\text{expected percentage of occurrences paid in lag 1}}$$

$$R2 = \frac{\text{expected percentage of occurrences paid in lag 3}}{\text{expected percentage of occurrences paid in lag 2}}$$

$$R3 = \frac{\text{expected percentage of occurrences paid in lag } (n+1)}{\text{expected percentage of occurrences paid in lag } (n)}, n \geq 3$$

The weights for each lag are then determined as follows:

$$\text{Lag 1 weight} = 1 / k, \text{ where } k = \{1 + R1 + [R1 \bullet R2] / [1 - R3]\}$$

$$\text{Lag 2 weight} = R1 / k$$

$$\text{Lag 3 weight} = R1 \bullet R2 / k$$

$$\text{Lag 4 weight} = R1 \bullet R2 \bullet R3 / k$$

$$\text{Lag 5 weight} = R1 \bullet R2 \bullet [R3^2 / (1 - R3)] / k$$

Note that the lag 5 weight includes lag 5 and all subsequent lags.

The lag weights represent the percentage of ground-up occurrences in each lag. Therefore, occurrences from umbrella or excess policies with non-zero attachment points are not included.

---

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### METHOD OF ESTIMATION: PAYMENT LAG PARAMETERS

For stability, we calculate the payment lag parameters (R1, R2 and R3) via maximum likelihood. A non-composite-rated occurrence with accident year  $a$  and payment lag  $L$  is reflected in the likelihood function by the probability that the lag equals  $L$  given that the accident year equals  $a$ . This conditional probability can be easily expressed in terms of the payment lag parameters.

For a composite-rated risk (CRR) occurrence, the probability that the loss comes from a given table is computed by the procedure described below. Each CRR occurrence generates several probabilities, one for each table. These probabilities are treated as fractional occurrences in the likelihood function.

Page C-15 shows the resulting values of these parameters.

---

### TAIL OF THE DISTRIBUTION

For the higher limits of liability, the empirical data is sparse. To account for this, and to limit random fluctuations between consecutive reviews in the higher limits, a procedure is used to adjust the tail of the empirical SDF.

We select a table-specific truncation point (\$900,000 for Light and Medium Trucks, \$600,000 for Heavy Trucks and Truck-Tractors, \$700,000 for Extra Heavy Trucks and Truck-Tractors, \$600,000 for Zone-rated Risks, and \$900,000 for All Other Risks) above which the empirical SDF can be relatively less stable. Then we select a parametric curve family that successfully models the behavior of the empirical distribution in the layers around the truncation point. During this process, we examine which curve parameters would minimize the overall severity difference between the empirical and adjusted distributions.

We use the resulting curves to extrapolate the empirical distribution above the selected truncation points. The empirical distribution below the lower truncation point is unaffected by this procedure.

Essentially, this procedure smoothes the tail of the empirical distribution by extending relationships from the highest credible limits (those limits around the lower truncation point) to those limits above the truncation point. We then fit a mixed exponential distribution to the resulting SDF for each increased limits table.

---

### FITTING A MIXED EXPONENTIAL DISTRIBUTION

ISO models the lag-weighted empirical survival distribution function for each table with the best-fitting mixed exponential distribution. The lag-weighted SDFs reflect smoothing. The resulting mixed exponential distribution produces the limited average severity component of the increased limit factor.

---

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### THE SIMPLE EXPONENTIAL DISTRIBUTION

To understand the mixed exponential distribution, first consider the simple exponential distribution. The simple exponential is a one-parameter distribution. The formulas for the survival distribution function SDF(x) and the limited average severity (LAS) at a given policy limit (PL) for an exponential distribution with mean parameter  $\mu$  are given by:

$$\text{SDF}(x) = \exp(-x/\mu) = 1 - \text{CDF}(x)$$

$$\text{LAS}(\text{PL}) = \mu [1 - \exp(-\text{PL}/\mu)]$$

---

### THE MIXED EXPONENTIAL DISTRIBUTION

The mixed exponential distribution is a weighted average of exponential distributions. Each exponential distribution has two parameters, a mean  $\mu_i$  and a weight  $w_i$ . Since the SDF at zero is unity, the weights will sum to 1.000.

The formulas for the survival distribution function and limited average severity for the mixed exponential distribution are the weighted averages of the respective single exponential formulas:

$$\text{SDF}(x) = \sum_i [w_i \exp(-x/\mu_i)]$$

$$\text{LAS}(\text{PL}) = \sum_i w_i \mu_i [1 - \exp(-\text{PL}/\mu_i)]$$

ISO found that the mixed exponential distribution is flexible and simple to use and provides a good fit to empirical data over a wide range of loss sizes. In fact, any distribution whose probability density function (pdf) has alternating derivatives,

$$\begin{aligned} \text{pdf}(x) &> 0, \\ d \text{ pdf}(x)/dx &< 0, \\ d^2 \text{ pdf}(x)/dx^2 &> 0, \\ d^3 \text{ pdf}(x)/dx^3 &< 0, \text{ etc., for all } x > 0, \end{aligned}$$

can be constructed as a mixture of exponentials with positive means and weights. Such distributions (including the mixed Pareto, if it has a finite mean) can be thought of as special cases of the mixed exponential distribution.

---



## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### THE MIXED EXPONENTIAL DISTRIBUTION SEVERITY PARAMETERS

ISO estimates the mixed exponential distribution parameters using minimum distance estimation. We compare the model SDF to the empirical SDF at many discrete loss size layers resulting from the construction.

We seek a mixed exponential distribution that minimizes the weighted sum of the square of the differences of these survival probabilities (model minus empirical) taken at each loss size layer. This procedure is known as the “minimum distance” method.

The number of exponential distributions needed to produce an optimal fit to the empirical SDF may vary by table and is allowed to be as large as necessary.

To extend our mixed exponential fitting procedure into higher layers (above \$10 million), we allow means up to \$100 million, in order to more closely follow the smoothed empirical distribution in layers above \$10 million. Allowing means up to \$100 million will tend to increase the number of means (and weights) for the fitted distribution in a given table, while having minimal effect on limits up to \$10 million, the highest limit for which we publish increased limit factor information.

Page C-16 displays the mixed exponential parameters (means and weights) for each increased limits table.

---

### MAY NOT BE APPLICABLE FOR ALL POLICY LIMITS

**ISO’s standard increased limits tables (shown in Section A) provide increased limit factors up to the \$10,000,000 per occurrence policy limit. We encourage the use of supplemental sources of information for analysis of layers above \$10,000,000.**

---

### FINAL LIMITED AVERAGE SEVERITIES

ISO calculates the limited average severities using the fitted mixed exponential distributions for each table. Page C-10 gives the formula for the limited average severity of a mixed exponential distribution. Page C-16 displays the severity parameters used in this formula for each increased limits table.

Pages C-17 to C-18 compare the fitted limited average severities to the empirical limited average severities. The empirical limited average severities are constructed in a manner analogous to the empirical survival distributions. The same conditions and assumptions are used in combination with actual trended loss amounts in each layer.

---

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

COMPOSITE-  
RATED RISKS  
ADJUSTMENT

We generally cannot identify the class for CRR data. This means we cannot use class to assign CRR data to a specific table. But a significant proportion of our data is composite-rated; for this reason, and for credibility considerations, we include CRR data in our calculations of increased limit factors.

For a CRR occurrence, we know the accident year, payment lag and indemnity amount. We use this information in a Bayesian analysis to allocate a portion of each CRR occurrence to each table.

Since the allocation of CRR data is performed on a state group basis, it is not performed on Zone-rated Risks data.

---

EXCESS AND  
UMBRELLA  
DATA

Excess and umbrella occurrences are allocated using the same Bayesian analysis as CRR occurrences.

---

BAYESIAN  
ANALYSIS

For each payment lag, the Bayesian analysis is as follows:

$$P(\text{Table} \mid \text{Indemnity}) \\ = \frac{P(\text{Indemnity} \mid \text{Table}) \cdot P(\text{Table})}{\sum P(\text{Indemnity} \mid \text{Table}) \cdot P(\text{Table})}$$

The sum in the denominator is over all tables.

Here  $P(\text{Table} \mid \text{Indemnity})$  is the conditional probability (within the payment lag) that an occurrence comes from the specified table, given the indemnity amount.

$P(\text{Table})$  is the marginal probability (within the payment lag) that an occurrence comes from the specified table.

Clearly, the table probabilities sum to one:

$$\sum P(\text{Table} \mid \text{Indemnity}) = 1;$$

that is, 100% of each occurrence is allocated.

We estimate  $P(\text{Table})$  as the ratio of two sums:

$$P(\text{Table}) = \frac{\# \text{ of occurrences with known table in this table}}{\# \text{ of occurrences with known table in all tables}}$$

Here we restrict both the numerator and denominator to the payment lag under consideration.

---

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### BAYESIAN ALLOCATION AND EMPIRICAL SURVIVAL DISTRIBUTIONS

For an occurrence with unknown table not censored by policy limits, we use:

$$P(\text{Indemnity} \mid \text{Table}) = f(\text{Indemnity Layer}),$$

where  $f(\text{Indemnity Layer})$  is the empirical probability of an occurrence being in the indemnity layer. This empirical probability is the difference of the empirical SDF (for the table-payment lag combination) between the top and the bottom of the layer.

For an occurrence with unknown table censored by policy limits, we use:

$$P(\text{Indemnity} \mid \text{Table}) = \text{SDF}(\text{Indemnity Layer}),$$

where  $\text{SDF}(\text{Indemnity Layer})$  is the empirical SDF evaluated at the bottom of a layer, for the table-payment lag combination.

We use the empirical SDF construction to allocate CRR data to tables. We use the allocated CRR data (as well as the non-CRR data) to construct the empirical SDFs. We resolve the mutual interdependence problem by iterating our construction and allocating.

We start our allocation by constructing SDFs from non-CRR data. After each construction step we have an intermediate estimate of the SDFs. We use this intermediate set of parameters to make an interim allocation of the CRR data. We then use this interim allocation to construct the next estimate of the SDFs. At each step, the allocation and SDFs change, until the procedure converges.

---

### ALLOCATED DATA IN PROBABILITY- OF-PAYMENT- LAG MODEL

We allocate CRR data to tables within an accident year and payment lag using the Bayesian analysis described above. We then have revised occurrence counts by accident year, payment lag and table. These counts include fractional occurrences from the CRR data. These counts are the raw data for our probability-of-payment-lag model.

We do not include excess and umbrella data in the probability-of-payment-lag model. This avoids bias from not including unreported occurrences smaller than the policy attachment points.

---

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

**TREND SELECTION**  
MULTISTATE AVERAGE CLAIM COST

PAID CALENDAR YEAR DATA

<b>Year Ended</b>	<b>\$1,000,000 Bodily Injury</b>	<b>Total Limits Bodily Injury</b>	<b>Total Limits Property Damage</b>
12/31/2010	37,827.39	39,234.91	3,303.29
3/31/2011	37,397.62	38,721.40	3,291.42
6/30/2011	37,239.19	38,464.69	3,314.71
9/30/2011	38,151.91	39,449.59	3,363.22
12/31/2011	38,347.85	39,487.55	3,441.73
3/31/2012	38,340.38	39,417.75	3,550.54
6/30/2012	38,921.10	40,104.30	3,594.94
9/30/2012	38,875.22	39,775.87	3,633.12
12/31/2012	39,152.37	40,140.66	3,646.67
3/31/2013	39,303.05	40,237.82	3,670.00
6/30/2013	39,021.54	39,915.69	3,731.41
9/30/2013	39,141.19	40,317.04	3,772.42
12/31/2013	40,114.92	41,110.07	3,799.61
3/31/2014	40,765.87	41,789.92	3,808.87
6/30/2014	42,025.46	43,155.96	3,824.15
9/30/2014	42,636.18	43,472.73	3,876.13
12/31/2014	43,311.12	44,622.83	3,938.95
3/31/2015	44,023.46	45,686.85	3,984.52
6/30/2015	43,865.75	45,539.93	4,014.66
9/30/2015	43,979.15	45,818.35	4,047.41
12/31/2015	43,492.19	44,905.58	4,107.51
3/31/2016	43,836.93	45,541.86	4,211.34
6/30/2016	44,817.50	46,295.88	4,306.59
9/30/2016	45,791.86	47,036.36	4,341.94

9/30/2016 Claims		54,211	54,211	191,613
Average Annual	24 PT	3.7%	3.7%	4.7%
Change	12 PT	3.9%	4.3%	5.2%
Coefficient of	24 PT	0.9361	0.9145	0.9813
Determination R <sup>2</sup>	12 PT	0.8392	0.8362	0.9682

Multistate data excludes Massachusetts.

**TREND SELECTION**                      **+5.0%**

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
PAYMENT LAG PARAMETERS AND LAG WEIGHTS<sup>a</sup>

Payment Lag Parameters

	<u>Light and Medium</u>	<u>Heavy</u>	<u>Extra Heavy</u>	<u>Zone-rated (Multistate)</u>	<u>All Other</u>
R1 =	0.25427491	0.28590075	0.33390075	0.44055731	0.24647924
R2 =	0.17278835	0.14947620	0.19781464	0.19902328	0.19125926
R3 =	0.41845568	0.43196411	0.38905710	0.40759305	0.43295927
$k = 1 + R1 + ((R1 \cdot R2) / (1 - R3)) =$	1.32982503	1.36113430	1.44201307	1.58856564	1.32961513

Generation of Lag Weights

		<u>Light and Medium</u>	<u>Heavy</u>	<u>Extra Heavy</u>	<u>Zone-rated (Multistate)</u>	<u>All Other</u>
<b>Lag 1 =</b>	1/k =	0.75197862	0.73468136	0.69347499	0.62949870	0.75209733
<b>Lag 2 =</b>	R1/k =	0.19120930	0.21004595	0.23155182	0.27733025	0.18537638
<b>Lag 3 =</b>	R1•R2/k =	0.03303874	0.03139687	0.04580434	0.05519518	0.03545495
<b>Lag 4 =</b>	R1•R2•R3/k =	0.01382525	0.01356232	0.01782050	0.02249717	0.01535055
<b>Lag 5 =</b>	$R1 \cdot R2 \cdot (R3^2 / (1 - R3)) / k =$	0.00994809	0.01031350	0.01134835	0.01547870	0.01172079
	TOTAL =	1.00000000	1.00000000	1.00000000	1.00000000	1.00000000

<sup>a</sup> The lag weight distribution includes allocated CRR data for all tables except Zone-rated.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
**MIXED EXPONENTIAL PARAMETERS**  
Average Accident Date of April 1, 2019

Light and <u>Medium</u>		<u>Heavy</u>		Extra <u>Heavy</u>	
<u>Mean</u>	<u>Weight</u>	<u>Mean</u>	<u>Weight</u>	<u>Mean</u>	<u>Weight</u>
3,535	0.768875	4,019	0.793368	4,636	0.737059
19,364	0.168823	18,624	0.138877	21,612	0.179304
51,583	0.031911	65,791	0.048040	71,248	0.054027
121,066	0.016878	306,122	0.014532	441,523	0.023173
413,542	0.009891	872,221	0.003631	1,394,236	0.004767
1,088,964	0.002520	2,278,589	0.001029	3,825,488	0.001129
2,667,458	0.000743	4,422,071	0.000153	8,610,208	0.000335
5,698,378	0.000159	6,956,871	0.000241	21,011,835	0.000160
8,318,914	0.000114	19,514,197	0.000102	100,000,000	0.000046
20,819,064	0.000069	100,000,000	0.000027		
100,000,000	0.000017				

  

Zone-rated <u>(Multistate)</u>		<u>All Other</u>	
<u>Mean</u>	<u>Weight</u>	<u>Mean</u>	<u>Weight</u>
5,447	0.728458	3,074	0.749263
22,500	0.144730	14,798	0.170684
60,142	0.084236	44,845	0.053216
350,918	0.032732	175,685	0.015427
1,055,644	0.007123	452,626	0.008028
2,826,757	0.001885	1,134,231	0.002280
7,167,975	0.000583	2,649,226	0.000686
20,218,611	0.000201	4,263,947	0.000115
100,000,000	0.000052	7,389,422	0.000205
		20,404,270	0.000077
		100,000,000	0.000019

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
COMPARISON OF LIMITED AVERAGE SEVERITIES

Policy Limit (,000s)	<u>Light and Medium Trucks</u>			<u>Heavy Trucks and Truck-Tractors</u>		
	Trended	Fitted	Percent	Trended	Fitted	Percent
	Empirical <u>LAS<sup>a</sup></u>	<u>LAS</u>	<u>Difference</u>	Empirical <u>LAS<sup>a</sup></u>	<u>LAS</u>	<u>Difference</u>
100	9,891	9,754	-1.39%	10,067	9,968	-0.98%
250	12,234	12,089	-1.19%	12,629	12,509	-0.95%
300	12,736	12,588	-1.16%	13,161	13,046	-0.87%
400	13,549	13,396	-1.13%	14,028	13,918	-0.78%
500	14,188	14,036	-1.07%	14,732	14,610	-0.83%
1,000	16,153	16,008	-0.90%	16,821	16,696	-0.74%
1,500	17,199	17,054	-0.84%	17,914	17,789	-0.70%
2,000	17,868	17,723	-0.81%	18,633	18,507	-0.68%
2,500	18,349	18,203	-0.80%	19,160	19,036	-0.65%
3,000	18,719	18,573	-0.78%	19,573	19,450	-0.63%
5,000	19,656	19,508	-0.75%	20,647	20,524	-0.60%
10,000	20,719	20,568	-0.73%	21,926	21,806	-0.55%

  

Policy Limit (,000s)	<u>Extra Heavy Trucks and Truck-Tractors</u>			<u>Zone-rated Risks (Multistate)</u>		
	Trended	Fitted	Percent	Trended	Fitted	Percent
	Empirical <u>LAS<sup>a</sup></u>	<u>LAS</u>	<u>Difference</u>	Empirical <u>LAS<sup>a</sup></u>	<u>LAS</u>	<u>Difference</u>
100	12,916	12,857	-0.46%	15,159	15,088	-0.47%
250	17,049	16,948	-0.59%	20,423	20,307	-0.57%
300	18,001	17,902	-0.55%	21,613	21,500	-0.52%
400	19,588	19,523	-0.33%	23,569	23,498	-0.30%
500	20,923	20,869	-0.26%	25,162	25,120	-0.17%
1,000	25,309	25,224	-0.34%	30,163	30,095	-0.23%
1,500	27,637	27,573	-0.23%	32,730	32,672	-0.18%
2,000	29,145	29,078	-0.23%	34,396	34,332	-0.19%
2,500	30,240	30,167	-0.24%	35,606	35,542	-0.18%
3,000	31,088	31,014	-0.24%	36,544	36,483	-0.17%
5,000	33,260	33,192	-0.20%	38,951	38,892	-0.15%
10,000	35,781	35,709	-0.20%	41,750	41,693	-0.14%

<sup>a</sup> This is the empirical LAS after the tail adjustment described on page C-9.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
COMPARISON OF LIMITED AVERAGE SEVERITIES

Policy Limit (,000s)	<u>All Other Risks</u>		
	Trended Empirical <u>LAS<sup>a</sup></u>	Fitted <u>LAS</u>	Percent <u>Difference</u>
100	9,302	9,179	-1.32%
250	11,706	11,583	-1.05%
300	12,238	12,110	-1.05%
400	13,092	12,964	-0.98%
500	13,755	13,633	-0.89%
1,000	15,760	15,626	-0.85%
1,500	16,809	16,673	-0.81%
2,000	17,484	17,348	-0.78%
2,500	17,973	17,836	-0.76%
3,000	18,350	18,213	-0.75%
5,000	19,312	19,174	-0.71%
10,000	20,417	20,277	-0.69%

<sup>a</sup> This is the empirical LAS after the tail adjustment described on page C-9.



INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION D - SUPPORTING MATERIAL - ALLOCATED LOSS ADJUSTMENT EXPENSE

Overview .....	D2
Calculation of Allocated Loss Adjustment Expense Per Occurrence .....	D3

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### SUPPORTING MATERIAL - ALLOCATED LOSS ADJUSTMENT EXPENSE

#### OVERVIEW

The standard liability policy contains a policy limit which represents the maximum amount an insurer will pay for any loss for which the insured is liable. However, the limit does not apply to the loss adjustment expenses. For this reason, we estimate allocated loss adjustment expense (ALAE) per occurrence as a single amount that does not vary by policy limit.

For each table, we estimate ALAE per occurrence as the product of two numbers. The first number is the ratio of paid ALAE to paid total limits (all limits combined) indemnity. The second number is the average (across all policy limits) limited average severity calculated from the mixed exponential model.

In order to calculate the ALAE per occurrence, we first determine the ratio of dollars of ALAE to dollars of total limits indemnity for the seven next-to-latest available fiscal accident years. (The latest accident year is excluded from the calculation because its development is less stable). We develop these ratios to ultimate maturity. To enhance stability, we employ a best 5-of-7 criterion and eliminate the lowest and highest ultimate ratios. We then average the remaining five ratios.

We employ an incremental development procedure to determine the ALAE to total limits indemnity loss ratio for each table. The procedure uses a triangle of incremental ALAE emergence (at each evaluation) as a percentage of ultimate total limits indemnity losses to determine additive incremental ALAE emergence ratios. Specifically, we calculate “incremental ALAE percentages” as the emergence of ALAE between two evaluation points, divided by ultimate paid indemnity losses. For example, we express the difference between historic ALAE evaluated at 27 months and ALAE evaluated at 15 months as a percentage of ultimate incurred indemnity losses. We determine similar percentages for the 27-to-39 month period, the 39-to-51 month period, etc. We then sum these percentages, finally combining them with the ratios from the most recent diagonals to determine the ratios of ALAE to total limits indemnity at ultimate.

The fitted total limits average severity for each table is a weighted-average of the limited average severities at the different policy limits. The weights are based on the number of occurrences from the second, third and fourth latest fiscal accident years.

For each table, the multi-year average ALAE to total limits indemnity ratio is then multiplied by the final fitted total limits average severity in order to calculate the ALAE per occurrence provision used in computing increased limit factors. The total limits average severity reflects trend to the average prospective accident date. This effectively contemplates trend in ALAE in a more stable manner than relying on a separate trend analysis of ALAE. See the following page for the ALAE calculations.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
CALCULATION OF ALLOCATED LOSS ADJUSTMENT EXPENSE PER OCCURRENCE

Ratios of Paid ALAE to Paid Total Limits Losses

Fiscal Accident Year	Light and Medium	Heavy	Extra Heavy	Zone-rated (Multistate)	All Other
2009	0.05691	0.06430	0.07341	0.10220	0.07911
2010	0.07472	0.07652	0.09097	0.08974	0.08284
2011	0.06098	0.06905	0.08591	0.10167	0.07844
2012	0.06136	0.07651	0.07300	0.10427	0.08545
2013	0.06457	0.07712	0.10936	0.12464	0.07042
2014	0.06347	0.06733	0.08218	0.11773	0.07454
2015	0.06277	0.07712	0.08241	0.11789	0.07555
Best 5-of-7 Average	0.06263	0.07330	0.08297	0.10875	0.07810

Indicated ALAE per Occurrence

	(1)	(2)	(3) (1) x (2)
Table	ALAE per Total Limits Indemnity	Mixed Exponential Average Total Limits Severity	Indicated ALAE per Occurrence
Light and Medium	0.06263	15,791	989
Heavy	0.07330	16,681	1,223
Extra Heavy	0.08297	25,326	2,101
Zone-rated (Multistate)	0.10875	30,271	3,292
All Other	0.07810	15,478	1,209

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION E - SUPPORTING MATERIAL - UNALLOCATED LOSS ADJUSTMENT EXPENSE

Overview .....	E2
Development of Unallocated Loss Adjustment Expense Factor .....	E3

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SUPPORTING MATERIAL - UNALLOCATED LOSS ADJUSTMENT EXPENSE

OVERVIEW

We calculate the unallocated loss adjustment expense (ULAE) at each limit of liability as a percentage of the sum of the limited average severity and the ALAE at that liability limit. We select the ULAE load of 9.25% based on a five-year average of multistate financial data reported to ISO. See the following page for the derivation of this factor.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

**DEVELOPMENT OF UNALLOCATED LOSS ADJUSTMENT EXPENSE FACTOR**

Calendar Year Experience

Bodily Injury

<u>ITEM</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>Five Year Average</u>
(1) Direct Losses Incurred	3,382,082	4,091,432	4,241,671	4,816,654	5,408,567	
(2) Allocated Loss Adjustment Expense Incurred (ALAE)	290,174	463,736	481,558	518,587	611,974	
(3) Unallocated Loss Adjustment Expense Incurred (ULAE)	368,213	392,749	440,405	473,498	481,607	
(4) Unallocated LAE as a ratio to Loss + Allocated LAE (3)/[(1) + (2)]	10.03%	8.62%	9.32%	8.87%	8.00%	8.97%

Property Damage

<u>ITEM</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>Five Year Average</u>
(1) Direct Losses Incurred	834,325	892,691	1,005,713	1,066,493	1,164,414	
(2) Allocated Loss Adjustment Expense Incurred (ALAE)	50,208	64,825	79,678	75,866	93,908	
(3) Unallocated Loss Adjustment Expense Incurred (ULAE)	108,058	110,707	115,006	129,452	129,263	
(4) Unallocated LAE as a ratio to Loss + Allocated LAE (3)/[(1) + (2)]	12.22%	11.56%	10.60%	11.33%	10.27%	11.20%

Bodily Injury and Property Damage Combined

<u>ITEM</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>Five Year Average</u>
(1) Direct Losses Incurred	4,216,407	4,984,123	5,247,384	5,883,147	6,572,982	
(2) Allocated Loss Adjustment Expense Incurred (ALAE)	340,382	528,561	561,235	594,454	705,882	
(3) Unallocated Loss Adjustment Expense Incurred (ULAE)	476,271	503,456	555,410	602,949	610,871	
(4) Unallocated LAE as a ratio to Loss + Allocated LAE (3)/[(1) + (2)]	10.45%	9.13%	9.56%	9.31%	8.39%	9.37%

**Selected Bodily Injury and Property Damage Combined ULAE Factor: 0.0925**

All items are from ISO Special Call Submissions for available national agency writers. All amounts displayed are in thousands of dollars.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION F - SUPPORTING MATERIAL - RISK LOAD

Overview .....	F2
Risk Load Formulas and Parameters .....	F3-F6

## INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

### SUPPORTING MATERIAL - RISK LOAD

#### OVERVIEW

Our increased limits methodology incorporates a procedure to reflect the relatively higher risk or variation in experience associated with higher limit policies. The model that we use, the Competitive Market Equilibrium Risk Load Model,<sup>1</sup> assumes that the insurance marketplace is competitive and efficient. In a competitive marketplace, individual insurers cannot influence the marketplace price. While individual insurers cannot influence the risk associated with a given policy limit, they will attempt to maximize their expected net revenue by choosing which lines and policy limits to write. This assumption is consistent with rational economic behavior and is reinforced by solvency regulation.

In an efficient marketplace, the supply of insurance matches the demand. ISO uses the distribution of basic limit losses by policy limit to represent the market demand for insurance at each limit. The model determines a set of risk loads that match supply and demand at each policy limit.

The variability of losses is caused by process risk and parameter risk:

- Process risk reflects the inherent uncertainty of the insurance process. Even if one could estimate expected losses exactly, actual losses will almost certainly differ from the expected. We derive the process risk component from the parameters of the indemnity severity distribution.
- Parameter risk reflects the risk of not estimating expected losses accurately. The derivation of the parameter risk component is based on the historical variation of losses.

These two risk elements combined comprise the total risk load at each policy limit.

The risk load formulas use a parameter, lambda ( $\lambda$ ), which governs the total amount of risk load over all policy limits for (non-professional) commercial liability tables. We determine lambda so that the ratio of the average indicated increased limit factor with risk load to the average indicated increased limit factor without risk load is equal to 1.06 for all General Liability and Commercial Automobile Liability tables combined. For State Group 2 in this Commercial Automobile Liability filing, increased limit factors with risk load are on average 4.8% higher than they would be if calculated excluding risk load.

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<sup>1</sup> Meyers, G. G., *Competitive Market Equilibrium Risk Load Model for Increased Limits Ratemaking*, Proceedings of the Casualty Actuarial Society, Volume LXXVIII, 1991



INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

RISK LOAD FORMULAS AND PARAMETERS

The following are the formulas underlying ISO's risk load model.

The risk load formulas incorporate parameter risk using a parameter transformation. In the following formulas, we use the notation AVSEV(PL,  $\alpha$ ) and SECM(PL,  $\alpha$ ) to represent the limited moments of a transformed loss size distribution. The distribution is transformed by multiplying all occurrences by the constant " $\alpha$ ". AVSEV represents the limited average severity and SECM represents the limited second moment of the transformed distribution. The following formulas represent an approximation of the effect of parameter risk on the severity distribution:

$$\text{AVSEV}(\text{PL}, \alpha) = \alpha \times \text{LAS}(\text{PL}/\alpha)$$

$$\text{SECM}(\text{PL}, \alpha) = \alpha^2 \times \text{SECM}(\text{PL}/\alpha)$$

The formula for the LAS(PL) and SECM(PL) is as follows:

$$\text{LAS}(\text{PL}) = \sum w_i \mu_i [1 - \exp(-\text{PL}/\mu_i)]$$

$$\text{SECM}(\text{PL}) = \sum_i 2 w_i \mu_i^2 \left[ 1 - \left( 1 + \frac{\text{PL}}{\mu_i} \right) \exp\left(-\frac{\text{PL}}{\mu_i}\right) \right]$$

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

RISK LOAD FORMULAS and PARAMETERS

(1) Total Risk Load

The vector of risk load amounts by limit for a particular increased limits table,  $R$ , is:

$$R = \lambda[U + 2(V^a \cdot \bar{n}^a + V^c \cdot \bar{n}^c)]$$

where

- $\lambda$  = the factor which reflects the overall impact of risk load over General Liability and Commercial Automobile Liability. ISO selects this parameter so that the average increased limit factor with risk load divided by the average increased limit factor without risk load equals 1.06.
- $U$  = the vector of risk elements corresponding to process risk. Its  $j^{\text{th}}$  component is  $u_j$ , corresponding to the  $j^{\text{th}}$  limit. The calculation of  $U$  is described further on the following page.
- $V^a$  = the matrix describing severity parameter risk. The calculation of  $V^a$  is described further on the following page.
- $\bar{n}^a$  = the vector of the expected number of occurrences per insurer, in the particular increased limits table (within the state group). The  $j^{\text{th}}$  component of  $\bar{n}^a$  is computed as follows: the basic limit loss weight for that policy limit in the increased limits table (as a percentage) is multiplied by  $n_{\text{bara}}$ , which is the expected number of occurrences per insurer per state group, in the particular increased limits table, for all limits combined.
- $V^c$  = the matrix describing frequency parameter risk. The calculation of  $V^c$  is described further on the following page.
- $\bar{n}^c$  = the vector of the expected average number of occurrences per insurer per state for all tables combined. The  $j^{\text{th}}$  component of  $\bar{n}^c$  is computed as follows: the basic limit loss weight for that policy limit in the increased limits table (as a percentage) is multiplied by  $n_{\text{barc}}$ , which is the expected average number of occurrences per insurer per state for all tables and limits combined.

# INCREASED LIMIT FACTORS COMMERCIAL AUTOMOBILE LIABILITY

## RISK LOAD FORMULAS AND PARAMETERS

### (2) Process Risk Load

The process risk load component of the risk load is given by  $\lambda \times U$ . The component,  $u_j$ , associated with the  $j^{\text{th}}$  limit, is

$$u_j = E_{\alpha}[\text{SECM}(PL_j, \alpha)] + [d \cdot E_{\alpha}[\text{AVSEV}(PL_j, \alpha)^2]]$$

where:

- $\alpha$  = random variable representing severity parameter risk, with mean 1 and variance a.
- a = .001, based on special ISO study.
- 1+d = variance-to-mean ratio for occurrence count distribution, contingent on parameters being known (in other words, if there were no frequency parameter risk, the variance-to-mean ratio would be 1 + d).
- $E_{\alpha}$  = expected value across all values of  $\alpha$ .

Let:

$$\alpha_1 = 1 - \sqrt{3a}; \quad \alpha_2 = 1; \quad \alpha_3 = 1 + \sqrt{3a};$$

The Gauss-Hermite approximation<sup>1</sup> provides a discrete approximation for the expected value of a function  $G(\alpha)$  across all values of the normally distributed variable  $\alpha$ :

$$E_{\alpha}[G(\alpha)] \approx (1/6)G(\alpha_1) + (2/3)G(\alpha_2) + (1/6)G(\alpha_3)$$

for any function  $G(\alpha)$ .

### (3) Parameter Risk Load

The parameter risk component of the risk load is given by  $\lambda \times 2 \times (\mathbf{V}^a \cdot \bar{\mathbf{n}}^a + \mathbf{V}^c \cdot \bar{\mathbf{n}}^c)$ .

#### Evaluation of $\mathbf{V}^a$

- $v^a_{ij}$  = element of  $\mathbf{V}^a$  corresponding to limit i, limit j
- =  $E_{\alpha}[\text{AVSEV}(PL_i, \alpha) \cdot \text{AVSEV}(PL_j, \alpha)] - E_{\alpha}[\text{AVSEV}(PL_i, \alpha)] \cdot E_{\alpha}[\text{AVSEV}(PL_j, \alpha)]$

#### Evaluation of $\mathbf{V}^c$

- $v^c_{ij}$  = element of  $\mathbf{V}^c$  corresponding to limit i, limit j
- =  $c E_{\alpha}[\text{AVSEV}(PL_i, \alpha) \cdot \text{AVSEV}(PL_j, \alpha)]$
- c = parameter quantifying frequency parameter risk (“c” does for frequency what “a” does for severity). Values vary by line based on a special ISO study.

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<sup>1</sup> Ralston, A., *A First Course in Numerical Analysis*, McGraw-Hill, 1965

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

**RISK LOAD FORMULAS AND PARAMETERS**

ALL COMMERCIAL (NON-PROFESSIONAL) LIABILITY

$$\text{Lambda}^a = 1.7524\text{E-}07$$

COMMERCIAL AUTOMOBILE LIABILITY  
STATE GROUP 2

Common Parameters

d	=	0
c	=	0.0025
a	=	0.001
nbarc	=	500

Values of nbara

Light and Medium	327.3
Heavy	47.9
Extra Heavy	47.4
Zone-rated (multistate)	84.9
All Other	172.8

<sup>a</sup> ISO determines lambda so that the ratio of the average increased limit factor with risk load to the average increased limit factor without risk load is equal to 1.06 for all General Liability and Commercial Automobile Liability tables combined.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION G - INDICATED AND SELECTED CHANGES BY TABLE

Summary .....	G2
Calculation of Indicated and Selected Changes .....	G3-G5

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SUMMARY

Pages G-3 to G-5 display the indicated and selected changes for Commercial Automobile Liability. Current, indicated and selected increased limit factors are shown by policy limit for each table. Average increased limit factors by table are summarized on page G-5.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
CALCULATION OF INDICATED AND SELECTED CHANGES

LIGHT AND MEDIUM TRUCKS

Policy Limit (\$,000)	Basic Limit Loss Weight	Current Increased Limit Factor	Indicated Increased Limit Factor	Indicated Percent Change	Selected Increased Limit Factor	Selected Percent Change
100	0.0109	1.00	1.00	0.0%	1.00	0.0%
250	0.0006	1.26	1.23	-2.4%	1.23	-2.4%
300	0.0285	1.31	1.28	-2.3%	1.28	-2.3%
400	0.0010	1.41	1.36	-3.5%	1.36	-3.5%
500	0.0447	1.48	1.43	-3.4%	1.43	-3.4%
750	0.0034	1.63	1.56	-4.3%	1.56	-4.3%
1,000	0.8672	1.74	1.65	-5.2%	1.65	-5.2%
1,500	0.0006	1.89	1.79	-5.3%	1.79	-5.3%
2,000	0.0352	1.99	1.88	-5.5%	1.88	-5.5%
2,500	0.0000	2.07	1.96	-5.3%	1.96	-5.3%
3,000	0.0013	2.15	2.02	-6.0%	2.02	-6.0%
5,000	0.0062	2.36	2.22	-5.9%	2.22	-5.9%
7,500	0.0002	2.55	2.39	-6.3%	2.39	-6.3%
<u>10,000</u>	<u>0.0002</u>	<u>2.71</u>	<u>2.54</u>	<u>-6.3%</u>	<u>2.54</u>	<u>-6.3%</u>
TOTAL	1.0000	1.721	1.634	-5.1%	1.634	-5.1%

HEAVY TRUCKS AND TRUCK-TRACTORS

Policy Limit (\$,000)	Basic Limit Loss Weight	Current Increased Limit Factor	Indicated Increased Limit Factor	Indicated Percent Change	Selected Increased Limit Factor <sup>a</sup>	Selected Percent Change
100	0.0030	1.00	1.00	0.0%	1.00	0.0%
250	0.0009	1.29	1.24	-3.9%	1.24	-3.9%
300	0.0070	1.36	1.29	-5.1%	1.29	-5.1%
400	0.0001	1.47	1.38	-6.1%	1.37	-6.8%
500	0.0153	1.57	1.45	-7.6%	1.45	-7.6%
750	0.0061	1.73	1.58	-8.7%	1.57	-9.2%
1,000	0.9230	1.85	1.67	-9.7%	1.67	-9.7%
1,500	0.0004	2.02	1.81	-10.4%	1.81	-10.4%
2,000	0.0341	2.14	1.91	-10.7%	1.91	-10.7%
2,500	0.0000	2.23	1.99	-10.8%	1.99	-10.8%
3,000	0.0014	2.31	2.06	-10.8%	2.06	-10.8%
5,000	0.0078	2.56	2.27	-11.3%	2.27	-11.3%
7,500	0.0009	2.79	2.47	-11.5%	2.47	-11.5%
<u>10,000</u>	<u>0.0000</u>	<u>2.98</u>	<u>2.64</u>	<u>-11.4%</u>	<u>2.64</u>	<u>-11.4%</u>
TOTAL	1.0000	1.855	1.675	-9.7%	1.675	-9.7%

<sup>a</sup> Selected ILFs may include judgmental adjustments to maintain consistency between successive policy limits.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
CALCULATION OF INDICATED AND SELECTED CHANGES

EXTRA HEAVY TRUCKS AND TRUCK-TRACTORS

Policy Limit (\$,000)	Basic Limit Loss Weight	Current Increased Limit Factor	Indicated Increased Limit Factor	Indicated Percent Change	Selected Increased Limit Factor <sup>a</sup>	Selected Percent Change
100	0.0005	1.00	1.00	0.0%	1.00	0.0%
250	0.0001	1.29	1.29	0.0%	1.29	0.0%
300	0.0015	1.36	1.36	0.0%	1.36	0.0%
400	0.0014	1.48	1.47	-0.7%	1.47	-0.7%
500	0.0083	1.58	1.58	0.0%	1.57	-0.6%
750	0.0048	1.77	1.78	0.6%	1.78	0.6%
1,000	0.9419	1.91	1.93	1.0%	1.93	1.0%
1,500	0.0004	2.11	2.15	1.9%	2.15	1.9%
2,000	0.0308	2.26	2.31	2.2%	2.31	2.2%
2,500	0.0000	2.37	2.43	2.5%	2.43	2.5%
3,000	0.0020	2.47	2.53	2.4%	2.53	2.4%
5,000	0.0082	2.77	2.86	3.2%	2.86	3.2%
7,500	0.0001	3.04	3.16	3.9%	3.16	3.9%
<u>10,000</u>	<u>0.0000</u>	<u>3.27</u>	<u>3.40</u>	<u>4.0%</u>	<u>3.40</u>	<u>4.0%</u>
TOTAL	1.0000	1.924	1.945	1.1%	1.945	1.1%

ZONE-RATED RISKS

Policy Limit (\$,000)	Basic Limit Loss Weight	Current Increased Limit Factor	Indicated Increased Limit Factor	Indicated Percent Change	Selected Increased Limit Factor	Selected Percent Change
100	0.0005	1.00	1.00	0.0%	1.00	0.0%
250	0.0001	1.30	1.30	0.0%	1.30	0.0%
300	0.0006	1.37	1.37	0.0%	1.37	0.0%
400	0.0000	1.49	1.49	0.0%	1.49	0.0%
500	0.0051	1.59	1.59	0.0%	1.59	0.0%
750	0.0009	1.78	1.78	0.0%	1.78	0.0%
1,000	0.9066	1.92	1.92	0.0%	1.92	0.0%
1,500	0.0004	2.11	2.11	0.0%	2.11	0.0%
2,000	0.0559	2.25	2.25	0.0%	2.25	0.0%
2,500	0.0000	2.36	2.36	0.0%	2.36	0.0%
3,000	0.0193	2.46	2.46	0.0%	2.46	0.0%
5,000	0.0104	2.76	2.75	-0.4%	2.75	-0.4%
7,500	0.0002	3.04	3.02	-0.7%	3.02	-0.7%
<u>10,000</u>	<u>0.0000</u>	<u>3.28</u>	<u>3.25</u>	<u>-0.9%</u>	<u>3.25</u>	<u>-0.9%</u>
TOTAL	1.0000	1.955	1.955	0.0%	1.955	0.0%

<sup>a</sup> Selected ILFs may include judgmental adjustments to maintain consistency between successive policy limits.



INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

STATE GROUP 2  
CALCULATION OF INDICATED AND SELECTED CHANGES

ALL OTHER RISKS

Policy Limit (\$,000)	Basic Limit <u>Loss Weight</u>	Current Increased <u>Limit Factor</u>	Indicated Increased <u>Limit Factor</u>	Indicated Percent <u>Change</u>	Selected Increased <u>Limit Factor</u>	Selected Percent <u>Change</u>
100	0.0064	1.00	1.00	0.0%	1.00	0.0%
250	0.0002	1.26	1.24	-1.6%	1.24	-1.6%
300	0.0206	1.32	1.30	-1.5%	1.30	-1.5%
400	0.0043	1.42	1.39	-2.1%	1.39	-2.1%
500	0.0615	1.49	1.46	-2.0%	1.46	-2.0%
750	0.0023	1.64	1.60	-2.4%	1.60	-2.4%
1,000	0.8401	1.74	1.70	-2.3%	1.70	-2.3%
1,500	0.0151	1.89	1.83	-3.2%	1.83	-3.2%
2,000	0.0358	1.99	1.94	-2.5%	1.94	-2.5%
2,500	0.0000	2.07	2.02	-2.4%	2.02	-2.4%
3,000	0.0028	2.14	2.08	-2.8%	2.08	-2.8%
5,000	0.0107	2.36	2.29	-3.0%	2.29	-3.0%
7,500	0.0002	2.55	2.48	-2.7%	2.48	-2.7%
<u>10,000</u>	<u>0.0000</u>	<u>2.71</u>	<u>2.63</u>	<u>-3.0%</u>	<u>2.63</u>	<u>-3.0%</u>
TOTAL	1.0000	1.729	1.689	-2.3%	1.689	-2.3%

SUMMARY

<u>Table</u>	Basic Limit <u>Loss Weight</u>	Current Increased <u>Limit Factor</u>	Indicated Increased <u>Limit Factor</u>	Indicated Percent <u>Change</u>	Selected Increased <u>Limit Factor</u>	Selected Percent <u>Change</u>
Light and Medium	0.5220	1.721	1.634	-5.1%	1.634	-5.1%
Heavy	0.0831	1.855	1.675	-9.7%	1.675	-9.7%
Extra Heavy	0.1077	1.924	1.945	1.1%	1.945	1.1%
Zone-rated	0.0269	1.729	1.955	0.0%	1.955	0.0%
<u>All Other</u>	<u>0.2603</u>	<u>1.955</u>	<u>1.689</u>	<u>-2.3%</u>	<u>1.689</u>	<u>-2.3%</u>
TOTAL	1.0000	1.762	1.694	-3.9%	1.694	-3.9%

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

SECTION H - CALCULATION OF DEDUCTIBLE DISCOUNT FACTORS

Overview of ISO Actuarial Procedures - Deductible Discount Factors .....	H2-H9
Calculation of Deductible Discount Factors.....	H10-H17
Calculation of Indicated Changes.....	H18

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

DEDUCTIBLE  
OPTIONS

ISO Commercial Automobile Liability deductibles apply to one of two types of loss categories: Property Damage (PD) only, or Combined Single Limit (Bodily Injury and Property Damage combined). For each type of loss category there are 11 deductible options ranging from \$250 to \$100,000. For Commercial Automobile Liability all deductibles apply on a per occurrence basis, as do policy limits.

In the interest of efficiency and in light of the overall similarity among indicated discounts across tables, a single average indicated discount for each deductible is calculated by state group to apply to all tables, except Zone-rated risks. For the non-Zone-rated discount calculations, all tables in this state group are combined due to the similarity of the indications. Deductible discounts for Zone-rated risks were calculated separately, on a multistate basis.

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REDUCTION OF  
DAMAGES VS.  
IMPAIRMENT OF  
LIMITS  
(DEPENDENCE ON  
POLICY LIMIT)

ISO Commercial Automobile Liability deductibles apply on a "Reduction of Damages" basis.

Under a "Reduction of Damages" basis, an insurer is responsible for losses in excess of the deductible, up to the point where an insurer pays an amount equal to the policy limit. Thus, an insurer might pay for losses in layers above the policy limit purchased, although the total amount paid will not exceed the limit.

For example, consider the case of a policy with a limit of \$100,000, a deductible of \$25,000, and an occurrence resulting in a loss of \$125,000. Under "Reduction of Damages" an insurer pays the entire \$100,000 excess of the deductible.

In contrast, under an "Impairment of Limits" basis, the most an insurer would pay is the policy limit minus the deductible. In the above example, an insurer would pay \$75,000 (\$100,000 - \$25,000).

Generalizing the above example, we can see that the reduction in insured loss due to a deductible under "Reduction of Damages" depends on the policy limit selected. In the above example if the insured had selected a \$150,000 policy limit with a \$25,000 deductible, the insurer would pay \$100,000 of the \$125,000 loss, a reduction of \$25,000 from the amount that it would pay if the policy had no deductible. But, with a \$100,000 limit and a \$25,000 deductible the insurer would also pay \$100,000 of the \$125,000 loss, which is what it would pay with no deductible and hence the reduction due to the deductible would be \$0.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

EXPERIENCE	<p>This review uses the latest eight fiscal accident years (2009-2016) of paid-settled data from the most recent five settlement years (2012-2016). The experience period is consistent with the 2017 review of Commercial Automobile Liability increased limit factors.</p> <hr/>
LIABILITY DEDUCTIBLES	<p>Like any other deductible, ISO Commercial Automobile Liability deductibles represent savings to the insurer that are reflected in the reduced premium paid by the insured. Several unique features of liability deductibles are pertinent in understanding the savings to the insurer.</p> <hr/>
THIRD PARTY	<p>Liability deductibles apply to third party insurance, not first party insurance.</p> <hr/>
INSURER HANDLES ALL CLAIMS	<p>In general, the insurer handles all claims, even the smallest. What the insured perceives as a small nuisance claim may turn into a large claim. Failure to report the claim promptly to the insurer may jeopardize coverage. Because the insurer handles all claims, there is no loss adjustment expense savings reflected in the deductible discount calculation. The savings for a given policy are therefore based on indemnity savings only and any related variable expense savings discussed below.</p> <hr/>
DEDUCTIBLE REIMBURSEMENT	<p>In general, the insurer pays the full amount (including the deductible) to the claimants, and then seeks reimbursement for the deductible from the insured. This is standard claims-handling practice as claimants will generally not sign a release of liability until they receive the full amount.</p> <p>Since the insurer initially pays the full amount, there is a risk that the insurer will be unable to collect the deductible amount from the insured.</p> <hr/>
DEFINITION OF DEDUCTIBLE DISCOUNT FACTORS	<p>When a deductible applies, the insured receives a discount reflecting the reduced coverage. The amount of the discount is the basic limit/full coverage premium multiplied by the deductible discount factor. The deductible discount factor thus represents the ratio of total costs saved by the insurer to basic limit/full coverage premium. For Commercial Automobile, the base deductible is full coverage.</p> <hr/>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

OVERVIEW OF  
CALCULATION

Total costs saved break down into net indemnity costs saved and the corresponding variable expense savings. Basic limit full coverage premium is defined as the expected basic limit full coverage indemnity, allocated loss adjustment expense (ALAE), unallocated loss adjustment expense (ULAE), and other expenses.

Net indemnity costs saved and basic limit full coverage indemnity and loss adjustment expenses (ALAE and ULAE) are expressed on a per occurrence basis.

Net indemnity costs saved per occurrence are the gross deductible savings per occurrence under “Reduction of Damages” adjusted for the insurer’s risk of not getting reimbursed for the deductible. Details of the gross deductible savings calculation are discussed further below.

The deductible discount factor can be expressed as the product of two factors. One factor is a kind of loss elimination ratio (LER). This loss elimination ratio is the ratio of net indemnity costs saved to the full coverage basic limit indemnity and all loss adjustment expense costs (ALAE and ULAE). The other factor tempers the LER for the combined effect of expenses (variable and fixed), recalling that fixed expenses will not be reduced.

For consistency, we calculate the basic limit/full coverage indemnity and loss adjustment expense from the occurrence severity distributions used to model the Combined Single Limit (CSL) deductible savings and increased limits factors.

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TOTAL COSTS  
SAVED

The premium paid by the insured covers indemnity, loss adjustment expense, and other expenses. Other expenses can be further subdivided into fixed expenses and variable expenses. Variable expenses are expenses that vary directly with the premium, such as premium taxes. When the insured chooses a deductible, some costs change (compared to the full coverage costs), while others do not. We assume that the costs that change are indemnity and variable expenses. Fixed expenses do not change by definition; loss adjustment expense does not change because the insurer still handles all claims, including those that will eventually settle below the deductible. Total costs saved thus stem from two sources: the expected net indemnity saved, and the corresponding reduction in variable expenses.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

EXPENSES

Expenses (other than loss adjustment expense) are loaded into the basic limit/full coverage premium by dividing basic limit losses and loss adjustment expenses by the Expected Loss Ratio (ELR):

$$(1) \quad \text{Basic Limit/Full Coverage Premium} = \frac{\text{Basic Limit/Full Coverage Indemnity and Loss Adjustment Expense}}{\text{ELR}}.$$

For calculating deductible discount factors, we load variable expenses as a constant fraction of premium:

$$(2) \quad \text{PREM} = (\text{All Other Costs}) + \text{VER} * \text{PREM}$$

Where VER is the variable expense ratio and PREM is the premium. It follows that

$$(3) \quad \text{PREM}(1 - \text{VER}) = (\text{All Other Costs}), \text{ or}$$

$$(4) \quad \text{PREM} = (\text{All Other Costs}) / (1 - \text{VER}).$$

To load variable expense savings, we divide the expected net indemnity saved by one minus the variable expense ratio:

$$(5) \quad (\text{Total Costs Saved}) = (\text{net indemnity saved}) / (1 - \text{VER}).$$

The deductible discount factor is the ratio of total costs saved to basic limit/full coverage premium. Dividing equation (5) by equation (1), we see that the deductible discount factor can be expressed as the ratio of expected net indemnity saved to basic limit/full coverage indemnity and loss adjustment expense, multiplied by the fixed expense adjustment factor (FEAF). The FEAF adjusts the ratio for fixed expenses, and would be exactly 1.00 if there were no fixed expenses.

$$\begin{aligned} (6) \quad & (\text{Total Costs Saved}) / (\text{Basic Limit Premium}) \\ &= \frac{(\text{Expected Net Indemnity Saved}) / (1 - \text{VER})}{(\text{Basic Limit/Full Coverage Indemnity and Loss Adjustment Expense}) / \text{ELR}} \\ &= \text{LER} * \text{FEAF}. \end{aligned}$$

Here LER stands for Loss Elimination Ratio:

$$(7) \quad \text{LER} = \frac{\text{Expected Net Indemnity Saved}}{\text{Basic Limit/Full Coverage Indemnity and Loss Adjustment Expense}}$$

and FEAF stands for Fixed Expense Adjustment Factor:

$$(8) \quad \text{FEAF} = \text{ELR} / (1 - \text{VER}).$$

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

EXPENSE ASSUMPTIONS	<p>Our assumed values for the ELR and VER (0.7090 and 0.1957, respectively) yield the following value for the FEAF:</p> $\text{FEAF} = 0.8815$ <hr/>
GROSS SAVINGS FROM DEDUCTIBLE	<p>The expected value per occurrence of the amount an insurer seeks from an insured is the gross savings from the deductible. The gross savings from any deductible at any policy limit are calculated by subtracting the expected indemnity for the selected deductible and limit from the expected indemnity for full coverage at that limit.</p> <hr/>
COSTS PER OCCURRENCE	<p>Since the deductible discount factor is a ratio, we can divide the numerator and denominator by the number of occurrences without changing the ratio. This expresses the deductible discount factor in terms of costs per occurrence, rather than costs per policy. This is useful because indemnity costs per occurrence can be described by a severity distribution without modeling claim frequency.</p> <hr/>
CALCULATING GROSS INDEMNITY SAVINGS FOR COMBINED SINGLE LIMIT DEDUCTIBLES	<p>The calculation of the gross indemnity savings per occurrence for Combined Single Limit (CSL) deductibles is very straightforward. The average savings per occurrence at deductible D for a policy written at policy limit L equals the limited average severity at D minus the limited average severity at L + D plus the limited average severity at L. This can be expressed as <math>\text{LAS}(D) - \text{LAS}(L+D) + \text{LAS}(L) = \text{LAS}(D) - (\text{LAS}(L+D) - \text{LAS}(L))</math>. <math>\text{LAS}(D)</math> is the direct savings due to application of the deductible, while <math>(\text{LAS}(L+D) - \text{LAS}(L))</math> is the offset to that savings due to the reduction of damages application of the deductible.</p> <p>Each of these limited average severities is calculated using the fitted mixed exponential occurrence size distributions found in this increased limits filing. The LASs at each combination of CSL deductible and limit for this state group, for the Light and Medium, Heavy, Extra Heavy and the All Other tables are weighted together by occurrence count to produce an average overall savings by deductible and limit. The savings for each deductible will differ by limit due to the interaction of the deductible and limit caused by the reduction of damage application of the deductible. However, the differences in savings by limit are relatively small for the more common small deductibles and so the indicated savings are weighted together across limit by occurrence count to produce a single discount for each deductible. Therefore, we do not provide separate deductible discount factors by limit for any deductible.</p> <p>For Zone-rated risks, which are reviewed on a multistate basis, the estimation process is much simpler. The Zone-rated risks mixed exponential occurrence size distribution is used to calculate the LAS amounts and the indicated savings are weighted across policy limit by occurrence count to produce a single discount for each deductible.</p> <hr/>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

CALCULATING  
GROSS INDEMNITY  
SAVINGS FOR  
PD-ONLY  
DEDUCTIBLES

Due to the interaction of PD losses and Bodily Injury (BI) losses with the PD-only deductible and the CSL policy limit, the analysis of the gross savings per occurrence for PD-only deductibles is more complex than the analysis for CSL deductibles. The gross indemnity saved per occurrence under a PD-only deductible depends on the BI loss per occurrence as well as on the PD loss. For example, the insured loss for an occurrence comprised of a \$2,000 PD loss and a \$20,000 BI loss on a policy with a \$100,000 limit will be reduced from \$22,000 to \$21,000 by the application of a \$1,000 PD-only deductible. An occurrence comprised of a \$2,000 PD loss and a \$100,000 BI loss on the same policy would result in a \$100,000 insured loss regardless of the selected PD-only deductible.

When analyzing the gross indemnity savings for PD-only deductibles we partition the population of Commercial Auto Liability occurrences into three sub-populations.

These are:

- 1) Occurrences comprised only of PD losses
- 2) Occurrences comprised only of BI losses
- 3) Occurrences comprised of both BI and PD losses

Occurrences comprised only of PD losses:

The savings for PD-only deductibles for occurrences comprised only of PD losses were analyzed using the same methodology as the savings for combined single limit deductibles. In both cases the entire loss is subject to the deductible. Fitted mixed exponential occurrence size distributions for occurrences comprised only of PD losses were calculated for Zone-rated risks on a multistate basis and for all other increased limits tables combined by state group. For the non-Zone-rated discount calculations, all tables in this state group are combined due to the similarity of the indications. These distributions were used to evaluate the limited average severities needed to calculate the savings for each deductible and limit combination using the formula: Gross Indemnity Savings = LAS(j) - LAS(i+j) + LAS(i). For each deductible, gross indemnity savings for each limit were weighted by occurrence counts to produce average gross savings.

Occurrences comprised only of BI losses:

There are no savings for PD-only deductibles for occurrences comprised only of BI losses. Further analysis of this sub-population is not necessary. The \$0 savings for this sub-population are weighted together with the average savings for the other sub-populations to determine the overall average savings for each deductible.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

CALCULATING  
GROSS INDEMNITY  
SAVINGS FOR  
PD-ONLY  
DEDUCTIBLES  
(CONTINUED)

Occurrences comprised of both BI and PD losses:

Analysis of the savings for PD-only deductibles for occurrences comprised of both BI and PD losses is more complex. For this sub-population we need to analyze the joint distribution of BI and PD losses. Generally, occurrences with higher BI losses are more likely to also have higher PD losses. This is consistent with both types of losses being highest for more severe accidents. We modeled this relationship by fitting separate mixed exponential loss size distributions to PD losses associated with BI losses of various loss sizes. We split occurrences into five groups by BI loss size intervals (\$1 - \$10,000; \$10,001 - \$20,000; \$20,001 - \$50,000; \$50,001 - \$100,000; and greater than \$100,000) and fit mixed exponential distributions to the PD losses associated with each group. We also fit a single mixed exponential distribution to the BI losses associated with occurrences comprised of both BI and PD losses.

We model the interaction between BI and PD losses using stochastic simulation. This is a straightforward and efficient way to analyze the gross indemnity savings subject to the complex interactions between PD-only deductibles and CSL policy limits. For each occurrence we first generate the BI loss. We then evaluate which BI loss size interval the occurrence belongs in. We then generate a PD loss from the PD loss size distribution associated with that BI loss size interval. This analysis is performed using combined data in this state group for all increased limits tables combined (excluding Zone-rated risks). Gross savings for Zone-rated risks are calculated separately on a multistate basis in the same manner.

Millions of occurrences are simulated. The mean (expected) insured severity across all simulated occurrences under each combination of limit and deductible is calculated. The average gross savings calculated from these severities are weighted across limit to produce a single average savings for each deductible.

Calculating Average Gross Indemnity Savings:

The gross PD-only deductible indemnity savings from each of the sub-populations are weighted together by occurrence counts to produce overall average gross savings for each PD-only deductible separately for Zone-rated risks and all other increased limits tables combined.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

OVERVIEW OF ISO ACTUARIAL PROCEDURES - DEDUCTIBLE DISCOUNT FACTORS

TEMPERING  
FACTOR

While the insurer initially pays the third party, then seeks reimbursement for the deductible from the insured, the insurer does not necessarily always get reimbursed. The expected net indemnity saved is the expected value of the amount the insurer seeks, multiplied by the probability that the insurer actually receives reimbursement for the deductible amount.

Although there are a number of factors that affect the calculation of deductible discount factors, it should be noted that, in general, deductible discount factors will tend to decrease over time (associated final deductible factors, which are 1.0 minus deductible discount factors, will tend to increase over time). This is due to the natural tendency of claims to increase over time and therefore, on average, a fixed deductible amount will tend to become a lower percentage of the overall loss all else being equal.

A tempering factor of 10% has been applied to reflect the possibility that the insurer will not be reimbursed by the insured, as well as the general tendency of DDFs to decrease over time.

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CALCULATION OF  
DEDUCTIBLE  
DISCOUNT FACTOR

To summarize, the deductible discount factor is the ratio of total costs saved to basic limit/full coverage premium. Taking account of expenses, the deductible discount factor is the product of a loss elimination ratio and a fixed expense adjustment factor.

In this context, the loss elimination ratio is the ratio of expected net indemnity saved per policy to basic limit/full coverage (\$0 deductible) indemnity and loss adjustment expense per policy. Expected net indemnity saved is the gross savings from the deductible multiplied by one minus the tempering factor.

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INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF DEDUCTIBLE DISCOUNT FACTORS

ALL NON-ZONE-RATED RISKS  
(State Group 2)

Combined Single Limit Deductible

Deductible Amount (\$,000)	Gross Savings from Deductible	Net Indemnity Savings	Loss Elimination Ratio	Indicated Deductible Discount Factor	Final Deductible Factor
\$250	242	218	0.018	0.016	0.984
\$500	471	424	0.035	0.031	0.969
\$1,000	892	803	0.067	0.059	0.941
\$2,500	1,916	1,724	0.143	0.126	0.874
\$5,000	3,082	2,774	0.231	0.203	0.797
\$10,000	4,429	3,986	0.331	0.292	0.708
\$20,000	5,863	5,276	0.438	0.387	0.613
\$25,000	6,358	5,722	0.476	0.419	0.581
\$50,000	7,961	7,165	0.595	0.525	0.475
\$75,000	8,888	7,999	0.665	0.586	0.414
\$100,000	9,538	8,584	0.713	0.629	0.371

Gross Savings = Average reduction in losses from deductible. (See the "Average" Column on page H-14 for the calculation of these values.)

Net Savings = Net Indemnity savings per occurrence  
= Gross Savings \* (1-Tempering Factor).  
where Tempering Factor = 0.10.

Loss Elimination Ratio = Ratio of Net Savings to Basic Limit Indemnity, ALAE and ULAE costs per occurrence (\$12,034).

Indicated Deductible Discount Factor = Premium Discount indicated for deductible with respect to the full-coverage premium at the basic limit of liability (\$100,000 Combined Single Limit), the product of the loss elimination ratio and the Fixed Expense Adjustment Factor, 0.8815.

Final Deductible Factor = 1- Indicated Deductible Discount Factor.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF DEDUCTIBLE DISCOUNT FACTORS

ZONE-RATED RISKS  
(Multistate)

Combined Single Limit Deductible

Deductible Amount (\$,000)	Gross Savings from Deductible	Net Indemnity Savings	Loss Elimination Ratio	Indicated Deductible Discount Factor	Final Deductible Factor
\$250	244	220	0.011	0.010	0.990
\$500	479	432	0.021	0.019	0.981
\$1,000	926	834	0.042	0.037	0.963
\$2,500	2,099	1,889	0.094	0.083	0.917
\$5,000	3,615	3,253	0.162	0.143	0.857
\$10,000	5,634	5,071	0.253	0.223	0.777
\$20,000	7,918	7,126	0.355	0.313	0.687
\$25,000	8,705	7,834	0.390	0.344	0.656
\$50,000	11,417	10,275	0.512	0.451	0.549
\$75,000	13,170	11,853	0.590	0.520	0.480
\$100,000	14,462	13,016	0.648	0.571	0.429

Gross Savings = Average reduction in losses from deductible. (See the "Average" Column on page H-15 for the calculation of these values.)

Net Savings = Net Indemnity savings per occurrence  
= Gross Savings \* (1-Tempering Factor).  
where Tempering Factor = 0.10.

Loss Elimination Ratio = Ratio of Net Savings to Basic Limit Indemnity, ALAE and ULAE costs per occurrence (\$20,080).

Indicated Deductible Discount Factor = Premium Discount indicated for deductible with respect to the full-coverage premium at the basic limit of liability (\$100,000 Combined Single Limit), the product of the loss elimination ratio and the Fixed Expense Adjustment Factor, 0.8815.

Final Deductible Factor = 1- Indicated Deductible Discount Factor.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF DEDUCTIBLE DISCOUNT FACTORS

ALL NON-ZONE-RATED RISKS  
(State Group 2)

Property Damage Deductible Only

Deductible Amount (\$,000)	Gross Savings from Deductible	Net Indemnity Savings	Loss Elimination Ratio	Indicated Deductible Discount Factor	Final Deductible Factor
\$250	232	208	0.017	0.015	0.985
\$500	448	403	0.034	0.030	0.970
\$1,000	840	756	0.063	0.055	0.945
\$2,500	1,755	1,579	0.131	0.116	0.884
\$5,000	2,704	2,434	0.202	0.178	0.822
\$10,000	3,604	3,244	0.270	0.238	0.762
\$20,000	4,215	3,794	0.315	0.278	0.722
\$25,000	4,345	3,911	0.325	0.286	0.714
\$50,000	4,582	4,124	0.343	0.302	0.698
\$75,000	4,647	4,182	0.348	0.306	0.694
\$100,000	4,678	4,210	0.350	0.308	0.692

Gross Savings = Average reduction in losses from deductible. (See the "Average" Column on page H-16 for the calculation of these values.)

Net Savings = Net Indemnity savings per occurrence  
= Gross Savings \* (1-Tempering Factor).  
where Tempering Factor = 0.10.

Loss Elimination Ratio = Ratio of Net Savings to Basic Limit Indemnity, ALAE and ULAE costs per occurrence (\$12,034).

Indicated Deductible Discount Factor = Premium Discount indicated for deductible with respect to the full-coverage premium at the basic limit of liability (\$100,000 Combined Single Limit), the product of the loss elimination ratio and the Fixed Expense Adjustment Factor, 0.8815.

Final Deductible Factor = 1- Indicated Deductible Discount Factor.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF DEDUCTIBLE DISCOUNT FACTORS

ZONE-RATED RISKS  
(Multistate)

Property Damage Deductible Only

Deductible Amount (\$,000)	Gross Savings from Deductible	Net Indemnity Savings	Loss Elimination Ratio	Indicated Deductible Discount Factor	Final Deductible Factor
\$250	227	205	0.010	0.009	0.991
\$500	445	401	0.020	0.018	0.982
\$1,000	854	769	0.038	0.034	0.966
\$2,500	1,895	1,705	0.085	0.075	0.925
\$5,000	3,153	2,838	0.141	0.125	0.875
\$10,000	4,612	4,151	0.207	0.182	0.818
\$20,000	5,826	5,244	0.261	0.230	0.770
\$25,000	6,126	5,513	0.275	0.242	0.758
\$50,000	6,817	6,135	0.306	0.269	0.731
\$75,000	7,070	6,363	0.317	0.279	0.721
\$100,000	7,196	6,477	0.323	0.284	0.716

Gross Savings = Average reduction in losses from deductible. (See the "Average" Column on page H-17 for the calculation of these values.)

Net Savings = Net Indemnity savings per occurrence  
= Gross Savings \* (1-Tempering Factor).  
where Tempering Factor = 0.10.

Loss Elimination Ratio = Ratio of Net Savings to Basic Limit Indemnity, ALAE and ULAE costs per occurrence (\$20,080).

Indicated Deductible Discount Factor = Premium Discount indicated for deductible with respect to the full-coverage premium at the basic limit of liability (\$100,000 Combined Single Limit), the product of the loss elimination ratio and the Fixed Expense Adjustment Factor, 0.8815.

Final Deductible Factor = 1- Indicated Deductible Discount Factor.

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF AVERAGE GROSS SAVINGS FROM DEDUCTIBLE

ALL NON-ZONE-RATED RISKS  
(State Group 2)

Combined Single Limit Deductible

					<b>Limit:</b>					
	100,000	300,000	500,000	750,000	1,000,000	2,000,000	3,000,000	5,000,000	10,000,000	<b>Average</b>
<b>Deductible</b>					<b>Weight:</b>					
<b>Amount</b>	<i>0.97%</i>	<i>2.35%</i>	<i>4.58%</i>	<i>0.36%</i>	<i>87.93%</i>	<i>3.09%</i>	<i>0.13%</i>	<i>0.58%</i>	<i>0.01%</i>	<i><b>100%</b></i>
\$250	237	240	241	242	242	243	243	243	243	<b>242</b>
\$500	460	467	469	471	471	472	472	472	474	<b>471</b>
\$1,000	869	884	887	894	893	894	894	894	900	<b>892</b>
\$2,500	1,855	1,890	1,896	1,925	1,918	1,918	1,919	1,921	1,945	<b>1,916</b>
\$5,000	2,955	3,022	3,033	3,106	3,087	3,085	3,088	3,092	3,154	<b>3,082</b>
\$10,000	4,175	4,306	4,330	4,470	4,439	4,434	4,444	4,452	4,573	<b>4,429</b>
\$20,000	5,395	5,648	5,701	5,904	5,881	5,881	5,903	5,918	6,103	<b>5,863</b>
\$25,000	5,796	6,104	6,172	6,395	6,379	6,385	6,411	6,428	6,637	<b>6,358</b>
\$50,000	6,976	7,529	7,667	7,986	7,995	8,028	8,076	8,106	8,397	<b>7,961</b>
\$75,000	7,543	8,294	8,502	8,902	8,933	8,997	9,070	9,113	9,437	<b>8,888</b>
\$100,000	7,881	8,797	9,071	9,540	9,592	9,688	9,788	9,843	10,180	<b>9,538</b>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF AVERAGE GROSS SAVINGS FROM DEDUCTIBLE

ZONE-RATED RISKS  
(Multistate)

Combined Single Limit Deductible

					<b>Limit:</b>					
	100,000	300,000	500,000	750,000	1,000,000	2,000,000	3,000,000	5,000,000	10,000,000	<b>Average</b>
<b>Deductible</b>					<b>Weight:</b>					
<b>Amount</b>	<i>0.17%</i>	<i>0.07%</i>	<i>0.48%</i>	<i>0.52%</i>	<i>94.11%</i>	<i>3.49%</i>	<i>0.43%</i>	<i>0.61%</i>	<i>0.12%</i>	<i>100%</i>
\$250	233	240	242	243	244	245	245	245	246	<b>244</b>
\$500	457	472	475	478	479	481	482	482	483	<b>479</b>
\$1,000	882	911	918	924	926	930	931	932	933	<b>926</b>
\$2,500	1,988	2,060	2,079	2,091	2,098	2,108	2,111	2,113	2,114	<b>2,099</b>
\$5,000	3,396	3,537	3,575	3,600	3,614	3,634	3,640	3,644	3,646	<b>3,615</b>
\$10,000	5,206	5,480	5,555	5,605	5,634	5,673	5,684	5,692	5,697	<b>5,634</b>
\$20,000	7,096	7,613	7,761	7,861	7,917	7,994	8,016	8,032	8,042	<b>7,918</b>
\$25,000	7,696	8,326	8,510	8,634	8,703	8,800	8,827	8,847	8,859	<b>8,705</b>
\$50,000	9,568	10,685	11,037	11,278	11,413	11,602	11,656	11,696	11,721	<b>11,417</b>
\$75,000	10,597	12,108	12,617	12,968	13,165	13,442	13,522	13,581	13,619	<b>13,170</b>
\$100,000	11,250	13,090	13,744	14,199	14,455	14,818	14,923	15,001	15,051	<b>14,462</b>



INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF AVERAGE GROSS SAVINGS FROM DEDUCTIBLE

ALL NON-ZONE-RATED RISKS  
(State Group 2)

Property Damage Deductible Only

					<b>Limit:</b>					
	100,000	300,000	500,000	750,000	1,000,000	2,000,000	3,000,000	5,000,000	10,000,000	<b>Average</b>
<b>Deductible</b>					<b>Weight:</b>					
<b>Amount</b>	<i>0.97%</i>	<i>2.35%</i>	<i>4.58%</i>	<i>0.36%</i>	<i>87.93%</i>	<i>3.09%</i>	<i>0.13%</i>	<i>0.58%</i>	<i>0.01%</i>	<i><b>100%</b></i>
\$250	227	230	231	232	232	232	232	232	232	<b>232</b>
\$500	439	445	446	449	448	449	449	449	450	<b>448</b>
\$1,000	821	833	835	843	841	842	842	843	846	<b>840</b>
\$2,500	1,702	1,730	1,735	1,769	1,757	1,756	1,759	1,760	1,775	<b>1,755</b>
\$5,000	2,596	2,646	2,656	2,740	2,710	2,704	2,713	2,717	2,752	<b>2,704</b>
\$10,000	3,405	3,491	3,511	3,670	3,614	3,603	3,625	3,633	3,687	<b>3,604</b>
\$20,000	3,913	4,045	4,079	4,302	4,230	4,216	4,256	4,268	4,324	<b>4,215</b>
\$25,000	4,012	4,158	4,198	4,437	4,361	4,346	4,392	4,405	4,459	<b>4,345</b>
\$50,000	4,173	4,354	4,406	4,684	4,600	4,586	4,646	4,662	4,709	<b>4,582</b>
\$75,000	4,207	4,400	4,458	4,754	4,667	4,652	4,718	4,737	4,781	<b>4,647</b>
\$100,000	4,221	4,420	4,481	4,788	4,699	4,684	4,755	4,774	4,818	<b>4,678</b>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF AVERAGE GROSS SAVINGS FROM DEDUCTIBLE

ZONE-RATED RISKS  
(Multistate)

Property Damage Deductible Only

					<b>Limit:</b>					
	100,000	300,000	500,000	750,000	1,000,000	2,000,000	3,000,000	5,000,000	10,000,000	<b>Average</b>
<b>Deductible</b>					<b>Weight:</b>					
<b>Amount</b>	<i>0.17%</i>	<i>0.07%</i>	<i>0.48%</i>	<i>0.52%</i>	<i>94.11%</i>	<i>3.49%</i>	<i>0.43%</i>	<i>0.61%</i>	<i>0.12%</i>	<i>100%</i>
\$250	218	224	226	227	227	228	228	228	228	<b>227</b>
\$500	426	438	441	444	445	447	447	447	447	<b>445</b>
\$1,000	816	839	847	852	854	857	857	857	857	<b>854</b>
\$2,500	1,802	1,857	1,876	1,888	1,895	1,901	1,901	1,901	1,901	<b>1,895</b>
\$5,000	2,979	3,082	3,118	3,141	3,153	3,164	3,165	3,165	3,165	<b>3,153</b>
\$10,000	4,303	4,486	4,549	4,591	4,612	4,633	4,634	4,634	4,634	<b>4,612</b>
\$20,000	5,325	5,621	5,725	5,792	5,827	5,859	5,862	5,863	5,863	<b>5,826</b>
\$25,000	5,556	5,892	6,010	6,087	6,126	6,163	6,167	6,167	6,167	<b>6,126</b>
\$50,000	6,050	6,502	6,661	6,764	6,817	6,867	6,872	6,873	6,873	<b>6,817</b>
\$75,000	6,211	6,716	6,896	7,011	7,070	7,127	7,133	7,134	7,134	<b>7,070</b>
\$100,000	6,281	6,818	7,010	7,134	7,196	7,258	7,264	7,266	7,266	<b>7,196</b>

INCREASED LIMIT FACTORS  
COMMERCIAL AUTOMOBILE LIABILITY

CALCULATION OF INDICATED CHANGES

Combined Single Limit Deductible

Deduct <u>Amount</u>	Non-Zone (Multistate) Current <u>Factor</u>	Non-Zone (StGrp 2) Indicated <u>Factor</u>	Percent. <u>Change</u>	Zone-rated (Multistate) Current <u>Factor</u>	Zone-rated (Multistate) Indicated <u>Factor</u>	Percent. <u>Change</u>
250	0.976	0.984	0.8%	0.985	0.990	0.5%
500	0.954	0.969	1.6%	0.970	0.981	1.1%
1,000	0.914	0.941	3.0%	0.942	0.963	2.2%
2,500	0.825	0.874	5.9%	0.874	0.917	4.9%
5,000	0.734	0.797	8.6%	0.794	0.857	7.9%
10,000	0.637	0.708	11.1%	0.700	0.777	11.0%
20,000	0.523	0.613	17.2%	0.600	0.687	14.5%
25,000	0.484	0.581	20.0%	0.565	0.656	16.1%
50,000	0.365	0.475	30.1%	0.442	0.549	24.2%
75,000	0.302	0.414	37.1%	0.370	0.480	29.7%
100,000	0.261	0.371	42.1%	0.320	0.429	34.1%

Property Damage Deductible Only

Deduct <u>Amount</u>	Non-Zone (Multistate) Current <u>Factor</u>	Non-Zone (StGrp 2) Indicated <u>Factor</u>	Percent. <u>Change</u>	Zone-rated (Multistate) Current <u>Factor</u>	Zone-rated (Multistate) Indicated <u>Factor</u>	Percent. <u>Change</u>
250	0.978	0.985	0.7%	0.986	0.991	0.5%
500	0.958	0.970	1.3%	0.972	0.982	1.0%
1,000	0.922	0.945	2.5%	0.947	0.966	2.0%
2,500	0.846	0.884	4.5%	0.888	0.925	4.2%
5,000	0.778	0.822	5.7%	0.825	0.875	6.1%
10,000	0.727	0.762	4.8%	0.767	0.818	6.6%
20,000	0.698	0.722	3.4%	0.732	0.770	5.2%
25,000	0.692	0.714	3.2%	0.725	0.758	4.6%
50,000	0.679	0.698	2.8%	0.708	0.731	3.2%
75,000	0.674	0.694	3.0%	0.699	0.721	3.1%
100,000	0.671	0.692	3.1%	0.693	0.716	3.3%