The 2008 California Private Passenger Auto Frequency and Severity Bands Manual Third Edition (Updated with Data through 2014)

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Abstract

Pursuant to Title 10 of the California Code of Regulations, section §2632.9, the California Department of Insurance publishes data on private passenger automobile insurance relative claims frequency rates and relative claims severity rates. These data are published so that insurers may, if necessary, have credible data upon which to base their private passenger automobile insurance class plans pursuant to Title 10 of the California Code of Regulations, section §2632.5. This publication is commonly referred to as the Bands Manual.

The 2008 Bands Manual was first updated in December 2015 and then again in April 2018. This paper provides an overview of the methods and data employed in the 2018 revision.

Auto insurance loss data were obtained from the California Department of Insurance Statistical Analysis Division. Private passenger claims frequency and severity were calculated by zip code, for each coverage type, using 2010-2014 data for liability coverages and 2009-2013 data for physical damage coverages. When data were insufficient to produce credible results in a particular zip code, the data was augmented by employing the band assignments and band relativities from the previous edition of the 2008 California Private Passenger Auto Frequency and Severity Bands Manual. The resulting relative claims frequency and severity data were calculated by coverage and by zip code and published as the 2008 Frequency and Severity Bands Manual, Third edition (Updated with Data through 2014).

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Introduction

California requires private passenger automobile insurance rates to be approved by the Insurance Commissioner before they may be employed by insurers (CA Insurance Code, section §1861.05 et seq.) The California Department of Insurance (CDI) has adopted regulations implementing this law (Title 10, Cal. Code Regulations, sections §2632.1 to §2632.9). These regulations require that the statistical significance of all non-geographic explanatory variables be calculated before any territory-related characteristics are modeled. Only two geographic variables are permitted, claim frequency and claim severity. Each of these variables is limited to no more than twenty rating bands. Each frequency band must be formed by grouping zip codes with similar claim frequencies. Each severity band must be formed by grouping zip codes with similar claim severities.

Many insurers operating in California lack their own company-specific data which are adequate to develop credible matrices for claim frequency and claim severity. On May 15, 2008, CDI published claim frequency and claim severity matrices which these insurers are permitted to use in developing their rates, pursuant to Title 10, California Code Regulations, section §2632.9. These matrices are commonly referred to as the Bands Manual. With the passage of time, the 2008 Bands Manual became obsolete, due both to changes in the governing law and to changes in loss statistics. Therefore, in December 2015, the CDI published the second edition to the 2008 Bands Manual with data through 2011. Starting with 2015, the CDI has taken the initiative to update the Bands Manual about every two years. The purpose of this document is to explain the methodology used to develop the third edition of the 2008 Bands Manual, which incorporates data through 2014 for liability coverages and through 2013 for physical damage coverages.

Data Used

Data used in all of the editions of the 2008 Bands Manual was supplied by the CDI Statistical Analysis Division (SAD). The SAD biennially tabulates all automobile private passenger exposures, losses, and claims separately for all private passenger auto coverages, from all insurers in the state writing this insurance. SAD data are compiled for the seven primary coverages. These coverages are:

1. Bodily Injury Liability (BI);
2. Property Damage Liability (PD);
3. Medical Payments (MP);
4. Uninsured Motorist Bodily Injury (UMBI);
5. Uninsured Motorist Property Damage (UMPD);
6. Collision (COLL); and
7. Comprehensive (COMP).

The SAD data includes total exposure years, paid losses, capped per occurrence incurred losses developed to ultimate, and total claim counts, by accident year, for each zip code. The third edition of the 2008 Bands Manual uses data from 2010 to 2014 for liability insurance (coverages 1-5), and data from 2009 to 2013 for physical damage (coverages 6-7).

In all cases, frequency is defined as total claims divided by total exposure years. For liability coverages, severity is defined as capped losses divided by total claims. (The definition of severity is dictated by CA Vehicle Code Section §16451, which mandates the capped amount as part of the Financial Responsibility law.) Severity for physical damage is defined as paid losses divided by total claims.

Not every zip code in the state had sufficient data to be fully credible. In order to improve the credibility of the data in these zip codes, the previous Band Manual's frequency and severity band relativities were applied to the statewide frequency and severities based on current data, to determine the complement for the zip codes that were not fully credible.

Methodological Changes from the Second Edition of the 2008 Bands Manual

With three minor exceptions, the methodology for generating the third edition of the 2008 Bands Manual followed the methodology employed in the second edition of the 2008 Bands Manual, published in 2015. This section of the report contains a brief comparison of the methods used in the second and third editions of the 2008 Bands Manual.

The third edition of the 2008 Bands Manual follows the methodology used by the second edition of the 2008 Bands Manual for determining the credibility standard with certain modifications. The third edition of the 2008 Bands Manual assumes that the claim count has a Poisson distribution, while the second edition assumed that the distribution for the claim count is Binomial. The change had an insignificant impact on the credibility standard. Similar to the second edition, the third edition of the 2008 Bands Manual determined the credibility standard for zip code frequency rates - the number of exposure years required for a zip code's data to be fully credible - by solving the formula for n, the number of vehicle years:

$$n = (y^2/k^2)(\sigma^2_f/\mu_f)/\ \mu_f$$

Where the variables are defined as follows:

y = 95% of probability of normal distribution = 1.96
k = the probability that observation X is within ±k of the mean = 10%
σ^2_f =Variance of Claim Count
μ_f = Mean of Claim Count

Since for the Poisson distribution $\sigma^2_f = \mu_f$, the (σ^2_f/μ_f) part of the above formula cancels out.

For the calculation of number of claims for full credibility of severity, the third edition of the 2008 Bands Manual, similar to the second edition, gathered a sample of zip codes with one claim count and used those statistics to generate the statewide severity (mean) and the standard deviation for each of the coverages. Because the data were not available for all losses on an individual claim basis, it was impossible to calculate the standard deviation for all of the losses. Using the collected sample of zip codes with one claim count, the severity mean μ_s and standard deviation σ_s were estimated for each of the coverages. The average severity, i.e. the mean of the distribution, is estimated by $(X_1 + X_2 + \ldots + X_N)/N$. The variance of the observed severity is $\text{Var}(\sum X_i/N) = (1/N^2)\sum \text{Var}(X_i) = \sigma_s{}^2/N$. According to the Central Limit Theorem, the distribution of severity $(X_1 + X_2 + \ldots + X_N)/N$ can be approximated by a normal distribution for large N. The formula to determine the number of claims for the full credibility standard for severity is as follows:

$$n = (y^2/k^2)(\sigma_s/\mu_s)^2$$

While both the second and third editions of the 2008 Bands Manual assume y = 95% in the above formula, the third edition assumes k to be 7.5%, which is a change from the assumption of 10%, considered in the second edition.

In the previous edition of the Bands Manual the complement of credibility was determined by aggregating the 2007-2011 industry zip code data using the band configuration from the 2008 Bands Manual. The third edition uses the previous Band Manual's frequency and severity band relativities and applies them to the statewide frequency and severities based on the current data (2010-2014 for liability coverages and 2009-2013 for physical damage coverages). The newly-calculated frequency and severity statistics are used as the complements in the third edition.

Tables One and Two below display the full credibility standards for frequency and severity. The full credibility standard for frequency is calculated using the number of vehicle years of exposures, and the full credibility standard for severity is calculated using the number of claim counts.

Table One
Claim Frequency Standards

Coverage	Statewide Frequency	Number of Vehicle Years of Exposures for Full Credibility
Bodily Injury	0.00931	41,266
Property Damage	0.04020	9,556
Medical Payments	0.00950	40,452
Uninsured Motorist Bodily Injury	0.00178	215,807
Uninsured Motorist Property Damage	0.00358	107,183
Collision	0.06404	5,999
Comprehensive	0.04046	9,494

Table Two
Claim Severity Standards

Coverage	Statewide Severity	Number of Claims for Full Credibility
Bodily Injury	$9,135	444
Property Damage	$2,439	236
Medical Payments	$826	77
Uninsured Motorist Bodily Injury	$10,109	497
Uninsured Motorist Property Damage	$1,876	158
Collision	$3,332	904
Comprehensive	$1,306	1,784

Tables Three and Four show data on the credibility distribution among zip codes in California by type of coverage for claim frequency and claim severity. The table divides the data into those zip codes with full credibility and those without full credibility. The table also displays two percentages for those zip codes that are fully credible and those that are not. One shows the percentage based on the number of zip codes, and the other shows the percentage based on the years of exposure.

For the major coverages of BI, PD, Collision, and Comprehensive, at least 93.0% of the earned exposure resided in zip codes that had fully credible frequency data. Similarly, for those same major coverages, at least 77.6% of the earned exposure resided in zip codes which contained severity data that was fully credible.

Table Three
Frequency Credibility Levels

Coverage Type	Credibility	# of Zip Codes	Zip Code Percentage	Exposure Years	Exposure Percentage
Bodily Injury (BI)	Fully Credible	941	51.9%	113,461,924	93.0%
	Not Fully Credible	873	48.1%	8,560,969	7.0%
Property Damage (PD)	Fully Credible	1,241	68.4%	120,307,898	98.6%
	Not Fully Credible	573	31.6%	1,717,462	1.4%
Medical Payments (MP)	Fully Credible	592	32.7%	40,500,603	74.3%
	Not Fully Credible	1,221	67.3%	14,021,270	25.7%
UMBI	Fully Credible	17	0.9%	4,040,973	3.9%
	Not Fully Credible	1,797	99.1%	98,376,023	96.1%
UMPD	Fully Credible	0	0.0%	0	0.0%
	Not Fully Credible	1,813	100.0%	22,839,433	100.0%
Collision (COLL)	Fully Credible	1,227	67.5%	81,167,108	98.7%
	Not Fully Credible	591	32.5%	1,085,227	1.3%
Comprehensive (COMP)	Fully Credible	1,170	64.4%	83,638,133	98.1%
	Not Fully Credible	648	35.6%	1,609,195	1.9%

Table Four
Severity Credibility Levels

Coverage Type	Credibility	# of Zip Codes	Zip Code Percentage	Exposure Years	Exposure Percentage
Bodily Injury (BI)	Fully Credible	838	46.2%	107,352,344	88.0%
	Not Fully Credible	976	53.8%	14,670,549	12.0%
Property Damage (PD)	Fully Credible	1,258	69.3%	120,385,257	98.7%
	Not Fully Credible	556	30.7%	1,640,104	1.3%
Medical Payments (MP)	Fully Credible	1,092	60.2%	52,314,543	96.0%
	Not Fully Credible	721	39.8%	2,207,330	4.0%
UMBI	Fully Credible	22	1.2%	3,493,918	3.4%
	Not Fully Credible	1,792	98.8%	98,923,078	96.6%
UMPD	Fully Credible	113	6.2%	4,452,566	19.5%
	Not Fully Credible	1,700	93.8%	18,386,867	80.5%
Collision (COLL)	Fully Credible	1,046	57.5%	79,128,350	96.2%
	Not Fully Credible	772	42.5%	3,123,985	3.8%
Comprehensive (COMP)	Fully Credible	696	38.3%	66,143,732	77.6%
	Not Fully Credible	1,122	61.7%	19,103,597	22.4%

Attachment A

Methodology summary for 2008 Frequency and Severity Bands Manual Second Edition

The major steps to creating the second edition of the 2008 Frequency and Severity Bands Manual can be summarized as follows:

1. The Bands Manual specifies claim frequency and claim severity relativities for twenty zip code bands for each rating factor (overall, four hundred different possible combinations of claim frequency and claim severity) for seven major coverages: Bodily Injury, Property Damage, Medical Payments, Uninsured Motorist Bodily Injury, Uninsured Motorist Property Damage, Collision, and Comprehensive.

2. The primary data source is the Section 11628 data collected by Statistical Analysis Division, which contains zip code level industry wide data on exposures and losses for the auto insurance coverages noted above.

3. Some insurers write combined single limits, where bodily injury and property damage are combined into a single product with the same coverage limits for both types of coverage. For purposes of the manual, the following exposure and loss data is combined: (a) bodily injury and combined single limits and (b) uninsured motorist bodily injury and combined single limits are also combined.

4. For claim severity, the liability data (BI, PD, MP, UMBI, and UMPD) is based on incurred capped losses, that is, losses incurred assuming that all insureds in the zip code have policies with coverage limits equal to the prescribed legal minimums ($15,000 / $30,000 per person / per accident bodily injury and $5,000 property damage). The most important reason for using the incurred capped loss data is that total incurred losses in a zip code will be influenced by differences in average coverage limits from one zip code to another. Insureds in some zip codes will have preferences for more coverage than required by state law. The Prop 103 rating factor weight requirements do not include coverage limits as a rating factor. The claim severity relativities estimated in the manual should thus control for the influence of differences in average coverage limits among different zip codes, otherwise, that would affect the rating factor weight for claim severity. The simplest way to do this is to use the capped loss data. A secondary reason for using incurred capped losses is that it does not include allocated loss adjustment expenses. Insurers' practices for allocated loss expenses vary from one company to another and therefore should not be included in the loss data for this analysis.

5. For Comprehensive and Collision coverages, the claim severity is based on paid losses.

6. Different standards of credibility are applied to the claim frequency and claim severity data at the zip code level. For frequency, a zip codes' data is fully credible when there are sufficient exposures that there is a 95% probability that the estimated frequency rate is within 10% of the true value. For severity, a zip code is fully credible when the number of claims is at least 384 claims adjusted for the square of the coefficient of variation of claim severity for each of the coverages. The credibility standard for severity also contemplates that there is a 95% probability that the estimated severity is within 10% of the true value.

7. Zip codes that are determined not to be fully credible have their claim frequency and claim severity adjusted by credibility weighting with the complement of credibility. The complement of credibility is determined using the previous Bands Manual configuration with newly aggregated data. The credibility level is calculated using the square root formula, specifically, the square root of (number of years of exposure or claims, divided by the credibility standard in exposure years or claims).

8. The credibility adjusted claim frequency and claim severity by zip code are divided into twenty bands with approximately equal number of exposures in each band. The claim frequency and claim severity for each band is the straight average of the frequency and severity for the zip codes included in the band.

Attachment B

Statewide Data from the Second and Third Editions of the 2008 Bands Manuals

Second Edition

	2007-2011 Exposure Years	2007-2011 # of Claims	2007-2011 Total Losses	2007-2011 Statewide Frequency	2007-2011 Statewide Severity
Bodily Injury (BI)	118,215,708	1,087,547	$9,458,591,717	0.00920	$8,697
Property Damage (PD)	118,218,185	4,517,773	$10,896,635,437	0.03822	$2,412
Medical Payments (MP)	55,356,645	530,274	$450,571,184	0.00958	$850
UMBI	98,522,371	183,266	$1,755,262,278	0.00186	$9,578
UMPD	22,063,116	82,933	$147,787,631	0.00376	$1,782
Collision (COLL)	83,762,715	5,365,192	$17,640,976,700	0.06405	$3,288
Comprehensive (COMP)	86,714,748	3,278,718	$4,946,621,991	0.03781	$1,509
Total		15,045,703	$45,296,446,938		

Third Edition

	2010-2014 Exposure Years	2010-2014 # of Claims	2010-2014 Total Losses	2010-2014 Statewide Frequency	2010-2014 Statewide Severity
Bodily Injury (BI)	122,022,893	1,135,918	$10,377,060,926	0.009309	$9,135
Property Damage (PD)	122,025,360	4,905,361	$11,966,094,347	0.040200	$2,439
Medical Payments (MP)	54,521,872	517,763	$427,634,082	0.009496	$826
UMBI	102,416,996	182,307	$1,842,935,593	0.001780	$10,109
UMPD	22,839,433	81,857	$153,576,972	0.003584	$1,876
Collision (COLL)*	82,252,335	5,267,294	$17,548,032,170	0.064038	$3,332
Comprehensive (COMP)*	85,247,329	3,449,102	$4,504,487,702	0.040460	$1,306
Total		15,539,602	$46,819,821,792		

*Underlying data for COLL and COMP is from 2009 -2013 Years.