COMPULSORY AUTOMOBILE INSURANCE RATE MAKING IN MASSACHUSETTS

BY

M. G. McDONALD

For the past few years the subject of Compulsory Automobile Insurance has been one of paramount importance to the industry, to the legislatures in many of the states and to the motoring public. Annually the Massachusetts Insurance Department receives hundreds of requests from legislators throughout the Country to "please send (or wire) me collect all the data you have on compulsory insurance; I am filing a bill in my state to provide for compulsory automobile insurance". The reply, "The Department has 90 four-drawer files of data on the subject" usually elicits a more reasonable and specific request.

While much has been written and said about Compulsory Insurance, only two papers pertaining to the rate making phase of this form of coverage appear in the *Proceedings*, and these are not of recent date.[1]

It will be remembered that the statutes require coverage for $5/10,000 limits only on the ways of the Commonwealth. Guest Occupant Coverage had also been required until 1936 when Chapter 459, Acts of 1935 excluded this coverage, effective January 1, 1936 so that in order to compare the data presented in this paper with experience under National Standard Policies, it will be necessary to adjust Massachusetts compulsory experience to include coverage off the ways of the Commonwealth and guest occupant coverage, on and off the ways of the Commonwealth.

Despite the fact that hundreds of proposals to amend or repeal the Act have been considered by the Legislature over the years, there have been very few substantive changes in the Law.[2] Chapter 570, Acts of 1953, recommended by the Governor, established a Statutory Assigned Risk Plan, created a Highway Safety Committee, and inaugurated a system of Demerit Rating.

STATUTORY ASSIGNED RISK PLAN

For many years the insurance companies operated a voluntary assigned risk plan. In 1948 approximately 25,000 risks were assigned. This number increased to 45,000 in 1952 and over 60,000 in 1953. The tightening market made it increasingly difficult to secure voluntary cooperation of all companies in any plan. For this reason, the Governor deemed it desirable to have a statutory plan in the event voluntary agreement could not be reached. The statute requires, in substance, that the companies cooperate in the preparation of a plan

[1] P.C.A.S. — XII — p. 205 G. F. Michelbacher.
XIII — p. 188 & XV — p. 171 W. J. Constable.

[2] Of the 130 bills heard by the Insurance Committee of the General Court in 1954, 69 pertained to Compulsory Insurance.

for the fair and equitable apportionment of risks who are in good faith entitled to insurance and who are unable to procure through ordinary channels, motor vehicle liability insurance. In addition to the compulsory coverage, companies must, if requested by the applicant, furnish coverage off the ways of the Commonwealth, guest occupant coverage and property damage. A plan similar to the voluntary plan was approved by the Commissioner, effective October 16, 1953.

HIGHWAY SAFETY COMMITTEE AND THE POINT SYSTEM

Governor Christian A. Herter in his inaugural address in 1953 expressed his concern over the mounting toll of highway accidents and the attendant death and suffering. He proposed legislation: "To reduce frequency of accidents on our highways—to reward careful drivers with the lowest premium rate—to establish a system under which accident-prone drivers pay stiff, additional cost penalties—to establish a long-range program which will eventually stop the constant increase in accident frequency and insurance rates—to establish a fair, but firm system for sorting out very bad drivers who are a threat to the life and safety of all of us and our families and ruling them off the road."

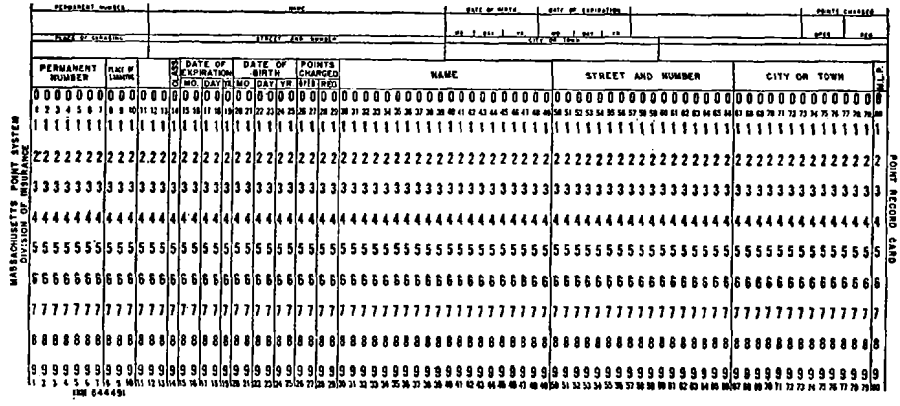
In substance, the Highway Safety Measure provides for the assessment of points for violations of the rules of the road and for "at fault" in a bodily injury accident or "at fault" in a property damage accident in which there is damage in excess of one hundred dollars to any one vehicle or other property. The Act became effective January 1, 1954, and the administration of the "Point System", including the determination of the party at fault in accidents is under the direction of the Registrar of Motor Vehicles. Due to shortage of trained personnel and the scarcity of punch card equipment, the Point System operated on an abbreviated Schedule of Points. Effective September 1, 1954, the full schedule of violations became operative and will be employed to evaluate Massachusetts motor vehicle operators. Points accruing to owners and operators are recorded on the license at time of renewal.

DEMERIT RATING

The Demerit Rating Plan is based on the theory that the combination of frequency of violations of the rules of the road with accident frequency will be a reliable yardstick for measuring driving ability and assessing insurance surcharges. The Demerit Rating Law provides that the Commissioner of Insurance shall establish a schedule of premium surcharges to apply to policies issued on and after January 1, 1956, covering private passenger cars and motorcycles which are not subject to Experience Rating. In addition, the Commissioner must give consideration to the surcharges to be collected by territory in determining the manual rates. Under the law the owner of a vehicle may be assessed points by the Registrar of Motor Vehicles

because of the operation of the vehicle by another. Points are recorded as operator's or registrant's, and the sum of operator's and registrant's points must be used in determining the surcharge.

For each point assessment the Registry of Motor Vehicles punches a card containing pertinent data, including date of license expiration. As of 90 days prior to expiration all assessment cards are matched by license number and master carded for listing of necessary data for the license bureau. At the time of listing, required data are reproduced in duplicate on a Point Record Card (IBM 844491) for the Insurance Department. The records of the Registrar of Motor Vehicles pertaining to the Point System are not public records.



The Insurance Department must code and punch on the Point Record Card: (1) The place of principal garaging, in order that surcharges by territory may be tabulated; (2) name of current carrier, for listing for insurance company information and collection of surcharges; and (3) Class, (Private Passenger, Motor Cycle, Commercial, Taxicab, etc.) in order that those operators who do not own a private passenger car or motorcycle can be excluded for calculation of surcharge offset. Two files are maintained within the Insurance Department. One is an alphabetical file, kept for reference purposes, of all who have been assessed points, the other, a statistical file containing cards for those who are eligible for surcharges.

Listings of non-licensed registrants and non-licensed, non-registrants who have been assessed points will be furnished the Insurance Department annually by the Registrar of Motor Vehicles. Points assessed will remain on the individual's record for four years (two license periods) and, will result in surcharges for four years. The law further requires that the schedule of surcharges shall provide for an equal surcharge in dollars throughout the commonwealth, irrespective of zones, and shall not be set up as a percentage of premiums.

In drafting the legislation, and establishing administrative procedure, extreme care was exercised to provide a practical and enforce-

able system at a minimum of expense. The assessment of points and surcharges is administered by state agencies, rather than by private industry. The Highway Safety Committee, with the Registrar of Motor Vehicles as permanent chairman, must meet monthly to study the problem of safety in connection with the operation of motor vehicles; to consult and cooperate with all departments of state government in regard to highway safety; to promote and encourage uniform and effective programs of safety on highways and to assist in the coordination of such programs among state departments, local government agencies, other governmental agencies, and private organizations; to encourage highway safety education in the commonwealth; and to make recommendations to the Legislature with respect to the problem of highway safety.

A point system has been in successful operation in several states, e.g., Connecticut, New Jersey and the District of Columbia. However, no other state has attempted to unite the Point System with a Demerit Rating Plan for automobile liability insurance. Many inquiries have been received from legislators in other states relative to the Point System and the Demerit Rating Plan. The experiment is being watched with interest by supervisory officials in other states.

There are currently several bills before the Legislature which would amend or repeal this Highway Safety Act. Officials and members of unions representing drivers of public vehicles are disturbed over the possibility of a driver of a bus or a municipal or state-owned vehicle, being assessed points by virtue of his operation of the vehicle which will result in surcharges on the insurance premium of his privately owned car. Instances have been cited of bus drivers who have refused to move their vehicles until icy streets have been sanded, for fear of involvement in an accident which might result in surcharges on their personal automobile insurance premiums. Such actions may inconvenience the public to some extent, but if such actions result in the elimination of accidents and the consequential damages, the inconvenience is outweighed by more important considerations.

PUBLIC HEARING

The Commissioner is required, by Section 113B, C175 G.L., to fix and establish, *after due hearing*, fair and reasonable classifications of risks, and adequate, just, reasonable and non-discriminatory premium charges for motor vehicle liability policies and bonds.

Over the twenty-eight years of compulsory insurance, a pattern for the quasi-judicial public hearing has evolved. An opportunity is afforded every interested party to introduce evidence, to testify, to argue, or to cross-examine witnesses. Insurance Department witnesses must present all the evidence used by the Commissioner in establishing rates.[3] Witnesses of the Massachusetts Automobile Rat-

[3]American Employers' Insurance Company vs. Commissioner of Insurance, 298 Massachusetts.

ing and Accident Prevention Bureau present evidence in behalf of the carriers. The transcript of the hearing on the 1954 rates contains 340 pages, plus 80 pages of communications pertaining to rates. The hearing was called to order at 10:00 A.M., and from that hour until 4:00 P.M., with a recess for lunch, 206 pages of argument by the general public were recorded before the Insurance Department ever presented its evidence. The Actuary and the Assistant Actuary of the Department took up 54 pages of the transcript in introducing and explaining the evidence for the state. The Chief Examiner, in describing the check of losses and statistical data under his supervision, covered 7 pages. The next 35 pages are devoted to cross-examination of the Department Actuary by various persons along several lines. Witnesses of the Bureau testified through 22 pages, and were subjected to cross-examination for another 22 pages, until the hearing adjourned at 8:45 P.M.

Prior to the hearing the Commissioner must advertise the proposed rates and classifications of risks in the newspapers of certain of the larger cities of the Commonwealth. Following the advertisement there is an influx of public officials from cities and towns into the Department to determine why the rates for a particular city or town or class have been increased. In most instances the representatives are surprised to find that the loss experience is available in detail for their particular municipality, and on departing, are reasonably satisfied that there exists adequate justification for the rate increases.

There are, however, some appearing regularly each year who absorb certain rate making techniques and who offer various and sundry suggestions for improving rate making methods. A few of the suggestions or theories offered in recent years, and the investigations or studies conducted by the Department in an attempt to prove or disprove these contentions, are cited for general interest.

EXPENSE LOADING BY TERRITORY VS. STATEWIDE

It is the practice of the Commissioner to issue a call to each insurance company each year for expenses incurred in connection with Compulsory Insurance, and on the basis of the expense returns, to establish a state wide loading for expenses for all classifications. Proprietors of taxicabs and public officials from high-rate municipalities have frequently complained that a statewide expense loading for all classifications is not just or reasonable. These persons advocate that the territorial rates should be so calculated that the *amount* of the expense provision in the rate should be uniform in each territory, instead of being pro-rated among the territories in proportion to the territorial gross premium as has been the custom over the years in liability insurance rate making. In addition to being proportional to territorial gross premiums the pro rating of expense is proportional to territorial expected losses since the rate is determined by loading

the expected losses by a percentage which is the same for all territories and classifications.

Under the requirements of the Department's call for expenses, the returns are segregated into the following groups:

1. Investigation and Adjustment of Claims
   A. Allocated
   B. Unallocated
2. Acquisition
   A. Commissions
   B. All Other
3. Taxes, licenses and fees
4. General Administration

The following analysis was made to determine if there was any merit in the contention that the expense loading should not be uniform by territory and by classification. Considering first commissions and taxes, it is apparent that both of these items are currently paid as a percentage of premium because of the universal practice of the industry in the negotiation of contracts between insurance companies and their producers, and because the great majority of taxes are imposed on gross premium by statute. In 1951, the items of commissions and taxes amounted to 12.6% of total 1951 stock company premiums and in 1952, 12.9%. It is obvious then that these two expense items are directly related to gross premiums.

The investigation and adjustment of claims is the next largest item of expense. Allocated claim expense is defined as those expenses incurred in the settlement of claims which can be directly allocated to a particular claim. Unallocated claim expense represents all other expenses incurred in connection with the recording and adjusting of claims.

In Massachusetts bodily injury insurance, allocated claim expense is not included with losses but is reported separately on punch cards when paid. A special survey indicated that through a fourth reporting, approximately 95% of losses and 90% of allocated claim expense was paid, and, through a third reporting, 90% and 80% respectively. Accordingly, a detailed statistical analysis of allocated claim expense for policy years 1946 and 1947, by rating territory and classification, was made and the results are contained in Exhibit A.

It had been argued that with wide variation in rate level between classifications and with claim frequency ranging from 2 to 100, per hundred car years of exposure, the higher-rated territories and classifications were paying more than their proportionate share of claims expense when pure premiums were loaded uniformly. Reference to Exhibit A conclusively demonstrates that allocated claim expense varies by rating territory directly in accordance with territorial losses

and consequently with territorial gross premiums. In addition, it is apparent that allocated claim expense varies by major classification directly in proportion to classification losses and classification pure premiums.

It is not possible to make a similar analysis of unallocated claim expense. The following table compiled from expense data and loss statistics furnished the Insurance Department is indicative:

Year	*Total Claim Expense*	*Developed Losses*	*Number of Claims*	*Ratio Expense to Losses*	*Ratio* Expense to No. of Claims*
1946	$2,938,438	$16,955,768	52,714	17.3%	5.6%
1947	3,239,002	18,793,444	56,847	17.2	5.7
1948	3,609,814	20,257,476	61,166	17.8	5.9
1949	3,984,063	23,134,223	65,793	17.2	6.1
1950	5,149,401	29,427,424	79,607	17.5	6.5
1951	5,420,838	33,560,683	85,460	16.2	6.3

*Expenses in thousands of dollars to number of claims.

This table indicates a remarkably close correlation between claim expense and losses and between claim expense and number of claims. This is to be expected because claim expense by definition consists of those expenses associated with the investigation, adjustment, recording and payment of claims. Therefore, the more claims, the greater the claim expense. Reference to a schedule of territory experience shows that the higher pure premiums are directly associated with comparatively high claim frequencies. It naturally follows that expenses connected with the settlement of claims in the territories with the higher frequencies should also be comparatively high and to approximately the same degree.

In 1951 claim expense, allocated and unallocated, constituted 12.8% of total stock company premiums; in 1952, 12.9%. With commissions, claim expense and taxes, we have now accounted for approximately 70% of the expense loading. There remain only other acquisition and general expenses to analyze.

These remaining items of expense do not lend themselves to analyses as readily as the preceding items since it is necessary to resort to cost accounting procedures to determine what portion of these expenses are chargeable to each line of insurance. In a multiple line company, the machine section — floor space, machines, personnel, records, power, heat, light, etc., for example, services all lines the company insures. A time study must be conducted to establish what part of the cost of this section is attributable to automobile bodily injury. Then a basis must be determined to allocate this item

of expense by state. The Uniform Accounting Regulations prescribe methods of determining these expenses by line, and the Massachusetts Automobile Bodily Injury Expense Plan further defines procedures for allocation by state and for separating compulsory and all other bodily injury expenses within these categories.

These procedures give reasonably accurate information within a broad area of expense allocation such as by line and by state. However, an attempt to further allocate general expenses and other acquisition costs to a more restricted area such as a rating territory within a state under the procedures outlined, or for that matter any other conceivable method, would result in substantially less accurate or reliable data.

To obtain even an approximate statistical answer as to whether or not expenses incurred in connection with general expenses and other acquisition costs are incurred in proportion to the number of policies written, to the gross premiums written, to the number or amount of claims incurred, or to some other base, many assumptions and inferences would have to be made because of the practical impossibility of making an objective analysis. Furthermore, even though each individual company might be successful in making an approximate allocation, it is to be expected that wide variations would exist between companies, because of the different methods of operation by the various companies in the rating territories. Therefore, it is apparent that some of the expenses in these categories are incurred in proportion to the number of policies written, many are incurred more nearly in proportion to the number or amount of losses incurred, and consequently in proportion to gross premium, because of the preponderance of company procedures which are directly or indirectly associated with the occurrence of a claim.

It is quite apparent that by far the greater proportion of the expense items are directly related to losses and premiums. The remaining proportion of the expenses which might conceivably be determined on a uniform basis throughout the various territories and classifications is very small. Even if it were possible to institute such procedures any advantage to be gained would be offset by the prohibitive cost of analysis involved, and by the impracticability of attempting further refinement of the presently prescribed cost accounting program.

In conclusion, it has been demonstrated that expenses incurred do vary substantially by territory; that this variation is overwhelmingly in proportion to the territorial gross premium and expected losses, and the customary method of expense loading is reasonable and realistic in relation to the actual facts. It is significant that in two court cases, American Employers Insurance Company vs. Commissioner, 298 Massachusetts 161, 164, 165 and Gaffer vs. Commissioner, Supreme Judicial Court, Equity 67540, Suffolk, the methods of the Department in fixing the expense loading were reviewed in detail and impliedly approved.

TRAFFIC CONGESTION HAZARD FACTOR

A former City Solicitor of one of the larger cities in Massachusetts in addition to being a lawyer is an accomplished mathematician. At one time he submitted to the Department an "Outline of Method of Computing 'Traffic-Hazard Credit' in Establishing Motor Vehicle Insurance Rates." Briefly the suggested method was:

To assume that insurance losses of equal amount result from the same exposure while operating in a certain area regardless of the place of principal garaging. It was proposed to develop area pure premiums representing the cost of exposure of one car year in a certain area and an acceptable method of calculating area pure premiums was proposed. With these pure premiums the exposures in the given areas were to be calculated. The density of traffic in each area was to be determined by dividing the exposure by the number of street miles in the area. The area pure premium and area traffic density was to be compared for correlation, if any. Next it was proposed to adjust the area rate by whatever extent the risk was increased by the presence of vehicles garaged outside the area, within the area.

The method outlined was tested and demonstrated the original assumption was incorrect. After calculating the different exposures, it was found that only 6.7% of the total exposure of the state would be in the area from which the proposal originated, whereas 9.7% of the vehicles in the state were principally garaged in that area. This result was in the nature of a *reductio ad absurdum.*

Designating the area from which the proposal came as Area 1 and the remainder of the State as Area 2; Area 1 developed a premium of $87.92, Area 2 of $16.49. The exposure in Area 1 for cars principally garaged in Area 1 was 22,645 car years; the exposure in Area 1 for cars garaged in Area 2 was 20,160 car years. The exposure in Area 2 for cars garaged in Area 1 was 39,551 car years; the exposure in Area 2 for cars garaged in Area 2 was 555,911 car years. The total exposure in Area 1 would then be 6.7% of the total of the State. The method of determining the subdivisions of exposure is illustrated in Exhibit J.

Further research produced the following: 18,348 claims amounting to $3,763,426 arose from accidents occurring in Area 1. Of this number, 9,451 amounting to $1,990,981 were charged to vehicles garaged in Area 1, and the balance 8,897 claims amounting to $1,772,445 were charged to vehicles garaged in Area 2. This meant that 52.9% of the losses occurring in Area 1 were charged to Area 1 and 47.1% of the losses occurring in Area 1 were charged to Area 2. Traffic surveys indicated that two-thirds of the vehicles driven in Area 1 were principally garaged in Area 2. Using these figures, index numbers representing pure premiums were developed for Area 1, $.529 \div .333 = 1.59$, and for Area 2, $.471 \div .667 = 0.71$. The ratio of 0.71 to 1.59 is 45%. This indicated that for each unit of exposure,

vehicles garaged in Area 2 caused 45% of the losses caused by cars garaged in Area 1, all while operating in Area 1. The ratio of the actual rate for Area 2 to that of Area 1 was 54%.

This comparison demonstrated that cars garaged in Area 2 do not cause as much in the way of losses as cars garaged in Area 1 while being operated in Area 1. Similarly, the regular statistics showed that this was true in approximately the same ratio for statewide operation. It was concluded that the difference in rate between Areas 1 and 2 was not due to traffic congestion in Area 1. In passing it might be added that the actuarial staff of the Department were indeed thankful that this method was not acceptable. The prospect of solving a set of seventeen simultaneous equations each year was not particularly appealing.

THE EFFECT ON RATES OF RACE TRACKS, AMUSEMENT PARKS AND BEACHES

In a recent court case one of the petitioners alleged, among other charges, that the Commissioner in fixing the rates "did not make any allowances to any territory for traffic hazards caused by special attractions", located in such territory.[4] In amplification of this allegation the petitioner stated that the Commissioner failed to take "into consideration special attractions or hazards in a city such as beaches, horse tracks, dog tracks or large shopping districts". It was argued that a territory in which such attractions are located is subjected to increased traffic hazards brought about to a considerable extent by automobiles coming from other territories where the hazards and rates are less, thereby placing an unfair burden on the automobile owners who garage their vehicles in the more hazardous area. The court said, "The petitioner's contention does not go beyond a bald assertion". However, it appeared desirable to investigate the effect of such attractions on accidents, if any.

Accordingly, a territory containing a large beach, an amusement park, a shopping center, a dog track and a horse track was selected for an anlysis of its experience. Private Passenger claims by month of accident, statewide and for the selected territory, were plotted and are shown on Exhibit B, to determine first if there were any deviation from the expected distribution during the months when the race tracks, beaches and amusement parks were in operation. The deviation was very slight, in fact the distribution statewide and for the territory was remarkably close.

Next, the claims charged against the territory were segregated by location of accident, within the territory or outside the territory. 70.8% of the claims charged against vehicles garaged in the territory arose from accidents occurring outside the territory and 29.2% from accidents occurring within the territory. The study, covering a period

[4]Massachusetts Bonding & Insurance Company & Others vs. Commissioner of Insurance (And a Companion Case) Adv. Sh. (1952) 829.

of a year, indicated that vehicles garaged in the territory were involved in accidents outside the territory which produced 2.44 times as many claims as accidents caused by vehicles garaged in the territory, within the territory. During the months the attractions were operating the ratio was 2.47 to 1; during the period the attractions were not operating the ratio was 2.37 to 1. From this study it was apparent that the allegation was without merit.

THE USE OF OUTSTANDING LOSSES IN RATE MAKING PRODUCES EXCESSIVE RATES — TEST OF DEVELOPMENT FACTORS

For many years the Commissioner has been criticized for using incurred losses rather than paid losses in making the compulsory rates. The charges allege that the outstanding losses are insurance company estimates of what they expect to pay in the future and are excessive, so that rates based on incurred losses, part of which are paid and a substantial amount unpaid, are excessive. These allegations had been repeated year in and year out, despite the testimony of the Chief Examiner of the extent to which the Department checks the data underlying the rates. The Department Actuary each year had testified to the calculation of development factors designed to adjust raw losses to ultimate on the basis of past experience. Members of the public still persisted in their arguments against the inclusion of unpaid losses in rate making. It was apparent from reading transcripts of hearings for several years that these lay people had no conception of the function of development factors. A simple test readily comprehended by the layman has been devised which illustrated the actual results of the application of development factors in dollars and cents.

Exhibit C shows a test of developed losses used in 1943 rates as compared with the ultimate losses of the tenth reporting. The proximity of the two figures is startling. The only objection was to the age of the data. In subsequent years losses through a fifth reporting have been used in support of the accuracy of the results produced by the application of development factors to raw losses, because, through a fifth reporting experience indicates in excess of 95% of the amount of the losses have been paid. The most recent test made in 1954 indicates developed losses used by the Department in the 1950 rates will be redundant to the extent of about $1.2 millions or 1.3%. From these tests it has been generally concluded by the Public and the Supreme Court that the development factors used by the Department in the past have been remarkably accurate in translating raw losses into ultimate losses.

SPECIAL CONSIDERATIONS IN COMPULSORY RATEMAKING DEVELOPMENT FACTORS

One may readily conclude from the preceding part of this paper that compulsory ratemaking is open to wider scrutiny by the public

in general in comparison with other lines. A witness for the companies at one of the recent hearings, an officer in one of the largest rating bureaus outside Massachusetts, commented that he had never seen a set of rates supported by such minute detail and so compresively introduced in evidence.

The development factors used in Massachusetts compulsory insurance are calculated from the incurred loss experience covering a period of ten years, using the average development of the two latest years available for each successive reporting. Under the requirement of the Commissioner's Statistical Plan, all loss payments under the compulsory law for a policy year are reported monthly through March 31 of the following year, at which time outstanding losses are valued and reported to complete the incurred losses for the first reporting of the policy year. On the following December 31, those losses still outstanding are valued and reported and together with prior payments constitute the second reporting of the policy year. At yearly intervals thereafter, policy year losses are reported up to and including a tenth report.

The incurred loss figures of the latest two policy years for which both a first and second reporting are available are utilized; similarly, the incurred losses of the latest two policy years for which both a second and third reporting are available are employed, and so on for a third to fourth and so on to ultimate. The use of the most recent experience bases loss development on the most recent settlements which are most likely to influence further settlements. Cumulative multiplication of the development factors thus obtained, produces the factors to be applied to the first, second, etc. reportings of incurred losses to reflect the expected ultimate development. To illustrate the calculation of the development factors the computation is shown for the factors used in the 1954 rates in Exhibit D. Application of Development Factors will be covered in the succeeding part of this paper.

SHORT RATE — SHORT TERM FACTOR

In Massachusetts the statute requires that the compulsory insurance be co-terminous with the period of registration which results in a substantial number of policies being written for less than one year. The policy year and calendar year coincide by law. Experience of the short-term private passenger risks is considerably worse than that of risks written on January 1, which necessitates charges for short-term policies considerably in excess of pro rata. A comprehensive study of private passenger short-term charges in 1950 demonstrated that such charges were inadequate. A study of the latest ten years experience compared with that of the four post-war years, 1946-1949, was found to be quite similar. The experience of these four years by month of issue is included as Exhibit E to illustrate the degree by which short-term experience differs from full term.

It is apparent that the application of short-term factors and short-

rate cancellation factors result in the collection of premiums over and above the pro rata provided in full-term rates. Therefore, it is necessary to compensate for this excess by decreasing the full-term rates by a factor measuring the percentage relationship of such premium above pro rata.

The ratio of the total pro rata premium to total collected premium represents for the latest year the short-term and short-rate offset. Pro rata premium is obtained by application of manual rates to territory exposure. In the revision of rates for 1954, the private passenger short-term and short-rate offset was 0.9630, a reduction of 3.70%. In the succeeding part of this paper the use of the offset will be demonstrated.

PROJECTION FACTORS

Prior to the advent of Compulsory Insurance in Massachusetts there had been eight rating territories, but under a Compulsory law the companies recommended three territories for 1927: Boston and 17 surrounding cities and towns, Boston Suburban plus four large cities in other parts of the State and the remainder of the State. As the 1927 experience became available in 1928 it was quite apparent that there was wide variation in experience within the territories. For 1929 the Commissioner proposed five territories and the commotion eventually resulted in his resignation without the establishment of a set of rates for 1929. The Supreme Court ordered the Acting Commissioner to establish rates for 1929 and he promulgated the five territories originally proposed by his predecessor.

Since 1929 cities and towns have been grouped in territories on the basis of similar experience without regard to geographic location. From 1929-1939 the movement of towns was on a judgment basis. From 1940 to date a formula has been applied.

Approximately fifteen years ago, the Commissioner of Insurance was concerned with the large number of cities and towns being moved from one territory to another each year by the application of the territory formula then in use. His concern was a practical one, in that each movement of a municipality upwards necessitated justification to those persons affected thereby and the explanations to laymen were difficult and unsatisfactory.

The effect of weather conditions, highway and road construction, reserve practice of certain companies and other extenuating circumstances caused various degrees of fluctuation, some tangible, others not, particularly in the experience of the smaller towns. To offset the effect of these fluctuations, the Actuarial Staff was instructed to develop what in reality amounted to a stabilizing factor to be used in conjunction with the territory formula for private passenger cars.

Using a five year base, as is the case in Massachusetts, the Department calculated a statewide private passenger developed pure pre-

mium for each of the five years of the experience period and for the five years combined. The ratio of the developed pure premium of the five years combined to the developed pure premium of the individual years produced a factor for each year, hereinafter called the projection factor. These factors, recalculated each year, have remained a stable part of the Commissioner's rating procedure over the years. The calculation of a set of projection factors used in the 1954 rates is set forth in Exhibit F. Application of the factors is illustrated in the section of this paper devoted to 1953 and 1954 rates.

TERRITORIAL FORMULAE AND THE ELIMINATION OF JUDGMENT

A preface to this subject is necessary, else the reader may gain the impression that the author is a strict advocate of the complete elimination of judgment in ratemaking with sole dependence on "actuarial science" to produce phenomenally accurate rates. Such is not the case because experience, being the best teacher, has long since discouraged even the mere harborage of such a thought.

However, experience has also taught that the uniform application of a tested formula in moving towns and cities between territories, without the application of any judgment factor which may or may not be termed arbitrary, has been well received by the public and the courts, if not with favor, at least as non-discriminatory. The "procedure used in assigning towns to territories for 1953 private passenger automobile rates," shown as Exhibit G, has been employed successfully with minor improvements since 1940.

The "Automobile Credibility Table" has also been used over the years in establishing the credibility of the experience of each city and town.[5] The subject of credibility is amply covered in the *Proceedings* and no elaboration will be attempted here. There are some inherent deficiencies in the present private passenger territory formula which are not serious, but are disturbing. For example a town may be suffering adverse experience due to lack of law enforcement, safety education or some other situation which can be corrected. During the unfavorable experience period, high claim frequency may produce enough credibility which combined with the other factors necessitates moving the town to a higher rated territory. After being shown the experience that caused the rate increase, the City Fathers launch a "speed drive", safety program, etc., and in a few years the experience has shown marked improvement. Claims have fallen way off. Exposure has remained relatively constant. What happened to credibility? It decreased with the decrease in claim frequency. The deviation necessary to warrant moving the town to a lower rated territory has however, increased. The town becomes more or less static in the higher rated territory.

Commercial car territories have been relatively stable over the

[5]P.C.A.S., Vol. XV, pgs. 219-222.

years, more for lack of a suitable territory formula than for a lack of indication that adjustments should have been made. Originally, and periodically since, commercial car territories were established on the basis of recommendations of a group of underwriters specializing in classifying and rating commercial cars. In 1950 it was quite obvious, from reviewing commercial car experience, that a number of cities and towns were out of line, territory-wise. Various formulae were suggested and tested, but the application of a formula to statistics lacking any semblance of homogeneity produced violent results. Meanwhile, as the studies were in process, the commercial car cities or towns showing the greatest variation from the territory were moved up or down as the experience warranted on a strictly judgment basis.

The formula or method producing the most logical results when applied to commercial vehicles was in effect a form of experience rating of the individual city or town. The credibility of the latest year's experience for each town was established from the credibility table, as was the five year credibility of each town. The developed pure premium on rate level of the latest year was weighted by the credibility of that year; the developed pure premium of the five years on rate level was weighted by the five-year credibility less the latest year credibility; the complement of the five-year credibility was then applied to the underlying pure premium on level. The sum of these components then gave a weighted pure premium on level for the town. Various methods could then be applied to group the towns into territories.

This formula or procedure appeared to have merit. All of the minor differences of the private passenger territory formula seemed to have been overcome. The new formula was more responsive to recent developments and it did not result in the freezing of a town within a territory. However, exhaustive tests over a period of years indicated that a small credibility town might be subject to undue fluctuation by use of the latest year's experience, even to the limited extent of its credibility. Statewide, the experience indicates that slightly in excess of 40% of the amount of claims has been paid by the first reporting. In the aggregate, the development factors offset any over valuation of outstanding losses, but in rare instances it has been found that due to several serious accidents charged against a small town, there may be occasions when the losses charged against the town vary considerably between the first and second reporting of losses. Under such circumstances a town might be prematurely moved to another territory.

Consequently, the procedure was modified to establish credibility of the latest two years and the latest five years. The two year credibility was then applied to the two year developed pure premium on level; the five year credibility less the two year credibility was applied to the five year developed pure premium on level; and the complement of the five year credibility applied to the underlying pure

premium on level. The sum of these components then gave a weighted pure premium on level for each town.

Various methods of moving towns into territories were tried and the following selected after tests.

A weighted pure premium was computed for each of the present rating territories in the same manner as for each town. Each town was then reassigned to the rating territory, the weighted pure premium of which was nearest to the weighted pure premium of the town, except that no town was moved more than one territory from its present position and no town was moved from one territory to another in opposite directions in two successive years. A pure premium for each new territory was then calculated by the weighting of the credibility weighted pure premiums of the towns assigned to the new territory.

To determine if this method of rating produced reasonable results, the experience of prior years was tested by the application of the rating formula to commercial car experience. The objection outlined above had been overcome by the use of the experience of the latest two years in lieu of the experience of the latest year. The test produced territorial alignment which was a substantial improvement over any previous method. Consequently, the Commissioner in establishing commercial car rates for 1954 adopted the method outlined. No towns were shifted within the private passenger classification in 1954 because of the adoption of the "age and use" classification plan. It is contemplated that in future years, this method, or a modification thereof, will be used for private passenger cars.

It has been observed in Massachusetts where territorial changes in commercial cars was indeed infrequent, that some fleet owners and individuals took advantage of this weakness to legally relocate their base of operations, or place of garaging, to take advantage of lower rates. It is contemplated that the adoption of a reasonably responsive rating formula will discourage such practices by making them economically infeasible.

In the section of this paper devoted to 1954 rates, the use of this formula is illustrated.

RATE LEVEL AND TREND FACTORS

A review of the history of rates over the years of the compulsory Act indicates a complete lack of use of trend factors until recent years. The majority of rates have been based on a three year rate level. In some instances a two-year rate level was employed. In 1942, with the advent of gas rationing and an expected decrease in exposure, rate levels were modified to reflect what might be expected under a war-time economy. A three year rate level was restored and continued in use through 1952. The reluctance of a Commissioner to adopt a trend factor in the face of the economic situation, stemmed more

from the desire not to deviate from an established and tested ratemaking procedure than from any other force.

However, it became quite apparent from mere observation, a tight market, a substantial increase in assigned risks, and underwriting results of the companies, that the customary ratemaking procedure needed modification. Consequently in the revision for 1953, since claim frequency was relatively stable, the Commissioner based his rates on a three year rate level adjusted to reflect the average developed claim cost of the latest year, 1951. Subsequently, in the revision for 1954, a similar adjustment was made and will be discussed in a subsequent section.

USE OF FACTORS AND FORMULAE AS APPLIED TO 1953 AND 1954 MASSACHUSETTS COMPULSORY RATES

PRIVATE PASSENGER CARDS

The calculation of development factors, the short rate-short term factor and projection factors has been illustrated in the preceding sections. In addition, the private passenger territory formula and the use of trend factors have been discussed. To simplify the rating process, a private passenger town card is prepared for each city or town with five year credibility in excess of 20%. Since no cities or towns were moved in 1954, the calculation of the rate and the application of the territorial formula is illustrated by an example from the 1953 Rate Revision.

The private passenger cards for Billerica, Brookline, Lynn and Medford are attached as Exhibit "H". Column (3) of the card represents a composite factor used solely for convenience and is obtained by multiplying the development factor by the short rate-short term factor by the 3 year rate level factor:

Year	*Dev. Factor*	*Short Rate-Short Term Offset*	*3 Yr. Rate Level Factor* *	*Comp. Factor*
1951	1.0061	.9605	1.0796	1.0433
1950	.9712			1.0071
1949	.9724			1.0083
1948	.9859			1.0223
1947	.9960			1.0328

*Ratio of Statewide 3 year Dev. Pure Premium to 5 year Dev. Pure Premium.

The projection factors, Column (6), for 1953 were calculated as for 1954 as shown in Exhibit "F". Column (7) shows the projected pure premiums referred to in the territorial formula. Column (5) shows the indicated pure premium by year and for the five years.

Considering Billerica, with 62% credibility, Exhibit G indicated a deviation of 15% which means that the five year indicated pure premium must exceed 30.30 before the town was considered for a move. In addition, in four of the five years including the latest, the projected pure premium exceeded the underlying pure premium. Therefore, Billerica was moved to the next higher territory.

In the case of Brookline, Lynn and Medford, all with 100% credibility, the five year indicated pure premium exceeded the underlying by more than 10% in each case, and the projected pure premium for each of the five years exceeded the underlying for each town. Consequently, the three cities were moved to the next higher territory along with Billerica. When the experience of these four municipalities was combined with that of the cities and towns remaining in the higher rated territory, a five year indicated pure premium of 30.24 resulted. This example demonstrates the use of the territorial formula.

Having obtained a five year indicated pure premium (developed and offset for short rate and short term, and on a 3 year rate level) for each territory it becomes a relatively simple operation to obtain rates. A review of claim frequency and claim cost statewide was made to determine if any trend existed. Claim frequency for private passenger cars had been static for the latest five years, and there was no indication to lead the Commissioner to believe that any change in frequency might be expected in 1953.

A review of average claim costs for the latest three years indicated a definite trend:

Year	*No. of Claims*	*Developed Losses*	*Average Claim Cost*	*Index to Previous Year*
1951	86,765	$33,493,372	$386	1.052
1950	80,184	30,310,244	367	1.052
1949	66,080	23,739,787	349	1.058
1949-51	233,029	$86,015,250	$369	

Since a three year rate level reflected a developed claim cost of $369 and the 1951 year indicated $386, the Commissioner decided to reflect the level of 1951 claim costs in the 1953 rates and consequently the territorial indicated pure premiums were multiplied by a factor of 1.0461 ($\frac{386}{369} = 1.0461$). To follow through the territory previously used as an example, the indicated pure premium of $30.24 when multiplied by 1.0461 produced a final pure premium of $31.63.

A study of the expense returns of non-participating Companies indicated that the expense and profit loading used in the prior year,

36.5%, was reasonable and the Commissioner continued that loading. The final pure premium ($31.63) when loaded produced an indicated rate of $49.81. It has been the practice of the Commissioner in recent years to round to the nearest half dollar. Consequently a rate of $50 was established for the territory used as the example. Rates for the other territories were similarly established for 1953. No classification plan was employed.

There exist today in Massachusetts sixteen territories. However, the first seven are single town territories. The majority of these seven territories were at one time or another included within another territory and were segregated in all except one instance at the request of the respective municipal officials. If single town territories were integrated with the multiple town territories, eleven territories would suffice for private passenger cars.

COMMERCIAL CARDS

Commercial motor vehicles in Massachusetts are classified according to the business occupation of the insured as Class 3 or Class 4 and are further subdivided into size type according to the maximum load to be carried as CA or CB.

As approximately 80% of the exposure is found in Class 4, Class 3 experience by territory is very thin. Therefore, territory alignment is based on Class 4 experience and pure premiums for Class 3, weight within class, are determined by use of differentials applied to Class 4 pure premiums. Classification differentials and load capacity differentials are based on five-year experience:

Classification Differentials Used in 1954 *Rates*

Territory	5 *Year* ('48-'52) *Pure Prem. Class* 4	*Class* 3	*Differential by Territory*
1	$60.09	$74.76	1.244
2	47.28	64.13	1.356
3	39.05	56.97	1.459
4	30.71	49.75	1.620
5	27.30	48.74	1.785
6	19.08	53.09	2.782
7	11.47	29.76	2.595

Calculation of Load Capacity Differentials

Territory	5 *Year* ('48-'52)	*Pure Prem.*	*Differential*
1	4CA	$58.30	.970
	4CB	66.60	1.108
	Total	60.09	
2	4CA	44.67	.945
	4CB	57.30	1.212
	Total	47.28	
3	4CA	35.63	.912
	4CB	53.44	1.369
	Total	39.05	
4	4CA	28.65	.933
	4CB	39.44	1.284
	Total	30.71	
5	4CA	25.40	.930
	4CB	36.48	1.336
	Total	27.30	
6	4CA	17.66	.926
	4CB	26.70	1.399
	Total	19.08	
7	4CA	10.39	.906
	4CB	18.20	1.587
	Total	11.47	

Similarly the Class 3 load capacity differentials were calculated to be:

Territory	*1*	*2*	*3*	*4*	*5*	*6*	*7*
3CA	.986	.885	.914	1.006	.873	.758	.790
3CB	1.015	1.105	1.138	.994	1.138	1.264	1.226

The following rate level factors for 1954 rates were calculated for use in the commercial territory formula:

		Rate Level Factor
1952 Class 4 Pure Premium / 1951-52 Class 4 Pure Premium	$\$31.67 / \$30.99 =$	1.022
1952 Class 4 Pure Premium / 1948-52 Class 4 Pure Premium	$\$31.67 / \$28.56 =$	1.109
1952 Class 4 Pure Premium / Pure Premium underlying Class 4 Rates	$\$31.67 / \$28.34 =$	1.118

Cards were then prepared for each city and town and assembled in 1953 territory order. To illustrate, cards for Dedham and Waltham, in 1953 Territory 3, are attached as Exhibits H-1 and H-2. The raw pure premium of the latest two years, 1951-52, was brought to level by the application of the factor 1.022 and this amount weighted by the credibility, Z_2, of the town for the two years. Similarly, the five year and underlying pure premiums on level were modified by the five years less the two year credibility ($Z_5 - Z_2$) and the complement of the five year credibility ($1 - Z_5$), respectively. The sum of these components produced a weighted average pure premium for each town. Expected losses were then obtained by multiplying the two year exposure by the weighted average pure premium.

A card was then prepared for each territory with towns in 1953 territory order. Exhibit H-3 shows the Territory 3 card and the weighted average pure premium, $44.82, for Territory 3 calculated in the same manner as for each town. To determine what towns should be moved, the mean of the territorial weighted average pure premium for consecutive territories was calculated to establish limits:

1953 *Territory*	*Avg. Wt. Pure Prem.*	*Mean*	*Limits*
1	$66.57	$59.87	over $59.87
2	53.17		
2	53.17	49.00	$49.00-59.87
3	44.82		
3	44.82	40.90	40.90-48.99
4	36.98		
4	36.98	32.99	32.99-40.89
5	29.00		
5	29.00	25.17	25.17-32.98
6	21.34		
6	21.34	17.21	17.21-25.16
7	13.07		under 17.21

Having established territory boundaries, it was a simple matter to compare the weighted average pure premiums of the towns within a territory with the limits so established and to move any town whose pure premium did not fall within the limits. For example, reference to Exhibit H-1 shows Dedham with a weighted average pure premium of $50.21 which exceeds the upper limit of $48.99 for Territory 3. Consequently, Dedham was moved to Territory 2. Conversely, Waltham, (Exhibit H-2) with a weighted average pure premium of $39.14 which is below the lower limit of $40.90 for Territory 3, was moved to Territory 4.

The application of the formula to all towns in the State resulted in seven towns moving to a higher rated territory and two to a lower rated territory. In the next revision seven towns were moved to a higher rated territory.

The town cards were then sorted in new territory order and a weighted pure premium calculated for each new territory. Class and weight differentials were then applied and a statewide weighted pure premium calculated for each class.

Rate level by class was based on three year average claim frequency and the latest developed average claim cost.

Class	(1) 1950-52 *Frequency*	(2) 1952 *Dev. Av. Cl. Cost*	(3) *Short Rate-Short Term Offset*	(4) *Rate Level P.P.* (1)x(2)x(3)
3	15.3	$431	.9826	$64.80
4	7.4	433	.9826	31.48

Wide variation by year within class and between classes indicated a broader base for frequency than for claim cost.

Comparison of the statewide weighted pure premiums with the rate level pure premiums by class produced the rate level factors.

$$\text{Class 3 } \frac{\text{Rate Level Pure Prem.}}{\text{Statewide Wt. Pure Prem.}} = \frac{\$64.80}{\$60.96} = 1.0630$$

$$\text{Class 4 } \frac{\text{Rate Level Pure Prem.}}{\text{Statewide Wt. Pure Prem.}} = \frac{\$31.48}{\$31.34} = 1.0045$$

In view of the insignificant factor for Class 4, weighted pure premiums were used without adjustment. Class 3 pure premiums were modified by the factor of 1.0630 to produce the desired rate level, loaded for expenses and profit at 36.5% and rates rounded to the nearest half-dollar.

To illustrate, the calculation of the rates for Territory 3 follows:

Class 4 Wt. Pure Prem. (1954 Terr. Order)	$43.66
Class 3 Territory Differential	× 1.459
Class 3 Indicated Pure Premium	$63.70

Class 4

Wt. Pure Prem.		*Wt. Differential*		*Final Pure Prem.*
$43.66	×	CA .912	=	CA $39.82
43.66	×	CB 1.369	=	CB 59.77

Class 3

Ind. Pure Prem.		*Wt. Differential*		*Final Pure Prem.*
$63.70	×	CA .914	=	CA $58.22
63.70	×	CB 1.138	=	CB 72.49

The application of the CA weight differential to the indicated pure premium for Class Three in Territory 4, produced an indicated pure premium for Class 3CA of $58.85. Consequently, Territories 3 and 4 were combined for Class 3CA to produce a pure premium of $58.63.

The loading factor, 1.5748 ($\frac{1}{.635} = 1.5748$) applied to these pure premiums produced the rates after adjustment for rate level.

Territory 3

Class 4

	Final Pure Prem.		*Rate Level Factor*		*Loading Factor*		*Rate*	*Rate Rounded*
CA	$39.82			×	1.5748	=	CA $ 62.71	$ 62.50
CB	59.77			×	1.5748	=	CB 94.13	94.00

Class 3

CA	$58.63	×	1.063	×	1.5748	=	CA $ 98.15	$ 98.00
CB	72.49	×	1.063	×	1.5748	=	CB 121.35	121.50

THE ADAPTABILITY OF METHODS TO PUNCH CARDS

Since all of the underlying data used in the rate making is collected and produced from punch cards, the possibility of carrying through

the process to completion on punch cards is attractive. With the advent of the "Point System" there has been established within the Insurance Department a modest machine section. With the addition of an electronic calculator it would indeed be a simple operation to convert to machine ratemaking.

OPERATING RESULTS UNDER THE COMPULSORY LAW

The attached exhibits I-1 and I-2 show by year the compulsory experience since inception through 1948 and include earned premium, incurred losses, loss ratio, provision for losses, excess or deficiency, expenses and profit or loss and totals for stock carriers and for non-stock carriers. Exhibit I-3 shows the experience for the years 1927-48 inclusive for stock and non-stock carriers combined.

The policy year losses are ultimate except for the latest five years which are as of the latest reporting, 5th report 1948, 6th, 1947, etc. As of the fifth report more than 95% of the losses are paid. The separation of losses between stock and non-stock carriers was accomplished by the application of the split at a first reporting to the latest reporting for the policy years 1932-48 by year. For prior years the division was obtained by applying the percentage split for the policy years 1932-36 in the aggregate.

The provision for losses was obtained by applying the permissible loss ratio to the earned premium for each group of carriers. The expenses were compiled from the company expense returns as reported to the Insurance Department annually.

THE DELAY IN THE ADOPTION OF THE AGE AND USE PLAN IN MASSACHUSETTS

CONFLICTING DATA AND REPORTS

It may seem odd that Massachusetts was the next to the last State in the United States to adopt the Age and Use Classification Plan in view of the pioneering in Massachusetts in the accumulation of data pertaining to the age of operators involved in accidents, and the accident experience of cars used in business. However, there were several good reasons for the delay.

In the paper by L. W. Scammon, there will be found results of early samplings within Massachusetts which appear to prove that young drivers are considerably worse as a class than older operators.[6] Meanwhile, a study conducted by the Center for Safety Education, Division of General Education, New York University, was released in August, 1949 which is quoted in part:

[6]P.C.A.S., Vol. XXXVII, pgs. 43-56.

"Massachusetts"

"Observations:

"1. The experience, on the whole, of drivers between the ages of 19 and 25 appears to be poorest."

"2. Drivers over 30 years of age appear to be the best risks."

"Conclusions:

"1. In no instance is the experience of the teen-age group any worse than that of the 20-24 year old group."

"2. In no instance is the experience of the 25-29 year old group *better* than their expected experience."

"3. On the basis of the combined totals of Connecticut, Massachusetts and Wisconsin, drivers between the ages of 20 and 24 have the poorest experience, with the teen-agers rating second, and the 25-29 year old group rating a close third."

Many officials concluded from this study that teen-age drivers in Massachusetts were neither better nor worse in their accident involvement experience than those in the 20-24 year and 25-29 year groups and therefore any classification plan with a breaking point at age 25 was then open to severe criticism.

In his report for the year 1952, the Massachusetts Registrar of Motor Vehicles included a table showing by age of operator the number of fatal and non-fatal accident involvements. When this distribution was compared with the distribution of licensees shown in the article by Mr. Scammon, it was apparent that the 25-29 group was substantially better than the younger operators. Similarly, the 1953 accident data reported to the Registrar when compared with the same distribution of licensees indicated that the breaking point was at about age 25. However, the 1953 data indicated the 16 and 17 year-olds were apparently getting worse.

However, the Commissioner of Insurance established the following "age and use" classification plan applicable to private passenger cars for 1954:

Class 1. No operator under 25. No business use.

2. Operator under 25.

2A. Operator under 25 accident free and possessing a certificate from a "Behind the Wheel" Driver Training Course approved by the Registrar of Motor Vehicles.

3. Business use.

The indicated relativities based on Massachusetts experience for the years 1950, 1951, and 1952 and the selected relativities for 1954 are shown below:

	Indicated	*Selected*
Class 1	1.00	1.00
2	1.97	1.60
2A	—	1.36*
3	1.29	1.275

*The class 2A relativity represented a 15% discount from class 2.

Immediately after the War, the Registrar of Motor Vehicles intensified his campaign to promote Driver Education in the high schools of the Commonwealth with emphasis on the "Behind the Wheel Training" phase and the results are tabulated below:

	Student Enrollment					
	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53
Classroom Instruction Only	28,147	35,814	36,328	35,900	34,513	31,741
Classroom & Behind the Wheel Training	1,250	4,435	6,809	7,912	8,538	8,946

Certificates are issued by the Registrar of Motor Vehicles upon recommendation of the Instructor to those students who have satisfactorily completed the entire course in Driver Education. Driver Education consists of classroom instruction, practice driving, examination by a Motor Vehicle Examiner, using the high school training car and receipt of a license. In January, 1950, the Registrar inaugurated a ten-year survey of the driving records of 1500 high school students selected at random throughout the Commonwealth. These students were divided into three groups of 500 each. The first group had no formal training whatever, the second group had classroom instruction only, while the third group had completed the entire course.

Detailed records, accident involvement, convictions, warnings, etc., have been maintained for each individual within the study. At the end of 30 months, the frequency of involvement, convictions and warnings was calculated for each group: no formal training, 7.8; classroom instruction only, 6.7; and classroom and behind-the-wheel training, 4.5. Although the sample lacks credibility, the wide variation in

frequency between the untrained and the behind-the-wheel trained groups warranted some recognition. Consequently, a 15% credit from Class 2 rates was allowed vehicles operated by certificate holders who were accident free.

Needless to say, the rate credit served as a stimulus to the Driver-training Program. In fact, many applicants were unable to take the course. Where 8,946 were enrolled in the 1952-53 year, in excess of 11,000 were certified in the 1953-54 year and the program is still expanding at an accelerated rate.

A special call for experience for the first five months of 1954 appears to justify the judgment of the Commissioner in erecting the behind-the-wheel trained driver class. The indicated relativities for this period are:

Class	*Indicated Relativity**
1	1.000
2	2.419
2A	1.313
3	1.329

*For supporting data see Exhibit "M".

It should be stated that the credibility of the 2A class is small and what the ultimate relativity should be will not be known for several years. It is interesting to note the distribution of amount of loss by age groups within class for the five months:

Amount of Losses by Age Group — January-May, 1954

Class	*Under* 25		25 *and Over*	
	Losses	*% of Class Losses*	*Losses*	*% of Class Losses*
1	$ 285,751*	5.53	$4,882,832	94.47
2	1,792,273	77.87	509,228	22.13
2A	36,773	64.27	20,441	35.73
3	107,330	10.15	950,364	89.85

*Losses caused by under 25 operators not resident in the household and persons in the Armed Forces of the U. S. who do not qualify as residents of the household if they do not regularly operate the vehicle, as well as persons learning to drive.

It was earlier stated that the experience of the 16 and 17 year olds appeared to be taking a turn for the worse in 1953 based on the accidents reported to the Registrar of Motor Vehicles and the dis-

tribution of licenses from the 1949 sampling. With the vast increase in number of trained drivers entering the exposure at ages 16 and 17, it was expected that there would be a substantial improvement in their experience. Assuming the distribution of personal injuries by age of operator to be reasonably accurate, since it compared favorably with similar distributions from other sources, it appeared that it would be desirable to obtain a new sample to test the distribution of licensees by age.

As of December 31, 1953, a new sample of licensees was taken by four individuals working independently and without duplication, of the 1,900,000 licensed operators in the Commonwealth. The four samples were tabulated separately and then combined to eliminate any distortion which might be due to the human element. Each of the four samples compared favorably with the combined and it was generally agreed that the results were indicative of a substantial change in distribution in the younger ages.

In Bests' Insurance News, September, 1953, Deputy Commissioner Veness of the New York State Bureau of Motor Vehicles reported experience of New York operators by age groups for the year 1952. Because of the restriction on drivers under 18 in New York City, Upstate New York was chosen for an age-accident involvement comparison with Massachusetts which follows.

	*% Drivers** (1)		*% Involvement*** (2)		*Age-Accident Invol. Index* (2)÷(1)	
Age of Driver	*Mass.*	*Up. N. Y.*	*Mass.*	*Up. N. Y.*	*Mass.*	*Up. N. Y.*
Under 18	2.5	1.2	4.0	2.3	1.60	1.92
18-20	5.1	4.3	8.7	7.9	1.71	1.84
21-24	8.3	7.7	11.2	10.5	1.35	1.36
25-29	12.5	12.4	16.6	16.4	1.33	1.32
30-39	25.3	25.5	24.8	26.3	.98	1.03
40-49	20.3	20.9	16.6	18.1	.82	.87
50-59	14.6	15.6	10.9	11.9	.75	.76
60-64	4.9	5.5	3.6	3.4	.73	.62
65 & over	6.5	6.9	3.6	3.2	.55	.46
	100.0	100.0	100.0	100.0		

*Mass. Sample as of 12/31/53, N. Y. as of 1952.
**Mass. — 20,850 Incurred Loss Reports — Jan.-May, incl., 1954, N. Y. — 1952 Reports to N. Y. Bureau of M. Vs.

It is interesting to note from the table above that although there exists some variation in the distributions between states, the Age-Accident Involvement Index, except for the under 18 and over 60 groups, is very similar. The comparison also questions the propriety of the break in the classification plan at age 25 and suggests further research into the possibility of three age differential groupings; 20 and under, 21-29, and 30 and over.

It appears at this time that there has been a substantial increase in the number of drivers under age 18, especially in Massachusetts. A number of things may contribute to this change, such as birth rate, war time economies, etc., but it would seem logical that the availability of driver training programs in the schools of Massachusetts has encouraged students, especially females, to obtain licenses at an earlier age. At present from 30 to 40% of the licensees at ages 16 and 17 have completed an approved Driver Training Program and at no direct cost to the parents.

Exhibit K shows the 1952 and 1953 distribution of personal injury involvements by age reported to the Registrar of Motor Vehicles plotted against the 1949 distribution of licensees by age included within Mr. Scammon's paper. In addition the same distribution of involvements for 1953 is plotted against the 1953 distribution of licensees by age.

The indicated improvement in the young ages is due to the shift in distribution of licensees as will be noted in the following table.

Percent of Total Licensees by Age

Age	1953 *Dist.**	1949 *Dist.***
16	1.0	0.45
17	1.5	0.96
18	1.6	1.06
19	1.8	1.41
20	1.7	1.75

*Based on sample of 138,782 licensees.

**Based on sample of 82,969 licensees.

Exhibit "L" shows a comparison of the Age-Accident Involvement Index curves for distributions of losses by age from four different sources. Three of the curves are based on the 1949 distribution of licensees; the N. Y. U. curve reflects an independent earlier sampling of licensees by age.

LEGISLATIVE INVESTIGATION OF COMPULSORY INSURANCE MERIT AND DEMERIT RATING PLANS

Since the enactment of the Law there have been several investigations of Compulsory Motor Vehicle Liability Insurance. The most comprehensive investigation is reported in the 288 pages of Senate Document 280, January, 1930. The index to this document covers 2½ pages and includes such subjects as Maximum Rates, Demerit rating, Fleet rating, Deductible Policies, Blanket Policies, Selecting Risks, Non-Resident cars, Rate Making in Massachusetts, "Fake" Claims and Court Procedure, Compensation regardless of negligence, State Fund and Initiative Fund Bills, Insure the Driver Plans, Safety Responsibility Laws and the Pedestrian Problem. Practically every modification of the Law proposed since that time has had its roots in Senate 280 which is interesting reading.

On the subject of Demerit Rating, the Special Commission recommended a plan whereby a risk would be classified as normal until he committed certain offenses or was involved in an accident whereupon the risk would be classified A, B or C depending on the nature of the offense or the severity of the accident. He would then pay a 10%, 25% or 50% increase in rate until such time as he completed twelve months of operation without any further record or accident involvement, whereupon he would revert to the next lower surcharge bracket.

In 1934 the Legislature directed the Commissioner of Insurance to study the Law "with a view to providing relief for careful operators of motor vehicles in the form of a reduction in the amount of insurance premiums paid by them under said law."

The report of the Commissioner is contained in House Document No. 1000 (1934). After 31 pages of the pros and cons of merit and demerit rating, the Commissioner concluded; "It requires no further discussion to demonstrate that the adoption of either the merit or the demerit rating plan in any form would serve only to increase the costs payable by motor vehicle owners for or in connection with their compulsory liability insurance, and further to complicate the operation of that law for nearly a million persons affected by it." The Commissioner's principal objection to a demerit rating plan was administrative cost.

Again in 1938 the Commissioner of Insurance was directed to make a similar study. His report is to be found in House Document No. 2147 (1939). This Commissioner devoted his report to the advantages and disadvantages of a merit rating plan since his instructions did not contemplate a study of demerit rating. His conclusion was that "We have given considerable thought to the possible effect of a merit rating plan as a medium of increasing safety on the highways, and we cannot believe that the possibility of saving a small amount on automobile insurance premiums will be an inducement which would materially affect the habits or reactions of car owners, particularly

when we consider that many accidents are caused by operators of automobiles who do not own cars and, therefore, do not pay premiums."

From 1938 to date there have been countless numbers of bills proposing various forms of relief for so-called careful drivers. None appeared to have merit without some tie-in with law enforcement and licensing of operators. Consequently, the 1953 proposal of the Governor to combine a demerit rating plan with a point system for evaluating operators and owners of automobiles on the basis of driving performance was received with mixed emotion in different circles. In general, everyone approved of the highway safety provisions in the proposed law, but those from the higher rated territories insisted that any demerit rating plan must be based on a statewide flat rate. The proponents of the flat rate were in the minority and after many hearings and rewrites the "Highway Safety Act" was enacted.

PROBABLE EFFECT OF POINT SYSTEM AND DEMERIT RATING LAWS ON CLAIM FREQUENCY AND RATES

Under the provisions of the legislation the Highway Safety Committee is charged with giving appropriate publicity to the point system and the schedules of penalties. The Registrar of Motor Vehicles and his committee started to publicize the system early in 1954 and succeeded in alerting the driving population of the advent of a new era in law enforcement and its potentials. Of course the publicity attendant upon the enactment of the law in the summer of 1953 first stimulated thinking about Highway Safety. It is quite probable that such publicity had some effect on claim frequency during 1954 and that those who were assessed points in 1954 became disciples for or against the point system.

During 1954 in excess of 30,000 operators or owners were assessed points. Earlier it has been pointed out that the full effect of the Point System was not felt until September, 1954; however, in 1955, it is expected that the number assessed will approximate 60,000, very few of whom will be repeaters. Not all of those assessed will be eligible for surcharges in 1956. The worst offenders will be off the highways and some of the operators are not owners of private passenger cars or motorcycles. The amount of the offset in the rates depends on the number of eligibles assessed and the value attached to the points by the Commissioner of Insurance.

At this writing it appears that the decrease in frequency noted in 1953 has continued in 1954 both in bodily injury and property damage claims. Some part of the decline is without doubt due to the Point System and the Demerit Rating Plan. Whether the increase in claim cost indicated in 1954 will offset the reduced frequency is a matter for the future.

EXHIBIT A

Ratio of Allocated Claim Expense Pure Premium to Incurred Pure Premium

Territory	*Private Passenger*		*Commercial*		*Taxicabs*	
	1946	1947	1946	1947	1946	1947
*1	.064	.036	.060	.032	.060	.030
*2	.060	.034	.053	.033	.069	.034
*3	.057	.039	.043	.028	.043	.024
4	.043	.038	.065	.048	.059	.041
5	.043	.033	.056	.030	.020	.028
6	.046	.036	.055	.036	.034	.058
7	.054	.037	.060	.038	.064	.026
8	.047	.031			.064	.026
*9	.046	.046				
*10	.039	.025				
11	.039	.037				
12	.045	.035				
*13	.060	.061				
14	.048	.035				
15	.058	.039				
16	.048	.037				
17	.047	.041				
Total	.049	.037	.056	.034	.051	.030

*Single Town Territories for Private Passenger Classification.

Note: 1946 Policy Year through a 4th Reporting
1947 Policy Year through a 3rd Reporting

Territories arranged from highest rate, Territory 1, to lowest rate, Territory 17.

EXHIBIT B

PRIVATE PASSENGER CLAIMS BY MONTH OF ACCIDENT

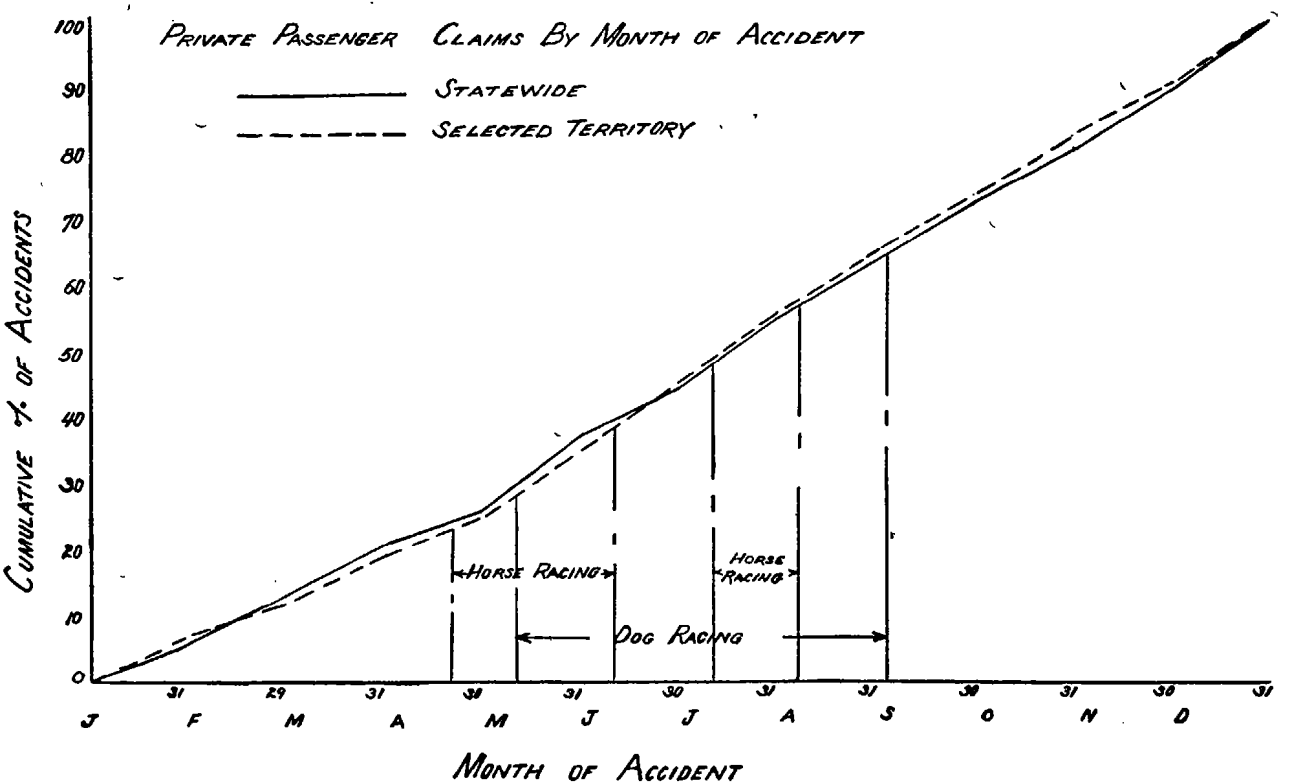


EXHIBIT C

TEST OF DEVELOPMENT FACTORS

The latest year for which a tenth Reporting of Losses is available is 1941. Rates for 1943 were based on the experience of the five years 1937-41, the latest 5 year period for which ten years of development is available. There follows a comparison by year of the raw losses, column (2) reported to the Department by the Companies; the tenth reporting of these losses, column (4) representing all paid losses; and the losses used by the Department, column (5) by the application of development factors to the raw losses, in the computation of the 1943 Rates:

(1) *Policy Year*	(2) *Raw Losses*	(3) *Reporting*	(4) *Tenth Reporting*	(5) *Developed Losses Used in Rates*
1937	$17,638,338	5th	$17,610,924	$17,578,368
1938	14,998,720	4th	14,925,493	14,913,227
1939	16,882,739	3rd	16,598,621	16,656,510
1940	17,626,691	2nd	16,896,723	17,078,501
1941	18,955,862	1st	17,781,879	17,500,052
	$86,102,350		$83,813,640	$83,726,658

The total developed losses used in the 1943 rates by the Department are $86,982, or about one tenth of one percent less than the losses as actually paid several years later.

EXHIBIT D

Calculation of Development Factors for 1954 Rates

Year	(1) *1st Report*	(2) *2nd Report*	(3) *Development*	(4) *Development Factor*
1950	28,846,221	30,310,244	(2)÷(1)	1st to 10th Report
1951	33,290,301	34,570,131		
	62,136,522	64,880,375	1.0442	1.0137
	2nd Report	*3rd Report*		
1949	23,821,494	23,739,787		2nd to 10th Report
1950	30,310,244	30,212,961		
	54,131,738	53,952,748	.9967	.9708

	3rd Report	*4th Report*		
1948	20,821,455	20,542,253		3rd to 10th Report
1949	23,739,787	23,448,432		
	44,561,242	43,990,685	.9872	.9740
	4th Report	*5th Report*		
1947	19,020,991	18,813,323		4th to 10th Report
1948	20,542,253	20,298,072		
	39,563,244	39,111,395	.9886	.9866
	5th Report	*6th Report*		
1946	17,003,629	16,962,032		5th to 10th Report
1947	18,813,323	18,802,845		
	35,816,952	35,764,877	.9985	.9980
	6th Report	*7th Report*		
1945	13,347,658	13,341,844		6th to 10th Report
1946	16,962,032	16,960,856		
	30,309,690	30,302,700	.9998	.9995
	7th Report	*8th Report*		
1944	10,895,494	10,894,121		7th to 10th Report
1945	13,341,844	13,338,969		
	24,237,338	24,233,090	.9998	.9997
	8th Report	*9th Report*		
1943	9,497,103	9,500,060		8th to 10th Report
1944	10,894,121	10,889,501		
	20,391,224	20,389,561	.9999	
	9th Report	10th *Report*		
1942	11,611,361	11,614,094		9th to 10th Report
1943	9,500,060	9,498,173		
	21,111,421	21,112,267	1.0000	

EXHIBIT E

PRIVATE PASSENGER CAR EXPERIENCE — POLICY YEARS 1946-1949

BY MONTH OF ISSUE

Month of Issue	*Earned Car Years*	*Compulsory Premium*	*Losses Incurred*	*No. of Claims*	*Claim Frequency*	*Pure Premium*	*Loss Ratio*	**Pro-Rata Loss Ratio*
January	2,705,843.80	77,941,887	50,028,281	151,523	5.6	18.49	64.2	64.2
February	53,749.20	1,716,315	1,590,723	4,820	9.0	29.60	92.7	95.8
March	75,766.80	2,576,567	2,024,409	6,177	8.2	26.72	78.6	82.1
April	100,293.40	3,507,903	2,612,719	8,045	8.0	26.05	74.5	79.8
May	46,953.80	1,753,843	1,547,560	4,792	10.2	32.96	88.2	100.9
June	34,476.20	1,431,239	1,295,322	3,764	10.9	37.57	90.5	115.9
July	27,750.10	1,242,084	992,477	2,970	10.7	35.76	79.9	111.5
August	19,852.70	911,352	780,379	2,140	10.8	39.31	85.6	123.4
September	13,879.10	663,018	580,040	1,566	11.3	41.79	87.5	132.4
October	9,364.50	512,268	400,266	1,211	12.9	42.74	78.1	129.6
November	4,326.50	285,928	232,757	652	15.1	53.80	81.4	157.8
December	1,102.20	70,738	40,826	114	10.3	37.04	57.7	150.9
TOTAL	3,093,358.30	92,613,142	62,125,759	187,774	6.1	20.08	67.1	68.7

*Obtained by dividing compulsory premium by present short term influence factors by month which are the difference between present short term percentages and pro rata.

EXHIBIT F

Projection Factors — Private Passenger — 1954 Rates

Pol. Yr.	*Exposure*	*Incurred Losses*	*Dev. Factors*	*Developed Losses*	*Dev. Pure Premium*	*Projection Factor*
1952	1,051,185.8	28,957,157	1.0137	29,353,870	27.92	.8693
1951	1,020,702.4	27,788,590	.9708	26,977,163	26.43	.9183
1950	946,873.8	24,080,527	.9740	23,454,433	24.77	.9798
1949	860,069.5	18,574,375	.9866	18,325,478	21.31	1.1389
1948	801,696.6	15,531,036	.9980	15,499,974	19.33	1.2556
Statewide	4,680,528.1			113,610,918	24.27	

EXHIBIT G

THE PROCEDURE USED IN ASSIGNING TOWNS TO TERRITORIES FOR 1953 PRIVATE PASSENGER AUTOMOBILE RATES

1. The average indicated pure premium for policy years 1947, 1948, 1949, 1950, 1951 (as of the latest reporting for each policy year), the underlying pure premium and the projected pure premiums for each of the aforementioned policy years were calculated for each city and town.

2. Where the indicated pure premium of any city or town showed a deviation from the pure premium underlying its 1952 rate greater than the appropriate one taken from the following schedule, the city or town was considered for a change. The schedule is as follows:

City or Town Credibility	*Deviation*
76% — 100%	10%
51% — 75%	15%
26% — 50%	20%
0% — 25%	25%

3. Any city or town considered for a change was moved to the next higher or next lower territory (not counting single town territories) provided —

(a) that the projected pure premiums for each of the five individual years (1947, 1948, 1949, 1950, 1951) or for four of the five individual years (1947, 1948, 1949, 1950, 1951) including the latest year were greater or less than the underlying pure premium, or

(b) that the projected pure premiums for three individual years, including the two latest years of the five individual years (1947, 1948, 1949, 1950, 1951) were greater or less than the underlying pure premium, and in addition, that in each of the two latest years (1950, 1951), the difference between the city or town indicated pure premium and the underlying pure premium was greater than the percentage indicated in the schedule given above.

4. In the remainder of state territory only those towns whose indicated pure premium exceeded the underlying pure premium by the percentage given in the schedule above and whose projected pure premiums were higher than the underlying in at least four, including the two latest of the five individual years (1947, 1948, 1949, 1950, 1951), were moved to the next higher territory and then only if the projected pure premiums in each of the two latest years (1950, 1951) exceeded the underlying pure premium by the percentages shown in the schedule above. In this territory no town "shall be" raised with a credibility of less than 20%.

5. No town shall be changed from one territory to another in an opposite direction from a change made in the revision of rates for the year 1952.

EXHIBIT H

PRIVATE PASSENGER EXPERIENCE

1952 Territory_____

Town Billerica

5 Year Credibility as of 1947-1951 62%

Underlying Pure Premium 26.35

Pol. Yr.	(1) *Exposure*	(2) *Losses Incurred*	(3) *Comp. Factor*	(4) (2) × (3)	(5) (4) ÷ (1)	(6) *Proj. Factor*	(7) (6) × (5)
1951	2,744.3	91,837	1.0433	95,814	34.91	.8516	29.73
1950	2,520.2	95,923	1.0071	96,604	38.33	.9098	34.87
1949	2,267.5	72,941	1.0083	73,546	32.43	1.0578	34.30
1948	2,046.9	37,972	1.0223	38,819	18.96	1.1646	22.08
1947	1,927.0	47,553	1.0328	49,113	25.49	1.1768	30.00
Total	11,505.9	xxxx	xxxx	353,896	30.76	xxxx	xxxx

EXHIBIT H

PRIVATE PASSENGER EXPERIENCE

1952 Territory_____

Town Brookline

5 Year Credibility as of 1947-1951 100%

Underlying Pure Premium 26.35

Pol. Yr.	(1) *Exposure*	(2) *Losses Incurred*	(3) *Comp. Factor*	(4) (2) × (3)	(5) (4) ÷ (1)	(6) *Proj. Factor*	(7) (6) × (5)
1951	15,833.9	511,335	1.0433	533,476	33.69	.8516	28.69
1950	15,039.0	490,732	1.0071	494,216	32.86	.9098	29.90
1949	13,960.2	386,758	1.0083	389,968	27.93	1.0578	29.54
1948	13,136.6	350,382	1.0223	358,196	27.27	1.1646	31.76
1947	12,456.6	280,600	1.0328	289,804	23.27	1.1768	27.38
Total	70,426.3	xxxx	xxxx	2,065,660	29.33	xxxx	xxxx

EXHIBIT H

PRIVATE PASSENGER EXPERIENCE

1952 Territory_____

Town Lynn

5 Year Credibility as of 1947-1951 100%

Underlying Pure Premium 26.35

Pol. Yr.	(1) *Exposure*	(2) *Losses Incurred*	(3) *Comp. Factor*	(4) (2) × (3)	(5) (4) ÷ (1)	(6) *Proj. Factor*	(7) (6) × (5)
1951	19,024.3	619,800	1.0433	646,637	33.99	.8516	28.95
1950	17,827.1	542,255	1.0071	546,105	30.63	.9098	27.87
1949	16,207.5	491,988	1.0083	496,072	30.61	1.0578	32.38
1948	15,141.2	342,066	1.0223	349,694	23.10	1.1646	26.90
1947	14,125.4	380,085	1.0328	392,552	27.79	1.1768	32.70
Total	82,325.5	xxxx	xxxx	2,431,060	29.53	xxxx	xxxx

EXHIBIT H

PRIVATE PASSENGER EXPERIENCE

1952 Territory_____

Town Medford

5 Year Credibility as of 1947-1951 100%

Underlying Pure Premium 26.35

Pol. Yr.	(1) *Exposure*	(2) *Losses Incurred*	(3) *Comp. Factor*	(4) (2) × (3)	(5) (4) ÷ (1)	(6) *Proj. Factor*	(7) (6) × (5)
1951	14,304.7	578,487	1.0433	603,535	42.19	.8516	35.93
1950	13,430.1	453,645	1.0071	456,866	34.02	.9098	30.95
1949	12,281.5	381,046	1.0083	384,209	31.28	1.0578	33.09
1948	11,486.6	268,476	1.0223	274,463	23.89	1.1646	27.82
1947	10,789.0	236,410	1.0328	244,164	22.63	1.1768	26.63
Total	62,291.9	xxxx	xxxx	1,963,237	31.52	xxxx	xxxx

DEDHAM—'53 Terr. 3 EXHIBIT H-1

				Comm'l Cl. 4 only
1. 51-52 Exposure			791.3	
2. 51-52 P.P.	70.61	× 1.022 =	72.16	
3. Z_2		.19		
4. (2) × (3)				13.71
5. 48-52 P.P.	56.38	× 1.109 =	62.53	
6. $Z_5 - Z_2$		.08		
7. (5) × (6)				5.00
8. Underlying	38.60	× 1.118 =	43.15	
9. $1 - Z_5$		.73		
10. (8) × (9)				31.50
11. Weighted Av. P.P. (4) + (7) + (10)				50.21
12. (1) × (11)				39,731

WALTHAM—'53 Terr. 3 EXHIBIT H-2

				Comm'l Cl. 4 only
1. 51-52 Exposure			1850.2	
2. 51-52 P.P.	31.29	× 1.022 =	31.98	
3. Z_2		.29		
4. (2) × (3)				9.27
5. 48-52 P.P.	33.58	× 1.109 =	37.24	
6. $Z_5 - Z_2$		.13		
7. (5) × (6)				4.84
8. Underlying	38.60	× 1.118 =	43.15	
9. $1 - Z_5$		.58		
10. (8) × (9)				25.03
11. Weighted Av. P.P. (4) + (7) + (10)				39.14
12. (1) × (11)				72,417

ALL TOWNS—Terr. 3 ('53 Order) EXHIBIT H-3

				Comm'l Cl. 4 only
1. 51-52 Exposure			13097.0	
2. 51-52 P.P.	44.41	× 1.022 =	45.39	
3. Z_2		.78		
4. (2) × (3)				35.40
5. 48-52 P.P.	38.59	× 1.109 =	42.80	
6. $Z_5 - Z_2$		.22		
7. (5) × (6)				9.42
8. Underlying	38.60	× 1.118 =	43.15	
9. $1 - Z_5$		0		
10. (8) × (9)				
11. Weighted Av. P.P. (4) + (7) + (10)				44.82
12. (1) × (11)				587,008

Exhibit I-1

MASSACHUSETTS STATUTORY AUTOMOBILE LIABILITY EXPERIENCE
1927-1948 INCLUSIVE
ALL STOCK COMPANIES COMBINED

Year	Earned Premium	Incurred Losses	Loss Ratio	Provision for Losses Amount	%	Excess or Deficiency (-) Amount	%	Expenses Amount	%	Profit or Loss Amount	%
1927	11 070 754	8 817 793	79.6	6 620 311	59.8	-2 197 482	-19.8	4 720 854	42.6	-2 467 893	-22.2
1928	12 657 417	9 597 866	75.8	7 569 135	59.8	-2 028 731	-16.0	5 323 586	42.1	-2 264 035	-17.9
1929	15 759 146	10 752 255	68.2	10 322 241	65.5	-430 014	-2.7	6 132 960	38.9	-1 126 069	-7.1
1930	16 056 731	12 360 606	77.0	10 356 591	62.5	-2 004 015	-14.5	6 265 654	39.0	-2 569 529	-16.0
1931	17 930 849	11 910 561	66.4	11 565 398	64.5	-345 163	-1.9	6 798 496	37.9	-778 208	-4.3
1932	17 668 158	11 285 735	63.9	11 395 962	64.5	110 227	.6	6 456 303	36.5	-73 880	-.4
1933	16 367 978	11 286 842	69.0	10 475 506	64.0	-811 336	-5.0	6 085 037	37.2	-1 003 901	-6.2
1934	16 302 592	12 679 918	77.7	10 433 659	64.0	-2 246 259	-13.7	6 014 118	36.9	-2 391 444	-14.6
1935	16 607 481	11 386 359	68.6	10 628 788	64.0	-757 571	-4.6	6 100 157	36.7	-879 035	-5.3
1936	17 662 047	10 805 970	61.2	11 303 710	64.0	497 740	2.8	6 311 094	35.7	544 983	3.1
1937	17 175 123	12 345 258	71.9	11 077 954	64.5	-1 267 304	-7.4	6 286 961	36.6	-1 457 096	-8.5
1938	16 048 309	10 223 963	63.7	10 351 159	64.5	127 196	.8	6 036 616	37.6	-212 270	-1.3
1939	17 194 341	11 403 253	66.3	11 090 350	64.5	-312 903	-1.8	6 374 755	37.1	-583 667	-3.4
1940	18 038 905	11 692 532	64.8	11 635 094	64.5	-57 438	-.3	6 642 134	36.8	-295 761	-1.6
1941	19 371 887	12 589 570	65.0	12 494 867	64.5	-94 703	-.5	7 142 560	36.9	-360 243	-1.9
1942	16 384 747	8 060 181	49.2	10 568 162	64.5	2 507 981	15.3	6 234 239	38.0	2 090 327	12.8
1943	11 195 837	6 648 721	59.4	7 221 315	64.5	572 594	5.1	4 493 361	40.1	53 755	.5
1944	11 708 030	7 470 198	63.8	7 551 679	64.5	81 481	.7	4 487 060	38.3	-249 228	-2.1
1945	12 297 900	9 417 312	76.6	7 932 146	64.5	-1 485 166	-12.1	4 676 193	38.0	-1 795 605	-14.6
1946	16 916 882	12 143 973	71.8	10 911 389	64.5	-1 232 584	-7.3	6 418 508	37.9	-1 645 599	-9.7
1947	19 571 237	13 500 443	69.0	12 427 735	63.5	-1 072 708	-5.5	7 158 458	36.6	-1 087 664	-5.6
1948	21 455 814	14 594 314	68.0	13 624 442	63.5	-969 872	-4.5	7 582 822	35.3	-721 322	-3.4
Total	355 442 165	240 973 623	67.8	227 557 593	64.0	-13 416 030	-3.8	133 741 926	37.6	-19 273 384	-5.4

Exhibit I-2

MASSACHUSETTS STATUTORY AUTOMOBILE LIABILITY EXPERIENCE
1927-1948 INCLUSIVE
ALL NON-STOCK COMPANIES COMBINED

Year	Earned Premium	Incurred Losses	Loss Ratio	Provision for Losses Amount	%	Excess or Deficiency (-) Amount	%	Expenses Amount	%	Profit or Loss Amount	%
1927	5 495 537	3 114 268	56.7	3 286 331	59.8	172 063	3.1	2 180 980	39.7	200 289	3.6
1928	6 106 392	3 389 774	55.5	3 651 622	59.8	261 848	4.3	2 161 976	35.4	554 642	9.1
1929	5 953 630	3 797 481	63.8	3 899 628	65.5	102 147	1.7	2 151 045	36.1	5 104	.1
1930	5 648 092	4 365 519	77.3	3 643 019	64.5	-722 500	-12.8	1 808 643	32.0	-526 070	-9.3
1931	5 273 544	4 206 572	79.8	3 401 436	64.5	-805 136	-15.3	1 810 295	34.3	-743 323	-14.1
1932	6 277 013	3 447 601	54.9	4 048 673	64.5	601 072	9.6	1 833 270	29.2	996 142	15.9
1933	6 518 050	3 883 645	59.6	4 171 552	64.0	287 907	4.4	1 791 831	27.5	842 574	12.9
1934	7 346 091	4 761 510	64.8	4 701 498	64.0	-60 012	-.8	1 945 492	26.5	639 089	8.7
1935	7 749 896	4 318 964	55.7	4 959 933	64.0	640 969	8.3	2 043 853	26.4	1 387 079	17.9
1936	8 003 315	3 896 030	48.7	5 122 122	64.0	1 226 092	15.3	2 010 772	25.1	2 096 513	26.2
1937	8 680 050	5 265 666	60.7	5 598 632	64.5	332 966	3.8	2 324 395	26.8	1 089 989	12.5
1938	8 458 316	4 701 530	55.6	5 455 614	64.5	754 084	8.9	2 275 320	26.9	1 481 466	17.5
1939	9 171 555	5 195 368	56.6	5 915 653	64.5	720 285	7.9	2 442 439	26.6	1 533 748	16.8
1940	9 631 971	5 204 191	54.0	6 212 621	64.5	100 843	10.5	2 552 359	26.5	1 875 421	19.5
1941	10 160 257	5 192 309	51.1	6 553 366	64.5	1 361 057	13.4	2 616 518	25.8	2 351 430	23.1
1942	8 681 312	3 553 913	40.9	5 599 446	64.5	2 045 533	23.6	2 247 719	25.9	2 879 680	33.2
1943	6 131 534	2 849 452	46.5	3 954 839	64.5	1 105 387	18.0	1 830 817	29.9	1 451 265	23.7
1944	6 355 634	3 419 303	53.8	4 099 384	64.5	680 081	10.7	1 909 949	30.1	1 026 382	16.1
1945	6 539 780	3 921 657	60.0	4 218 158	64.5	296 501	4.5	1 980 271	30.3	637 852	9.8
1946	8 537 161	4 816 883	56.4	5 506 469	64.5	689 586	8.1	2 518 256	29.5	1 202 022	14.1
1947	9 711 819	5 302 402	54.6	6 167 005	63.5	864 603	8.9	2 817 413	29.0	1 592 004	16.4
1948	11 055 613	5 703 758	51.6	7 020 314	63.5	1 316 556	11.9	3 341 607	30.2	2 010 248	18.2
Total	167 486 562	94 307 796	56.3	107 187 315	64.0	12 879 519	7.7	48 595 220	29.0	24 583 546	14.7

EXHIBIT I-3

MASSACHUSETTS STATUTORY AUTOMOBILE LIABILITY EXPERIENCE

1927 - 1948 *Inclusive*

Stock and Non-Stock Companies Combined

Earned Premium	$522,928,727
Incurred Losses	$335,281,419
Loss Ratio	64.1
Provision for Losses	$334,744,908
Per Cent of Premium	64.0
Deficiency	– $536,511
Per Cent of Premium	– .1
Expenses	$182,337,146
Per Cent of Premium	34.9
Profit	$5,310,162
Per Cent of Premium	1.0

EXHIBIT J

Method of determining subdivisions of exposure in Traffic-Congestions-Hazard discussion:

From tabulations of actual experience it was found that:

Exposure in Area 1 = 62,196 car years = E_1

Exposure in Area 2 = 576,071 car years = E_2

Losses in Area 1 by Cars Garaged in Area 1 = \$1,990,981 = L_1^1

Losses in Area 1 by Cars Garaged in Area 2 = 1,772,445 = L_2^1

Losses in Area 2 by Cars Garaged in Area 1 = 652,664 = L_1^2

Losses in Area 2 by Cars Garaged in Area 2 = 9,169,868 = L_2^2

$$\text{Then: } E_1 = \frac{L_1^1}{Q_1} + \frac{L_1^2}{Q_2} = 62{,}196 = \frac{1{,}990{,}981}{Q_1} + \frac{652{,}664}{Q_2}$$

$$E_2 = \frac{L_2^1}{Q_1} + \frac{L_2^2}{Q_2} = 576{,}071 = \frac{1{,}772{,}445}{Q_1} + \frac{9{,}169{,}868}{Q_2}$$

Whence the Area Pure Premiums rounded are: $Q_1 = 87.92$ and $Q_2 = 16.49$. Then, the exposure in Area 1 for cars garaged in Area 1, E_1^1, the exposure in Area 1 for cars garaged in Area 2, E_1^2, the exposure in Area 2 for cars garaged in Area 1, E_2^1, and the exposure in Area 2 for cars garaged in Area 2, E_2^2, were determined as follows:

$$E_1^1 = \frac{L_1^1}{Q_1},\ E_1^2 = E_1 - E_1^1,\ E_2^1 = \frac{L_2^1}{Q_1} \text{ and } E_2^2 = E_2 - E_2^1$$

$$E_1^1 = \frac{1{,}990{,}981}{87.92} = 22{,}645 \quad E_1^2 = 62{,}196 - 22{,}645 = 39{,}551$$

$$E_2^1 = \frac{1{,}772{,}445}{87.92} = 20{,}160 \quad E_2^2 = E_2 - E_2^1 = 576{,}071 - 20{,}160 = 555{,}911$$

$$\frac{E_1^1 + E_2^1}{E_1 + E} = \frac{42{,}805}{638{,}267} = 6.7\% \text{ vs. } \frac{62{,}196}{638{,}267} = 9.7\%$$

EXHIBIT K

MASSACHUSETTS AUTO BODILY INJURY LIABILITY

DIFFERENTIAL (Y AXIS) = AGE INVOLVEMENT INDEX =

$$\frac{\text{PERCENTAGE OF TOTAL NO. OF ACCIDENT INVOLVEMENTS OF A GIVEN AGE}}{\text{PERCENTAGE OF TOTAL NO. OF LICENSED DRIVERS REPRESENTED BY SAME AGE}}$$

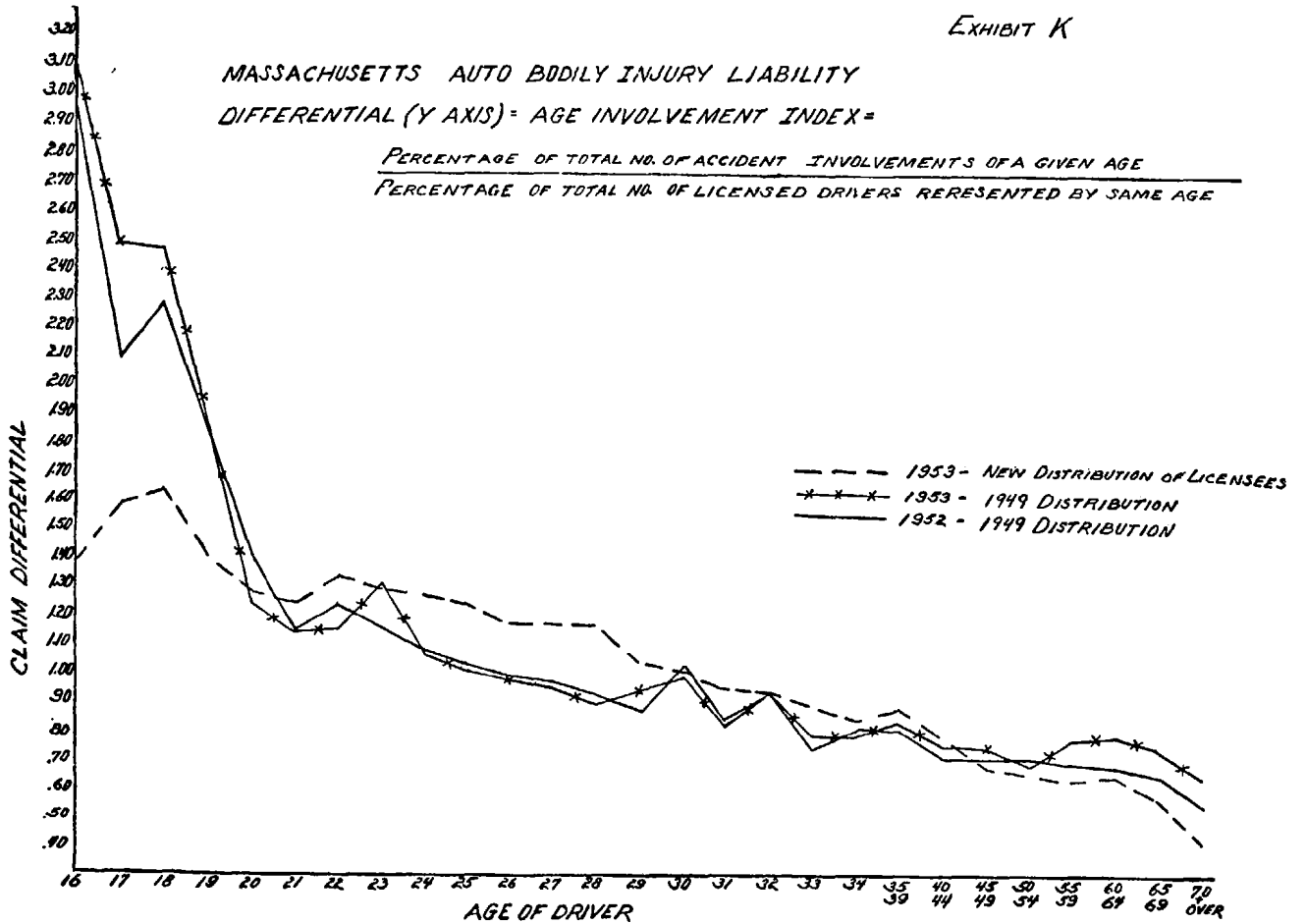


EXHIBIT L

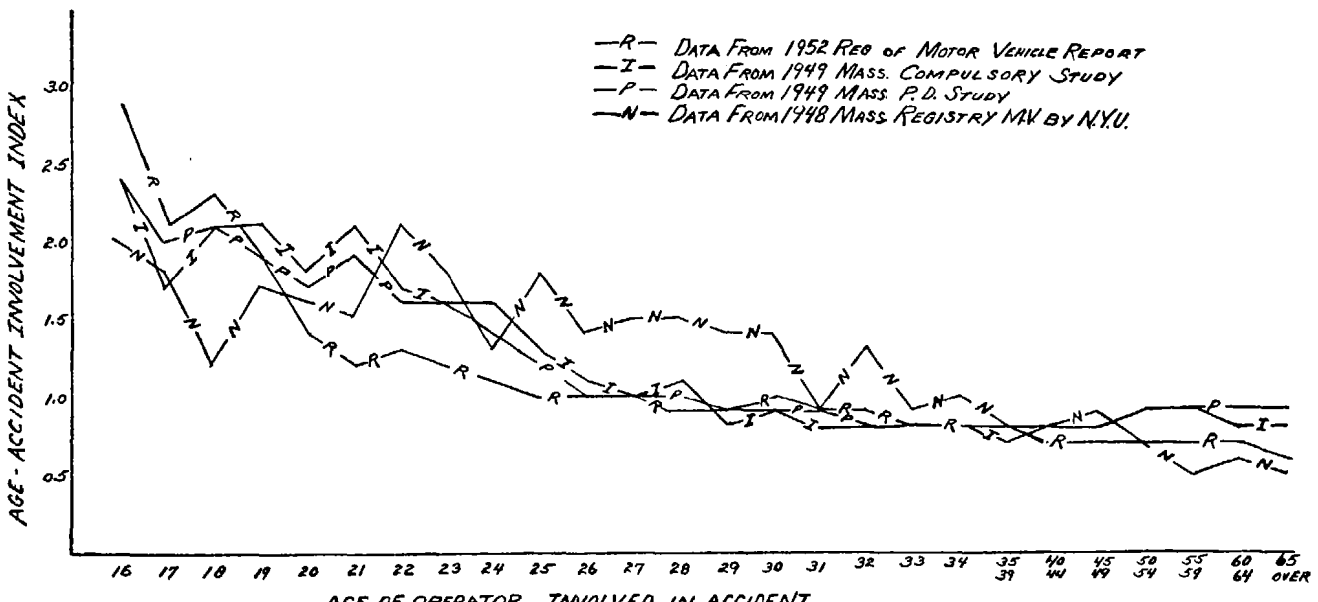

—R— DATA FROM 1952 REG OF MOTOR VEHICLE REPORT
—I— DATA FROM 1949 MASS. COMPULSORY STUDY
—P— DATA FROM 1949 MASS. P.D. STUDY
—N— DATA FROM 1948 MASS. REGISTRY M.V. BY N.Y.U.
AGE - ACCIDENT INVOLVEMENT INDEX
3.0
2.5
2.0
1.5
1.0
0.5
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35-39 40-44 45-49 50-54 55-59 60-64 65 OVER
AGE OF OPERATOR INVOLVED IN ACCIDENT

EXHIBIT M

Calculation of Indicated Relativities of Private Passenger Experience for January through May 1954.

(1) *Class*	(2) *Exposure Car Months*	(3) *% of Exposure*	(4) *Losses**	(5) *% of Losses*	(6)=(5)÷(3) *Differential*	(7) *Indicated Relativities*
1	9,171,376	74.30	5,227,099	60.27	0.811	1.000
2	1,681,322	13.62	2,317,307	26.72	1.962	2.419
2A	76,294	0.62	57,300	0.66	1.078	1.329
3	1,415,055	11.46	1,071,459	12.35	1.065	1.313
Total	12,344,047	100.00	8,673,165	100.00		

*Raw Losses as of June 30, 1954.