THE UNIVERSITY OF NORTH CAROLINA
HIGHWAY SAFETY RESEARCH CENTER

SEAT BELTS: A FOLLOW-UP STUDY OF THEIR USE UNDER NORMAL DRIVING CONDITIONS

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OCTOBER, 1969

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A B S T R A C T

This study, conducted in the summer of 1968 as follow-up research to the original 1967 survey, was concerned with the actual use of seat belts by drivers observed when they passed a slow moving panel truck in which the researchers rode. A total of 1,031 vehicles was observed, but final calculations were based on the 868 cars in which judgments were made on eight variables.

Compared to the 1967 survey results, the follow-up data indicate an increase in belt usage over the past year. For the newer, belt-equipped vehicles (1964 and later), the percentage of usage (35.8%) is approximately 14% higher than the corresponding 1967 statistic (31.5%). As in the earlier study, this usage was related to several factors. First, the drivers of the newer, belt-equipped cars were more likely to be observed wearing a belt than the drivers of older cars (35.8% vs. 9.3%). Second, drivers of out-of-state vehicles had a higher usage percentage than drivers of in-state vehicles (38.1% vs. 28.0%). Third, white drivers were more likely to be belt users than non-white drivers (33.0% vs. 11.1%). Fourth, men were again found to have a significantly higher percentage of usage than women (34.7% of the men vs. 20.1% of the women). In addition, the older drivers were found to be wearers in a higher percentage of the cases than the young or middle age drivers (48.8% vs. 31.6% and 29.3%, respectively). Checks of shoulder harness usage indicate that an estimated 30% - 35% of the drivers with the device available to them were using it.

Although there has been an increase in usage over the 1967 study results, still approximately two out of every three people with belts available do not wear them. Much effective work is needed on behalf of this device.

SEAT BELTS: A Follow-Up Study of Their Use Under Normal Driving Conditions[1]

INTRODUCTION AND METHOD

In the summer of 1967, the University of North Carolina Highway Safety Research Center conducted a pilot study of on-the-road seat belt usage.[2] In the summer of 1968, a follow-up study was conducted in an attempt to determine if there had been significant changes in usage habits in a year during which much emphasis had been placed on various aspects of highway safety.

As in the pilot study, the objective of the follow-up study was to obtain information regarding the use of seat belts by passenger car drivers while such vehicles were actually traveling on the highway. The observations were made from a panel truck, and the routes traveled were the same as in the 1967 study. Data were obtained on the driver and his vehicle. The only major difference in the methodology of the two studies lay in the fact that in the second study very little data were collected in the urban areas. Most observations were taken on four-lane roads which were major arteries between towns.

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[1] The author wishes to express his appreciation and thanks to Allen Lytch, Harold Bender, and Don Davenport whose help made this study possible, and to Dr. Patricia F. Waller and Mrs. Patricia Z. Barry for their comments and editing.

[2] B. J. Campbell, P. F. Waller, and F. M. Council, SEAT BELTS: A Pilot Study of Their Use Under Normal Driving Conditions. University of North Carolina Highway Safety Research Center, Chapel Hill, N. C., November, 1967.

Between July 26 and August 6, 1031 vehicles were observed by the research team. In 887 of these cases (86%), the observers were able to say with confidence whether or not the driver was wearing a seat belt. The final analysis was based on the 868 cases in which the observers were able to make confident judgments concerning age of car (pre-1964 or later), car registration (in-state or out-of state), driver age, race, and sex, number of passengers, and whether or not the driver wore a seat belt and/or a shoulder harness.

It should again be noted that while all these observations were made in a few seconds time, the author feels that because of free use of the "unknown" category, the final results are trustworthy. In the short time available for an observation, each of four observers was responsible for slightly different portions of the data. As the target vehicle approached from the rear, the rearmost observer noted car make, model, number of passengers, and data on the driver. As the target vehicle drew even with the research unit, he and the middle observer noted belt usage. The driver and the recorder rechecked car and passenger information and recorded the license number as the vehicle passed. Through this division of tasks, useful data were obtained.

THE SAMPLE

As can be seen in Table 1, the sample obtained in this follow-up study is distributed somewhat differently from the sample in the 1967 study according to the variables car registration, car age, and driver sex. This is not unexpected because of the inherent difficulties present in attempting to obtain two closely identical samples at different points

in time. Although the sampling methodology was the same in the two studies, differences could have arisen from the changes in traffic volumes and characteristics, the differences in sampling times, both in terms of days of the month and hours of the day, and the more rural nature of the follow-up study.

These sample distribution differences could affect the final seat belt usage statistics to a large degree. For example, it is noted in the table that the percentage of out-of-state male drivers in the 1968 sample population is much greater than the same figure in the 1967 study. Because this group is known to have a high percentage of belt users, the presence of a greater percentage in sample could tend to inflate the overall usage figures and the "1964 & Later" usage figures. Thus, an apparent increase in usage could actually represent only an increase in the percentage of out-of-state males in the sample. To some extent, this is what has happened, and this effect must be considered in the related results.

Table 1. Distribution of the 1967 and 1968 Drivers in the Sample by Sex, Car Age, and State Registration

		Drivers			
		1967		1968	
		Freq.	%	%	Freq.
OLDER CARS	In-State				
	Male	128	18.05	8.75	76
	Female	43	6.06	3.80	33
	Out-of-State				
	Male	19	2.68	3.91	34
	Female	8	1.13	0.81	7
NEWER CARS[a]	In-State				
	Male	303	42.74	42.28	376
	Female	108	15.23	13.14	114
	Out-of-State				
	Male	82	11.57	21.08	183
	Female	18	2.54	6.23	54
	TOTAL	709	100.00	100.00	868

[a]1964 & Later

RESULTS

Belt Use by Age of Car

In this follow-up study, drivers of older vehicles (pre-1964) were less likely to be observed wearing belts than drivers of newer cars in which the belts were known to be factory installed. These results are consistent with those of the earlier study. In the older vehicles, only 9.3% of the drivers were users while 35.8% of the drivers of newer cars were observed wearing belts.

This "1964 & Later" statistic (35.8%) is 13.6% higher than the related 1967 figure (31.5%). In terms of all vehicles, there has also been an increase in usage from 26. 5% to 31.2% (see Table 2).

Table 2. Percentage of Belt Usage in 1967 and 1968 Studies By Car Age

	1967	1968
Overall Use[a]	26.5%	31.2%
Pre-1964 Vehicles	13.6%	9.3%
1964 and Later	31.5%	35.8%

[a] $z = 2.05$ $(p < .05)$

This overall increase is partly attributable to a general increase in the availability of belts, as the percentage of pre-1964 vehicles in the 1968 study (17.3%) was lower than the figure of the 1967 study (27.9%) (see Table 3). The availability of the safety equipment is again shown important. As noted earlier, the increase in both the "1964 & Later" statistic and the overall statistic is also partly attributable to the large sample of out-of-state male drivers in the follow-up study. However, even when the newer car data are controlled for sample size, the follow-up study figure is still 6.9% higher than the original statistic.

Table 3. Comparison of Car Age in the 1967 and 1968 Studies

Year of Study	Car Age: Pre-1964	Car Age: 1964 & Later	Total
1967	198 (27.9%)	511 (72.1%)	709
1968	150 (17.3%)	718 (82.7%)	868

$z = 5.07$ $(p < .001)$

Belt Use by Registration of Car

Paralleling the results of the original study, the proportion of drivers using belts in vehicles bearing North Carolina license tags (28.0%) was smaller than the proportion of out-of-state users (38.1%). For the 1964 and later models only, the percentages were 32.9% and 41.8%, respectively. As noted in the original study, this difference perhaps can be attributed to the fact that the out-of-state vehicles were traveling greater distances. There is evidence that people seem to feel that belts are more important on long trips than on short trips. (Auto Industries Highway Safety Committee, 1968; Waller and Barry, 1969).

Of interest here are the comparable statistics reported in the original study. A 4% net increase in observed belt use is noted in the in-state vehicles in both overall observations and in observations restricted to the newer models. In the out-of-state newer vehicles, however, the percentage has remained virtually unchanged. By looking at the male and female usage percentages in Table 6 and referring again to the sample distribution in Table 1, an explanation for this lack of change in the overall statistic can be hypothesized. The percentage of out-of-state female users has decreased by a considerable amount while that of

their male counterparts has increased by a small increment. Coupled with the greatly increased size of the out-of-state male sample and the small increase in the female sample, these figures indicate that a canceling effect might be present, leading to the overall lack of change. Even when this effect is accounted for, the out-of-state usage does not appear to have increased by an amount proportional to the increase in in-state usage. These comparisons may be interpreted from two points of view. First, it is encouraging to note that North Carolina drivers appear to be using their seat belts more often now than they were a year ago. It is discouraging, however, in considering percentages of observed use in out-of-state cars, to note that there has not been a proportionate increase in "long trip" usage in the past year. This lack of significant change in observed usage as indicated by these data is paralleled by figures published by the Auto Industries Highway Safety Committee concerning reported usage among drivers on long trips. In that study, in both 1967 and 1968, 55% of the population questioned indicated that they always wear seat belts on long trips. The lack of change in actual as well as reported use indicates that less than one-half of the drivers on presumably "long trips" see enough value in the seat belt to wear it (see Table 4).

Table 4. Belt Use by Car Age and Registration

		Belts Used					
		1967			1968		
Car Age	Registration	Yes	N	% Yes	Yes	N	% Yes
Pre-1964[a]	In-State	23	171	13.5	7	109	6.4
	Out-of-State	4	27	14.8	7	41	17.1
	Total	27	198		14	150	
1964 & Later[b]	In-State	119	411	29.0	158	481	32.9
	Out-of-State	42	100	42.0	99	237	41.8
	Total	161	511		257	718	

[a] $z = 2.00$ ($p < .05$) (1968)

[b] $z = 2.35$ ($p < .02$) (1968)

Belt Use by Race

Before looking at the observed usage figures comparing white drivers with non-white drivers, it is important to note the sample size involved. The proportion of non-whites in the overall total of observed drivers was 8.4%. Of the observed in-state drivers, 9.3% were classified as non-white. This percentage can be compared to the 13.9% of the licensed drivers in North Carolina who are non-white. These two figures did not represent a statistically significant difference between the sample of non-white drivers observed and the percentage of non-whites licensed to drive; therefore, the author feels that the results obtained are meaningful.

In terms of overall belt use, it was found that 33.0% of the total number of white drivers were observed using belts while only 11.1% of the non-whites were using them ($p < .001$, see Table 5). While this difference

is statistically highly significant, it should also be pointed out that there was a significant relationship between race and age of car. The non-white was more likely than the white to be driving an older vehicle which was presumably not equipped with belts. While in the original study a trend toward higher white belt usage in the newer vehicles was only indicated, this trend was statistically significant in this follow-up study. In late model cars, 37.4% of the white drivers were observed wearing belts while only 15.4% of the non-whites were observed users ($p < .01$). This difference appears to be due mainly to the significant differences between observed belt use of white males compared to non-white males. In 1964 and later model cars, the difference in use between white and non-white women does not appear to be significant, but the small sample size of non-white women precludes statistical analysis. The relationship between race and usage found in this study emphasizes the results found in the original study and suggests the need for a program aimed specifically at this particular group.

Table 5. Belt Use by Race

		Belts Used					
		1967			1968		
Car Age	Race	Yes	N	% Yes	Yes	N	% Yes
Overall[a]	White	183	660	27.7	263	796	33.0
	Non-white	5	49	10.2	8	72	11.1
	Total	188	709		271	868	
1964 & Later[b]	White	156	484	32.3	249	666	37.4
	Non-white	5	27	18.5	8	52	15.4
	Total	161	511		257	718	

[a] $z = 3.85$ ($p < .001$) (1968)

[b] $z = 3.19$ ($p < .01$) (1968)

Belt Use by Sex

The findings of the 1968 follow-up study concerning the difference in belt usage related to the sex of the driver support the original 1967 findings; the 1968 results indicate that women are significantly less likely to be wearing belts than men. In the newer cars which are equipped with belts, 39.5% of the male drivers were observed wearing belts as compared to 23.8% of the women ($p < .01$, see Table 6). While both figures reflect an increase in belt usage over the original study, the difference between the usage patterns of men and women remains highly significant. Even in the small sample of pre-1964 vehicles, the difference was still noted (10.9% vs. 5.0%) although it was not statistically significant.

Belt use according to sex was further analyzed according to both age of vehicle and registration. Here, results similar to the overall findings were noted. For the newer, in-state vehicles, 36.2% of the men were observed wearers compared with 21.9% of the women. This difference is highly significant ($p < .01$). In contrast to the 1967 study, the follow-up study also revealed a significant difference between the men and women drivers of the newer, out-of-state vehicles. Again, a higher percentage of men were observed wearing belts (45.9%) than women (27.8%) ($p < .02$). This result raises doubts concerning the suggestion contained in the earlier study that on longer trips both men and women seemed to recognize the value of the seat belt and to use it. The high usage percentage for this group of females in the earlier study could possibly have resulted from the small sample size used. It appears that while both sexes may feel that belts are important on "long trips," a greater proportion of the male drivers put their beliefs into action. The sex difference noted in out-of-state drivers provides additional support for the idea that women do not wear belts as much as men.

It must also be noted that these differences in usage cannot be attributed to the vehicle age or registration, the number of passengers in the car, the location of the observation (either rural or urban), or the type of highway (2-lane or 4-lane). There were no significant differences with respect to the male versus female driving patterns associated with these variables.

Table 6. Belt Use by Sex and Registration (1964 & Later)

		Belt Usage					
		1967			1968		
Registration	Sex	Yes	N	% Yes	Yes	N	% Yes
In-State[a]	Male	100	303	33.0	133	367	36.2
	Female	19	108	17.6	25	114	21.9
	Total	119	411		158	481	
Out-of-State[b]	Male	35	82	42.7	84	183	45.9
	Female	7	18	38.9	15	54	27.8
	Total	42	100		99	237	

[a] $z = 2.84$ ($p < .01$) (1968)

[b] $z = 2.37$ ($p < .02$) (1968)

The prevailing pattern of a greater percentage of male usage was present throughout the analysis. The only case in which this difference was not statistically significant was the in-state urban observations, and even here the percentage of men wearers was twice that of the women. The lack of statistical significance can perhaps be explained by the small sample size.

When belt use according to sex and race was analyzed, a highly significant difference between the usage habits of men and women among the white drivers was obtained. In the non-white classification, there were found no statistical differences between the usage patterns of the men and women. This was probably due in part to the poor usage habits of non-white men, and in part to the small sample of non-white women (see Table 7).

Table 7. Belt Use by Race and Sex

		Belt Usage					
		1967			1968		
Race	Sex	Yes	N	% Yes	Yes	N	% Yes
White[a]	Male	153	497	30.8	222	609	36.5
	Female	30	163	18.4	41	187	21.9
	Total	183	660		263	796	
Non-white[b]	Male	3	35	8.6	7	51	13.7
	Female	2	14	16.7	1	21	4.8
	Total	5	49		8	72	

[a] $z = 3.70$ ($p < .01$) (1968)

[b] $p = .51$ using Fisher's Exact Test (Steel and Torrie, 1960, page 379)

When belt use according to sex and approximate age of driver (young adult -- 16 to 35 years old; mature adult -- 35 to 60 years old; or older adult -- over 60 years old) were analyzed, significant differences were noted. Because of the small size of the teenage sample, these data were combined with the young adult group. In both the young adult and mature

adult groups (together covering from 16 to 60 years of age), men were more likely to have been observed wearing a belt than women. The most significant difference was found in the mature adult group ($p < .001$); these results are different from the findings of the 1967 study in which the only significant differences reported in belt use according to age and sex were found in the young adult group.

Belt Use by Age of Driver

In addition to the age breakdown in the analysis of sex differences, driver age was also studied in terms of registration (in-state or out-of-state), and car age (before 1964 or later). In this analysis, no significant differences in belt usage by age of driver were found in the vehicles classed as pre-1964 cars in which the belts were unlikely to be available.

When the combined in-state and out-of-state data for all vehicles and for the 1964 and later were divided into the young adult, mature adult, and older adult classes, a significant difference in usage was indicated. For the newer vehicles, the totals demonstrated that while approximately 34% of the young group and 37% of the mature adults were observed using belts, 51.3% of the older adults were users ($p < .10$). The older drivers, therefore, had a significantly higher observed usage percentage than did the other two groups (see Table 8).

Table 8. Belt Use by Age of Driver

Age of Vehicle	Age of Driver	Yes	No	Total
Overall[a]	Young Adult	134 (29.3%)	324 (70.7%)	458
	Mature Adult	116 (31.6%)	251 (68.4%)	367
	Older Adult	21 (48.8%)	22 (51.2%)	43
	Total	271	597	868
1964 & Later	Young Adult	127 (33.5%)	252 (66.5%)	379
	Mature Adult	110(36.7%)	190 (63.3%)	300
	Older Adult	20 (51.3%)	19 (48.7%)	39
	Total	257	461	718

[a] $X^2 = 7.06$ ($p < .025$)

[b] $X^2 = 5.03$ ($p < .10$)

Shoulder Harness Usage

In conjunction with the observations concerning the lap belt usage, data were also collected on drivers wearing the shoulder harness, a newer and better restraint system. The presence of these devices in all new cars sold after January 1, 1968 was made mandatory by Federal statute. One U. S. manufactured make and most foreign automobiles had the devices installed at the beginning of the model year, in October of 1967. Thus, in terms of availability, shoulder harnesses were found on many 1968 models and had been available for approximately six to nine months. This figure is in error to some extent because of the fact that many foreign entries have included the device as standard equipment for a much longer period and some U. S. manufacturers did not install them until January 1, 1968.

Overall, out of the 868 cases in the study, only 17 drivers were observed wearing shoulder harnesses. This represents approximately 2% of the population analyzed. While information on the number of 1968 cars on the road in our sample (the number of cars with shoulder harnesses in the population-at-risk) is not available, certain assumptions employing sales figures and vehicle registration figures were used to determine an estimated percentage of equipped 1968 vehicles; based on these assumptions, the data indicate, then, that between 30% to 35% of those vehicles equipped with harnesses were observed with the device in use. This figure suggests that approximately the same percentage of people who use seat belts when they are available are likely to be observed using shoulder harnesses when they are available. Thus, it appears that the driver who considers belts important enough to use in the first place will use the additional restraint system it it is available.

DISCUSSION AND RECOMMENDATIONS

For the automotive public, the seat belt and shoulder harness are perhaps the greatest single individually controlled safeguard against serious injury or death in the event of a crash. Yet, this follow-up study indicates that even when belts are available only about one out of every three drivers can be observed using the device on the road. Serious questions are raised concerning the "why" of the high percentage of non-use. This study has attempted to relate several variables to belt use, and in doing so, to indicate the areas in which further work should be concentrated.

The first of the related variables is the age of the vehicle, or in effect, the availability of the restraint system. As noted in the original study, while making seat belts as well as other safety devices available does not insure that they will be used, the statistics indicate that the availability does increase the overall usage.

The registration of the vehicle is also related to seat belt usage. The out-of-state, and presumably "long trip" drivers are more likely to be observed wearing belts than are the drivers of the in-state vehicles. This corresponds to the 1967 findings. It is somewhat disturbing to note, however, that the out-of-state usage has not increased over the past year. This lack of change is in contrast to the 14% increase (31.5% to 35.8%) in the in-state usage over the same period. It would be hoped that the out-of-state results were biased by the sample sizes involved in the original study and do not indicate that a usage threshold has been reached. If this were the case, the threshold has been reached at a point where over one-half of the drivers on "long trips" do not employ seat belts; in terms of the amount of possible injury and death reduction that will not be achieved, the threshold possibility is particularly disturbing.

A third variable related to seat belt usage is the race of the driver; non-white drivers are significantly less likely to be observed wearing a belt than their white counterparts. While it is a fact that this group is more likely to be driving older unequipped vehicles, the data also indicate that even when this sub-group is observed in the newer vehicles, a smaller percentage of belt usage is noted. There appears to be a particular need for educational or persuasive programs directed toward this group.

In the analysis of belt usage according to the sex of the driver, the results demonstrated that men are much more likely to be observed wearing belts than are women. As noted earlier, this difference exists in both the in-state and out-of-state vehicles which had the belts available (1964 & Later). This differs from the 1967 study in which the difference in usage habits of men and women in out-of-state vehicles was not significant, possibly because of the small sample of female drivers in that earlier study.

This difference in usage cannot be explained by the location of the observation. While it might be hypothesized that this bias toward higher usage for men might result from the fact that the women might have been observed in more short trips of an urban nature (in which fewer people wear belts), analysis of the data shows that this is not the case. The belt use patterns of men and women are the same in both urban and rural locations. The fact that women are less likely to be observed wearing belts than men is surprising in two ways. First, the women are more likely to be affected by disfigurement which could result from being thrown into the dash or windshield, occurrences which the belt can help prevent. Second, women, and especially those who fall in the young adult group, are the wives and mothers who are most likely to be teaching safety habits to their children.

A final variable analyzed was the age of the driver. When the drivers of the observed vehicles were classed as either young adults, mature adults, or older adults, it was surprising to find that the oldest group was observed with the highest proportion of use. In the cars in which the belts were available, approximately one-half of the older group wore belts while only one-third of the other two groups was observed with the belts in use. Drivers in the young adult group were the least likely to be wearers.

Perhaps the results may be explained by the hypothesis that older people are more conservative in all things and therefore would be more conscious of their safety habits. What is alarming about this finding is that the two groups with the lower percentages include the people who have, in a sense, the greatest stake in life. These are the parents of small children, the leaders in all phases of life, and the people whose families are not yet financially set in most cases. These are the people to whom it would appear that life and health are most important. Yet, these groups do not use the seat belt, a proven and easily operated safety device, as much as do their older counterparts. Whether the reason behind the non-use is the attitude of "it can't happen to me," can only be guessed, but there is a definite need for some worthwhile program aimed at these groups.

In addition to the counts of seat belt usage, the 1968 study also included data concerning the use of shoulder harnesses. Approximately two percent of the observed population were wearing this newer and better restraint system. When correction is made for the estimated percentage of shoulder harnesses in the population-at-risk (1968 vehicles only), it is estimated that approximately 30% - 35% of the drivers who have the devices available to them are using them. As noted earlier, this indicates that the driver who believes in the seat belt enough to use it constantly will probably use the shoulder harness if it is in his vehicle. The availability of the safety device is important.

The basic fact which overrides all other findings is the overall <u>non-use</u> of belts by the driving population under study. While the 1968 belt use percentage is somewhat higher than the 1967 figure, there still

remain two out of every three drivers observed who are not utilizing this simple safety device when it is available.

In order to improve the belt usage habits of the driving population, effective programs must be initiated. Based on the findings of the earlier seat belt questionnaire study (Waller and Barry, 1968), most people, when asked why they do not wear a belt, reply that they simply forget to put it on. This is related to the feeling that belts are less important on short trips. Since these drivers do not form a habit of wearing the belts on these shorter trips, they tend to forget to fasten them on the longer trips, even though they believe in the importance of the device. The formation of the "buckle up" habit is the key.

Seat belt promotion could perhaps be attacked from two angles. First, the knowledge that the belts are important on the short trips must be emphasized. Since most driving is done within a short distance of home, it follows that most accidents occur within the same area. The Auto industries Highway Safety Committee has noted that four out of five accidents occur within 25 miles of the driver's home.[3] Increased awareness of this fact possibly could lead to more belt use.

A second approach directed toward those who remain unwilling to accept the usefulness of the belt on short trips could be made by convincing the driver that he is more likely to remember to put on the belt for long trips if he forms the habit by buckling up for the short ones.

Both of these methods of attack involve a situation in which the safety people, who are attempting to show the public the importance of

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[3] Auto Industries Highway Safety Committee, News Release, October, 1967.

the belt use, must work directly and effectively with this public. It has been shown that the simple propaganda approach is relatively ineffective, even when the mass media (radio, TV, and print) are utilized.[4] Other methods must be developed. One of the most promising methods of reaching the public today is the "Innovation - Diffusion" process.[5] In this process, the idea (of belt use) is first accepted and put into practice by "innovators" in a community. These are the leaders (though not necessarily elected) who have the respect of the community. From this select, influential group, the word spreads. While this process has not been tried in the highway safety field, it has been proven effective in the area of agriculture. This and similar methods could be a partial answer to the question of how to influence the driving public.

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[4] M. Blumenthal, The Denver Symposium on Mass Communications Research for Safety. National Safety Council, 1964.

[5] B. M. Beal and J. M. Bohlen, The Diffusion Process. Ames Iowa State University Experiment Station Special Report No. 18, November, 1962.

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