

DELAWARE COMPENSATION RATING BUREAU, INC.

Tail Factors and Paid Bridge Factors for Loss Development

For a given calendar year, the DCRB collects financial loss development data for the current policy year and the thirty previous individual policy years. A single aggregate line of experience is reported for all older policy years combined.

The DCRB's incurred tail factor methodology is applied separately for indemnity and medical loss experience using two separate methods. These two methods, which are described below, are averaged to generate the selected tail factors. A summary of the results of both methods is shown on Page 1.

The first tail method uses a ten-year arithmetic average of loss development factors from 20th and beyond. The derivation of the tail factors using this approach are shown on Page 2.

The second tail method, the Weibull curve fit method, is a commonly used distribution for fitting Workers Compensation data. A number of Weibull models were generated and reviewed using various data points and calendar years to fit the data to project the 20th to ultimate incurred tail factor. A Weibull fit was selected for indemnity and medical from the various models generated. The model selections for indemnity and medical were considered separately to contemplate their unique characteristics relating to model fit, the stability of the data points and consistency of the development patterns before and after the tail attachment point. The detail of each of the selected Weibull models is shown on Page 3.

Pages 4 (indemnity) and 5 (medical) show the selected curves for the 20-ult incurred to paid loss development factors ("bridge" factors) and the development periods used to select the curve. The average of the fitted factors from 20-21 to 50th-Ultimate was selected for both indemnity and medical. The 50th point was selected as the cutoff as the data shows that is the point where virtually all claims have been historically settled.

Page 6 shows graphically the two selected curve fits, and the resulting bridge factors based on the average of the points between the 20th and 50th reports.

Limited Incurred Tail Factor Summary

(1) Average of Incurred 20th-Ultimate Loss Development Factors (Page 2)

Indemnity	0.9956	Medical	0.9857
Based on:		Based on:	
Average	10-Year	Average	10-Year (x H/L)
Data Points Used	20-29+	Data Points Used	20-29+

(2) Incurred Tail Selections using a Weibull Curve Fit (Page 3)

Indemnity	1.0024	Medical	1.0050
Based on:		Based on:	
Average	8-Year	Average	8-Year
Data Points Used	1-19	Data Points Used	1-19

(3) Incurred Tail Selections using a 50/50 Weight Between (1) and (2)

Indemnity	0.9990	Medical	0.9953
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(4) Paid to Incurred Bridge Factors (Pages 4 through 5)

Indemnity	1.0035	Medical	1.0312
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(5) Paid Tail Selections ((3) * (4))

Indemnity	1.0025	Medical	1.0264
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10-Year Average of Incurred 20th-Ultimate Loss Development Factors

INDEMNITY	Incurred LDF 13-14	Incurred LDF 14-15	Incurred LDF 15-16	Incurred LDF 16-17	Incurred LDF 17-18	Incurred LDF 18-19	Incurred LDF 19-20	Incurred LDF 20-21	Incurred LDF 21-22	Incurred LDF 22-23	Incurred LDF 23-24	Incurred LDF 24-25	10-Year Average LDF
20-ULT	0.9911	1.0228	0.9707	1.0066	0.9738	0.9939	1.0031	0.9933	0.9899	1.0172	0.9775	1.0303	0.9956
Beyond	0.9896	0.9994	1.0004	1.0016	0.9820	0.9956	1.0001	0.9957	0.9963	1.0194	0.9837	1.0314	1.0006
29-30			0.9939	1.0068	0.9996	1.0013	1.0006	0.9990	0.9999	1.0000	1.0000	0.9981	0.9999
28-29		0.9993	0.9989	0.9994	0.9999	0.9993	0.9988	1.0000	1.0000	0.9999	0.9991	0.9996	0.9995
27-28	1.0005	0.9990	0.9988	0.9976	1.0010	0.9989	0.9987	0.9999	0.9991	0.9944	0.9975	1.0005	0.9986
26-27	0.9997	1.0017	0.9993	1.0029	0.9989	0.9982	1.0013	0.9955	0.9983	0.9991	1.0005	1.0001	0.9994
25-26	0.9990	0.9954	0.9987	0.9970	0.9989	0.9998	1.0008	1.0001	0.9988	1.0004	1.0001	1.0000	0.9995
24-25	0.9978	1.0149	0.9966	0.9985	0.9964	1.0022	1.0021	1.0005	0.9998	1.0001	1.0000	1.0000	0.9996
23-24	0.9988	1.0008	0.9979	1.0005	1.0044	0.9986	0.9993	1.0004	0.9996	1.0018	0.9991	0.9990	1.0001
22-23	1.0086	0.9991	0.9990	1.0024	1.0005	0.9979	1.0014	1.0003	1.0000	1.0010	0.9987	1.0009	1.0002
21-22	0.9983	1.0029	0.9942	0.9998	0.9915	1.0024	1.0000	1.0000	0.9990	1.0023	0.9977	1.0003	0.9987
20-21	0.9989	1.0102	0.9926	1.0001	1.0006	0.9997	1.0000	1.0019	0.9992	0.9989	1.0009	1.0004	0.9994

MEDICAL	Incurred LDF 13-14	Incurred LDF 14-15	Incurred LDF 15-16	Incurred LDF 16-17	Incurred LDF 17-18	Incurred LDF 18-19	Incurred LDF 19-20	Incurred LDF 20-21	Incurred LDF 21-22	Incurred LDF 22-23	Incurred LDF 23-24	Incurred LDF 24-25	10-Year (xH/L) Average LDF
20-ULT	1.0328	1.0526	1.0339	0.9962	1.0528	0.9990	0.8932	0.9181	0.9568	1.0069	0.9553	1.0195	0.9857
Beyond	1.0165	0.9826	1.0067	1.0318	0.9970	1.0084	0.9598	0.9672	1.0068	1.0241	0.9931	1.0351	1.0030
29-30			1.0004	0.9915	1.0016	1.0021	0.9857	1.0023	1.0018	0.9955	0.9992	1.0051	0.9985
28-29		1.0013	1.0077	1.0013	0.9971	1.0009	1.0040	1.0001	1.0025	0.9896	0.9874	0.9993	0.9990
27-28	1.0056	1.0083	1.0017	1.0068	1.0106	1.0004	0.9966	1.0000	0.9983	1.0045	0.9922	1.0012	1.0012
26-27	1.0041	1.0040	1.0050	0.9929	1.0069	1.0030	0.9776	0.9823	1.0027	1.0011	1.0007	0.9983	0.9971
25-26	0.9967	1.0121	1.0134	1.0019	0.9955	1.0126	0.9881	0.9952	0.9776	1.0000	0.9963	0.9987	0.9979
24-25	1.0077	1.0115	0.9996	1.0000	1.0081	1.0129	0.9974	0.9952	0.9997	1.0022	1.0000	0.9992	1.0014
23-24	1.0027	1.0039	1.0083	0.9994	1.0152	0.9966	0.9965	1.0009	0.9999	0.9972	0.9977	0.9842	0.9996
22-23	0.9838	1.0153	1.0001	1.0041	1.0037	0.9798	0.9976	0.9884	0.9890	1.0013	1.0024	1.0014	0.9968
21-22	1.0034	1.0070	0.9865	0.9735	1.0010	0.9870	0.9884	0.9864	0.9907	0.9909	0.9840	0.9976	0.9886
20-21	1.0122	1.0058	1.0042	0.9940	1.0151	0.9958	0.9967	0.9975	0.9871	1.0007	1.0016	1.0001	0.9993

The Estimation of Loss Development Tail Factors: Weibull Curve Fit

Eight-Year Average of Incurred Development Factors

Development Period	Average Age of Claim (x)	Unfitted Indemnity LDF	Fitted Cumulative Indemnity LDF *	Unfitted Medical LDF	Fitted Cumulative Medical LDF *
(2)	(3)	(4)	(5)	(6)	(7)
1/2	1.5	1.3720	1.6448	1.0581	1.1310
2/3	2.5	1.1307	1.4286	1.0107	1.1102
3/4	3.5	1.0596	1.2980	0.9907	1.0928
4/5	4.5	1.0257	1.2131	1.0049	1.0782
5/6	5.5	1.0129	1.1553	1.0086	1.0660
6/7	6.5	1.0104	1.1147	0.9962	1.0557
7/8	7.5	1.0059	1.0855	1.0004	1.0470
8/9	8.5	1.0065	1.0641	1.0052	1.0396
9/10	9.5	1.0037	1.0483	1.0036	1.0335
10/11	10.5	1.0028	1.0366	1.0029	1.0282
11/12	11.5	1.0022	1.0277	0.9980	1.0238
12/13	12.5	1.0009	1.0211	0.9935	1.0201
13/14	13.5	1.0031	1.0161	1.0007	1.0169
14/15	14.5	1.0008	1.0122	1.0010	1.0142
15/16	15.5	0.9986	1.0093	1.0000	1.0120
16/17	16.5	1.0019	1.0071	0.9955	1.0101
17/18	17.5	1.0004	1.0055	0.9897	1.0085
18/19	18.5	1.0000	1.0042	0.9978	1.0071
19/20	19.5	1.0004	1.0032	0.9973	1.0060
20/21	20.5	1.0002	1.0024	0.9993	1.0050

Curve Fit Parameters

	Data Points Used	# of Data Points Used	Selected Parameters			Tail Factor
		λ	c	t	20th - Ult	
Indemnity	1-19	19	0.268	2.000	1.000	1.0024
Medical	1-19	19	0.080	15.000	1.175	1.0050

* Fitted Cumulative LDF (5) & (7) = $1 / e^{(-\lambda(x+c)^t)}$

INDEMNITY PAID TO INCURRED BRIDGE FACTOR

<u>EQUATION COEFFICIENTS</u>	Model	Y = a+b/x+c/x^2+d/x^3+e/x^4			
	a	(0.001595301)			
	b	0.083611036			
	c	2.553342447			
	d	(1.813052702)			
	e	0.159563305			
	R^2	0.9993			
	<u>Report</u>	<u>4 Year Average</u>	<u>Points Used</u>	<u>Fitted Value</u>	<u>Selected</u>
	1st	1.9819	1.9819	1.9819	
	2nd	1.4605	1.4605	1.4619	
	3rd	1.2500	1.2500	1.2448	
	4th	1.1528	1.1528	1.1512	
	5th	1.0919	1.0919	1.1030	
	6th	1.0834	1.0834	1.0750	
	7th	1.0561	1.0561	1.0572	
	8th	1.0318	1.0318	1.0452	
	9th	1.0324	1.0324	1.0368	
	10th	1.0268	1.0268	1.0305	
	11th	1.0273	1.0273	1.0258	
	12th	1.0253	1.0253	1.0221	
	13th	1.0308	1.0308	1.0191	
	14th	1.0224	1.0224	1.0167	
	15th	1.0231	1.0231	1.0148	
	16th	1.0198	1.0198	1.0132	
	17th	1.0123	1.0123	1.0118	
	18th	1.0099	1.0099	1.0106	
	19th	1.0113	1.0113	1.0096	
	20th	1.0057	1.0057	1.0087	1.0087
	21st	1.0076	1.0076	1.0080	1.0080
	22nd	1.0089	1.0089	1.0073	1.0073
	23rd	1.0061	1.0061	1.0067	1.0067
	24th	1.0048	1.0048	1.0062	1.0062
	25th	1.0034	1.0034	1.0057	1.0057
	26th	1.0013	1.0013	1.0053	1.0053
	27th	1.0019	1.0019	1.0049	1.0049
	28th	1.0029	1.0029	1.0046	1.0046
	29th	1.0026	1.0026	1.0042	1.0042
	30th	1.0029	1.0029	1.0040	1.0040
	31st			1.0037	1.0037
	32nd			1.0035	1.0035
	33rd			1.0032	1.0032
	34th			1.0030	1.0030
	35th			1.0028	1.0028
	36th			1.0027	1.0027
	37th			1.0025	1.0025
	38th			1.0023	1.0023
	39th			1.0022	1.0022
	40th			1.0021	1.0021
	41st			1.0019	1.0019
	42nd			1.0018	1.0018
	43rd			1.0017	1.0017
	44th			1.0016	1.0016
	45th			1.0015	1.0015
	46th			1.0014	1.0014
	47th			1.0013	1.0013
	48th			1.0012	1.0012
	49th			1.0012	1.0012
	50-Ult *	1.0000	1.0000	1.0011	1.0011

Bridge Factor (Average of Selected Factors)

1.0035

* Selected

MEDICAL PAID TO INCURRED BRIDGE FACTOR

<u>EQUATION</u> <u>COEFFICIENTS</u>	Model	Y = a+b*log(x)/x+c*exp(-x)
	a	(0.000615732)
	b	0.300553436
	c	1.937129236

R^2 0.9848

<u>Report</u>	<u>4 Year Average</u>	<u>Points Used</u>	<u>Fitted Value</u>	<u>Selected</u>
1st	1.7164	1.7164	1.7120	
2nd	1.3498	1.3498	1.3657	
3rd	1.2159	1.2159	1.2059	
4th	1.1500	1.1500	1.1390	
5th	1.0926	1.0926	1.1092	
6th	1.0831	1.0831	1.0939	
7th	1.0662	1.0662	1.0847	
8th	1.0667	1.0667	1.0782	
9th	1.0719	1.0719	1.0730	
10th	1.0611	1.0611	1.0687	
11th	1.0798	1.0798	1.0649	
12th	1.0712	1.0712	1.0616	
13th	1.0722	1.0722	1.0587	
14th	1.0657	1.0657	1.0560	
15th	1.0583	1.0583	1.0536	
16th	1.0629	1.0629	1.0515	
17th	1.0609	1.0609	1.0495	
18th	1.0748	1.0748	1.0476	
19th	1.0844	1.0844	1.0460	
20th	1.0660	1.0660	1.0444	1.0444
21st	1.0715	1.0715	1.0430	1.0430
22nd	1.0441	1.0441	1.0416	1.0416
23rd	1.0328	1.0328	1.0404	1.0404
24th	1.0252	1.0252	1.0392	1.0392
25th	1.0292	1.0292	1.0381	1.0381
26th	1.0195	1.0195	1.0370	1.0370
27th	1.0216	1.0216	1.0361	1.0361
28th	1.0243	1.0243	1.0352	1.0352
29th	1.0167	1.0167	1.0343	1.0343
30th	1.0105	1.0105	1.0335	1.0335
31st			1.0327	1.0327
32nd			1.0319	1.0319
33rd			1.0312	1.0312
34th			1.0306	1.0306
35th			1.0299	1.0299
36th			1.0293	1.0293
37th			1.0287	1.0287
38th			1.0282	1.0282
39th			1.0276	1.0276
40th			1.0271	1.0271
41st			1.0266	1.0266
42nd			1.0261	1.0261
43rd			1.0257	1.0257
44th			1.0252	1.0252
45th			1.0248	1.0248
46th			1.0244	1.0244
47th			1.0240	1.0240
48th			1.0236	1.0236
49th			1.0233	1.0233
50-Ult *	1.0000	1.0000	1.0229	1.0229

Bridge Factor (Average of Selected Factors)

1.0312

* Selected

