

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	0.9931	Medical	1.0158
Based on:		Based on:	
Average	10-Year	Average	10-Year
Data Points Used	20-29+	Data Points Used	20-29+

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

Indemnity	1.0082	Medical	1.0225
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	1.0007	Medical	1.0192
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(4) Paid to Incurred Bridge Factors (Pages 4 through 5)

Indemnity	1.0044	Medical	1.0266
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(5) Paid Tail Selections ((3) * (4))

Indemnity	1.0051	Medical	1.0463
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10-Year Average of Incurred 20th-Ultimate Loss Development Factors

INDEMNITY	Incurred LDF 11-12	Incurred LDF 12-13	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	10-Year Average LDF
20-ULT	0.9915	0.9808	0.9911	1.0228	0.9707	1.0066	0.9738	0.9950	1.0046	0.9941	0.9931
Beyond	0.9939	0.9941	0.9896	0.9994	1.0004	1.0016	0.9820	0.9980	1.0016	0.9966	0.9957
29-30					0.9939	1.0068	0.9996	1.0000	1.0006	0.9988	1.0000
28-29				0.9993	0.9989	0.9994	0.9999	0.9993	0.9988	0.9997	0.9993
27-28			1.0005	0.9990	0.9988	0.9976	1.0010	0.9989	0.9987	0.9999	0.9993
26-27		0.9984	0.9997	1.0017	0.9993	1.0029	0.9989	0.9982	1.0013	0.9959	0.9996
25-26	1.0008	0.9901	0.9990	0.9954	0.9987	0.9970	0.9989	0.9998	1.0008	1.0001	0.9981
24-25	1.0001	1.0041	0.9978	1.0149	0.9966	0.9985	0.9964	1.0022	1.0021	1.0009	1.0014
23-24	1.0009	1.0022	0.9988	1.0008	0.9979	1.0005	1.0044	0.9986	0.9993	1.0000	1.0003
22-23	0.9987	0.9986	1.0086	0.9991	0.9990	1.0024	1.0005	0.9979	1.0014	1.0003	1.0007
21-22	0.9993	0.9968	0.9983	1.0029	0.9942	0.9998	0.9915	1.0024	1.0000	1.0000	0.9985
20-21	0.9978	0.9964	0.9989	1.0102	0.9926	1.0001	1.0006	0.9997	1.0000	1.0019	0.9998

MEDICAL	Incurred LDF 11-12	Incurred LDF 12-13	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	10-Year Average LDF
20-ULT	1.0260	1.0477	1.0328	1.0526	1.0339	0.9962	1.0528	1.0092	0.9816	0.9254	1.0158
Beyond	1.0072	1.0553	1.0165	0.9826	1.0067	1.0318	0.9970	1.0187	1.0548	0.9745	1.0145
29-30					1.0004	0.9915	1.0016	1.0021	0.9857	1.0027	0.9973
28-29				1.0013	1.0077	1.0013	0.9971	1.0009	1.0040	0.9992	1.0016
27-28			1.0056	1.0083	1.0017	1.0068	1.0106	1.0004	0.9966	1.0000	1.0038
26-27		0.9757	1.0041	1.0040	1.0050	0.9929	1.0069	1.0030	0.9776	0.9823	0.9946
25-26	1.0013	1.0281	0.9967	1.0121	1.0134	1.0019	0.9955	1.0126	0.9881	0.9954	1.0045
24-25	1.0090	0.9995	1.0077	1.0115	0.9996	1.0000	1.0081	1.0129	0.9974	0.9950	1.0041
23-24	1.0022	1.0027	1.0027	1.0039	1.0083	0.9994	1.0152	0.9966	0.9965	1.0015	1.0029
22-23	1.0001	0.9917	0.9838	1.0153	1.0001	1.0041	1.0037	0.9798	0.9976	0.9884	0.9965
21-22	1.0065	0.9944	1.0034	1.0070	0.9865	0.9735	1.0010	0.9870	0.9884	0.9866	0.9934
20-21	0.9995	1.0014	1.0122	1.0058	1.0042	0.9940	1.0151	0.9958	0.9967	0.9975	1.0022

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	1.3452	1.1568	1.1427	1.3897
2/3	2.5	1.1174	1.1324	1.0641	1.3250
3/4	3.5	1.0516	1.1121	1.0276	1.2732
4/5	4.5	1.0251	1.0952	1.0349	1.2310
5/6	5.5	1.0171	1.0811	1.0322	1.1964
6/7	6.5	1.0183	1.0692	1.0156	1.1677
7/8	7.5	1.0083	1.0591	1.0214	1.1437
8/9	8.5	1.0090	1.0505	1.0152	1.1234
9/10	9.5	1.0058	1.0433	1.0106	1.1063
10/11	10.5	1.0048	1.0371	1.0049	1.0918
11/12	11.5	1.0022	1.0318	1.0005	1.0794
12/13	12.5	1.0006	1.0273	1.0067	1.0688
13/14	13.5	1.0023	1.0235	1.0086	1.0596
14/15	14.5	0.9996	1.0202	1.0014	1.0518
15/16	15.5	0.9974	1.0174	1.0032	1.0450
16/17	16.5	1.0003	1.0149	0.9995	1.0391
17/18	17.5	0.9993	1.0129	0.9939	1.0341
18/19	18.5	0.9993	1.0111	0.9981	1.0297
19/20	19.5	0.9985	1.0095	0.9992	1.0259
20/21	20.5	1.0005	1.0082	1.0027	1.0225

Curve Fit Parameters

	Data Points Used	# of Data Points Used	Selected Parameters			Tail Factor
		λ	c	t	20th - Ult	
Indemnity	1-19	19	0.148	12.000	1.000	1.0082
Medical	1-19	19	0.134	8.000	1.000	1.0225

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

INDEMNITY PAID TO INCURRED BRIDGE FACTOR

<u>EQUATION</u> <u>COEFFICIENTS</u>	Model	$Y = a \cdot (1+x)^b$
	a	5.273724025
	b	(2.039034014)

R^2 0.9943

<u>Report</u>	<u>4 Year Average</u>	<u>Points Used</u>	<u>Fitted Value</u>	<u>Selected</u>
1st	2.2634	2.2634	2.2832	
2nd	1.6419	1.6419	1.5614	
3rd	1.2958	1.2958	1.3122	
4th	1.1525	1.1525	1.1981	
5th	1.1175	1.1175	1.1366	
6th	1.0761	1.0761	1.0998	
7th	1.0628	1.0628	1.0760	
8th	1.0548	1.0548	1.0598	
9th	1.0509	1.0509	1.0482	
10th	1.0434	1.0434	1.0397	
11th	1.0409	1.0409	1.0332	
12th	1.0380	1.0380	1.0282	
13th	1.0236	1.0236	1.0243	
14th	1.0204	1.0204	1.0211	
15th	1.0201	1.0201	1.0185	
16th	1.0128	1.0128	1.0163	
17th	1.0139	1.0139	1.0145	
18th	1.0154	1.0154	1.0130	
19th	1.0089	1.0089	1.0117	
20th	1.0095	1.0095	1.0106	1.0106
21st	1.0074	1.0074	1.0097	1.0097
22nd	1.0057	1.0057	1.0088	1.0088
23rd	1.0046	1.0046	1.0081	1.0081
24th	1.0082	1.0082	1.0074	1.0074
25th	1.0081	1.0081	1.0069	1.0069
26th	1.0064	1.0064	1.0064	1.0064
27th	1.0039	1.0039	1.0059	1.0059
28th	1.0069	1.0069	1.0055	1.0055
29th	1.0081	1.0081	1.0051	1.0051
30th	1.0079	1.0079	1.0048	1.0048
31st			1.0045	1.0045
32nd			1.0042	1.0042
33rd			1.0040	1.0040
34th			1.0037	1.0037
35th			1.0035	1.0035
36th			1.0033	1.0033
37th			1.0032	1.0032
38th			1.0030	1.0030
39th			1.0029	1.0029
40th			1.0027	1.0027
41st			1.0026	1.0026
42nd			1.0025	1.0025
43rd			1.0023	1.0023
44th			1.0022	1.0022
45th			1.0021	1.0021
46th			1.0021	1.0021
47th			1.0020	1.0020
48th			1.0019	1.0019
49th			1.0018	1.0018
50-Ult *	1.0000	1.0000	1.0017	1.0017

Bridge Factor (Average of Selected Factors)

1.0044

* Selected

MEDICAL PAID TO INCURRED BRIDGE FACTOR

<u>EQUATION</u> <u>COEFFICIENTS</u>	Model	$Y = a + b/x^{.5} + c \cdot \ln(x)/x^2$
	a	0.187067143
	b	(0.034085372)
	c	1.396719098
	R^2	0.9563

<u>Report</u>	<u>4 Year Average</u>	<u>Points Used</u>	<u>Fitted Value</u>	<u>Selected</u>
1st	1.7139	1.7139	1.7068	
2nd	1.3251	1.3251	1.2621	
3rd	1.2061	1.2061	1.2165	
4th	1.1488	1.1488	1.1952	
5th	1.1314	1.1314	1.1783	
6th	1.1103	1.1103	1.1637	
7th	1.1058	1.1058	1.1509	
8th	1.1148	1.1148	1.1394	
9th	1.1271	1.1271	1.1293	
10th	1.1442	1.1442	1.1201	
11th	1.1258	1.1258	1.1119	
12th	1.1223	1.1223	1.1044	
13th	1.1024	1.1024	1.0976	
14th	1.1162	1.1162	1.0914	
15th	1.1238	1.1238	1.0856	
16th	1.1109	1.1109	1.0804	
17th	1.1183	1.1183	1.0755	
18th	1.0839	1.0839	1.0709	
19th	1.0665	1.0665	1.0667	
20th	1.0673	1.0673	1.0627	1.0627
21st	1.0592	1.0592	1.0590	1.0590
22nd	1.0584	1.0584	1.0555	1.0555
23rd	1.0517	1.0517	1.0522	1.0522
24th	1.0580	1.0580	1.0491	1.0491
25th	1.0526	1.0526	1.0462	1.0462
26th	1.0355	1.0355	1.0434	1.0434
27th	1.0171	1.0171	1.0407	1.0407
28th	1.0294	1.0294	1.0382	1.0382
29th	1.0251	1.0251	1.0358	1.0358
30th	1.0137	1.0137	1.0335	1.0335
31st			1.0314	1.0314
32nd			1.0293	1.0293
33rd			1.0273	1.0273
34th			1.0253	1.0253
35th			1.0235	1.0235
36th			1.0217	1.0217
37th			1.0200	1.0200
38th			1.0184	1.0184
39th			1.0168	1.0168
40th			1.0153	1.0153
41st			1.0138	1.0138
42nd			1.0124	1.0124
43rd			1.0110	1.0110
44th			1.0097	1.0097
45th			1.0084	1.0084
46th			1.0071	1.0071
47th			1.0059	1.0059
48th			1.0047	1.0047
49th			1.0036	1.0036
50-Ult *	1.0000	1.0000	1.0025	1.0025

Bridge Factor (Average of Selected Factors)

1.0266

* Selected

Paid Tail Bridge Factors

