

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	0.9981	Medical	1.0053
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	1.0016	Medical	1.0080
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	<input type="text" value="0.9999"/>	Medical	<input type="text" value="1.0067"/>
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(4) Paid to Incurred Bridge Factors (Pages 4 through 5)

Indemnity	1.0038	Medical	1.0336
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(5) Paid Tail Selections ((3) * (4))

Indemnity	<input type="text" value="1.0037"/>	Medical	<input type="text" value="1.0405"/>
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10-Year Average of Incurred 20th-Ultimate Loss Development Factors

INDEMNITY	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	Incurred LDF 21-22	Incurred LDF 22-23	10-Year Average LDF
20-ULT	0.9808	0.9911	1.0228	0.9707	1.0066	0.9738	0.9939	1.0031	0.9933	0.9962	1.0296	0.9981
Beyond	0.9941	0.9896	0.9994	1.0004	1.0016	0.9820	0.9956	1.0001	0.9958	1.0027	1.0336	1.0001
29-30				0.9939	1.0068	0.9996	1.0013	1.0006	0.9988	0.9999	1.0000	1.0001
28-29			0.9993	0.9989	0.9994	0.9999	0.9993	0.9988	0.9997	1.0000	0.9999	0.9995
27-28		1.0005	0.9990	0.9988	0.9976	1.0010	0.9989	0.9987	0.9999	0.9989	0.9944	0.9988
26-27	0.9984	0.9997	1.0017	0.9993	1.0029	0.9989	0.9982	1.0013	0.9959	0.9983	0.9991	0.9995
25-26	0.9901	0.9990	0.9954	0.9987	0.9970	0.9989	0.9998	1.0008	1.0001	0.9988	1.0004	0.9989
24-25	1.0041	0.9978	1.0149	0.9966	0.9985	0.9964	1.0022	1.0021	1.0009	0.9998	1.0001	1.0009
23-24	1.0022	0.9988	1.0008	0.9979	1.0005	1.0044	0.9986	0.9993	1.0000	0.9996	1.0000	1.0000
22-23	0.9986	1.0086	0.9991	0.9990	1.0024	1.0005	0.9979	1.0014	1.0003	1.0000	1.0010	1.0010
21-22	0.9968	0.9983	1.0029	0.9942	0.9998	0.9915	1.0024	1.0000	1.0000	0.9990	1.0023	0.9990
20-21	0.9964	0.9989	1.0102	0.9926	1.0001	1.0006	0.9997	1.0000	1.0019	0.9992	0.9989	1.0002

MEDICAL	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	Incurred LDF 21-22	Incurred LDF 22-23	10-Year (xH/L) Average LDF
20-ULT	1.0477	1.0328	1.0526	1.0339	0.9962	1.0528	0.9990	0.8932	0.9283	0.9465	1.1166	1.0053
Beyond	1.0553	1.0165	0.9826	1.0067	1.0318	0.9970	1.0084	0.9598	0.9777	0.9960	1.1325	1.0109
29-30				1.0004	0.9915	1.0016	1.0021	0.9857	1.0027	1.0018	0.9955	0.9977
28-29			1.0013	1.0077	1.0013	0.9971	1.0009	1.0040	0.9992	1.0025	0.9896	1.0004
27-28		1.0056	1.0083	1.0017	1.0068	1.0106	1.0004	0.9966	1.0000	0.9983	1.0045	1.0033
26-27	0.9757	1.0041	1.0040	1.0050	0.9929	1.0069	1.0030	0.9776	0.9823	1.0027	1.0011	0.9980
25-26	1.0281	0.9967	1.0121	1.0134	1.0019	0.9955	1.0126	0.9881	0.9954	0.9776	1.0000	0.9993
24-25	0.9995	1.0077	1.0115	0.9996	1.0000	1.0081	1.0129	0.9974	0.9950	0.9997	1.0023	1.0034
23-24	1.0027	1.0027	1.0039	1.0083	0.9994	1.0152	0.9966	0.9965	1.0015	0.9999	1.0001	1.0024
22-23	0.9917	0.9838	1.0153	1.0001	1.0041	1.0037	0.9798	0.9976	0.9884	0.9890	1.0013	0.9963
21-22	0.9944	1.0034	1.0070	0.9865	0.9735	1.0010	0.9870	0.9884	0.9866	0.9907	0.9909	0.9915
20-21	1.0014	1.0122	1.0058	1.0042	0.9940	1.0151	0.9958	0.9967	0.9975	0.9871	1.0007	1.0009

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	1.3663	1.3558	1.0870	1.2874
2/3	2.5	1.1150	1.2513	1.0360	1.2356
3/4	3.5	1.0592	1.1816	1.0069	1.1939
4/5	4.5	1.0223	1.1333	1.0099	1.1601
5/6	5.5	1.0109	1.0989	1.0182	1.1325
6/7	6.5	1.0124	1.0740	1.0072	1.1099
7/8	7.5	1.0069	1.0556	1.0130	1.0912
8/9	8.5	1.0050	1.0420	1.0100	1.0758
9/10	9.5	1.0041	1.0318	1.0057	1.0630
10/11	10.5	1.0011	1.0242	1.0005	1.0524
11/12	11.5	1.0033	1.0184	0.9960	1.0435
12/13	12.5	1.0010	1.0140	0.9979	1.0362
13/14	13.5	1.0029	1.0107	1.0061	1.0300
14/15	14.5	1.0006	1.0082	1.0070	1.0249
15/16	15.5	0.9978	1.0062	1.0065	1.0207
16/17	16.5	1.0007	1.0048	0.9988	1.0171
17/18	17.5	1.0005	1.0036	0.9951	1.0142
18/19	18.5	0.9994	1.0028	0.9966	1.0118
19/20	19.5	1.0000	1.0021	1.0019	1.0097
20/21	20.5	0.9991	1.0016	0.9989	1.0080

Curve Fit Parameters

	# of Data		Selected Parameters			Tail Factor
	Data Points Used	Points Used	λ	c	t	20th - Ult
Indemnity	1-19	19	0.268	3.500	1.000	1.0016
Medical	1-19	19	0.080	10.000	1.200	1.0080

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

INDEMNITY PAID TO INCURRED BRIDGE FACTOR

<u>EQUATION</u>	Model	$Y = a*(1+x)^b$
<u>COEFFICIENTS</u>	a	4.751893579
	b	(2.049466176)

R^2 0.9973

<u>Report</u>	<u>4 Year Average</u>	<u>Points Used</u>	<u>Fitted Value</u>	<u>Selected</u>
1st	2.1364	2.1364	2.1479	
2nd	1.5471	1.5471	1.5001	
3rd	1.2594	1.2594	1.2773	
4th	1.1714	1.1714	1.1755	
5th	1.1074	1.1074	1.1208	
6th	1.0625	1.0625	1.0881	
7th	1.0550	1.0550	1.0670	
8th	1.0478	1.0478	1.0526	
9th	1.0381	1.0381	1.0424	
10th	1.0328	1.0328	1.0349	
11th	1.0357	1.0357	1.0292	
12th	1.0282	1.0282	1.0248	
13th	1.0302	1.0302	1.0213	
14th	1.0276	1.0276	1.0185	
15th	1.0173	1.0173	1.0162	
16th	1.0152	1.0152	1.0143	
17th	1.0137	1.0137	1.0127	
18th	1.0089	1.0089	1.0114	
19th	1.0108	1.0108	1.0102	
20th	1.0115	1.0115	1.0093	1.0093
21st	1.0078	1.0078	1.0084	1.0084
22nd	1.0065	1.0065	1.0077	1.0077
23rd	1.0048	1.0048	1.0070	1.0070
24th	1.0027	1.0027	1.0065	1.0065
25th	1.0030	1.0030	1.0060	1.0060
26th	1.0064	1.0064	1.0055	1.0055
27th	1.0045	1.0045	1.0051	1.0051
28th	1.0026	1.0026	1.0048	1.0048
29th	1.0027	1.0027	1.0045	1.0045
30th	1.0057	1.0057	1.0042	1.0042
31st			1.0039	1.0039
32nd			1.0037	1.0037
33rd			1.0035	1.0035
34th			1.0033	1.0033
35th			1.0031	1.0031
36th			1.0029	1.0029
37th			1.0027	1.0027
38th			1.0026	1.0026
39th			1.0025	1.0025
40th			1.0024	1.0024
41st			1.0022	1.0022
42nd			1.0021	1.0021
43rd			1.0020	1.0020
44th			1.0019	1.0019
45th			1.0019	1.0019
46th			1.0018	1.0018
47th			1.0017	1.0017
48th			1.0016	1.0016
49th			1.0016	1.0016
50-Ult *	1.0000	1.0000	1.0015	1.0015

Bridge Factor (Average of Selected Factors)

1.0038

* Selected

MEDICAL PAID TO INCURRED BRIDGE FACTOR

<u>EQUATION</u>	Model	Y = a+b*x^2+c/x
<u>COEFFICIENTS</u>	a	0.014924103
	b	(2.43337E-06)
	c	0.713279904
	R^2	0.9586

<u>Report</u>	<u>4 Year Average</u>	<u>Points Used</u>	<u>Fitted Value</u>	<u>Selected</u>
1st	1.7725	1.7725	1.7282	
2nd	1.3608	1.3608	1.3716	
3rd	1.2048	1.2048	1.2527	
4th	1.1484	1.1484	1.1932	
5th	1.1014	1.1014	1.1575	
6th	1.0907	1.0907	1.1337	
7th	1.0861	1.0861	1.1167	
8th	1.0725	1.0725	1.1039	
9th	1.0905	1.0905	1.0940	
10th	1.0861	1.0861	1.0860	
11th	1.0950	1.0950	1.0795	
12th	1.0960	1.0960	1.0740	
13th	1.0803	1.0803	1.0694	
14th	1.0777	1.0777	1.0654	
15th	1.0788	1.0788	1.0619	
16th	1.1050	1.1050	1.0589	
17th	1.1018	1.1018	1.0562	
18th	1.0810	1.0810	1.0538	
19th	1.0861	1.0861	1.0516	
20th	1.0653	1.0653	1.0496	1.0496
21st	1.0551	1.0551	1.0478	1.0478
22nd	1.0391	1.0391	1.0462	1.0462
23rd	1.0334	1.0334	1.0446	1.0446
24th	1.0402	1.0402	1.0432	1.0432
25th	1.0395	1.0395	1.0419	1.0419
26th	1.0359	1.0359	1.0407	1.0407
27th	1.0267	1.0267	1.0396	1.0396
28th	1.0177	1.0177	1.0385	1.0385
29th	1.0125	1.0125	1.0375	1.0375
30th	1.0151	1.0151	1.0365	1.0365
31st			1.0356	1.0356
32nd			1.0347	1.0347
33rd			1.0339	1.0339
34th			1.0331	1.0331
35th			1.0323	1.0323
36th			1.0316	1.0316
37th			1.0309	1.0309
38th			1.0302	1.0302
39th			1.0295	1.0295
40th			1.0289	1.0289
41st			1.0282	1.0282
42nd			1.0276	1.0276
43rd			1.0270	1.0270
44th			1.0264	1.0264
45th			1.0258	1.0258
46th			1.0253	1.0253
47th			1.0247	1.0247
48th			1.0242	1.0242
49th			1.0236	1.0236
50-Ult *	1.0000	1.0000	1.0231	1.0231

Bridge Factor (Average of Selected Factors)

1.0336

* Selected

