AUTOMOBILE RATE MAKING

BY

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The scientific development of Automobile rates was delayed for a long time by the lack of necessary statistics. For many years the establishment of rates was largely a matter of underwriting judgment supplemented by a meager volume of statistical fact. The growth of the business was so rapid that such statistical data as were tabulated from time to time were wholly insufficient as a basis for the solution of the new developments and refinements in the rating process which had to be established from one year to another. New methods were introduced and new underwriting classifications established for which there existed no statistical information. In fact, statistical classifications to correspond with new underwriting classifications were established after the latter were created with the hope that at some time in the future the statistics so accumulated might be used to prove the soundness or the incorrectness of the innovations adopted.

In the last two or three years, however, there has become available for rate making purposes a vast mass of accurate, finely divided experience data, and with the availability of that information the rate making technique has taken definite form and structure. The result has been that some of the old judgment theories have been substantiated by the developed facts, while others have been altered or entirely abandoned. Today it can be truly said that all the rates in the Automobile Manual are scientifically developed from known facts, with the exception of rates on unusual classifications and coverages which are so infrequently written as to preclude the possibility of the accumulation of sufficient data; and in regard to those, underwriting judgment is still applied.

INTRODUCTORY

Before considering the actual problems involved in rate making, it might be well to describe the Automobile rates for each form of coverage written, and to touch on the factors which determine the differentiation in those rates.

The Casualty companies write three forms of coverage, Public Liability, Property Damage, and Collision insurance, and the Collision form is sub-divided into Full Coverage, $50 Deductible, and $100 Deductible. The rates for all these forms vary first, by territory, second, by the type of car insured, and third, by classification. There is a further distinction in the rates for gasoline and steam cars and the rates for electric cars.

For rating purposes the United States is divided into a number of territorial schedules (in the 1925 Automobile Casualty Manual there are fifty schedules). Schedule 1, which applies to New York City, takes the highest rates, and Schedule 50, which includes the rural districts of the South and West, takes the lowest rates. As may be supposed, these territorial schedules reflect the degree of congestion of traffic and population in different communities and the severity of the automobile hazard.

All automobile risks are divided into four types, known as private passenger cars, commercial cars, public automobiles, and automobile dealers and garages. The private passenger type includes any gas or steam automobile of the usual private passenger type of construction used for pleasure and/or business purposes and excludes any automobiles used for renting and livery work, or for the business of demonstrating or testing. Further, the type includes any automobile of the private type which has been altered by the attachment of a small box to permit artisans and mechanics to transport tools and materials, or to permit salesmen to carry samples, excluding, however, wholesale or retail store delivery. The commercial group includes automobiles of the truck or delivery type, used for the transportation or delivery of goods or merchandise and other business uses, but not for the carrying of passengers for a consideration or the business of demonstrating and testing. Private passenger type automobiles which have been altered for the purpose of wholesale or retail store delivery as well as certain other kinds of vehicles, such as invalid carriages, ambulances, and hearses are also included in the commercial group. A public automobile is any automobile used to carry passengers for a consideration and includes private livery automobiles, public livery automobiles, taxicabs, jitneys, buses, school buses, and funeral cars. The automobile dealers and garages division includes automobiles operated by public garages, automobile sales

agencies and service stations, automobile manufacturers, and automobile schools.

The third factor underlying rate variation is the classification of risks within each type. The Public Liability and Property Damage rates on private passenger cars vary by four symbol groups designated, W, X, Y, and Z, which reflect a variation in the physical attributes of the different makes of cars. The Public Liability and Property Damage rates on commercial cars vary first, according to the business of the assured, and second, according to the load capacity of the truck. Under the public automobile type, there is a variation by broad classes, such as private livery, public livery, taxis, and jitneys, and the last named classification is further sub-divided according to the passenger carrying capacity of the vehicle. There are really no classifications of the automobile garage and dealer's type, apart from the separation of storage garages from the regular public sales agency and repair shop. For Collision insurance on all types of cars there is a variation by ten symbol groups, which reflect the relativity of cost and type and construction of the different makes, and beyond that there is a separation into two age groups, the rates on new cars being higher than the rates on old cars.

The premiums for cars of the private passenger, commercial, and public types are flat charges per car per year, whereas the rates for the automobile garage and dealers classification are rates per $100 of payroll.

Automobile Statistical Plan

Properly compiled statistics are the basis of rate making, and it therefore seems quite necessary to describe in some detail the methods of keeping experience data on automobile risks. In the first place, separate data are tabulated for Public Liability, Property Damage, and for each of the three forms of Collision insurance. For statistical purposes, the United States is divided up into five hundred forty territorial divisions, which for purposes of coding and tabulation are condensed to two hundred fifty-one. These territorial divisions give the following:

1. An individual experience for each city of 100,000 population and over.

2. An individual experience on each of the territories suburban to very large cities.

3. Combined experience within each state on all territories immediately surrounding the cities with a population of 100,000 and over.

4. Combined experience within each state on all cities with a population of 25,000 to 100,000.

5. Combined experience within each state on all territories immediately surrounding the cities with a population of 25,000 to 100,000.

6. Experience for the remainder of each state (all area in each state lying outside the territories enumerated in 1 to 5).

The data on each coverage in each of these territorial divisions are further divided according to the four general types of risks and then there is a further subdivision according to the rating classification. Thus on private passenger cars there are four symbol divisions for Public Liability and Property Damage, and on commercial cars there are fifty-nine business and load capacity divisions for the same types of coverage. The data on Collision insurance are tabulated by symbol groups and also by age groups. Under each of these many thousand statistical classifications is recorded the number of cars insured, the premiums written, the losses paid, the losses outstanding, and the number of claims directly attributable to the cars insured.

The statistical unit of exposure is the car-year, (that is, one car insured for a period of twelve months) as respects the private, commercial, and public types, and for the garage type, the unit is $100 of payroll. In order to preserve the unit of exposure intact, cars written for less than a year are counted as a fraction of a car year. Thus a car written for six months is one-half a car year, a car written for nine months is three-quarters of a car year, and so on. With this information it is possible to compute loss ratios, pure premiums, and claim frequencies,—that is the number of claims per one hundred cars insured.

Tabulation of the Data

As a rule, two tabulations of the data are made for each line of insurance and for each type of risk;—one tabulation by individual territories with all rating classifications combined, and one tabulation by rating classifications with all territories

combined. Sometimes the tabulation by rating classification is made for three broad territorial divisions,—that is, for large cities, for medium sized and smaller cities, and lastly, for the rural districts. It is found more advantageous to make these two tabulations, because if one tabulation were made showing each rating classification separately under each territorial division, the data would be too finely divided to be dependable for rate making purposes. In actual practise, the first tabulation is used to establish an average rate for a particular community, and then this average rate is in turn divided up into rates for the different classifications by the application of a set of differentials obtained from an analysis of the second tabulation.

Usually the experience for at least three, and sometimes four, policy years is used in the establishment of a given set of rates. In making Automobile rates, it has been found possible to use to advantage the incomplete data on the latest policy year. For example, in the rate revision undertaken in the Fall of 1924, the experience for the policy year 1923, brought down to December 31st, 1923, was used in making the rates for 1925. In other words, there was a lag of but one year between the latest experience year and the year for which the rates became effective.

Treatment of the Incomplete Policy Year

The data for the incomplete policy year are converted to an earned basis by the application of earned factors to the exposure and premiums, both of which are of course reported on a written basis. These earned factors are calculated on the basis of the ratio of the pure premium indications of previous policy years reported at the end of twelve months to the pure premium indications of those same policy years reported at the end of twenty-four months. The following example will show those developments on the Public Liability experience for private passenger cars:

Policy Year	As of Dec. 31st	Cars	Losses Incurred	Pure Premium	Ratio
1920	1920	530,403	$5,889,647	$11.10	53.7
	1921	505,015	10,435,054	20.66	
1921	1921	675,554	7,035,048	10.41	56.9
	1922	647,597	11,852,942	18.30	
1922	1922	837,591	7,531,237	8.99	58.6
	1923	807,818	12,385,385	15.33	

It will be observed from the foregoing tabulation that the ratios developed represent a combination of two factors, the one an earned factor and the other a decreasing cost factor. The finally developed pure premiums for the policy years 1921 and 1922 reported as of the end of twenty-four months after the inception of each, show a steady trend downward. In other words, the second twelve months' indications of each of these policy years are a bit better than the first twelve months' indications. (Prior to 1920 there was an upward tendency which reached its peak during the 1920 policy year.) Had the finally developed pure premiums remained constant from one year to another, the ratio, instead of increasing gradually, would probably have been about 55%. As a matter of fact, it has been demonstrated by the tabulation of other data for which loss costs remain stationary from one year to another, that a true earned factor of 55% shows itself from one year to another. Of course, when an incomplete policy year is converted to an earned basis, it is quite essential that a decreasing or increasing cost be taken into account with the earned factor, so that in the example just given, a factor of 57% or 58% might conservatively be applied to the written cars and premiums for the incomplete year.

Principles of Rate Making

There are two principles of rate making which are so woven into the rate making process that it seems advisable to explain them in detail, apart from the actual rating technique. Later on it will be indicated how these principles work themselves in as an integral part of the mathematical development of rates. The first of these two principles may be stated as follows: Wherever an individual community develops an experience of dependable volume, then the rates for that community shall be predicated on its individual data. The second principle, which has to do with the stability of rates, merely enunciates the idea that a certain permanence should be given to the rating schedules and that violent fluctuation from one year to another should be avoided. The first principle involves the setting up of a criterion for a dependable volume of experience, and the second principle is worked out by injecting into the rate making process

the whole principle of experience rating, and involves the application of credibility factors to the experience indications.

Criterion for Dependable Exposure

The problem of dependable exposure was discussed by Mr. A. H. Mowbray in an article contained in Volume 1, of the *Proceedings* of this Society, page 26. Mr. Mowbray employed the integral descriptive of the probability that if n trials are made of an event whose probability of success on a single trial is p (where $p + q = 1$), the number of successes will lie between $p\,n - s\,n$ and $p\,n + s\,n$; that is,

$$P = \frac{2}{\sqrt{\pi}} \int_0^{hsn} e^{-t^2}\, d\,t$$

where

$$h^2 = \frac{1}{2\,p\,q\,n}$$

Applied to the automobile problem, this integral may be interpreted as the probability, if n cars are insured against a hazard involving an accident frequency p, that the number of cars having accidents will lie between $p\,n - s\,n$ and $p\,n + s\,n$, where $p\,n$ is the expected number of accidents.

An exposure may be assumed to be dependable if the probability is high that the value produced thereby is within, let us say, 10% of the most probable value. Thus if we assume the value of the foregoing integral to be .9, *i. e.*, the probability to be 9 in 10 that the variation will not be more than 10% of the most probable value, and solve for n, we have

$$n = 2\left(\frac{1.16}{.10}\right)^2 \cdot \frac{1 - .05}{.05} \text{ or } n = 5113.$$

In other words, a city ought to develop an exposure of approximately five thousand earned cars before its experience can begin to receive any credence. Communities developing less than that exposure can hardly be treated on their individual merits, and combinations of those territories must be resorted to in order to produce a volume of experience which is dependable. It develops, for example, that the remainder of state territory in

the majority of states does not develop enough experience individually so that it can be rated individually, and it is therefore necessary to combine the "remainders" of a number of states in which the rural hazard may be assumed to be somewhat similar. This combination does no violence to the indications of any particular territory, but assists in the establishment of a closer approximation of the hazard of the group.

Stability of Rates—Application of Experience Rating Principle

The experience for the respective territories and rating classifications often varies considerably from year to year, especially for those groups which develop low exposures. Inasmuch as Automobile rates are revised at frequent intervals, usually once a year, it is quite necessary that some method be developed for ironing out the fluctuations in the experience indications. If the experience indications for particular cities and classes were followed literally from one year to another, it would be impossible to achieve any stabilization in the rating schedules, with the result that agents and policyholders alike would be continually disturbed by radical increases and decreases in rates. It is therefore necessary that the chance fluctuation of the data be eliminated and that the true trend of the experience be ascertained. This end may be accomplished by compromising the rate indicated by the latest experience indications with the rate in force.

Assume for example, that the rate in a particular city is $100 per car and the latest experience indicates the necessity for a rate of $130. No doubt the experience does indicate that the hazard has grown worse, but it is not likely that it has grown worse to the extent indicated by the experience. Now the rate in force has a certain authority. It is the going rate developed in accordance with the experience of the past, and therefore cannot be disregarded altogether. It would therefore seem wise to modify the existing rate not to the full extent indicated by the latest experience, but only part way. Let us ascribe a credence of 60% to the rate in force and a credence of 40% to the indicated rate. On that asumption, we would establish a rate of $112. Now it may be that a year from the establishment of that rate

the experience will improve to the extent that the $112 rate might be continued in effect for another year. On the other hand, the unfavorable indications which pointed to the need for a $130 rate this year might again develop a year later, in which event the $112 rate would be increased still further, let us say to $120.

The problem of obtaining credibility factors can apparently be treated by the same method of reasoning that was applied in the development of the experience rating plan for Workmen's Compensation. (See "The Theory of Experience Rating" by Albert W. Whitney, in the *Proceedings* of this Society, Volume IV, page 274). In that case it was necessary to balance the credibility of the risk experience against the credibility of the class experience. In this case it is necessary as a guide to future rates to balance the credibility of this year's experience against the credibility of the previous years' experience as represented by the going rate. In the former theory it was assumed that the frequency curve for the hazard of the risks belonging to a class would be a normal probability curve, having the hazard of the class as the abscissa of its middle point. In the present case it seems reasonable to assume similarly that the frequency curve giving the hazard of the year in question will be expressed by a normal probability curve whose middle point will be the hazard indicated by the going rate. With this assumption the form of the credibility factor will be the same as in the case of Workmen's Compensation and can be represented by $z = \frac{n}{n+k}$ where n is the number of cars insured and k is a constant.

Unfortunately as in the corresponding Workmen's Compensation case, there is no practical criterion by which to determine k. We may, however, make use of the integral referred to previously in the discussion of dependable exposure, namely

$$P = \frac{2}{\sqrt{\pi}} \int_0^{hsn} e^{-t^2} dt$$

where $h^2 = \frac{1}{2pqn}$.

Values of $p = 1/20$, $s = 1/400$, and $n = 50{,}000$ give us a value of

P of .99. We are therefore abundantly justified as a practical matter in assuming that an exposure of 50,000 cars is sufficient to base rates upon, or in other words, for this number of cars we may assume the credibility to be unity. Since the formula $z = \frac{n}{n+k}$ cannot as it stands be made to give a value of $z = 1$ for a finite value of n, we have assumed another law which has this property and which produces the same general effect, viz., $z : 1 :: \sqrt{n} : \sqrt{50{,}000}$, in other words, the credibility for n cars is to the credibility for 50,000 cars, as $\sqrt{n}$ is to $\sqrt{50{,}000}$.

It may be noticed that the formula $z = \frac{n}{n+k}$ and the expression for the probability already referred to, viz.,

$$P = \frac{2}{\sqrt{\pi}} \int_0^{hsn} e^{-t^2} dt \text{ or } P = \phi(h\,s\,n),$$

plotted as a function of n, both have the same form; they pass through the origin and approach unity asymptotically. The formula $z = c\sqrt{n}$ gives on the other hand a parabola passing through the origin but reaching unity at a finite point.

The credibility factors so developed are applied to what would be known in experience rating as the "actual departure," that is, the difference between the rate in force and the indicated rate. For example, in the case recited above where the rate in force was $100 and the indicated rate $130, the actual departure would be $30. On the basis of the risk's exposure, a credibility would be developed, say of 40%, and this factor would be applied to the $30 difference. The resulting amount of $12 might be considered the "allowable departure," and this would be added to the rate in force, thus producing $112 as the proper rate for the territory.*

Derivation of Average Territorial Rates

It was indicated previously that two distinct tabulations of the statistical data are made, one by territories with all classifications

*Note: The author is indebted to Mr. A. W. Whitney for his assistance in the development of the mathematical theory in connection with the credibility factors.

combined and one by classifications with all territories combined, and it was also pointed out that the former was used for the derivation of average rates for individual territories. There are nine distinct steps in the process of establishing territorial rates, and these are listed below:

1. Calculation of weighted average pure premiums for three or four policy years.
2. Selection of pure premiums with regard to trends and local conditions.
3. Test of the selected pure premiums and their reduction to the experience indications of the latest policy year converted to an earned basis.
4. Derivation of indicated premiums by applying the overhead expense loading to the adjusted pure premiums.
5. Establishment of the actual departures between the rates indicated by the experience and the rates actually in force.
6. Establishment of credibility factors for individual territories.
7. Establishment of the allowable departures obtained by applying credibility factors to the actual departures.
8. Determination of indicated rates by applying the allowable departures to the existing rates.
9. Test of the indicated rates and their final adjustment on the basis of the experience for the latest policy year.

A brief explanation of each of these items follows:

1. *Calculation of Weighted Average Pure Premiums.*

In order to bring into play a large quantity of statistical data, the exposure and losses incurred for the four latest policy years are combined for each individual territory, and weighted average pure premiums are established from the combination. The experience for the latest available policy year which is reported on a written basis, is converted to an earned basis and included with the data for the three policy years preceding it. In some cases it is found that the indications of the earliest years are not representative of expected future conditions, and in those cases only the latest two or three years' experience is used. For example, in establishing the 1925 Public Liability rates on

commercial cars, the experience for the policy years 1921-23 inclusive was used, but the experience for the year 1920 was excluded because the experience for that year represented the exceptionally high costs produced by post war conditions, and did not represent conditions as they might be anticipated for 1925.

2. *Selection of Pure Premiums.*

After weighted average pure premiums are established, the individual experience for each territory is reviewed in order to determine whether the average pure premium so established is representative of the hazard, or whether further modification of the pure premium is necessary. Particular attention is paid to the trends in the experience and if, for example, a distinct trend downward should be noted in a particular territory, then a pure premium below the average is selected as representative of the anticipated hazard. Furthermore consideration is given to any local conditions of recent development which might influence the compiled experience either favorably or adversely.

3. *Adjustment of Selected Pure Premiums.*

After pure premiums have been selected for the individual territories, they are all brought down to the loss level of the latest available policy year. This adjustment is made as follows—The written cars reported for the latest available policy year are first reduced to earned cars by the application of a reduction factor. The earned cars are then multiplied by the selected pure premiums in the respective territories, and the products so obtained are summed up in order to find out the total countrywide losses which might be expected on the basis of the selected pure premiums. These losses are compared with the actually incurred losses for the latest available policy year, and if the indicated losses should be higher than the actually incurred losses, horizontal reduction is made in all the pure premiums selected; conversely, if the indicated losses should be lower than the losses actually incurred, a horizontal upward adjustment of the pure premiums is made.

4. *Derivation of Indicated Premiums.*

After pure premiums have been selected in regard to local conditions and trends, and after they have been adjusted to the level of the latest experience indications, it becomes possible to establish indicated gross premiums by dividing the selected pure premiums by one minus the overhead expense loading. The expense loadings used in establishing the 1925 rates are as follows:

	P.L.	P.D.	Coll.
Unallocated Claim Expense	.07	.11	.08
Administration Expense	.08	.08	.08
Inspection & Bureau Expense	.005	.005	.005
Taxes	.025	.025	.025
Acquisition	.175	.20	.20
Field Supervision	.075	.05	.05
Total	.43	.47	.44

The foregoing are based on the New York State Casualty Exhibit for 1923.

5. *Calculation of the Actual Departure.*

At this point in the rating process, the principles of experience rating are injected. The indicated rate established on the basis of the latest experience is compared with the average rate in force, and the difference between the two noted. This comparison, of course, implies the calculation of the present average rate in force and that is done by applying the ascertained distribution of cars by classes to the class rates for the various territories. If the indicated rate is greater than the rate in force, the actual departure is designated by a plus sign. If the indicated rate is lower, it is designated by a minus sign.

6. *Establishment of Credibility Factors.*

Credibility factors for individual territories are calculated on the basis of annual earned car exposures. An assumption is made of the number of cars which a city ought to develop in order to have its rate based entirely on its indications, and the number of cars thus assumed is given a credibility value of 100%. Thus, in respect to the Public Liability coverage on private passenger cars, the assumption is made that a city ought to de-

velop an annual earned exposure of fifty thousand car years before its rate can be predicated entirely on its own indications. The credibility factors for territories developing less than fifty thousand are developed in accordance with the following formula:

$$\frac{\sqrt{50{,}000}}{\sqrt{n}} = \frac{1.00}{z}$$

On the basis of the foregoing equation, a city developing an annual exposure of seven thousand car years would have a credibility factor of 37.5%.

7. *Calculation of the Allowable Departure.*

The allowable departure—that is, the amount to be added to or substracted from the existing average rate—is obtained by multiplying the actual departure by the credibility factor. Assume, for example, that the existing average rate in a given community is $100 and that the latest experience indications point to the need for a rate of $120, and assume further that the territory's exposure has earned a credibility of 40%. In this example the actual departure would be +$20, and the allowable departure only 40% of that amount, namely, +$8.00. The procedure is the same, of course, when the rate required by the latest experience indications is below the rate in force.

8. *Determination of Adjusted Indicated Rates.*

The adjusted indicated rate is obtained, obviously, by reducing the rate in force by the allowable departure if the experience indications point to a decrease in rates, or by increasing the rate in force by the amount of the allowable departure in case the experience shows the need for an increase. In the example cited in connection with the preceding step, the adjusted indicated rate would be $108.

9. *Final Adjustment of Indicated Rates.*

The scale of rates produced in the preceding step of the analysis will not necessarily produce a premium income consistent with the experience indications for the reason that the use of credibility factors has a tendency to hold the whole level of rates up where the experience indicates the possibility for a decrease in

most territories, and tends to keep the level down when the experience shows the necessity for an increase in most territories. It is therefore necessary to make a still further adjustment of the entire level of indicated premiums. This adjustment is made by comparing the expected countrywide premium income on the basis of the indicated rates with the actually needed countrywide income on the basis of the total losses incurred for the latest policy year. The indicated rate for each territory is multiplied by the earned cars for the territory, and the products so formed are summed up for the entire country. This gives the expected premium income on the basis of the reported exposures. By dividing the total losses incurred for the latest policy year by one minus the overhead expense loading, the needed premium income is obtained. The needed income can then be compared with the expected income and if the expected income is higher than the needed income, horizontal reductions are made in the indicated rates. On the other hand, if the expected income is below that needed by the loss experience, horizontal increases are made.

Derivation of Rates by Classifications

Thus far the discussion has been confined to the derivation of average territorial rates. These average territorial rates have been derived from a statistical tabulation showing the experience of all classifications combined under individual territories. The rate Manual does not, of course, show average rates for territories, but rather distinct classification rates for each territory schedule, and it therefore becomes necessary to make another tabulation of the data by individual classifications. It is not necessary, however, that classification experience be tabulated for the various territorial divisions. In fact, a tabulation of such detail would be worthless for rate making purposes, inasmuch as the volume for an individual class in an individual territory would in all likelihood be small and productive of misleading results. It is usual, therefore, to make one tabulation by classifications for the country as a whole, and to apply the results derived from such tabulation to all individual territories.

It has been demonstrated that the relativity in the class hazard does not vary appreciably from one territory to another. It may be said with some reservations that the distribution of cars by

classes is constant in the various territorial schedules. To be sure, certain classes dominate more in the large cities, for example, than they do in the rural districts, yet that domination is usually not sufficient to require the use of more than the one set of differentials.

The tabulation by classifications is used primarily for the establishment of a set of differentials which reflect the relativity of the class hazards. The experience of the two latest policy years is usually sufficient for that purpose. The following example will show how the symbol differentials are established for Public Liability insurance on private passenger cars:

Symbol	Policy Year 1922		Policy Year 1923	
	Car Yrs. Exposure	Pure Premium	Car Yrs. Exposure	Pure Premium
W	400,269	$12.50	316,368	$12.32
X	347,305	15.58	257,212	15.10
Y	130,906	21.69	90,304	19.23
Z	37,450	25.90	19,369	20.70
TOTAL....	915,930	$15.53	683,253	$14.52

Symbol	Combined Pure Prem.	Differential
W	$12.42	.823
X	15.37	1.018
Y	20.69	1.371
Z	24.15	1.600
TOTAL.....	$15.09	1.000

After the differentials have been established, it is necessary that they be checked against the percentage distribution of cars for the latest policy year in order to ascertain if they produce exactly unity. The distribution of cars among the various symbol groups varies slightly from year to year because of the increased popularity of the cheaper and lighter cars, and for that reason it is important that the differentials produce the correct result on the basis of the latest available distribution. In the foregoing example the differentials applied to the percentage distribution of cars for the policy year 1923 add up to .99 as the grand average, and it is therefore necessary to raise each of the differentials approximately 1% in order to have the ultimate rates produce the proper premium income.

The differentials for other types of cars and for other kinds of coverage are produced in exactly the same fashion as the differentials for the Public Liability coverage on private passenger cars. For commercial cars it is necessary to establish differentials reflecting the relativity in cost between the four classifications by business of the assured, and further for the three subdivisions by load capacity. For Collision insurance one set of ten differentials by symbol group is established and these are applied directly to the average pure premium for a given territory. The resulting symbol rates are in turn divided into rates for new and old cars by the application of a further age group differential.

Conclusion

The system of rating outlined in this paper has been developed only within the last two years, and was used in the rate revisions of 1923 and 1924. It is by no means perfect, and no doubt will be modified quite materially after more experience has been gained in the application of these methods to rating problems as they develop from year to year. The principles involved seem fundamentally correct, and it is to be hoped that greater refinement and exactitude will come about in the course of time.