UMTRI-84-30

Alcohol-related Accidents and DUIL Arrests in Michigan: 1981

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Prepared in cooperation with
Michigan Office of Highway Safety Planning
and
U.S. Department of Transportation
National Highway Traffic Safety Administration

November 1984

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTRI-84-30		

4. Title and Subtitle	5. Report Date
Alcohol-Related Accidents and DUIL Breath Tests in Michigan: 1981	November 1984
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
L.D. Filkins	UMTRI-84-30
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Transportation Research Institute The University of Michigan Ann Arbor, Michigan 48109	11. Contract or Grant No. #MAL-84-007A
	13. Type of Report and Period Covered Final October 1, 1983 - October 31, 1984
12. Sponsoring Agency Name and Address Office of Highway Safety Planning Department of State Police 111 South Capitol Avenue, Lower Level Lansing, Michigan 48913	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Michigan accident and drunk-driving arrest data for 1981 were analyzed. Data include all accidents investigated by police agencies and subesequently processed by the Michigan Department of State Police.

Drunk-driving arrest data, also for 1981, were obtained from Breathalyzer Test Logs (BTLs). These logs contain entries for all breath tests given in conjunction with DUIL arrests. Data for DUIL arrestees who did not take a breath test are not included.

DUIL data have been analyzed with respect to age, sex, state of residence, and BAC (blood alcohol concentration). Information about drivers with two or more arrests during 1981 is also included. The county, hour of day, and month of the arrest are also discussed. The BTLs contain data that identify whether the arrest arose from a driving violation or from an accident, and this factor is discussed as well.

Regression analyses relating alcohol-related accidents and DUIL arrests were undertaken for Michigan's 83 counties. Traffic volume information was used as a control variable in these studies. A DUIL enforcement index for each county, and for the state as a whole, was determined.

17. Key Words	18. Distribution Statement
Alcohol-related accidents; DUIL arrests; blood alcohol concentration	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
		33	

ACKNOWLEDGEMENTS

The Michigan Department of State Police (MDSP) regularly provides accident data for inclusion in UMTRI's Automated Data Access and Analysis System (ADAAS). These data are placed into ADAAS by UMTRI's Data Operations Group, responsible for its operation and maintainenance and for adding new accident and exposure datasets to the system files.

Breathalyzer Test Log data were also provided by MDSP. M.J. Bowman processed the forms, edited the data, and supervised data entry. The data were entered into computer files by P. Ferullo.

The author gratefully acknowledges the indispensable contributions of these individuals and organizations.

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1. INTRODUCTION

This is the final report of a project sponsored by Michigan's Office of Highway Safety Planning (OHSP) entitled "File Building and Analysis of 1981 OUIL Arrest Data," Project # MAL-84-007A. Results of the work conducted from October 1, 1983 - October 31, 1984 are presented.

A number of related projects conducted by UMTRI for OHSP in prior years have resulted in several research reports. One of these [1] dealt exclusively with nine years (1968-1976) of Michigan's fatal accident experience.[1] The second interim report [2] of an earlier project reported several important extensions. Accidents for 1977-1979 had been added to the database, so that twelve years of accident experience were available for analysis. Further, non-fatal accidents had been added and were analyzed as well. A 20% random sample of all Michigan accidents was used for this purpose. Additionally, DUIL (Driving Under the Influence of Liquor) arrest data were obtained for 1978 and 1979, and the results of analyzing those data were presented. A DUIL enforcement index, intended to assist policy makers and program planners in allocating resources, was formulated and presented for the state as a whole and for each of its 83 counties.

Both fatal and sample accident data for 1980 were added to the accident database in the final year of the preceding project. Arrest data for 1980 were also added. Thus thirteen years of accident data--1968-1980--and three years of arrest data--1978-1980--were available and were analyzed during the course of the project. The final report [3] of that project summarizes all of the earlier work and is recommended for the reader wishing to review the prior analyses.

The Traffic Services Division of the Michigan Department of State Police is now building a computer database of DUIL arrests, including results of breath tests and breath-test refusal information as well. However, 1982 is the first year included in their database. Thus 1981 was the only year since 1978 for which the breath-test data were not in machine-readable form ready for computer analysis. The present project has been undertaken to fill this

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[1] Numbers in brackets [ ] refer to References at end of report.

gap. Further, additional research regarding the relationship between enforcement and alcohol-related crashes was deemed worthwhile and the results are presented here.

The 1981 Breathalyzer Test Log data are first described in Section 2. Section 2.1 deals with these data from the perspective of the characteristics of the arrested drivers, while Section 2.2 focuses on the characteristics of the arrest itself, such as time and location. Section 3 introduces the accident data. The results of regression analyses attempting to relate drunk-driving enforcement, as measured by DUIL arrests, to the alcohol-related crash problem, as measured by the frequency of HBD accidents, are contained in Section 3.1. The final section presents the DUIL index for the state as a whole and for each of Michigan's 83 counties.

2. 1981 BREATHALYZER TEST LOG DATA

Michigan's breath-testing program began in the fall of 1967 following passage of the well-known "implied consent" legislation. A state-wide network of Breathalyzer test instruments was established to administer breath tests arising from DUIL arrests, and the results of such tests were recorded on a Breathalyzer Test Report (BTR) form. BTR forms for 1978 and 1979 were obtained by UMTRI for data processing and analysis, and the results have been reported in [2] and [3].

Starting in 1980, a revised version of the Breathalyzer Test Log (BTL) was used to record breath-test results. The logs are collected monthly by the Traffic Services division for administrative and statistical purposes. The change to the BTLs was motivated, in part, by the belief of headquarters personnel that not all of the BTRs were being forwarded to Lansing for processing. The BTL form was also revised at that time so that essential information recorded on the BTRs would also be recorded on the new log form. The complete set of 1980 BTLs was also made available to UMTRI for processing and analysis, and the results of that work are also reported in [3].

Similarly, 1981 BTL data have been obtained from the Traffic Services Division for analysis. The data forms were first organized and edited by an UMTRI staff member. A key-entry operator then entered the data into microcomputer floppy disk files, and these were subsequently transmitted to the Michigan Terminal System main-frame computer. The files containing all four years of these breath-test related arrest data are available for further analysis to authorized personnel from OHSP, the Michigan Departments of State and State Police, and UMTRI. The present analytic work was conducted with the MIDAS (Michigan Interactive Data Analysis System) software package.

These BTL data provide much valuable information about the drunk-driving situation. Subsequent sections describe, for example, the sex, age, state of residence, and BAC of arrested and tested drivers. The time, month, location, and incident which preceded the arrest are also available. However, the breath-test data are not a complete record of 1981 drunk-driving arrests in Michigan. The most notable omission, of course, is that arrested drivers who refused to take a test are not included. In 1981 a copy of the refusal record

was not forwarded to the Department of State Police; refusal data were aggregated only by the Department of State for inclusion in the master driving records. The prior study [3] found 8,578 drivers to have at least one implied-consent refusal on their driving record during 1980. In the same year 39,930 breath tests were conducted. Thus, about 82% of the arrests known from these two sources came from the breath-test data. Further, there are undoubtedly arrests made without either a breath test or a refusal in cases of injured drivers transported to a hospital for medical care. Such cases are relatively few in number, however, and their omission will not distort the findings given here.

2.1 Characteristics of Arrested and Tested Drivers

This section provides an overview of the characteristics of drivers who were arrested for DUIL and who were offered and accepted a breath test. Age, sex, state of residence, and BAC (blood alcohol concentration) are discussed. Information about drivers arrested two or more times in 1981 for DUIL is also included in this section.

Date of birth is one of the items recorded on the BTLs for most tested drivers; it was not determinable for 268 of these drivers. Age at time of arrest was calculated from the birth and arrest dates. The mean age of the arrested and tested drivers in 1981 is 32.8 years, and the standard deviation of the age distribution is 12.6 years.

The oldest driver was 89 years of age; he was arrested at 4:00 p.m. in connection with an accident and recorded a BAC of 0.16%. A highly similar case involves an 85-year old male also arrested in connection with an accident--at 6:40 p.m.--with a BAC of 0.17.

The youngest driver in the file was a 14-year old male. The event in this instance which resulted in the arrest was a driving violation, and the breath test showed a BAC of 0.01. This driver had no license at the time of arrest, but follow-up by the MSP established conclusive identity of the driver from the combined name and date-of-birth data. The Department of State's master driving records showed two different (but similar) driver license numbers for this individual, one with a middle name and the other without. The records did not indicate a conviction resulting from the 1981 arrest. However, a conviction for DUIL for an incident on July 6, 1983, at age 16, was recorded.

The records available to the UMTRI staff do not show what remedial action arising from the 1981 incident may have been attempted, but the case does illustrate the potential for early intervention that these records may hold.

Table 1 gives the age distribution of all of the tested drivers in 1981 for whom age could be determined. The age groups are in three-year intervals except for the oldest and youngest drivers. The table shows that the drunk-driving problem, insofar as it is exemplified by these 1981 arrestees, is not strictly confined to any age range. Nonetheless, it is also clear that the problem is concentrated among the younger drivers. The 21-23 age group contains the most arrestees, followed by the adjacent 18-20 and 24-26 groups. The number in the older 3-year groups is seen to decrease monotonically. The first five age groups, up to and including the 27-29 group, contain over half the arrestees.

Sex of the arrestee was noted on 98% of the BTL entries. As in prior years, drunk-driving arrests continue to be a primarily male phenomenon, with 89.7% of the 1981 arrestees being male. By way of comparison, females comprised 7.6% of 1978 arrestees, 8.5% of 1979 arrestees, 9.4% of 1980 arrestees, and 10.3% of 1981 arrestees. The gradual increase of females among the DUIL arrestees noted in prior years is seen to continue into 1981. The female percentage varies rather considerably by age. Females comprise 8.7% of the youngest age group (14-17), and this percentage gradually increases to its maximum of 12.8% for the 36-38 age group. It then decreases rather uniformly with increasing age, with 6.8% of arrested drivers 60 years of age and older being female. None of the 13 drivers over 77 was female. The mean age of the females is 31.8 years, about one year less than that of the males. The standard deviation of the female age distribution is only slightly less as well, 11.5 compared to 12.7 for the males.

The state in which the arrestee's driver license (if any) was issued is also recorded on the BTL. The state was determinable for 88.2% of the 1981 cases. Of these, 95.8% carried a Michigan license. For the combined years of 1978-1979, the comparable percentage is 96.2%, and for 1980 it is 96.4%. One can conclude that the bulk of Michigan's drunk-driving problem continues to be home grown.

Table 1

Distribution of 1981 DUIL Arrestees by Age

Age Group	Drivers	
	Number	Percent
14-17	913	2.1
18-20	5007	11.8
21-23	6327	14.9
24-26	5246	12.4
27-29	4261	10.0
30-32	3329	7.8
33-35	2980	7.0
36-38	2463	5.8
39-41	2132	5.0
42-44	1782	4.2
45-47	1564	3.7
48-50	1346	3.2
51-53	1342	3.2
54-56	1203	2.8
57-59	963	2.3
60-62	639	1.5
63-65	415	1.0
66-68	257	.6
69-71	154	.4
72-74	92	.2
75-77	44	.1
78-89	14	.0
TOTAL	42,743	100.0
Missing data	268	---

Blood alcohol concentration data are available for 42,698 of the 1981 DUIL arrestees. The highest recorded reading was .42, the lowest was zero, and the mean was .1696. An insignificant difference between males and females can be noted. The average BAC for 37,532 males was .1695, compared to .1702 for 4,323 females. Some difference in average BAC does occur as a function of age, but it is not large. Except for the drivers aged 78 and over, the lowest average BAC (.143) occurs for the youngest ages (17 and under), and then

gradually rises to peak at .185 for the 42-44 group. The average BAC decreases gradually to .170 in the mid-sixties, to .152 in the mid-seventies, and falls off to .120 for the very oldest drivers.

Driver license numbers, when available, are recorded on the BTLs at the time of arrest. These numbers, entered into the UMTRI analysis files, make it possible to determine how many repeat offenders appear among the 1981 arrestees. Since the data files under consideration here contain only drivers arrested during 1981, there has been no determination of whether these 1981 DUIL arrestees may have had other DUIL arrests in prior years.

A Michigan driver license number was recorded in 92.8% of the cases; this does not necessarily imply that the license was valid, however. Out-of-state licenses appeared in 3.7% of the cases, and the number was missing or unreadable in 2.2% of the cases. In the remaining 1.3%, the BTL record showed a notation of either no license, a suspended license, or a revoked license.

Analysis of the license numbers shows that 38,188 individual drivers are found among those whose license was recorded. Of these, 96.4% (36,821) had only a single arrest, 3.3% (1278) had two arrests, and 0.2% (74) had three arrests. In addition, eleven drivers were arrested four times during 1981, two were arrested five times, and two were arrested six times.

The percentage of repeat male arrestees was 3.7%; the comparable figure for females is 2.8%. BAC readings for the single arrestees averaged .169, while those of drivers arrested twice averaged .176, three time-arrestees averaged .159, and four-time arrestees averaged .174. The average age of these drivers was not much different from the overall mean; these average ages are 32.8, 32.6, 32.2, and 34.6 for the single through the quadruple arrests.

Four drivers are of particular interest. Two of these were each arrested five times during 1981, and the other two were each arrested six times during 1981.

A 26-year old male was one of the drivers arrested five times, all of them in Oakland County. He was arrested in January in connection with a driving violation, in June, September, and October because of accidents, and again in November in connection with another driving violation. Three of these arrests occurred between 4:30 p.m. and 6:30 p.m., the fourth at 9:00 p.m., and the fifth at 10:40 p.m. Three of the arrests resulted in DUIL

charges, another in "Other," and the charge was missing from the BTL log in one case. The BAC in four of the five cases was zero, and it was .03 in the other. The data available from the BTL logs do not establish whether this driver was under the influence of drugs or not, but the low BACs lend support to such a conjecture. Neither is there any information, in this case or the ones that follow, about prosecution, conviction, or sentencing.

A young female was also arrested five times, four of them occurring in Macomb County and the fifth in Wayne County. Three of these arrests occurred at age 20--two in March and one in August--and the other two occurred in October and December at age 21. BACs for this driver were .01, .01, .02, .05, and .08. Two accidents and three violations appeared on the BTL logs, all of them resulting in DUIL charges.

The two drivers each arrested six times during 1981 were both males. One of them, 31 years of age, experienced an accident in February, both an accident and a driving violation in May, another accident in June, and two more violations in August and December. Five of these events occurred in Oakland County and the sixth in Wayne County. Five BACs of zero were recorded, and one of .05. DUIL was charged five times, and "Other" was charged once. Five of these incidents occurred between 7:30 p.m. and 10:30 p.m., and the sixth occurred shortly after midnight.

The other male driver also arrested six times during 1981 was 23 years old when first arrested March 9 in connection with a driving violation; his BAC was .11. We was arrested again on March 28 (also from a driving violation) with a BAC of .10. The third arrest, on April 12, resulted from an accident; the BAC was .16. A fourth arrest occurred on April 30, this in connection with a driving violation and producing a BAC of .07. The fifth and sixth events--both accidents--occurred June 6 and June 10, with BACs of .14 and .01. Five of these arrests were recorded in the same county, and the sixth occurred in an adjacent county.

As noted above, the data at hand do not tell us anything at all about what may have happened during prosecution--if any--or sentencing in any of these cases. Nor do we have any information about the severity of the accidents or whether there were injuries or fatalities. And we also know nothing from these data about the drivers' prior or subsequent driving records. It is clear, however, that sufficiently swift and effective

preventive action, whether punitive or rehabilitative, did not occur. These cases point to the obvious need for quick resolution of drunk-driving charges in the judicial system. Assuming that whatever legal issues exist can be resolved, they also suggest that modern telecommunications and data processing capabilities be employed to maintain a file of pending cases. Such a file of drunk-driving defendants could be utilized to mount early intervention efforts and to take immediate precautionary efforts to prevent such persons from driving.

2.2 Other Arrest Characteristics

BTLs include, in addition to the factors discussed thus far, information about the county in which the arrest occurred, the hour of the day, and the date and month of the arrest. The incident which gave rise to the arrest, whether accident or violation, is also recorded. These factors are discussed in this section.

The complete distribution of DUIL arrests (accompanied by a breath test) by county is given in Table 3. The county of arrest was not recorded in 1.25% of the cases. The five counties with the highest frequency of DUIL arrests (Wayne, Oakland, Macomb, Washtenaw, and Berrien) account for 21,709 arrests, 51.4% of the 1981 total. Differences among counties in arrest frequencies compared to HBD experience are discussed further in the last section concerning the DUIL index.

Average BACs also differ by county. Clare and Wayne Counties have the lowest averages, both at .160. Montmorency and Schoolcraft Counties have the highest average BACs, .192 and .196, respectively. Whether these differences arise from the underlying drunk-driving experience or from differing attitudes and practices on the parts of the arresting officers is not clear.

The time of arrest was determinable in 97.1% of the cases. The after-midnight hours, as might be expected, account for the majority of arrests. The 2:00 a.m. - 3:00 a.m. hour alone has 22.4% of the arrests; the preceding hour accounts for 16.2% of the arrests. The four hours after midnight combine for 58.9% of the arrests, and the four hours before midnight have 23.5% of them, together accounting for 82.4% of all arrests. No single hour is empty; the 9:00 a.m. - 10:00 a.m. has the fewest arrests--87--.2% of the total.

Average BACs also differ by time of arrest, although not markedly so. The highest average BACs of the arrestees occur when one might least expect them, 10:00 a.m - 11:00 a.m., 12:00 p.m. - 1:00 p.m., and 2:00 p.m. - 3:00 p.m., with averages of .194, .194, and .195, respectively. The post-midnight hours, by way of contrast, are .166 or lower, with the lowest average hourly BAC of .158 occurring from 4:00 a.m. - 5:00 a.m. This tends to contradict common knowledge about the heavy drinking-driving hours. A possible explanation is that officers patrolling during the daytime hours are not as alert to possible drunk-driving episodes as are officers on night-time patrol, and arrest only the most flagrant cases.

Differences in arrest experience also exist by month, although they are not large. March and May, with 9.7% and 9.6% of the arrests, respectively, had the most arrests. January, with 6.8%, had fewer arrests than even the 28-day month of February, with 7.5%.

BTLs provide a record of whether the traffic episode which led to the subsequent DUIL arrest was an accident or a driving violation. Missing data on this variable was very low, only .42%. The accident block was checked in 17.0% of the non-missing-data cases, a preceding violation was noted in 82.0% of the cases, and both blocks were checked in the remaining 1%. These figures are all within 1% of those recorded from 1978-1980.

BACs differ little according to the preceding incident. The average BAC for accident-related arrests was .175, with a minimum of zero and a maximum of .41. Violation-related arrests averaged .169, also with a minimum of zero and with a maximum of .42.

Considerable differences are found among counties with respect to the percentage of arrests preceded by an accident. St. Joseph County, for example, had 37.5% of its DUIL arrests preceded by an accident, the highest percentage of the 83 counties. The comparable figure for Ogemaw County is 7.0%, the lowest in the state. Differences of this magnitude are almost certainly the result of different police practices in the two counties, rather than differences between the underlying drunk-driving experience. Such differences could arise because police officers in St. Joseph County are particularly alert to drunk drivers at accident scenes. The fact that 23.8% of St. Joseph County's 328 HBD accidents in 1981 resulted in DUIL arrests, compared to 11.3% of for Ogemaw County, would tend to support this conjecture.

On the other hand, Ogemaw's DUIL index (from the next section) of 1.669, compared to .662 for St. Joseph, would tend to suggest that it has the more active DUIL enforcement activity. Vigorous enforcement of drunk-driving laws might very well result in a higher percentage of arrests arising from driving violations than from accidents. These sorts of questions will be pursued in subsequent work for OHSP in that the most effective use of new resources devoted to DUIL enforcement within a county may depend heavily on its current practices.

3. RELATIONSHIPS BETWEEN HBD ACCIDENTS AND DUIL ARRESTS

Relationships between HBD accidents and DUIL arrests in Michigan during 1981 were considered from two perspectives in the prior work [3]. The first was an initial attempt to determine whether HBD accidents could be modeled as a function of DUIL enforcement efforts. The second was derivation of an DUIL enforcement index for Michigan and each of its 83 counties.

These two thrusts are continued here for the 1981 HBD and DUIL datasets. This work--particularly the modeling of HBD-DUIL relationships--must still be considered in its infancy. Nonetheless, the seriousness and long-term nature of the drunk-driving problem continue to merit the development of whatever theoretical and empirical models relating alcohol-related accidents and drunk-driving enforcement that are possible. As noted below, such models will necessarily have to include appropriate exposure variables to obtain meaningful results.

3.1 Enforcement and Alcohol-Related Accidents

In the preceding study DUIL arrests were used as a measure of drunk-driving enforcement intensity. It was argued that this measure, however imperfect, was the only such measure currently available for all--indeed, any--of Michigan's 83 counties. It was further argued that only DUIL arrests for which the preceding traffic incident was a driving violation, rather than those accompanying an accident, should be used in the modeling efforts. It was reasoned that the latter would necessarily be correlated with HBD accidents on a one-to-one basis, and that therefore they would not provide as good an independent measure of enforcement as would DUILs not associated with accidents. These arguments still hold.

HBD accidents were used as the dependent variable measuring the extent of the drunk-driving problem. This approach is still considered valid, and HBD accidents will be used here in the same role as before.

The major difference between the prior work and the current effort is the choice of exposure variables. Total road miles and population were used in the prior model. It was found that, after controlling for the effects of these two variables, the coefficient of the enforcement variable (DUIL arrests

preceded by a driving violation) was negative with respect to HBD accidents. The interpretation of that model is that HBD accidents decrease as DUIL enforcement increases. It was cautioned, however, that cross-sectional correlation models should not be interpreted as causal models.

Traffic volume data--commonly referred to as VMT, Vehicle Miles Traveled--have become available for 1981 since the prior study and have been included in the present analysis.[1] The conclusion emerging thus far is that the frequency of HBD accidents is such a strong function of VMT that other factors, including enforcement as measured by DUIL arrests, have relatively little effect.

This conclusion can be reached in several ways. Figure 1 is a scatter plot of the frequency of HBD accidents versus traffic volume (in millions of vehicle miles traveled) for Michigan's 83 counties. The nearly linear relationship between the two variables is immediately apparent. The same two variables are also shown in the scatter plot of Figure 2. Oakland and Wayne Counties have been eliminated from this plot, resulting in a change of scale and thus providing a better look at the counties with lower VMTs and fewer HBDs. Again the strongly linear relationship between HBD accidents and traffic flow is clear.

Shown below, including in this case all 83 counties, is a correlation matrix of four of the variables of interest: V1. HBD (frequency of Had Been Drinking accidents); V7. VMT 1981 (vehicle miles traveled); V9. INC81VIO (1981 DUIL arrests in which the preceding incident was a driving violation); and V11. P80/1000 (1980 population in thousands). All of these variables are strongly correlated with each other, with the lowest coefficient being .9963 between HBD and enforcement as measured by DUILs preceded by a violation. The highest coefficient--.9997--exists between HBD and VMT, and also between HBD and population. The inference from this limited perspective is that both traffic volume and population, highly correlated with each other, are stronger determinants of the frequency of HBD accidents than is DUIL enforcement.

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[1] VMT data for 1980 and 1983 obtained for Michigan counties by OHSP staff from the Bureau of Transportation Planning, Michigan Department of Transportation, were provided to UMTRI. The 1981 figures were obtained by linear interpolations from these data.

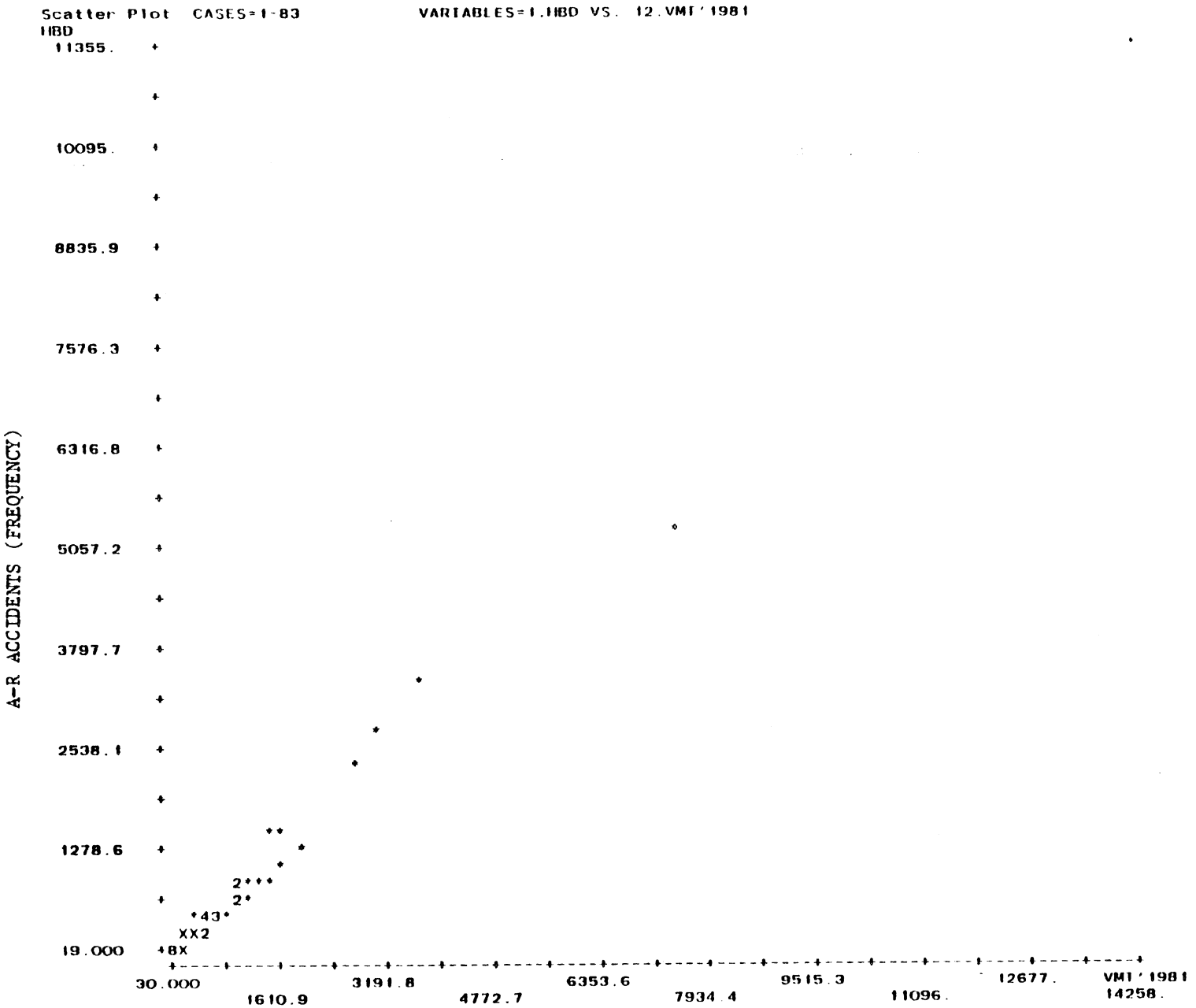

Figure 1 - Alcohol-Related Accidents vs. Traffic Volume: 83 Counties

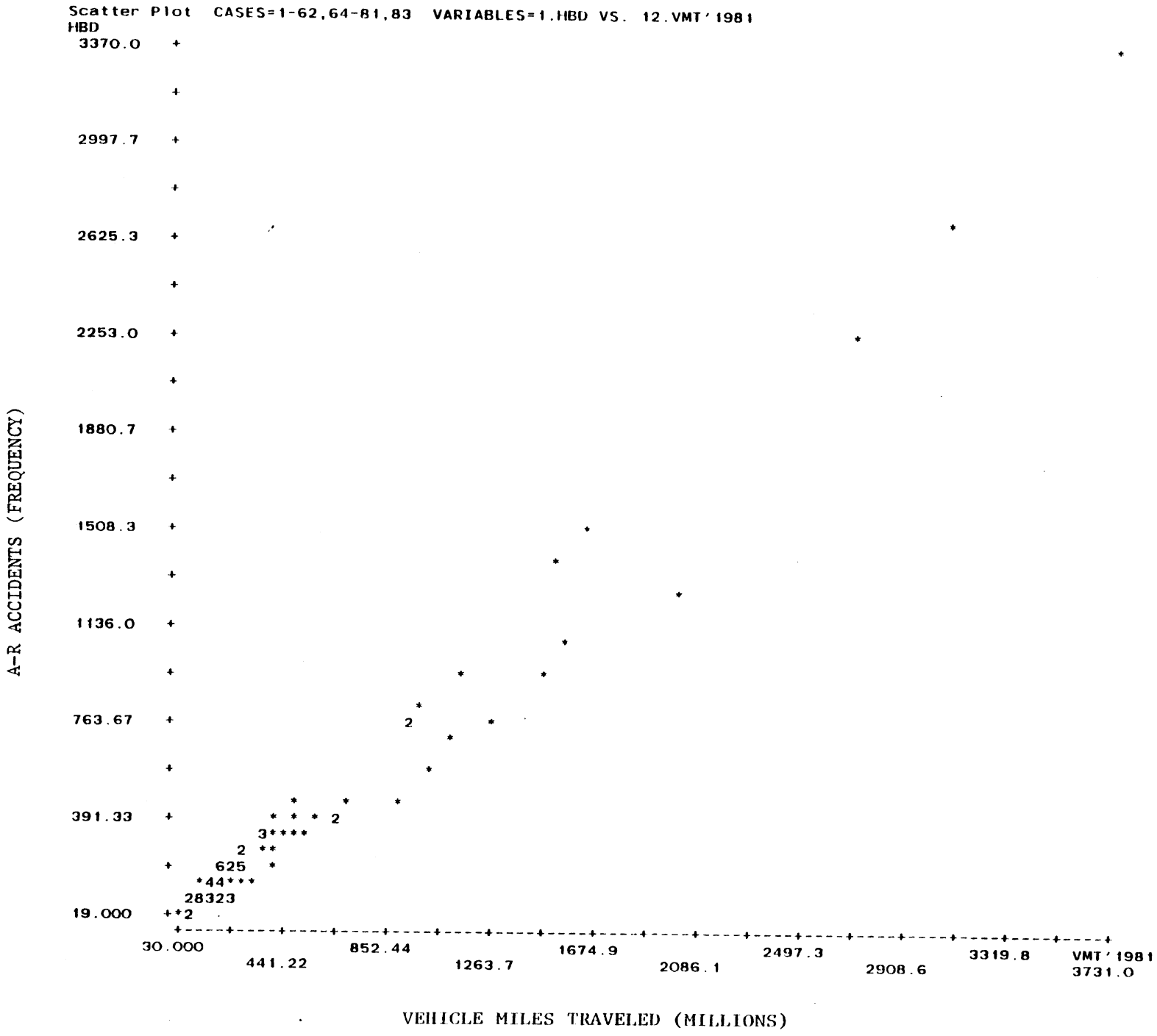

Figure 2 - Alcohol-Related Accidents vs. Traffic Volume: 81 Counties

Correlation Matrix

N= 84 DF= 82 R@ .0500= .2146 R@ .0100= .2796

VARIABLE				
1.HBD	1.0000			
7.VMT 1981	.9997	1.0000		
9.INC81VIO	.9968	.9974	1.0000	
11.P80/1000	.9997	.9993	.9963	1.0000
	1. HBD	7. VMT 1981	9. INC81VIO	11. P80/1000

Finally, one of several regression analyses involving these variables is presented below. The regression of variables 1,7, and 9--HBD, VMT, and DUILs--have been selected for presentation. Data for all 83 counties are included. It can be seen that "R-SQR=.99261," indicating a very good fit of the regression model to the data. Neither the constant term nor the measure of enforcement (9. INC81VIO) is significant, but the traffic-volume measure (7. VMT 1981) is highly significant. The coefficient of the enforcement variable, although not significant, is negative, suggesting a trend for the frequency of HBD accidents to decrease with increasing enforcement. Nonetheless, the message of this model is that the linear relationship between HBD accidents and VMT is is so strong that there is very little variability left over to be explained by any other variable.

<REGRESS VAR=1,7,9 CASES=1-83>

Least Squares Regression CASES=CASE#:1-83

ANALYSIS OF VARIANCE OF 1.HBD N= 83 OUT OF 83

SOURCE	DF	SUM SQRS	MEAN SQR	F-STAT	SIGNIF
REGRESSION	2	.16478 +9	.82391 +8	5372.6	0.
ERROR	80	.12268 +7	15335.		
TOTAL	82	.16601 +9			

MULT R= .99630 R-SQR= .99261 SE= 123.84

VARIABLE	PARTIAL	COEFF	STD ERROR	T-STAT	SIGNIF
CONSTANT		-16.990	14.821	-1.1463	.2551
7.VMT 1981	.95992	.81584 -3	.26631 -4	30.635	.0000
9.INC81VIO	-.13178	-.58492 -1	.49193 -1	-1.1890	.2379

Several other sets of dependent and independent variables have been tried in other regressions. In particular, the frequency of HBD accidents per VMT was tried as a dependent variable against DUIL arrests per road mile as the independent variable.. Although this choice of variables seems reasonable, the fit was very poor in the regression model. Thus little can be learned from the model, but it will be noted that the constant term was highly significant and the enforcement term, as before, was not significant.

It must be emphasized strongly that none of these observations is meant to imply that drunk-driving enforcement does not help to prevent alcohol-related accidents. We should repeat the caveat that cross-sectional correlational models should not be interpreted as causal models. Further, we should observe that law enforcement across the state may be sufficiently uniform that its effects do not show up in these models. Without law enforcement, the slope of the HBD-VMT curve might very well be much steeper than that presented above.

Further studies of this type are needed, and they will be modified in at least two ways. Breath-test refusal data, now being processed by the Traffic Services Division for 1982 and later, should be added so that the DUIL arrest information will be complete for each county. In addition, the scatter plot of Figure 2 suggests that several of the counties have a pattern of lower HBD accidents at given VMT levels. These counties will be identified and analyzed further to determine if this observation can be explained by greater DUIL enforcement compared to that existing for other counties.

A final recommendation about these modeling efforts is offered. Although a satisfactory functional relationship between DUIL enforcement and HBD accidents has not yet been established, it is important that efforts be continued along this line. As quality data are aggregated over the years from Michigan and elsewhere, it is entirely likely that stable relationships

between alcohol-related accidents and drunk-driving enforcement will be found. The development of cost-effectiveness analyses based on such relationships could then be developed. These would prove to be of major value in policy making and allocation of traffic-safety resources to drunk-driving enforcement efforts.

3.2 DUIL Enforcement Index

An DUIL enforcement index has been calculated and reported for prior years for the state as a whole and for each of the individual counties [2,3]. It is the ratio of the number of DUIL arrests to the number of HBD accidents. Its intent is to provide a capsule summary of a jurisdiction's enforcement efforts relative to the size of its alcohol-related crash problem. A large index can result either from a significant amount of enforcement activity, as indicated by a relatively large number of DUILs, or from a relatively small number of HBD accidents.

The newly derived indexes for 1981 are presented in Table 3. Table 2 (the same as Table 32 from the preceding report [3]) presents the 1980 indexes as well for convenience in comparison.

Table 2

1980 Accidents, DUILs, and DUIL Index by County

County		Arrests	Accidents				DUIL Index
Name	#		HBD	HNBD	NKID	TOTAL	
Alcona	1	23	63	235	6	304	.365
Alger	2	32	94	229	13	336	.340
Allegan	3	480	494	1862	88	2444	.972
Alpena	4	109	240	690	54	984	.454
Antrim	5	57	90	419	19	528	.633
Arenac	6	126	119	552	25	696	1.059
Baraga	7	19	65	225	31	321	.292
Barry	8	100	288	1275	69	1632	.347
Bay	9	527	923	2942	141	4006	.571
Benzie	10	109	88	327	5	420	1.239
Berrien	11	1241	965	4574	357	5896	1.286
Branch	12	271	204	1181	49	1434	1.328
Calhoun	13	754	802	4493	287	5582	.940
Cass	14	237	416	1302	78	1796	.570
Charlevoix	15	67	163	511	31	705	.411
Cheboygan	16	73	165	492	26	683	.442
Chippewa	17	118	243	666	67	976	.486
Clare	18	97	184	851	25	1060	.527
Clinton	19	238	317	1395	79	1791	.751
Crawford	20	102	65	377	47	489	1.569
Delta	21	74	243	1104	77	1424	.305
Dickinson	22	77	145	712	26	883	.531
Eaton	23	339	460	2022	73	2555	.737
Emmet	24	125	191	778	27	996	.654
Genesee	25	1435	2758	10029	721	13508	.520
Gladwin	26	76	106	518	32	656	.717
Gogebic	27	106	131	499	56	686	.809
Grand Traverse	28	125	458	2048	68	2574	.273
Gratiot	29	108	220	1018	42	1280	.491
Hillsdale	30	110	225	1150	109	1484	.489
Houghton	31	180	272	905	90	1267	.662
Huron	32	181	251	1006	30	1287	.721
Ingham	33	1179	1572	8263	194	10029	.750
Ionia	34	149	403	1559	107	2069	.370
Iosco	35	261	221	822	28	1071	1.181
Iron	36	73	98	370	52	520	.745
Isabella	37	92	305	1271	55	1631	.302
Jackson	38	656	1052	4486	271	5809	.624
Kalamazoo	39	975	1230	6913	440	8583	.793
Kalkaska	40	75	81	416	7	504	.926
Kent	41	1132	2614	13413	990	17017	.433
Keweenaw	42	18	19	41	3	63	.947
Lake	43	23	82	308	10	400	.280
Lapeer	44	415	372	1682	91	2145	1.116

Table 2 (continued)

1980 Accidents, DUILs, and DUIL Index by County

County		Arrests	Accidents				DUIL Index
Name	#		HBD	HNBD	NKID	TOTAL	
Leelanau	45	64	108	312	24	444	.593
Lenawee	46	493	447	2433	188	3068	1.103
Livingston	47	545	519	2163	75	2757	1.050
Luce	48	47	52	180	20	252	.904
Mackinac	49	66	83	332	21	436	.795
Macomb	50	4853	3681	14898	1209	19788	1.318
Manistee	51	69	160	668	83	911	.431
Marquette	52	195	590	1682	210	2482	.331
Mason	53	37	197	907	44	1148	.188
Mecosta	54	137	221	1421	50	1692	.620
Menominee	55	71	239	837	85	1161	.297
Midland	56	112	399	1945	31	2375	.281
Missaukee	57	21	60	311	8	379	.350
Monroe	58	558	897	2767	113	3777	.622
Montcalm	59	149	250	1573	59	1882	.596
Montmorency	60	37	48	251	11	310	.771
Muskegon	61	255	968	4192	169	5329	.263
Newaygo	62	92	214	1066	39	1319	.430
Oakland	63	4658	5546	26988	1364	33898	.840
Oceana	64	62	141	543	40	724	.440
Ogemaw	65	148	156	565	28	749	.949
Ontonagon	66	25	71	223	26	320	.352
Osceola	67	49	103	709	34	846	.476
Oscoda	68	56	79	305	10	394	.709
Otsego	69	170	75	439	36	550	2.267
Ottawa	70	399	623	3596	62	4281	.640
Presque Isle	71	34	85	372	18	475	.400
Roscommon	72	93	128	549	35	712	.727
Saginaw	73	781	1561	6844	206	8611	.500
St. Clair	74	808	852	3205	430	4487	.948
St. Joseph	75	242	329	1512	82	1923	.736
Sanilac	76	177	202	945	52	1199	.876
Schoolcraft	77	29	64	254	6	324	.453
Shiawassee	78	322	351	1441	149	1941	.917
Tuscola	79	270	354	1250	50	1654	.763
Van Buren	80	533	431	1436	113	1980	1.237
Washtenaw	81	1131	1494	6307	281	8082	.757
Wayne	82	8932	12680	55877	11726	80283	.704
Wexford	83	64	193	871	62	1126	.332
STATE TOTALS	84	39548	54148	238100	22345	314593	.730

Table 3

1981 Accidents, DUILs, and DUIL Index by County

County		Arrests	Accidents				DUIL Index
Name	#		HBD	HNBD	NKID	TOTAL	
Alcona	1	22	52	265	16	333	.423
Alger	2	31	71	282	10	363	.437
Allegan	3	513	396	1788	97	2281	1.295
Alpena	4	130	216	675	51	942	.602
Antrim	5	81	86	396	17	499	.942
Arenac	6	138	112	488	27	627	1.232
Baraga	7	38	80	188	27	295	.475
Barry	8	142	250	1257	58	1565	.568
Bay	9	497	753	2665	140	3558	.660
Benzie	10	102	87	330	17	434	1.172
Berrien	11	1462	943	4394	349	5686	1.550
Branch	12	268	170	1072	63	1305	1.576
Calhoun	13	804	705	4209	311	5225	1.140
Cass	14	213	308	1193	81	1582	.692
Charlevoix	15	99	122	564	27	713	.811
Cheboygan	16	76	137	473	41	651	.555
Chippewa	17	120	192	640	74	906	.625
Clare	18	102	196	868	39	1103	.520
Clinton	19	293	311	1467	76	1854	.942
Crawford	20	140	81	447	13	541	1.728
Delta	21	135	266	1214	127	1607	.508
Dickinson	22	111	154	750	41	945	.721
Eaton	23	430	393	2212	69	2674	1.094
Emmet	24	120	176	741	54	971	.682
Genesee	25	1336	2673	9970	749	13392	.500
Gladwin	26	99	123	569	26	718	.805
Gogebic	27	220	160	529	82	771	1.375
Grand Traverse	28	175	374	1996	81	2451	.468
Gratiot	29	122	195	1035	49	1279	.626
Hillsdale	30	165	207	1092	106	1405	.797
Houghton	31	219	230	826	84	1140	.952
Huron	32	197	204	983	36	1223	.966
Ingham	33	1323	1488	8131	203	9822	.889
Ionia	34	171	315	1406	110	1831	.543
Iosco	35	294	208	813	43	1064	1.413
Iron	36	57	86	354	41	481	.663
Isabella	37	143	296	1345	83	1724	.483
Jackson	38	619	935	4260	304	5499	.662
Kalamazoo	39	1177	1069	6372	358	7799	1.101
Kalkaska	40	64	71	422	8	501	.901
Kent	41	1030	2259	13116	979	16354	.456
Keweenaw	42	25	19	59	5	83	1.316
Lake	43	40	77	365	18	460	.519
Lapeer	44	499	344	1534	64	1942	1.451

Table 3 (continued)

1981 Accidents, DUILs, and DUIL Index by County

County		Arrests	Accidents				DUIL Index
Name	#		HBD	HNBD	NKID	TOTAL	
Leelanau	45	90	114	327	20	461	.789
Lenawee	46	497	426	2397	178	3001	1.167
Livingston	47	580	471	2133	60	2664	1.231
Luce	48	41	49	147	22	218	.837
Mackinac	49	66	79	353	18	450	.835
Macomb	50	4404	3370	14448	1198	19016	1.307
Manistee	51	49	161	649	86	896	.304
Marquette	52	281	483	1714	208	2405	.582
Mason	53	36	208	909	46	1163	.173
Mecosta	54	138	214	1287	55	1556	.645
Menominee	55	63	218	929	80	1227	.289
Midland	56	180	362	1932	39	2333	.497
Missaukee	57	17	55	333	16	404	.309
Monroe	58	702	783	2729	95	3607	.897
Montcalm	59	151	300	1508	67	1875	.503
Montmorency	60	36	48	250	2	300	.750
Muskegon	61	242	761	3817	215	4793	.318
Newaygo	62	87	218	1111	44	1373	.399
Oakland	63	5646	5212	26278	1362	32852	1.083
Oceana	64	86	151	523	17	691	.570
Ogemaw	65	207	124	646	24	794	1.669
Ontonagon	66	30	65	263	28	356	.462
Osceola	67	61	110	730	27	867	.555
Oscoda	68	56	67	296	5	368	.836
Otsego	69	117	71	416	35	522	1.648
Ottawa	70	464	574	3449	76	4099	.808
Presque Isle	71	24	59	340	18	417	.407
Roscommon	72	140	150	659	32	841	.933
Saginaw	73	888	1386	6512	193	8091	.641
St. Clair	74	851	824	3130	375	4329	1.033
St. Joseph	75	217	328	1495	81	1904	.662
Sanilac	76	181	186	869	54	1109	.973
Schoolcraft	77	29	69	250	21	340	.420
Shiawassee	78	412	331	1421	180	1932	1.245
Tuscola	79	279	294	1163	63	1520	.949
Van Buren	80	563	371	1544	81	1996	1.518
Washtenaw	81	1644	1284	6265	307	7856	1.280
Wayne	82	8553	11355	53979	11206	76540	.753
Wexford	83	64	121	863	82	1066	.529
STATE TOTALS	84	42214	49042	231819	21970	302831	.861

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