GENERAL LIABILITY INSURANCE RATEMAKING

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"In its present shape it is not the only possible world"
—Paul Klee

Liability insurance is designed to protect an individual against the possibility that he will be held responsible in a court of law for injury to another's person, property, or other interests. The property owner is held responsible for accidents happening on his property if negligence can be established or legal liability exists by statute. Similarly, the contractor is held responsible for accidents that result from his operations, and the manufacturer for accidents arising from the use of his product, while the professional may even be held liable for the advice he gives. The insurance for these diverse forms of liability is provided by several lines of insurance which are generally grouped together under the title "Liability Other Than Automobile," or "General Liability Insurance." Manuals of rules and rates for general liability insurance are published by the National Bureau of Casualty Underwriters, by the Mutual Insurance Rating Bureau, and by several independent insurance companies. These rules and rates are also the basis of the liability rates appearing in the multi-peril manuals published by the Multi-Line Insurance Rating Bureau and the various state fire rating bureaus.

The rating techniques used by the general liability underwriter are in some ways similar to those used by fire underwriters despite their superficial antitheses. Both liability and fire insurance premiums are determined by a complex process in which the rates are influenced by the business of the insured occupying the premises and by risk characteristics that modify the hazard (e.g., the existence of elevators); however, the actuarial procedures used to establish the rates charged by the general liability underwriter are closely related to the other casualty lines rather than property insurance. The determination of the overall rate level change closely resembles the procedure used for automobile liability insurance, while the determination of class rates mixes techniques borrowed from both automobile and workmen's compensation ratemaking with some unique procedures. Unlike many other lines of insurance, there is no single general liability insurance rate filing in a given state. Individual rate filings are made for each subline of general liability insurance and for each coverage. The filings for individual sublines differ considerably from each other because the form of liability insured under each of them is quite different:

therefore, some knowledge of the coverage provided by the various sublines is essential in understanding the ratemaking procedures.[1] It should be noted that the ratemaking techniques discussed in this paper are those developed and used by the National Bureau of Casualty Underwriters. Similar procedures are used by the Mutual Insurance Rating Bureau in their filings.

Lines of Insurance

Although each liability line corresponds to a particular type of liability hazard, there is some overlap between lines for a particular hazard. The basic liability hazard is generally considered to be the liability which arises out of the existence of the premises occupied by the insured and his operations. There are four ways of providing this coverage:

1. Owners', Landlords' and Tenants' (OL&T) covers the liability which arises out of the existence of the premises and *necessary and incidental* operations.
2. Manufacturers' and Contractors' (M&C) covers the liability which arises out of the existence of the premises and *all* operations.
3. Farmers' Comprehensive Personal Liability (FCPL) covers premises, farm operations, and personal liability of the insured.
4. Comprehensive Personal Liability (CPL) covers premises and personal liability but not business operations of the insured.

Each of the four is a basic coverage component, or part, which is separately rated and which may be purchased by the insured as a separate policy or as an integral part of a broader liability package. The typical commercial risk would need either the OL&T or the M&C coverage; in addition, CPL coverage might be added to the basic policy by endorsement to cover the personal liability of the owner of the business.

OL&T and M&C coverages do not include liability hazards which may be separately identified and rated; for example, an OL&T policy would not cover liability imposed by a workmen's compensation statute. Such hazards may be covered by separate policies and/or by other coverage components in the basic general liability policy. In the following list those hazards which may be covered in a general liability insurance policy are listed first (items 1-7) and are followed by hazards which are covered in other liability policies. (There are other liability hazards which are generally not covered by insurance, e.g., liability resulting from war, revolution,

[1] Magee, J. H., *General Insurance* (Richard D. Irwin, 1964). Seventh ed., chap. 15.

etc.) In a few cases, a part of the hazards mentioned below is covered in the basic policy (e.g., some automobile liability coverage is given in an OL&T policy). A discussion of the details of the insuring agreements and exclusions is beyond the scope of this paper, but the following list is specific enough to indicate what type of hazard is covered by each liability line:

1. Liability arising out of the existence and use of elevators located on the premises of the insured (Elevator Liability Insurance).
2. Liability arising from the use of products sold or distributed by the insured or from operations of the insured after the insured has relinquished control over the operations (Product Liability Insurance).
3. Liability arising out of the operations of independent contractors employed by the insured (Owners' or Contractors' Protective Insurance).
4. Liability assumed by the insured under written agreement (Contractual Liability Insurance).
5. Liability resulting from the sale of alcoholic beverages (Liquor Law Liability).
6. Liability resulting from sprinkler leakage, etc. (Water Damage Liability).
7. Liability resulting from the rendering of (or failure to render) medical care or professional service (Professional Malpractice Liability).
8. Liability imposed by workmen's compensation statute (Workmen's Compensation Insurance).
9. Liability arising out of the ownership of an automobile (Automobile Liability Insurance).
10. Liability arising out of the ownership of aircraft (Aircraft Liability Insurance).
11. Liability resulting from the operation of an atomic reactor, the production of nuclear energy, etc. (Nuclear Energy Liability).

Class Rating

The variation in hazard presented by the diverse risks seeking to purchase general liability insurance necessitates a wide range of rates. Schedule rating of the type used in fire insurance rating is unknown in the general liability field. Individual risk rating techniques similar to those which apply for workmen's compensation are used for general liability insur-

ance. In addition, the experience rating plan applicable in most states provides credits and debits for certain general management characteristics such as cooperation with the insurance company. A majority of the liability risks do not develop premium and loss experience of sufficient volume to have any significant degree of credibility, and therefore fail to qualify for the application of rating plans. As a result, in most cases neither experience nor schedule rating techniques can be used to tailor the manual rate to the individual risk; therefore, general liability underwriters have relied upon the use of a large number of manual classifications in order to arrive at a premium for an individual risk which as closely as possible represents the hazard of that risk, and which needs little further modification for most risks. The rates for these numerous classes may be varied by state, or even by city, depending upon the nature of the coverage provided. For example, the class rates for Owners', Landlords' and Tenants' subline vary by rate territory, resulting in a total of over 30,000 individual manual rates.

The multiplicity of classifications coupled with the large number of sublines, each covering a specific type of liability insurance, results in a rating technique which, in end result, parallels fire schedule rating even though the techniques employed seem quite different. A typical fire rating schedule provides an extensive list of credits and debits which are used to modify the basic class rate for the risk; these credits and debits reflect various risk characteristics which have some bearing on the hazard. In rating an individual risk for general liability insurance, there is no one basic manual rate and no lengthy list of credits or debits. Instead there are a number of manual rates which apply to the risk; these rates reflect various liability hazards (line of insurance) as well as risk type and characteristics (class rates). For example, in rating the liability insurance of the owner of an individual building, the underwriter might first have to apply several different OL&T rates to provide the basic premises coverage. The section of the building used as a store by the owner would take a higher rate than that used for offices. A section of the building occupied by a tenant would be rated a still lower rate. Having applied the appropriate OL&T rates reflecting type of occupancy and location, the underwriter would then rate any other public liability hazard. For example, the owner would be charged separately for any elevators on the premises, and for the hazard resulting from products he sells. In each case, it might be necessary to use more than one class rate. The overall general liability premium reflects those risk characteristics which tend to increase or lessen the hazard, just as the overall fire premium does; however, for liability

insurance this has been accomplished by a schedule of coverages and by the use of a number of class rates for each coverage rather than a schedule of credits and debits modifying a single class rate.

There is one more significant difference between the fire and liability approaches. Whereas the credits and debits used for fire insurance must of necessity be established on a judgment basis, the various class rates used in rating liability risks may be established statistically. To assess statistically the credits and debits of a fire rate schedule, it would be necessary to apportion each individual fire loss among those risk characteristics which contributed to the loss. Since many factors influence the loss, and as the loss is destructive, this is impossible. Liability losses, on the other hand, usually result from a specific accident at a single location. Such a loss can generally be assigned to a particular subline and class.

Setting rates for the individual classes within each of the sublines is in many respects comparable to attempting to determine statistically the appropriate credits and debits in a fire rating schedule. Since the latter is considered impossible, it should not be surprising that the former is somewhat abstruse.

RATEMAKING

Each of the various general liability insurance sublines is considered independently for ratemaking purposes. The sublines are further subdivided by coverage: bodily injury, property damage, medical payments, and personal injury coverages are each rated independently. In addition, the basic limits experience is reviewed separately from excess limits. Manual rates are generally published for limits of $5,000 per person and $10,000 per accident for bodily injury coverage and $5,000 per accident for property damage coverage.[2] These rates are generally termed basic limits rates, and the charges for limits of liability above basic limits are referred to as excess, or increased limits, rates. The rate filings discussed in the following sections are filings of basic limits manual rates; therefore, premiums exclude any charges for excess limits coverages and losses are limited to basic limits (e.g., if a claimant were paid $15,000, only the first $5,000 would be included in the basic limits losses and the remaining $10,000 would be considered excess losses). The determination of excess limits charges is quite

[2] For Professional Malpractice Liability Insurance basic limits are $5,000 per person and $15,000 in aggregate. For Product bodily injury liability, and for certain property damage liability sublines, aggregate limits apply in addition to the limit per accident.

different from the determination of the basic limits rates, and a discussion of excess limits ratemaking is beyond the scope of this paper.

The ratemaker is presented with the problem of setting basic limits manual rates for a particular coverage and a particular subline. With a limited volume of statistical data, he must revise several thousand individual rates. In most cases, there are so many classes that a number of years of experience would be necessary to obtain credible experience for individual classes even on a countrywide basis. As liability loss levels are sensitive not only to inflationary trends but also to changes in the legal climate, the ratemaker should rely only on the latest data in setting rates. Finally, in many cases he must develop rates that vary by state and even by city. The result is a two-fold dilemma: to assure credibility many years of statistics should be used, but to assure responsiveness only the latest data should be used; to assure credibility the statistics for broad geographic regions should be used, but to assure responsiveness to the local situation statistics should be analyzed by state and city.

This dilemma has been solved by a rather involved procedure. The latest experience of all classes on a combined basis is used to establish the overall rate change needed in a particular state (or countrywide). This rate change is distributed by rate territory (if any) using a longer experience period. The resulting overall rate changes are then used to develop class rates by means of a procedure which gives recognition to class experience both in the state and countrywide. The complex procedures used to establish class rates for the various sublines represent an attempt to give recognition to the experience of individual classes whose data has very low credibility. This is accomplished by grouping similar classes and analyzing the experience of each group of classes in the state and the experience of the individual classes countrywide. For a typical subline the individual class rate results from an analysis of the class experience on a countrywide basis, the experience of similar classes in the state during the past five years, the experience of all classes in the rating territory during the last five years, and the experience of all classes in the state during the last year or two. The exact method of accomplishing this varies by subline of insurance.

Determination of Overall Rate Level

The first step in the development of manual rates for a subline of insurance is to determine the overall rate change. For the major sublines this is usually done on a statewide basis while for the minor sublines it is done on a regional or countrywide basis. While the ratemaking procedures

are not identical for the various sublines, it is possible to make certain general statements which hold true for most sublines.

For most of its rate filings the National Bureau uses the experience of members, subscribers, and some other companies; however, some filings include the experience of the Mutual Insurance Rating Bureau. Experience is tabulated on a policy year basis and the loss ratio method is used in ratemaking. A comparison is made between basic limits incurred losses and the premiums at present manual rates, which are computed by multiplying the earned exposures for each class in each territory by the appropriate basic limits manual rate.

The reported losses include all allocated loss adjustment expense; for ratemaking purposes they are multiplied by 1.16 to reflect unallocated loss adjustment expense. This countrywide factor is obtained from the Insurance Expense Exhibit by taking the three year average of the ratios of unallocated loss adjustment expenses to the sum of losses and allocated loss adjustment expense.[3] The losses must be adjusted to the present cost level since they will be compared to premiums at present rates. This is accomplished in two steps: first, these losses must be adjusted for subsequent changes in the level of reserves and for incurred but not reported losses, i.e., for loss development; second, the losses must be adjusted to reflect changes in the level at which claims are being paid, i.e., for the trend in average paid claim costs.

The calculation of loss development factors is accomplished in the manner outlined by Stern in "Rate Making Procedures for Automobile Liability Insurance."[4] It should be noted that for certain general liability sublines (e.g., Professional Malpractice) the loss development factors are much more significant numerically than are those shown in the example in Stern's paper.

The calculation of average paid claim cost trend factors is carried out as outlined by Benbrook in "The Advantages of Calendar—Accident Year Experience and the Need for Appropriate Trend and Projection Factors in the Determination of Automobile Liability Rates."[5] For those lines of

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[3] Separate reporting of allocated and unallocated loss adjustment expenses are required in a supplement to the Insurance Expense Exhibit.

[4] Stern, P. K., "Ratemaking Procedures for Automobile Liability Insurance," *PCAS Vol. LII*, p. 162.

[5] Benbrook, P., "The Advantages of Calendar-Accident Year Experience and Need for Appropriate Trend and Projection Factors in the Development of Automobile Liability Rates," *PCAS Vol. XLV*, p. 20. The actual calculation of a trend factor is outlined in a discussion of Mr. Benbrook's paper by R. Lino, *PCAS Vol. XLVI*, p. 301, and in Stern, op. cit., p. 172.

insurance where the exposure basis is payroll, sales, or receipts, no trend factor has been used in the past because the exposure base itself rises during periods of inflation.

At least five years of premium and loss experience at present level are available for the determination of the overall rate level change; however, in order to achieve responsiveness it is customary to use a weighted average of the loss ratios for the latest two years with weights of 30% for the earlier year and 70% for the later year. This average loss ratio is adjusted by the factor reflecting the change in the level of average paid claim costs, and it is then credibility weighted with the expected loss ratio, i.e., the provision in the rates for losses and loss adjustment expenses. The resulting loss ratio is divided by the expected loss ratio to obtain the indicated rate change.

The expected loss and loss adjustment ratio is obtained as it is in all liability lines by substracting from unity the total service and overhead expense provisions in the manual rates. For some expense items the actual amount will vary by line, i.e., inspection costs for elevator liability insurance are much greater than in other general liability lines. Taxes may differ by state, while the 5% provision for underwriting profit and contingencies is constant for all liability insurance lines in most states. These expense provisions are grouped under the following headings (with typical percentages shown in parenthesis): total production cost (25%); administration (8.5%); inspection, exposure audit, and bureau (4.5%); taxes, licenses, and fees (3%); underwriting profit and contingencies (5%).

Credibility is based upon the number of claims in the last two years. The standard for 100% credibility is 683 claims which corresponds to 95% probability of being within 7.5% of the true value for a Poisson process (see L. H. Longley-Cook, "An Introduction to Credibility Theory").[6] Partial credibilities are obtained from a table based upon the formula

$$Z = \sqrt{(\text{number of claims}) \div 683}$$

The calculation of the overall rate change may be expressed algebraically as follows:

WLR = weighted average of the loss ratios for the two most recent years

ELR = expected loss ratio

[6] Longley-Cook, L. H., "An Introduction to Credibility Theory," *PCAS Vol. XLIX*, p. 200.

T = trend factor
Z = credibility

$$\text{Rate change} = \frac{WLR \times T \times Z}{ELR} + (1.00 - Z)$$

The numerical example in Exhibit 1 illustrates the determination of the overall rate change. The actual data was drawn from a recent OL&T filing in an average sized state. As is frequently the case in general liability insurance ratemaking, the proposed rate change is somewhat less than the indicated rate change. At the rating bureaus, the proposed change is generally selected by the underwriters after a review of the indicated rate change and the individual components of the rating formula.

Classification Rates

Having established the overall rate change statewide, the next question is: How shall each class rate in each territory be modified in order to achieve the desired overall change—how should the rate change be "distributed"?

Most states are divided into rating territories for only one major subline—Owners', Landlords' and Tenants' Liability; for many other major general liability sublines, only the two or three largest states are subdivided into rate territories and for some lines, several states are combined into one rate territory.

General liability sublines are subdivided into a number of risk classifications. The two major sublines—Owners' Landlords' and Tenants', and Manufacturers' and Contractors'—are subdivided into 264 and 192 classes respectively. Due to the number and diversity of these classes, it is impossible to use countrywide differentials to a single base class (as is done for private passenger automobile insurance). While some recognition must be given to the classification experience by state in setting the rates, the experience for individual classifications by state is too sparse to permit the use of a classification relativity procedure like that used in workmen's compensation insurance.

Although there are differences in the methods of analyzing class and territory experience, the essential features are the same. The term territory relativity (or classification relativity) is generally applied to this analysis because its aim is to establish how much the individual territory (or class) differs from the average. The experience of each territory (or class) is used to the extent it is credible; the complement of credibility is applied to our "prior estimate" of the experience for that territory (or

EXHIBIT 1

DETERMINATION OF OVERALL RATE CHANGE

(1) Policy Year	(2) Premium at Present Manual Rates	(3) Basic Limits Incurred Losses Incl. all Loss Adj.	(4) Loss Development Factor	(5) Incurred Losses Including Development (3)×(4)	(6) Number of Claims	(7) Loss Ratio (5)÷(2)
1959	473,553	239,430	.98	234,641	468	.495
1960	514,836	261,620	.98	256,388	621	.498
1961	541,217	286,624	.98	280,892	501	.519
1962	593,528	312,510	.98	306,260	589	.516
1963	662,678	366,816	.99	363,148	598	.548
Total	2,785,812	1,467,000		1,441,329	2,777	.517

(8)	Weighted loss and loss adjustment ratio at present rates (30% 1962 + 70% 1963)	.538
(9)	Factor to adjust losses for average claim cost changes in subsequent 33 months based on average paid claim cost data	1.061
(10)	Product (8) × (9)	.571
(11)	Expected loss and loss adjustment ratio	.540
(12)	Credibility based on policy years 1962-1963 number of claims	1.000
(13)	Indicated change [(10) ÷ (11)] × (12) + [1.00 − (12)]	1.057
(14)	Proposed statewide rate level change	+5%

class). The average experience of all territories receives the remainder of the credibility in a territory relativity; the average for all similar classes or the countrywide experience for that class receives it in a class relativity. Algebraically, the index representing the relative experience of the ith territory (or class) may be represented as follows:

$$\text{Index} = FLR_i \div \left[\left(\sum_{i=1}^{n} P_i \times FLR_i\right) \div \sum_{i=1}^{n} P_i\right]$$

where P_i = the premium at present rates in the ith territory

FLR_i = The formula loss ratio for the ith territory

$FLR_i = Z_i \times LR_i + (1 - Z_i) \times SLR$

Z_i = credibility for the ith territory (based upon the number of claims during the past five years)

SLR = statewide average loss ratio

LR_i = loss ratio for the ith territory

In the following example, the five year loss ratios shown in column three were obtained by dividing the basic limits incurred losses (including all loss adjustment) by the premium at present manual rates:

Territory or Class (1)	Premium at Present Rates for the latest year (2)	5 Year Loss Ratio (3)	Credibility (4)	Formula Loss Ratio (5)	Index (6)
1	$ 75,203	.506	.40	.519	.961
2	69,373	.485	.60	.502	.930
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
Total or Average	662,678	.527	1.00	.540	1.000

The indices developed in the last column are a measure of how much better or worse the individual loss ratio is than the average. These indices can be multiplied by the overall rate change to determine territory (or class) rate changes to be applied to the present rates. For some lines of insurance such indices are computed independently by territory (all classes combined) and by class group (all territories combined), and a composite index is used to develop class rates within each territory.

Although the experience of major classifications will have some credibility by state, the experience of most classes will have little or no credibility by state; therefore, for several sublines, classifications have been divided into groups in which they are related to base classifications by differentials. In the classification relativity, the experience of the class group is treated as a single class and an index is developed for the group as a whole. This index multiplied by the territory rate change is used to modify the group average rate which is divided by the average differential to obtain the base rate. Class rates are determined by multiplying the base rate by the class differentials. The differentials themselves are developed from countrywide statistical experience.

A different way of using countrywide data to overcome low credibility by class by state is the introduction of "national loss ratios" in the classification relativity within an individual state. The natonal loss ratio is simply the countrywide loss ratio for the class. In the classification relativity the complement of the class credibility is applied to the class national loss ratio (adjusted to the overall state rate level) instead of the experience of all classes in the state.

Other variations in the manner of obtaining class rates are possible. In fact, each of the major sublines uses a different procedure for establishing class rates. The manner of establishing class rates is the major difference between the ratemaking procedure for each of the sublines, as the method for establishing the overall rate change for each subline varies only in minor details. For every subline, the procedure has the same general pattern: the class experience is used to the extent it is credible, and the complement of credibility is applied to the "prior estimate of the class experience." The procedural variations may best be studied by reviewing the key exhibits from the rate filings for several sublines. Attention is first directed to the two major bodily injury insurance rate filings. Following a detailed discussion of these filings the distinguishing features of ratemaking for other sublines are discussed. It should be noted that the ratemaking techniques discussed are the standard ones employed in almost all states but that some states, notably New York, employ slightly different techniques.

RATE FILINGS

Owners', Landlords' and Tenants' Bodily Injury Liability Insurance

This is the largest of the general liability sublines and probably best illustrates general liability ratemaking. The basic rate filing includes ap-

proximately 130 rate classes, including classes with several different exposure bases: area, frontage, pupil day (schools), admissions (theatre), and miscellaneous bases.[7] Rates for this subline vary not only by class but also by rate territory (of which there are almost 150). An overall rate change is established in each state using the method set forth in the previous section: the weighted average of the basic limits loss ratios for the two most recent years is adjusted for the trend in average paid claim costs and then, after reflecting credibility, compared to the expected loss ratio.

The overall rate change is then distributed by rate territory using a relativity procedure like that described in the last section. The five year average basic limits loss ratio,[8] computed using premium at present rates for each rate territory, is first credibility weighted with the statewide five year average loss ratio. This formula loss ratio is then divided by the average formula loss ratio in the state to obtain a measure of how much better or worse each individual territory is than the statewide average. The statewide rate change is multiplied by these territorial indices to obtain the indicated rate change for each territory. This two-stage rating procedure makes possible the use of the latest two years of experience for development of the statewide rate change while using a longer experience period in each territory where the statistical data is sparser and hence less credible. Credibility weighting, as explained above, permits inclusion of the experience of territories too small to be rated independently. The numerical example in Exhibit 2 illustrates this procedure:

Having established the needed rate changes by territory, the ratemaker must now determine the appropriate adjustment for each class. Since individual class experience by territory and state (and even countrywide for some classes) is so thin as to be unreliable, individual classes are grouped, based upon inherent hazard, about certain large classes for ratemaking purposes. The major class in each group is called the base class and the rates for the other classes are related to the rate for the base class through the use of countrywide rate relationships or differentials. For example, the eleven school and church classifications are grouped together with the church class as the base classification. The differentials relating the rate for each individual class to the base class are developed from an

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[7] Separate rate filings are made for certain minor OL&T classes which present unusual hazards (e.g., amusement parks).

[8] In large states only three years of data are used in setting rates by territory.

EXHIBIT 2

DETERMINATION OF PROPOSED RATE CHANGES BY TERRITORY

OL&T Bodily Injury Liability

(1) Territory	(2) Basic Limits Premium at Present Rates Pol. Yr. 1963	(3) Loss & Loss Adj. Ratio Pol. Yrs. 1959-1963	(4) Credibility Pol. Yrs. 1959-1963	(5) Formula Loss & Loss Adj. Ratio	(6) Indices (5) ÷ Tot. (5)	(7) Proposed Territory Rate Change Factor (6) × 1.050
01	382,054	.474	1.00	.474	.894	.839
02	108,201	.575	.70	.561	1.058	1.111
03	172,423	.634	1.00	.634	1.196	1.256
Total	662,678	.527		.530	1.000	1.050

Formula loss ratio = (3)(4) + [1.00 − (4)][total (3)]

analysis of countrywide statistical experience. A list of the classification groups is set forth below:

OL&T CLASSIFICATION GROUPS

Group Number	Number of Classes	Major Types of Classes Included in Group
1	3	Apartments and hotels
2	4	Offices and office buildings
3	11	Candy stores, salesrooms, etc.
4	8	Grocery stores, department stores
5	1	Supermarkets
6	2	Restaurants, bars
7	28	Clubs, pools
8	22	Miscellaneous
9	6	Hospitals, rest homes
10	11	Schools, churches
11	21	Theatres, halls
12	15	Storekeepers[9]

Within each state, the experience of the 12 classification groups is analyzed on a statewide basis using a relativity procedure similar to that used in computing territorial rate changes. The five year average basic limits loss ratio at present rates is computed for each class group. The loss ratio for the group is credibility weighted with the loss ratio for all classes to obtain a formula loss ratio. The group's formula loss ratio is compared to the statewide average formula loss ratio for all classes to determine whether the group's experience has been better or worse than average. The effect of this class grouping procedure is to permit a selected group of classes to develop its own level of rates, as a group, within the framework of the state's overall experience indications. Individually, each class would have taken a rate reflecting more closely the statewide change for all classes combined, because of its limited credibility, if this grouping procedure were not used. Exhibit 3 illustrates the method outlined above.

The group indices developed above show how much the rates for an individual class group should be changed relative to the average; the individual class differential for a class within a group reflects the proper relationship among classes; the territorial rate change combines the needed

[9] The term "storekeepers" refers to a liability insurance package; see the Owners', Landlords' and Tenants' Liability Insurance Manual, National Bureau of Casualty Underwriters, p. 211 ff.

EXHIBIT 3

DEVELOPMENT OF GROUP INDICES

OL&T Bodily Injury Liability

(1) Classification Group	(2) 1963 Premium at Present Rates	(3) 1959-1963 Basic Limits Loss & Loss Adj. Ratio	(4) Credibility	(5) Formula Loss Ratio	(6) Group Index
1	75,203	.506	.40	.519	.961
2	69,373	.485	.60	.502	.930
3	116,457	.607	.80	.591	1.094
4	57,458	.558	.60	.546	1.011
5	61,326	.737	.70	.674	1.248
6	44,185	.544	.40	.534	.989
7	49,861	.576	.50	.552	1.022
8	93,467	.390	.50	.459	.850
9	25,227	.528	.30	.527	.976
10	23,333	.420	.40	.484	.896
11	16,586	.494	.60	.507	.939
12	30,202	.474	.40	.506	.937
Total	662,678	.527	1.00	.540	1.000

overall increase with indications of the individual territory. All that remains is to combine these elements of the class rate change.

The present average rate for the class group in each territory is computed by dividing the premium at present rates for the class group by the exposures. The proposed average rate for the group is equal to this present average rate times the territory rate change times the group index adjusted for an overall rate change produced by the group indices in the given rate territory. (The group indices are computed on a statewide basis; hence, although they are balanced on a statewide basis, they need not be balanced in any given territory.) By dividing the proposed average rate by the average differential, we obtain the base rate for the group. The base rate times the class differentials gives the proposed class rates.

CALCULATION OF RATES FOR GROUP 1 IN TERRITORY 01
OL&T BODILY INJURY LIABILITY

(1) Group 1 present average rate	.400
(2) Index for Group 1	.961
(3) Rate change for Territory 01	.940
(4) Adjustment for change produced by group index in rate territory[10]	.998
(5) Group 1 proposed average rate, (1)×(2)×(3)×(4)	.360
(6) Group 1 average differential	1.200
(7) Group 1 base rate, (5)÷(6)	.300
(8) Class rates, (7)×(Class differential)	
a) Base class (differential 1.00)	.300
b) Other classes (differential .50)	.150
(differential 2.00)	.600

Manufacturers' and Contractors Bodily Injury Liability Insurance

This is the second largest general liability insurance subline. As the statistical data are of smaller volume than for OL&T certain modifications are necessary in the ratemaking procedure. Rates are currently established on a statewide basis in all states except New York, which is divided into two rate territories. In order to achieve sufficient credibility for ratemaking it is necessary to group the experience of several of the smaller states in establishing overall rate changes.

[10] $[\sum_{i=1}^{n} (\text{Index}) \ (P_i)] \div \sum P_i$ where the summations are carried out by group within each territory.

The overall statewide rate change is established in a manner identical to that for OL&T except that a trend factor is not used for M&C. The exposure basis for M&C is payroll, which tends to rise and fall with the business cycle in a manner similar to average paid claim costs.

As there are rate territories in only one state, the next step is the distribution of the rate change by class. M&C classes fall into three natural divisions: manufacturing, contracting, and all other. This division of classifications into industry groups parallels that used in workmen's compensation insurance because most M&C classes correspond (in definition) to some workmen's compensation class. Each of these industry groups is further subdivided into classification groups.

The determination of classification rates and group indices is similar to the procedure used for OL&T. The two major exceptions are the subdivision of classes on two bases—industry group and class group—and the use of national loss ratios. These modifications of the procedure used for OL&T are necessary for two reasons. First, the volume of M&C experience is less than that of OL&T; hence, the credibility for each M&C class group will be smaller, and in fact most class groups will have much less than 100% credibility in each state. Second, the differences within any state in relative hazard among the various types of M&C risks are greater than the differences among the various OL&T risks.

For OL&T the principal hazard arises out of the existence of the premises, while for M&C the principal hazard may come from the existence of the premises (e.g. a manufacturing risk), or from the operations performed away from the premises (a servicing risk), or equally from both (a contracting risk). Thus, the measure of difference in hazard due to the location of the premises is more important for OL&T than for M&C where the principal hazard may arise from the operations of the risk away from the premises; hence, for OL&T most states are divided into rate territories while for M&C they are not. On the other hand, the measurement of differences in hazard among classifications (and groups of classifications) is more vital for M&C than for OL&T since there is a greater diversity in type of hazard among classes. As the volume of experience is limited for M&C, it is necessary to construct a rating procedure which makes the greatest possible use of experience by class.

The differences between the OL&T and M&C rating method involve the following problem: if the class group lacks 100% credibility, to what should the complement of credibility be applied? If we cannot rely on the data developed for the class group, what data should be used to esti-

mate the rate change for the class group? For OL&T, the answer was the experience for all classes; however, this would be inappropriate for M&C with its diverse risk types. Two answers seem possible. The experience for the class group for some broader geographic region (perhaps the entire country) might be used, or the experience of some broader group of classes in the given state might be used.

M&C ratemaking techniques used in the past have incorporated specific instances of both of these possibilities. The following paragraphs describe a ratemaking procedure which has been suggested for use in the future. It includes the techniques used in past M&C rate filings augmented by some borrowed from recent OL&T rate filings.

The distribution of the rate change by class is carried out in two steps. First, the rate change is apportioned among the three industry groups. Then, the change is distributed among the class groups within each industry group.

One novel technique incorporated at several stages of the calculations is a three-way credibility weighting procedure. The credibility for a given class group is applied to the loss ratio for that group and the complement of credibility is applied to the average of two other loss ratios: the national loss ratio for the group and the statewide average loss ratio for some broader group of classes.

This technique is illustrated by distribution of the rate change by industry group. Before the national loss ratios can be used in the calculations they are adjusted to the average level of the experience in the state. This step eliminates any bias which might be introduced by the use of countrywide data reflecting an average loss level different from that in the state. These adjusted national loss ratios are computed by multiplying the national loss ratio by the ratio of the average state loss ratio to the average national loss ratio. Algebraically, the calculations may be represented as follows:

P_i = State premium for industry group i
LR_i = State loss ratio for industry group i
NLR_i = National loss ratio for industry group i
NLR'_i = Adjusted national loss ratio for industry group i

$$NLR'_i = NLR_i \cdot \left(\sum_{i=1}^{n} P_i \times LR\right) \div \left(\sum_{i=1}^{n} P_i \times NLR_i\right)$$

Z_i = Credibility for industry group i
FLR_i = Formula loss ratio for industry group i

EXHIBIT 4

DETERMINATION OF INDUSTRY GROUP RATE CHANGES

M&C Bodily Injury Liability

Industry Group	1963 Premium at Present Rates	1959-63 Basic Limits Loss & Loss Adjustment Ratio			1959-63 Credibility	Formula Loss Ratio	Index	Industry Group Rate Change
		State	National	Adjusted National				
Manufacturing	379,817	.578	.527	.540	1.00	.578	1.070	1.124
Contracting	212,740	.482	.523	.536	.80	.492	.911	.957
All Other	70,121	.461	.496	.508	.70	.478	.885	.929
Total	662,678	.535	.522	.535		.540	1.000	1.050

$$FLR_i = Z_i\, LR_i + (1 - Z_i) \times [NLR'_i + (\sum_{i=1}^{n} P_i \times LR_i) \div \sum_{i=1}^{n} P_i] \div 2$$

$$\text{Index} = FLR_i \div (\sum_{i=1}^{n} P_i \cdot FLR_i \div \sum_{i=1}^{n} P_i)$$

The rate change for each industry group is determined by multiplying the index for the group by the statewide rate level change. In the numerical example in Exhibit 4, a 5% statewide rate change has been assumed:

The rate changes by industry group are then distributed among the classification groups using a very similar three-way credibility weighting procedure. The formula loss ratio is computed by applying the credibility to the class group loss ratio and applying the complement of credibility to the mean of the adjusted national loss ratio for the class group and the *industry group* loss ratio for the state. A group index is obtained by dividing the class group formula loss ratio by the average industry group formula loss ratio. The rate change for the group equals the product of the industry group rate change and the group index. From this point on class rates (Exhibit 5) are obtained by multiplying the class group rate change by the present average rate, and dividing the product by the average differential. The resulting base rates times the class differentials yield the class rates.

Elevator Bodily Injury Liability Insurance

Rate making for this line is distinctive in two major respects: the special treatment in ratemaking afforded inspection costs, and the mixture of loss ratio and pure premium techniques in rating. Inspections are a major feature of elevator insurance; in fact, the cost of inspections exceeds the cost of paying claims. Inspection costs, unlike loss costs, are not subject to chance variation. Like other expenses, they are computed on a countrywide basis; however, inspection expenses do vary by type of elevator. An individual rate is determined from the inspection pure premium which applies uniformly countrywide by type of elevator, from the loss pure premium which varies by state by type of elevator, and from the countrywide percentage provision for expenses other than inspections.

Although the individual class rates are computed using the pure premium approach, the overall state rate change (Exhibit 6) is computed using the loss ratio approach. The method used is identical to that described for other lines except for the treatment of inspection cost. A two year weighted average loss ratio is adjusted for trend and credibility as under the standard procedure. To this rate level (or formula) loss ratio

EXHIBIT 5

DETERMINATION OF CLASS RATE CHANGES

M&C Bodily Injury Liability

Class Group	1963 Premium at Present Rates	1959-63 Basic Limits Loss & Loss Adjustment Ratio			1959-63 Credibility	Formula Loss Ratio	Index	Class Group Rate Change
		State	National	Adjusted National				
Manufacturing								
1	75,203	.506	.556	.569	.40	.547	.945	1.062
2	69,373	.485	.512	.524	.60	.511	.883	.992
3	116,457	.607	.529	.542	.80	.598	1.033	1.161
4	57,458	.558	.541	.554	.60	.561	.969	1.089
5	61,326	.737	.492	.504	.70	.678	1.171	1.316
Sub Total	379,817	.578	.527	.540		.579		1.124
Contracting								
6	44,185	.544	.512	.524	.40	.519	1.051	1.006
7	49,861	.576	.524	.537	.50	.543	1.099	1.052
8	93,467	.390	.537	.550	.50	.453	.917	.878
9	25,227	.528	.488	.500	.30	.502	1.016	.972
Sub Total	212,740	.482	.523	.536		.494		.957
All Other								
10	23,333	.420	.457	.468	.40	.447	.939	.872
11	16,586	.494	.490	.502	.60	.489	1.027	.954
12	30,202	.474	.530	.543	.40	.491	1.032	.959
Sub Total	70,121	.461	.496	.508		.476		.929
Grand Total	662,678	.535	.522					1.050

EXHIBIT 6

DEVELOPMENT OF PROPOSED RATE LEVEL CHANGE

Elevator Bodily Injury Liability

(1) Policy Year	(2) Basic Limits Premium at Present Rates	(3) Basic Limits Incurred Losses Incl. Loss Adjustment	(4) Number of Claims	(5) Basic Limits Loss & Loss Adjustment Ratio (3) ÷ (2)	(6) Policy Year Weights	(7) Weighted Loss & Loss Adj. Ratio Σ[(5) × (6)]
1962	$437,748	$104,564	163	.239	30%	.220
1963	467,375	99,302	144	.212	70%	

(8)	Expected loss, loss adjustment, and inspection cost ratio	.564
(9)	Present provision for inspection costs	.361
(10)	Present provision for loss and loss adjustment, (8) – (9)	.203
(11)	Proposed provision for inspection costs	.384
(12)	Weighted loss and loss adjustment ratio, Col. (7)	.220
(13)	Factor to adjust losses for average claim cost changes in subsequent 33 months based on average paid claim cost data	1.092
(14)	Product, (12) × (13)	.240
(15)	Credibility based on policy year 1962-63 number of claims	.60
(16)	Rate level loss ratio, (14) × (15) + (10) × [1.00 – (15)]	.225
(17)	Proposed loss, loss adjustment, and inspection cost ratio, (11) + (16)	.609
(18)	Proposed rate level change, [(17) ÷ (8)] – 1.000	+8.0%

is added the proposed provision for inspection costs,[11] expressed as a ratio to premium. The combined loss and inspection ratio is compared to the expected provision to produce the proposed overall rate level change.

In the development of the class rates, the loss and inspection portions of the rate change are treated independently. Actual loss pure premiums are compared to underlying loss pure premiums to determine indicated changes by class. These indicated changes are credibility weighted with the average indicated change for all classes combined using the standard credibility weighting procedure. From these formula changes indices are computed by comparing the change for the individual class to the change for all classes. (The resulting indices correspond to the indices computed by class group for other lines.) The indices are multiplied by the proposed change in the loss provision in the rates (the statewide rate level, or formula, loss ratio divided by the provision for losses) and the product is applied to the underlying loss pure premiums. The resulting loss pure premiums are added to the proposed countrywide inspection pure premiums by class to obtain the loss and inspection pure premium for the class which is divided by the provision for losses and inspections to obtain the proposed manual rate. An example of these calculations is shown in Exhibit 7.

Product Bodily Injury Liability Insurance

The rating procedure currently used for this line is interesting in that it is the same as the procedure used for all lines with a relatively low premium volume but a large number of classifications. Rates are established on a countrywide basis using a two step procedure: first the overall rate change is computed, and then this change is distributed by classification.

The overall change is established using a technique like that for M&C: a two year average loss ratio is credibility weighted with the expected loss ratio and the result is divided by the expected loss ratio to obtain the overall rate change. The distribution of this change by class follows the procedure set forth in the first section of this paper: the five year average loss ratio for each class (or group of classes) is credibility weighted with the five year average for all classes to obtain a formula loss ratio; the formula loss ratio is divided by the average to obtain indices to which the overall rate change is applied to obtain rate changes by class.

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[11] The provision in the rate for inspection costs is obtained by comparing the sum of the exposures by class times the inspection pure premiums with the premium at present rates.

EXHIBIT 7
DEVELOPMENT OF PROPOSED CLASSIFICATION RATES
Elevator Bodily Injury Liability

(1) Class Code	(2) Pol. Yr. 1963 No. of Elev.	(3) Pres. Manual Rate	Countrywide Inspection Pure Premium (4) Pres.	(5) Prop.	Loss and Loss Adj. Pure Premiums (6) Underlying Present Rate (3) × E.L.R. (a) − (4)	(7) Actual Pol. Yrs. 1959-1963 Combined	(8) Indicated Change (7)/(6)
002	16	$ 63.00	$26.70	$26.70	8.83	4.20	.476
005	51	164.50	58.50	75.00	34.28	75.74	2.209
006	162	43.50	20.00	23.60	4.53	22.99	5.075
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
Total	6,659				14.14	12.73	.900

DEVELOPMENT OF PROPOSED CLASSIFICATION RATES
(Continued)

(1) Class Code	(8) (7)/(6)	(9) Credibility No. of Claims Pol. Yrs. 1959-1963 Combined	(10) Formula Change (8) × (9) + Total (8) × [1.0 − (9)]	(11) Index (10)/Total (10)	(12) Col. (11) on Proposed Loss Level (b)	(13) Formula Loss & Loss Adj. Pure Premium (6) × (12)	(14) Prop. Manual Rate (c) (5) + (13) / E.L.R. (a)
002	.476	.10	.858	.910	1.009	8.91	$ 63.00
005	2.209	.20	1.162	1.232	1.366	46.83	216.00
006	5.075	.30	2.153	2.283	2.530	11.46	62.00
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
Total	.900		.943				

(a) Expected loss, loss adjustment, and inspection cost ratio = .564

(b) Column (12) = Column (11) × $\frac{\text{Proposed provision for loss and loss adjustment, .225}}{\text{Present provision for loss and loss adjustment, .203}}$ = 1.1084

(c) Rounded to the nearest dollar

The Product rate filing differs from other filings of this type in that it includes two sections which are actually almost independent filings. Separate overall rate changes and class relativities are computed for completed operations classes and for all other classes. Countrywide statistics are used in most of the filing; however, separate rates are established for a few classifications in New York by using New York statistics.

Comprehensive Personal Liability

This is a personal liability package that was introduced several years prior to the Homeowners' package. It is chiefly interesting from the ratemaking viewpoint in that it is an exception to the loss ratio ratemaking techniques used for other lines. Rates are generally established on a statewide basis using a pure premium approach. A formula pure premium is established statewide in the same way as a formula loss ratio is computed; i.e., a two year average pure premium reflecting trend is credibility weighted with the underlying pure premium. The sum of the formula pure premium and an expense constant is divided by the appropriate expected loss ratio to obtain the indicated rate. (If the rate is sufficiently large no expense constant is included in the calculations.) An identical procedure is used for Farmers' Comprehensive Personal Liability Insurance.

Professional Malpractice Liability Insurance

These sublines differ from most other general liability sublines in that they have a very small premium volume and few rate classes. Rates for these sublines often vary substantially by state because the public's attitude toward bringing malpractice suits to court varies widely from one region to another. Although malpractice cases are quite common in most states there are some states in which such cases are virtually unknown.

The paucity of data has precluded the adoption of any standard ratemaking formula. In general, basic limits losses reflecting loss development are divided by premium at present manual rates in order to obtain basic limits loss ratios for a period of from five to ten years. An overall rate change is determined based upon these loss ratios and a large measure of underwriting judgment. Classification relationships are usually determined on a countrywide or regional basis after a review of loss ratios and other relevant information.

Physicians and Surgeons: The overall rate change is determined separately for each state. Rate realtionships among classes are determined on a countrywide basis.

Dentists: Same as Physicians and Surgeons.

Lawyers: Same as Physicians and Surgeons.

Druggists: Rates are established for two groups, each made up of a number of states, with separate overall rate changes and rate relationships in each group.

Hospitals: States are grouped according to the immunity status of hospitals in the state. There are three groups: states in which charitable hospitals enjoy complete immunity from liability suits for malpractice, states where the immunity is only partial, and states in which there is no immunity. Overall rate changes are established more or less independently for each group. In addition, several large states are rated apart from these groups.

Miscellaneous Medical Malpractice Classifications: The malpractice manuals display rates for a number of classifications which develop almost no premium volume at this time. These rates are established on a countrywide basis from a review of basic limits loss ratios using a large measure of underwriting judgment.

Other Lines

There are a number of other general liability sublines. Most of the other bodily injury rate filings resemble the Product rate filing: rates are established on a countrywide basis with a classification relativity like that used for Product. Property damage liability insurance is usually rated on a countrywide basis, and most such filings closely resemble the Product bodily injury filing. The exception is the Manufacturers' and Contractors' property damage filing which is similar to the M&C bodily injury filing.

Special Multi-peril Policy Program

The liability rates appearing in the commercial package policy manuals that have been published in recent years are based upon the rates appearing in the various general liability insurance manuals. SMP liability rates are generally developed for a single limit of liability applicable to both bodily injury and property damage coverages in excess of basic limits, and are often computed on a three year basis, rather than on an annual basis. They are developed using the ordinary manual rates (R), increased limits factors (I), single limit discount (D), and term discount (T) along with an overall package discount (P) developed on a judgment basis for the program in question.

Package rate $= P \times T (D \times I_{BI} \times R_{BI} + D \times I_{PD} \times R_{PD})$ where P,T, and D are expressed as multipliers equal to unity minus the actual discount.

It is interesting to note that although SMP liability rates are still developed directly from the corresponding general liability rates, the SMP experience data is not included in the general liability ratemaking process.

CONCLUSION

The general principles that underlie ratemaking for all general liability lines are the same as those used for other casualty lines. Both premiums and losses are adjusted to current levels; care is taken to reflect trends in the development of claims and their costs. Class rates are determined after a formula analysis of the statistics for individual classes and groups of classes with credibility playing a major role. Most differences between ratemaking for general liability and ratemaking for other casualty lines (and most differences among general liability sublines) are manifested in minor details of procedure. The unique features of general liability ratemaking are the grouping of classifications about certain base classifications for the determination of class rates, and the credibility weighting of state and national data to obtain estimates of a class group's experience in an individual state.

General liability ratemaking procedures are in a constant state of flux. The use of classification groups in rating OL&T was introduced in 1961 and the procedure was modified in 1963. Credibility weighting procedures involving national loss ratios have been used sporadically for OL&T and M&C over the last ten years. In many of its details the procedure described in this paper for M&C represents a departure from past procedures. The various techniques described are examples of the ratemaking procedures used for general liability insurance and do not represent the final method, or only method, of rating the sublines involved.

It is interesting to note that the diverse and changing procedures used for general liability insurance ratemaking have produced very satisfactory results in the past. National Bureau member companies have shown an underwriting profit for these sublines in eight of the last ten years, and achieved an average profit of 4% in the last decade.

DISCUSSION BY PHILIP PRESLEY

One of the more tedious and even discouraging tasks facing the student preparing himself for an actuarial career is gaining an understanding of the various ratemaking systems being used in property and casualty