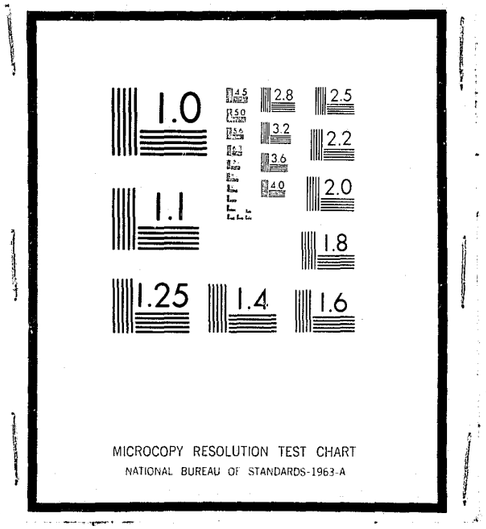

RESEARCH

PRELIMINARY STUDY OF THE EFFECTIVENESS OF AUTO ANTI-THEFT DEVICES

NATIONAL INSTITUTE OF LAW ENFORCEMENT
AND CRIMINAL JUSTICE
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION
UNITED STATES DEPARTMENT OF JUSTICE

Library of Congress Cataloging in Publication Data
Perchonok, Eugene.
Preliminary study of the effectiveness of auto anti-theft devices.
Bibliography: p.
1. Automobile theft—United States. 2. Theft from motor vehicles—United States. 3. Automobile—Anti-theft devices. I. National Institute of Law Enforcement and Criminal Justice. II. Title.
HV6658.P47 629.2'7 75-619403

PRELIMINARY STUDY OF THE EFFECTIVENESS OF AUTO ANTI-THEFT DEVICES

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This project was supported by Contract No. J-LEAA-025-73 with the AEROSPACE Corporation and an Interagency Agreement No. LEAA -J -IAA -021-3 with the National Bureau of Standards, awarded by the National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U.S. Department of Justice, Points of view or opinions stated in this document are those of the authors, and do not necessarily represent the official position or policies of the U.S. Department of Justice.

OCTOBER 1975

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Washington, D.C. 20402-Price $1
Stock Number 027-000-00365-6

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FOREWORD

The Federal government recently initiated a nationwide program to reduce automobile theft by 50 percent in five year. The National Institute is participating in this program and has prepared this initial report on auto theft and the effectiveness of currently available auto anti-theft devices.

This study found that the anti-theft ignition locks required by current standards do not provide adequate theft deterrence. The time needed to defeat these locks varies from a few seconds to several minutes, and cars with the most easily defeated lock have the highest theft rate.

It is clear that additional and more stringent anti-theft standards are required, including minimum performance guidelines for ignition locks.

Gerald M. Caplan
Director
National Institute of Law
Enforcement and Criminal
Justice

October 1975

EXECUTIVE SUMMARY

An overview report on auto theft and the effectiveness of currently available auto anti-theft devices was prepared by the Law Enforcement Assistance Administration as part of a recently initiated Federal program to reduce auto theft by 50% in five years.

Analysis of available data reveals that the anti-theft ignition locks currently required by DOT Vehicle Safety Standard No. 114 do not provide adequate theft deterrence. The time needed to defeat these locks varies from a few seconds to several minutes, and cars with the most easily defeated lock have the highest theft rate. Moreover, the buzzers required under Standard No. 114 to remind drivers to remove the ignition key when leaving the car do not appear to be effective.

It is recommended that, on the basis of cost effectiveness, Standard No. 114 be amended to include minimum performance guidelines for anti-theft ignition locks. It is further recommended that consideration be given to providing standards as an aid in preventing larcency from the passenger compartment, engine area, and the trunk of non-commercial motor vehicles.

It is clear that additional and more stringent vehicle theft protection standards will have no effect on theft of the current auto fleet. Only after a significantly large portion of the current auto fleet has been replaced can a meaningful result be expected. To accelerate the desired reduction in auto theft, a number of other programs are also required. These programs should be designed to influence the behavior and response of the public, potential offenders, and law enforcement personnel, and should include a more effective information system than currently exists.

I. INTRODUCTION

Between 1968 and 1974, the reported number of auto theft offenses rose 23%. Only because of increases in the other index crimes of larceny, burglary, robbery, rape, murder, and aggravated assault did the proportionate share of auto theft appear to be less in 1974 (9.5%) than it was in 1968 (11.7%), Figure 1. Moreover, the gross dollar loss attributed to auto theft has been rising and by 1973, the last year for which data are currently available, this loss exceeded $1 billion (Reference 1). The net dollar loss, which would take into consideration the value and extent of stolen vehicles which are recovered in good condition, was not estimated due to the unavailability of needed data.

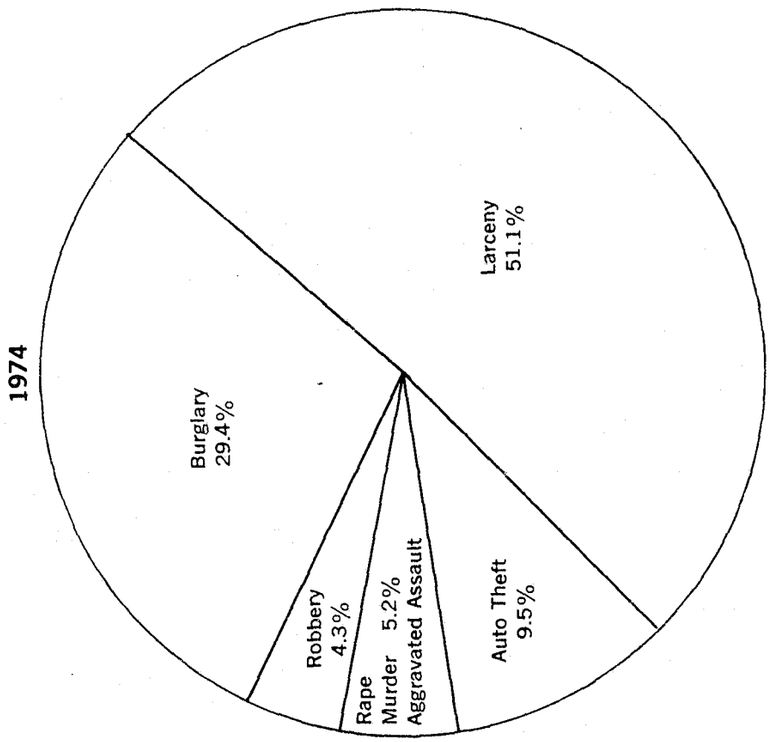
Concerned by this trend, The Federal Government has recently initiated a nationwide program to reduce automobile theft by 50% in 5 years. The Law Enforcement Assistance Administration is participating in this program and has prepared this initial overview report on auto theft and an assessment of the effectiveness of currently available auto anti-theft devices. The extent of automobile-related larceny, potential improvements of automobile anti-theft devices, and identification of needed research are also discussed.

The U.S. Department of Transportation, by its legislated authority, promulgated Motor Vehicle Safety Standard No. 114, Theft Protection—Passenger Cars, effective January 1, 1970. This standard imposed requirements for theft protection to reduce the incidence of accidents resulting from unauthorized auto use. In brief, the standard requires each passenger car to have a key-locking system which:

- Can prevent normal engine activation and either steering or self-mobility, and
- Provides a warning to the driver when the key is left in the locking system and the driver's door is opened.

Passenger cars manufactured by the General Motors Corporation met the requirements of the standard beginning with model year 1969 and all other passenger cars had a model year 1970 effectivity. Since the Standard 114 requirements were met beginning in 1969, the base year used in this report for data related to auto theft is 1968.

The data presented and analyzed herein were obtained from diverse sources. Inconsistencies in definitions and the resulting data interpretation by the individual sources requires that caution be exercised in the data collection and analysis process. For example, until 1974, the FBI UCR statistics grouped passenger car, motorcycle, and light-truck theft into the auto theft category. Since this report is devoted primarily to passenger car theft, the pre-1974 FBI data had to be appropriately interpreted. Nevertheless, it appears that substantive conclusions can be drawn and recommendations for passenger car theft-reduction procedures can be offered. Attention was focused on passenger automobile theft and includes theft of the vehicle, theft of vehicle components, or theft of vehicle contents. Only anti-theft devices in the category of "target hardening" were considered. Indirect theft deterrents, such as insurance incentives or public awareness campaigns, were beyond the scope of this survey.



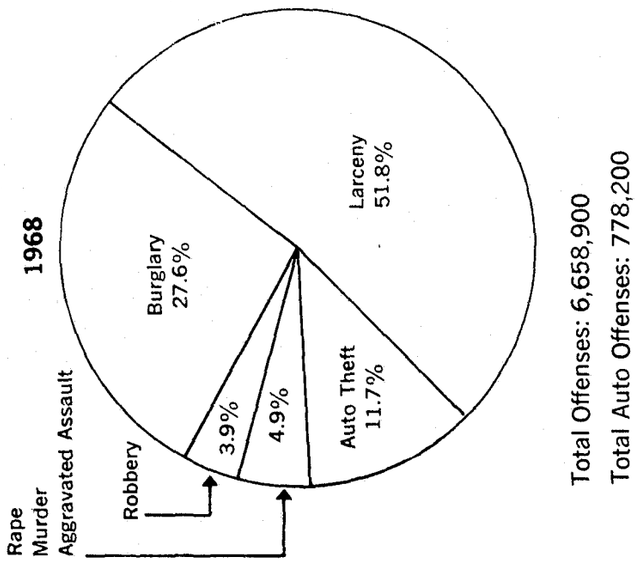


Figure 1

SERIOUS CRIMES IN THE UNITED STATES

Data Sources: 1968 and 1973 FBI UCR; FBI Advance Release, March 31, 1975

II. BACKGROUND

In order to provide the appropriate perspective on passenger anti-theft devices and their effectiveness, some knowledge of the basic statistics relating to passenger car theft is useful. This chapter presents background information collected from a variety of published sources on:

- Reasons for theft.
- Age profile of passenger car thief.
- Thief's prior arrest record.
- Where and when passenger cars are stolen.
- Methods of entering and starting stolen cars.
- Model and make preference of stolen cars.
- Recovery of stolen cars.
- Condition of recovered cars.
- Theft of other automotive vehicles.
- Auto-related larceny.
- Accident incidence of stolen cars.
- Summary.

In addition, because of the marked increase in motorcycle and light truck thefts, some statistics are also included for these categories.

A. Reasons for Passenger Car Theft

Cars are generally stolen for joy-riding, use in committing another crime, stripping, scrapping, or reselling. The frequency with which cars are stolen and never recovered represents an index of theft for personal gain by either scrapping or reselling. The incidence with which recovered cars are found stripped is a conservative indication of stripping as the purpose for the theft. (Scrapped cars may also have been previously stripped.) Stolen cars which are recovered undamaged have generally been stolen for joy-riding. A small number may have been stolen for use in committing another crime.

The results of two surveys on the status of recovered cars from which the purpose of the theft may be deduced are given in Table 1. One set of data represents the results of a 7-month study in 1972 by the A.D. Young Company for the California Highway Patrol (Reference 2). The other set of data is from recent FBI surveys (References 3 and 4). Based upon the limited sampling represented by these surveys, it would appear that at least one-fifth of all stolen cars are never recovered and that almost one-third of all car thefts probably have a joy-riding motive.

Table 1—Recovery Statistics for Stolen Cars

Car Status	*A. D. Young Study (Reference 2)*	*FBI Surveys (References 3 & 4)*
Intact	39%	29%
Damaged	10%	12%
Stripped	31%	28%
Not Recovered	20%	31%

B. Car Thief Age Profile

References 2 and 3 also provide information on the age distribution of persons arrested for auto theft. These data are tabulated according to age grouping in Table 2. Also included in Table 2 are the FBI Uniform Crime Report statistics for 1971 on apprehended car thieves.

There is some uncertainty in the conclusions to be drawn from these data which arises from the likelihood that older, more experienced thieves are presumably better able to avoid apprehension than are younger, less-experienced thieves. Nevertheless, the available data suggest that those under 18 represent about half the thief population and that persons under the age of 25 represent three fourths of the thief population.

C. Car Thief Prior Arrest Record

The FBI general survey (Reference 3) reported that

Table 2—Age Distribution of Apprehended Car Thieves

Age	*A. D. Young Study (Reference 2)*	*FBI General Survey (Reference 3)*	*1973 FBI UCR (Reference 5)*
Under 18	45%	54%	57%
18 to 24	30%	31%	29%
25 and over	18%	15%	14%
Unknown	7%	–	–

15,109 individuals were arrested for car theft during the survey period. Their previous arrest history is summarized in Table 3. The data indicate that almost 42 percent of the apprehended car thieves have no prior arrest history.

Table 3—Previous Arrest History of Apprehended Car Thieves (Source: Reference 3)

Status	*Percent*
No Prior Arrest	42
At Least One Prior Arrest for Vehicle Theft	21
At Least One Prior Arrest for Other Offenses	37

D. Time and Place of Passenger Car Theft

The results of a Michigan study (Reference 5) on the specific locations from which 4847 cars were stolen are given in Table 4. While it would appear that street parking provides the greatest theft vulnerability, the actual risk of theft depends upon the volume and duration of vehicle exposure (both of which are unknown) at each location.

The results on auto location at the time of theft reported in the FBI general survey (Reference 3) are categorized in a somewhat different fashion. In this latter survey, 59% of all reported thefts occurred from residential areas, i.e, residential streets or residence and apartment parking areas; 34% of all reported thefts occurred from commercial areas, i.e., business and commercial streets, shopping center parking lots, or commercial parking lots. Reference 3 also reported that the ratio of thefts from free parking areas to paid parking areas and garages was 5 to 1.

Data in Reference 3 also provide insight on the time when cars are stolen. As indicated in Table 5 and intuitively anticipated, two-thirds of all auto thefts occur at night when the probability of being observed is least.

Table 4—Places From Which Passenger Autos Are Stolen (Source: Reference 5)

Auto Location When Stolen	*Proportion of Thefts*
Street	50%
Parking Area	26%
Private Property	10%
New or Used Dealer Lot	2%
Not Reported	12%

Table 5—Times At Which Passenger Autos Are Stolen (Source: Reference 3)

Time of Theft	*Proportion of Thefts*
6:00 AM to 6:00 PM	30%
6:00 PM to 6:00 AM	59%
Unknown	11%

E. Methods of Car Entry and Mobilization

The FBI special survey (Reference 4) presents data on 10,014 recovered 1972–1975 model year passenger cars. A breakdown of the techniques used to gain vehicle entry is given in Table 6.

Although an appreciable portion of the "no visible means" of entry category in Table 6 may be due to limited police investigation, the large number of entries represented by this category are believed to include a significant proportion of unlocked cars. Moreover, although the large percentage of "no visible marks on lock" category in Table 7 may also be due in part to limited police investigation, it was concluded in Reference 4 that a significant number of the stolen and recovered cars involved keys left in the ignition lock or concealed in the car (under a mat or above the sun visor, for example). It would thus appear that owner/operator action may have directly contributed to a very large proportion of these thefts.

F. Model Year and Make Preference of Auto Thieves

The frequency of theft of a specific make, model, and year passenger automobile depends upon the demand for the car or its parts and the ease of defeating its locking system. There is obviously great interest, therefore, in whether the anti-theft ignition locks required by law since 1970 have had the desired effect on auto theft. According to the FBI general survey (Reference 3), the breakdown by model year grouping of the autos stolen during the survey period was as follows:

1968 and older (prior to DOT Standard)	55	percent
1969 through 1971 (interim phase)	20	percent
1972 through 1975 (DOT Standard in effect)	25	percent

Additional analysis of the data from Reference 3 provides insight into auto thief preferences. The distribution by manufacturer of the total sample of stolen cars was as follows:

General Motors	50%
Ford	25%
Chrysler	10%
AMC	2%
Foreign and miscellaneous American	13%

It should be noted that care must be exercised in assessing this distribution. A more meaningful assessment is provided by examining the rate of car theft of a specific manufacturer. Accordingly, the data were adjusted to an annual, national basis and theft rates by manufacturer were computed. Annual registration figures for the model year groupings involved were obtained from Reference 9. The theft rate results thus computed are summarized in Table 8.

At the present time, older cars—with the exception of Ford products—have a higher theft rate than newer cars. The theft rate of Ford-built cars increases for newer cars and is twice as high as any other make for the 1972–75 model year grouping. This is probably attributable to a less effective locking system, as suggested by the Massachusetts Consumer's Council study (Reference 10).

Table 6—Method Used to Enter Recovered Cars (Source: Reference 4)

Method	*Percent Distribution*
Use of Key	15%
Broken Window	2%
Door Lock	8%
—removed	7%
—tampered	1%
*Robbery or burglary	3%
**Miscellaneous means	7%
No visible means	65%

*Keys are obtained to commit an auto theft through a robbery or burglary.

**Wire, coat hanger, bent radio antenna, prying, etc.

The method of attacking the ignition lock once entry was achieved, is also treated in Reference 4 and is summarized in Table 7.

*Table 7—Method Used to Start Recovered Cars (Source: Reference 4)**

Method	*Percent Distribution*
Intact Ignition Lock	57 (27 percent of these cars are Fords; 51 percent are GMs; 11 percent are Chryslers; 3 percent are AMC; and 8 percent are other)
—original key in car	16
—duplicate key in car	8
—no visible marks on lock	33
Ignition Lock Removed	25 (85 percent of these cars are Fords)
Ignition Lock Forced	18 (78 percent of these cars are Fords)

*It is important to note that 50 percent of the 10,014 (1972–1975) recovered cars in the FBI survey are Fords and that 70 percent of the 13,904 (1972–1974) stolen cars in the Massachusetts study are Fords.

Table 8—Theft Rates Per 1000 Registered Cars

Manufacturer	*Model Years*		
	1968 and before	*1969–71*	*1972–75*
AMC	7	5	5
Chrysler	7	5	4
Ford	7	8	12
General Motors	13	5	6
Foreign and Misc. American	14	7	6

G. Recovery of Stolen Cars

Recovery rates for stolen passenger cars range from 69% in the FBI general survey (Reference 3) to 80% in the A.D. Young, California study (Reference 2). In an earlier study by Frese and Heller, conducted in St. Louis, Missouri, in 1970 (Reference 8), recoveries for the decade 1960 to 1970 averaged about 87%.

According to the FBI general survey (Reference 3), 75% of the vehicle recoveries occurred within the same jurisdiction as where the vehicle had been stolen. The A.D. Young study (Reference 2) reported that 48% of the California recoveries were made in the same jurisdiction, 27% in a different city, and 25% in an unincorporated area.

The FBI general survey (Reference 3) also showed that 63% of the stolen cars recovered during the survey period were recovered within 48 hours. Since only 69% of all of cars stolen were recovered, this represents recovery of 43% of all stolen cars within two days of the theft.

H. Condition of Recovered Cars

As indicated in Section A, one third or more of all stolen cars are stripped. The specific statistics on car stripping vary with model year. Some insight on this variation is offered by data from the Michigan survey (Reference 5). These data are plotted in Figure 2 and reveals that the incidence of stripping is greatest for very new cars.

Of the 10,014 recovered cars reported in the FBI special survey (Reference 4), 231 (2%) were totally stripped of the engine, transmission, tires, and most of the major engine accessories. An additional 3,835 (38% of the recovered cars) were partially stripped. Of the partially stripped cars, 2,966 (30% of the total recovered) were stripped of tires and wheels, 1,453 (15% of the total recovered) were stripped of sound equipment (radios and tape players), 979 (10% of the total recovered) were stripped of body parts, and 1015 (10% of the total recovered) were stripped of engine parts. Since a single partially stripped car is often stripped of several items, the above percentages cannot be added to obtain the total percentage of the recovered cars which were partially stripped.

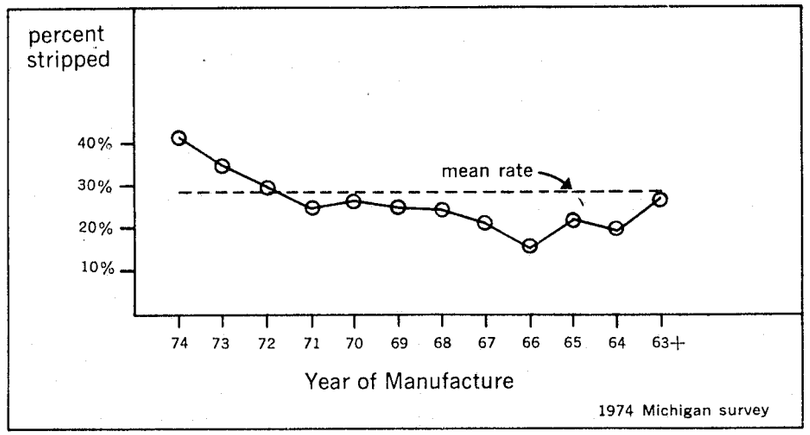


Figure 2

Rate of Strippage, As A Percent of Cars Recovered By Year of Manufacture

Similar results (see Table 9) were reported in the Michigan survey (Reference 5), namely, that tires and wheels are the stripper's favorite targets, followed by sound equipment and engine parts. The most frequently stripped engine part was the battery. Since individual cars may have parts stripped in several of these categories, the percentage column is not additive.

Table 9—Parts Stripped from 3401 Recovered Cars
(Reference 5)

Stripped Component	*Portion of Recovered Cars*
Road tire	21%
Spare tire	17%
Radio	10%
Tape deck	2%
Drive train	1%
Body parts	4%
Engine parts	8%

I. Theft of Other Automotive Vehicles

As previously indicated, the scope of this report is limited to passenger car theft. Nevertheless, a brief examination of the magnitude and trends of non-passenger car automotive vehicles is appropriate and informative. The distribution by vehicle type reported in the FBI general survey (Reference 3) is summarized in Table 10.

The A.D. Young study (Reference 2) reported that during 1970–71 motorcycles accounted for 13% of all reported vehicle thefts in California. Clearly, after passenger cars, motorcycles represent the next largest category of stolen vehicles.

Table 10—Distribution of 137,975 Reported Stolen Vehicles

Vehicle Type	*Percent of Total Stolen*
Passenger Cars	85%
Trucks and Buses	6%
Motorcycles	8%
Miscellaneous	1%

J. Auto-Related Larceny

Auto theft offenses are separately reported in the FBI Uniform Crime Reports. The theft of auto accessories and of property from autos is also reported, but under the index crime category of larceny. On the basis of the data presented in the FBI UCR, a projection can be made on a national basis of the extent of theft of auto accessories and the theft of property from within autos. The specific number of offenses for 1968, 1970, and 1973, are presented in Figure 3 and the corresponding dollar losses are given in Figure 4. No clear trend is observed.

K. Accident Incidence With Stolen Cars

Both the Michigan survey (Reference 5) and the FBI special survey (Reference 4) include data on the number of accidents and the resulting number of fatalities involving stolen cars. Using an average retention period by the thief of two days (see Section H), the accident rate for stolen passenger cars could be estimated. The results thus obtained were than compared with an estimate for the

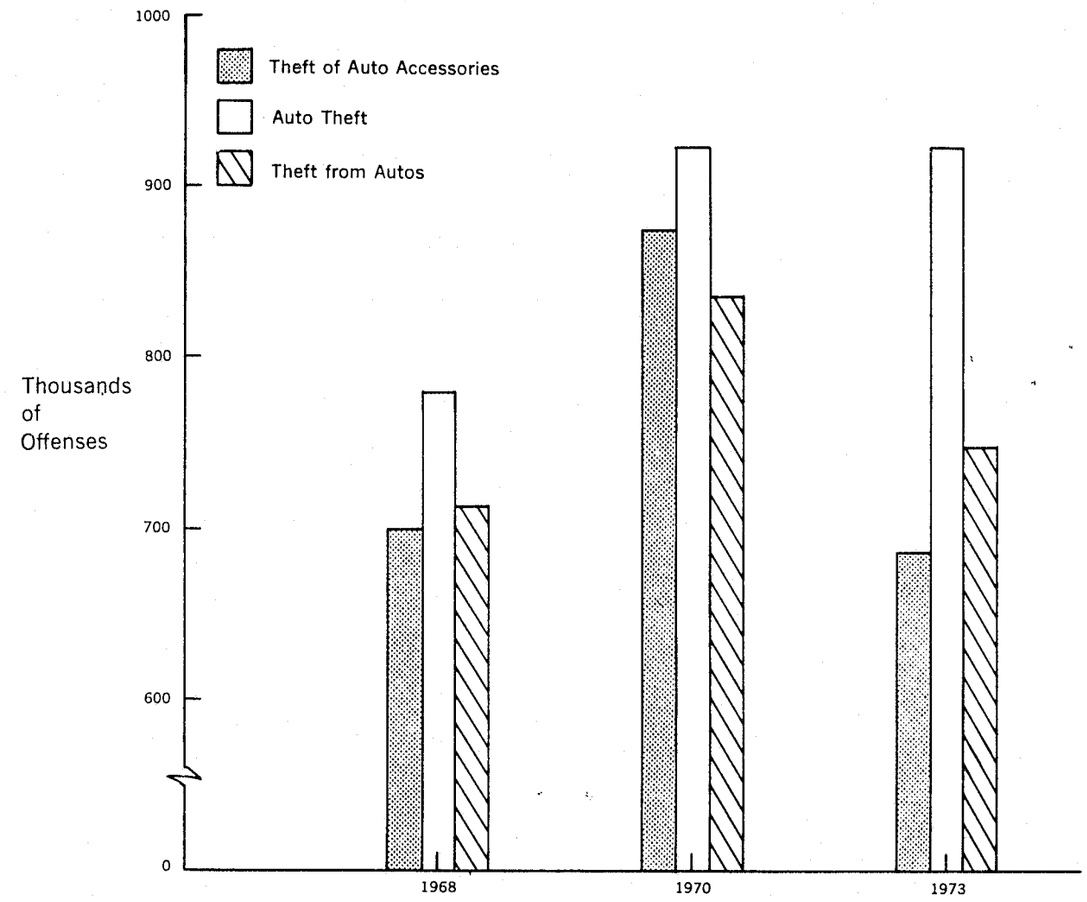


FIGURE 3

AUTO THEFT AND AUTO-RELATED LARCENY

(Reference 1)

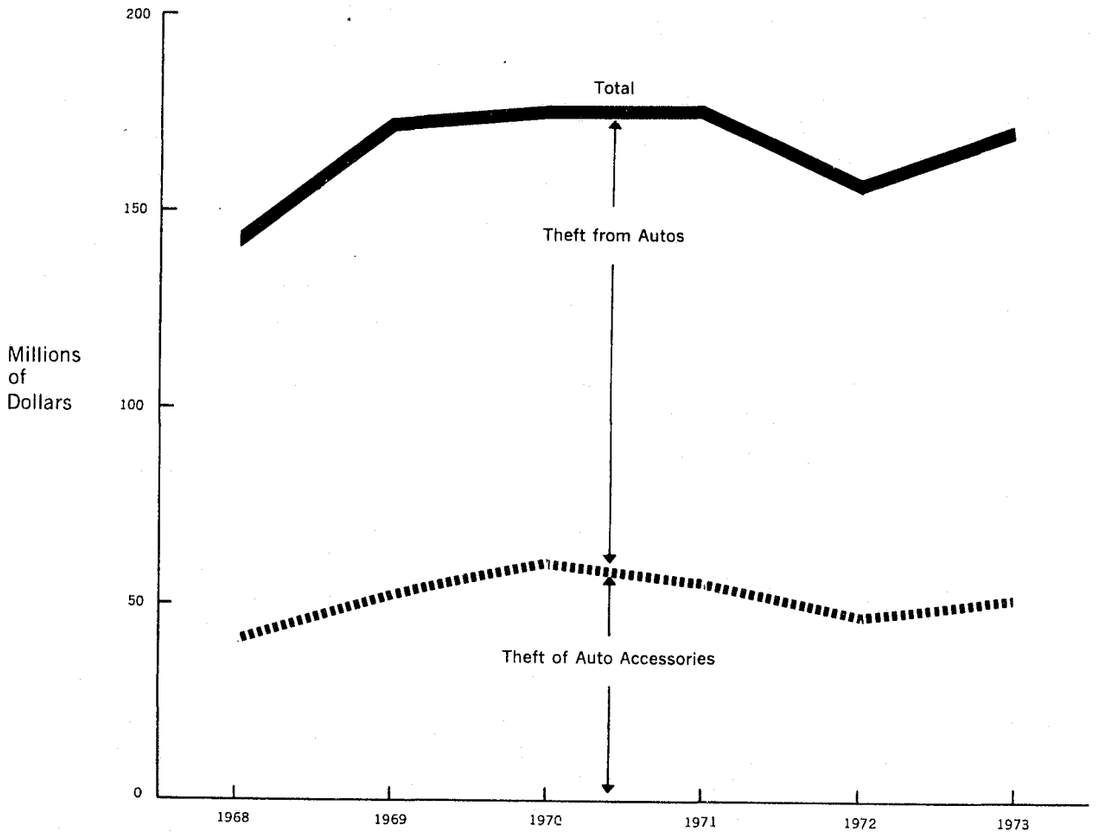


FIGURE 4

GROSS LOSS FROM AUTO-RELATED LARCENY

(Reference 1)

general public accident rate obtained from Department of Transportation vehicle registration data (Reference 6) and National Safety Council accident data for 1973 (Reference 7).

The accident rate for stolen cars, apparently, is many times greater than that of vehicles that are not stolen. Thus, based on the same populations of stolen and non-stolen cars per vehicle-year, for every non-stolen car accident, there would be approximately 43 stolen car accidents. (One vehicle-year is one car on the road for 1 year.)

L. Summary

Currently available auto theft statistics form a basis for assessing the effectiveness of existing anti-theft devices. The findings, based on an examination of these data, are summarized below:

1. The rate of theft for most newer American-built cars is currently lower than for older American-built cars.
2. Auto theft is a youthful offender problem with about half of the persons arrested under 18 years of age.
3. The primary reasons why automobiles are stolen are apparently transportation and profit.
4. The majority of stolen vehicles are recovered. Of the vehicles recovered, about one-third are found intact, almost one-third incur stripping of part(s) and the rest are damaged.
5. About one-half of the recovered stolen cars have intact ignition locks, and the data indicate that at least one-fourth of the recovered cars had been mobilized by use of an ignition key.
6. The incidence of stolen cars involved in accidents continues to be much higher than for the general public.
7. Most stolen cars are recovered within the jurisdiction reporting the theft, but a considerable number are also recovered in other jurisdictions.

III. ANTI-THEFT DETERRENTS

Numerous solutions have been suggested for dealing with the auto theft problem. In general, these suggestions may be classified as *direct* deterrents which involve the vehicle itself or *indirect* deterrents which are usually processes or procedures relating to auto theft but not necessarily physically involving the auto. In either case, they operate in one of the following ways:

- Prevent or discourage vehicle entry/theft.
- Prevent or deter vehicle movement.
- Avoid or degrade conditions conducive to attempted theft.
- Provide effective means for identifying stolen auto/components/contents.
- Reduce profit opportunities from sale of stolen items.

A matrix of the more frequently considered anti-theft procedures is given in Table 11. Also indicated in the table is the place at which the initiative for each solution generally rests. Some of these approaches are already being exploited and others remain to be initiated. It should be noted that exploitation of an anti-theft approach does not imply that the procedures or designs utilized are necessarily effective. Improvements are still required in many of the implemented auto theft deterrents.

The origin of indirect deterrents generally resides with various governmental levels. Direct deterrents, on the other hand, may in some cases be required by legislated authority, but their specific mode of introduction rests with the manufacturer. Some direct deterrents actually originate with the manufacturer and some with the vehicle owner/operator. Clearly, although some leverage can be exerted by Federal, state, and local regulations and by insurance carriers on direct deterrents, the resulting success or failure of the direct deterrents that are implemented generally rests with the manufacturer and the design and operation of the specific device.

As indicated in the Introduction, only direct deterrent anti-theft devices that prevent theft of the auto, its components, or contents are being examined in this report. The next chapter discusses such devices and summarizes their effectiveness in deterring or preventing auto entry and theft.

Table 11–Automobile Theft Deterrents

Deterrent	Initiative Responsibility					
		private		government		
Direct	other	owner	mfg.	local	state	federal
Anti-Theft Ignition Lock			X			X
Ignition Buzzer						X
Minimum Ignition Key Combinations [1]						X
Kill Switch Group [2], Krook-Lok [3]		X				
Alarms		X	X			
Different Door and Ignition Locks			X			
Anti-Theft Door Lock			X			
Anti-Theft Trunk Lock			X			
Indirect						
Juvenile Delinquency				X	X	
e.g., "Reduction of Youth Related Property Crime" (N.M.) early I. D., counseling, and diversion from court						
Police Department Improvements				X	X	
Training—e.g., IACP Vehicle Theft Inves. Training Course, NYC "Auto Crime Units"						
Tactical Forces—e.g., Fairfax, Va. "Auto Theft Prevention Squad"						
Special Incentive Programs—e.g., "Screaming Eagle" Kentucky St. P., "Blue Max" Ohio S. P.						
Equipment—BEAT Pgm. Lowell, Mass—to develop computer capabilities						
Vehicle Theft Information System				X	X	X
e.g.,—California Dept. of Highway Patrol NCIC						
Vehicle Titling Uniformity Laws					X	
DOT project to establish uniform titling req.						
Vehicle Theft Inspection				X	X	
Dept. H. P.–identify stolen autos, parts, etc.						
Programs Designed to Decrease Profit Motive				X	X	X
Fencing—e.g., Clayton Co. Ga.—"Detection and Control of Organized Crime"						
Inter-Country Shipping—DOJ & Bureau of Customs exportation control plans						
Public Awareness Campaigns				X	X	
e.g., "Lock it and Pocket the Key", St. Louis						
Insurance Incentive	X		X			
anti-theft devices a factor when determining insurance rates						

[1] Provides a large number of different locks, thus preventing use of a small set of master keys.
[2] Hidden secondary switches which must be activated to run the motor.
[3] Steering wheel/brake pedal locking fixture.

IV. EFFECTIVENESS OF ANTI-THEFT DEVICES

There are a number of devices currently available either as standard or optional equipment on currently available passenger automobiles which are intended to deter theft. Some are mandatory under Federal regulations and some have been provided by the automobile industry.

Three Federally mandated requirements were established under 49C.F.R.571.114 (Standard 114) effective January 1, 1970, and 15 U.S.C. 1381, P.L.89–563, September 9, 1966, 80 Stat. 718. See appendix D for Standard 114. Responsibility for implementing and enforcing Standard 114 rests with the Department of Transportation. There are no other Federal requirements for passenger car anti-theft devices.

The mandatory devices required under Federal law include:

- Ignition locks that prevent the car from being steered or moved forward when the key is out of the lock.
- Buzzers to remind the driver to remove the key from the ignition when he leaves the car.
- Ignition locks for cars from each manufacturer which generally have at least 1000 key combinations.

All new cars sold in the U.S. must now be equipped with devices that comply with these standards. Additional anti-theft devices are also available as standard or optional equipment from the factory or as owner procured and installed equipment. These devices, which are currently provided by the manufacturer but are not required by Federal regulation, include:

- Door locks that do not use the same key as the ignition lock—instituted on General Motors cars beginning with 1974 models.
- Tampering or theft alarm—either factory or owner-installed.
- Locking fixture simultaneously restraining the steering wheel and the brake pedal—owner-procured and installed.
- Miscellaneous devices including kill switches, fuse switches, and fuel locks—owner-procured and installed.

Following is a discussion of the effectiveness of each of these devices as a deterrent to auto theft.

A. Current Anti-Theft Devices

1. *Ignition locks.* Motor Vehicle Safety Standard 114 requires that each passenger car have a key-locking system that prevents "either steering or forward self-mobility of the car, or both" when the key is out of the ignition lock. In promulgating this standard in 1968, the Federal Highway Administration noted that "it would be unwise to establish a standard in terms so restrictive as to discourage technological innovation in the field of theft inhibition" (33F.R. 6471, 5–27–68).

The anti-theft standard gives the auto manufacturer a free hand in the locking system design and provides the opportunity to minimize cost or maximize deterrence. Nearly all of the auto manufacturers supplying the U.S. market responded to the Federal standard with a locking system that prevented steering when the key was not in the ignition lock and the lock in the "on" position. At present, Saab is the only major manufacturer using an ignition lock that prevents forward motion. In this latter case, the ignition switch is located on the floor above the transmission, between the two front seats. In all other cases, the ignition switch locks the steering column.

Each of the major manufacturers uses a different ignition lock design and their theft experience is varied. (Available surveys, References 3, 4, and 5 offer inadequate data on autos of foreign manufacture as well as on certain domestic autos. Consequently, unless otherwise noted, the discussion herein is limited to the "big three," namely Chrysler, Ford, and General Motors.)

As indicated in the discussion of Tables 7 and 8 in Section II, Ford-manufactured automobiles have a theft rate at least double that of other recently manufactured cars. A 1974 Massachusetts Study (Reference 10) indicates that a possible major cause for this higher theft rate is that the ignition lock is easier to remove from post-1970 Ford-manufactured cars than from other post-1970 cars. That is not to say that the other post-1970 cars are invulnerable to ignition lock removal, but rather that defeat of the Ford lock is easier and accomplished much more rapidly.

a. *Defeat of ignition locks.* The 1974 Massachusetts study (Reference 10) on auto theft discusses the design of various automotive ignition locks and techniques used by thieves in defeating them. Thieves defeat ignition locks of post-Standard 114 cars by two primary means. The thief either removes the ignition lock, usually with a dent puller, or else he forces the lock into the "on" position by breaking the tumblers. In either case, the anti-theft mechanism is deactivated, and the car can be started and driven.

1.) *Dent puller.* The time required to remove steering column ignition locks with a dent puller from late model "big three" passenger cars was reported in Reference 10 and are given in Table 12.

Table 12–Minimum Time Required For Ignition Lock Removal (Source: Reference 10)

Manufacturer	*Minimum Lock Removal Time*
Ford	10 seconds
Chrysler	30 seconds
General Motors*	120 seconds

*The locks on AMC cars have substantially the same characteristics as the locks on GM cars.

The Ford lock clearly requires much less time to defeat than either Chrysler or General Motors locks.

2.) *Lock twisting.* The second most frequently used method of defeating the steering-column-mounted ignition lock involves twisting the lock to break the tumblers. A key which can be inserted into the keyway of the lock is used to raise the tumblers. Then the lock is twisted with a pliers or other suitable tool and the tumblers resisting the turning action are crushed. The entire operation takes about 5 seconds. The *method* is useable only on Ford and Chrysler automobiles. Due to a side bar to prevent lock turning and the resulting stronger internal construction, General Motors (and AMC) locks are not very susceptible to this approach.

These tests indicate that the performance of the 1972–1975 Ford ignition lock in preventing lock removal or the twisting of the lock to force its operation is very low, as is that of the Chrysler ignition lock, while GM's lock performance is much better. However, a comparison of the actual field performance of the Ford, Chrysler and GM locks is a better measure of their effectiveness. Thus, the FBI survey (Reference 4) found that over 81 percent of the recovered cars with ignition locks removed or forced were Fords while only 2 percent were Chrysler and 13 percent were GM cars. (See Table 7 in Section II.) Therefore, the significantly large number of 1972–1975 Ford cars stolen (maybe as high as 70 percent of all 1972–1975 stolen cars) is not surprising. (See the footnote to Table 7 in Section II.) Finally, it is evident that this poor performance is recognized by the industry since the Ford Motor company has indicated that a redesigned ignition/steering lock will be installed in its 1976 model cars.

If Ford does significantly improve its ignition/steering lock, this could lead to some crime displacement in the sense that other automobiles that are more vulnerable may then become preferred targets of theft. For example, this could affect the theft rate of Chryslers and other automobiles.

2. *Buzzers.* It is difficult to assess the effectiveness of buzzer systems which alert the driver that the key has been left in the "off" position in the ignition lock when the driver's door is opened. The problem is caused by the reluctance of passenger car owner/drivers to admit that the ignition lock key had been left in the car at the time of the theft. Their reluctance may be due to the mistaken belief that insurance companies will not cover the loss in such circumstances, or due to local ordinances against leaving the key in the car (which have been violated), or due merely to embarrassment of such an oversight. Although the FBI special study (Reference 4) reported that 16% of the recovered passenger cars were recovered with the original key in the car (see Table 7), the method by which the thief obtains the key is not known. A large number of these cases undoubtedly involved keys left in the car, but the key may also have been obtained from a robbery or burglary (see Table 6). Nevertheless, 17% of the theft reports filed on the 10,014 cars examined in the FBI special study reported that the ignition key was in the car when the vehicle was stolen.

The data presented in this document for the incidence of keys left in the car are based entirely on owner admission and probably should be considered a minimum estimate for the actual situations where keys were in the ignition lock at the time of the theft. In a commercial situation where leaving the key in the car is a matter of need, less reluctance to admit that the key was in the ignition lock at the time of the theft would be expected than for the situation where convenience or neglect was involved.

The FBI general survey on 116,409 automobile thefts (Reference 3) provides data on the number of keys admittedly in the ignition lock of stolen automobiles and classifies the data according to the vehicle location at the time of the theft. The pertinent statistics are summarized in Table 13.

Only 25% of the stolen cars treated in this survey were manufactured during the 1972–75 model years. Unfortunately, a breakdown similar to Table 13 for just that category of car was not provided in Reference 3 nor was the raw data available to the authors of this document for further analysis. Consequently, it is not known at this time whether the same distributions as indicated in Table 13 generally apply to buzzer-equipped autos.

Since the probability that drivers of different makes of buzzer-equipped cars leave their keys in the ignition lock upon exiting the vehicle is likely to be similar, any

Table 13–Reported Incidence of Keys in Ignition Lock At Time of Theft
(Reference 3)

Car Location at Time of Theft	*Portion of Total No. of Auto Thefts*	*Portion of Thefts at Location with Key Reported Left in Ignition*
Residential Area	59%	11%
Commercial Area	33.5%	16%
Dealer and Rental Agency Lot	4.4%	32%
Not Indicated in Ref. 3	3.1%	–

difference in the rate at which different makes of cars are reported stolen with the ignition key in the lock is of interest. Such data are available from the 1974 Michigan survey (Reference 5) and the 1974 FBI special survey (Reference 4). Appropriate data from these sources are summarized in Table 14.

Comparison of the two surveys reveals that although the percentage of cars reported stolen with the ignition key in the lock is consistently greater in the FBI survey for all makes listed, there is a marked reduction in both surveys between Ford-built cars and those of the other major domestic manufacturers. It appears that Ford drivers are not necessarily more responsive to the ignition lock buzzer but rather that since the Ford ignition lock is more easily removed than those of the other domestic manufacturers, the auto thief appears to be less inclined to locate a Ford with the ignition key left in the lock. He probably prefers to remove or force the ignition lock and then drive away.

The Michigan survey (Reference 5) provides an apparently direct assessment of the effect that introduction of the ignition lock buzzer has had on making drivers more conscious of leaving their ignition key in the lock. The data provided therein indicate the number of cars reported stolen with the ignition key in the lock by model year. These data have been grouped into pre-1970 models and post-1970 models to separate the buzzer-equipped models and the results are given in Table 15.

It would appear that cars equipped with an ignition key buzzer are left with keys in the ignition lock and subsequently stolen about as frequently as cars not equipped with a buzzer. The problem faced by drawing any conclusion from the trend suggested by Table 15 is apparent when the model year variations upon which Table 15 is based are examined, Table 16. Clearly, the model year variations are erratic, and the rise for the 1974 model year is inconsistent with trend established in previous years for buzzer-equipped automobiles.

3. *Minimum number of key combinations.* There is no direct evidence on whether or not the portion of the Standard 114 which requires a minimum of 1000 different ignition key combinations of all major automobile manufacturers has been effective. With the implementation of this requirement, a thief must possess a very large set of keys in order to open the ignition locks of cars produced by a given major manufacturer. Such sets are made and available and may possibly be used by car thieves.

These sets, called try-out keys, consist of about 100 keys. Each individual key is cut so that it approximates several of the 1000 different key codes in use. In fact given any key of the try-out set, 6 out of 10 times it will open any given lock used by a specific manufacturer without the use of force. If force is used, this likelihood increases to 7 out of 10 times.

The available surveys do not present any information from which the frequency of use of try-out keys could be established. Consequently direct contact was established with police agencies in Boston, St. Louis, California, and Michigan. None of the police agencies contacted had ever discovered any evidence suggesting the use of try-out sets. Consequently, it can be assumed that this tedious approach to mobilizing a stolen car is infrequently utilized and that the standard is effective in preventing car thefts by this technique.

Table 14–Incidence Rate by Make of Buzzer-Equipped Cars Reported Stolen With Key in Ignition Lock 1972 to 1975 Models

	Michigan Survey (Reference 5)		*FBI Special Survey (Reference 4)*	
Manufacturer	*Total Stolen*	*% With Key in Lock*	*Total Stolen*	*% With Key in Lock*
AMC	28	21	158	41
Chrysler	135	20	725	29
Ford	1453	3	5027	9
General Motors	358	17	3495	24

Table 15–Incidence of Keys Reported in Ignition At Time of Theft
(Reference 5)

Category	*Total Stolen*	*Reported With Key in Ignition Lock*
Cars minus buzzer (pre-1970 models)	1956	157 (8.1%)
Cars with buzzer (1970–74 models)	2880	205 (7.1%)

Table 16–Model Year Variation in Incidence of Keys Reported in Ignition at Time of Theft
(Reference 5)

Model Year		*Total Stolen*	*% Reported With Key in Ignition Lock*
1974	Buzzer-equipped	533	11
1973		834	6
1972		638	6
1971		499	5
1970		376	9
1969		346	8
1968		377	7
1967		264	11
1966		345	8
1965		271	11
1964		150	5
1963 and earlier		183	5

4. *Post-1974 separate door locks (General Motors products only).* Utilizing the door lock to obtain a key which then also fits the ignition lock is one way to mobilize a stolen car. The thief externally removes the door lock and either takes it to locksmith to have a key made or makes a key himself with his own key maker. Since the door and ignition locks are usually identical, the thief has thus acquired a key which also fits the car's ignition lock. Although this approach to car theft takes longer than simply pulling out the ignition lock, the thief has the benefit of being on the outside of the car in case of being observed and capture attempted. Moreover, it leaves him with a key for later use, including after the car is recovered from the initial theft.

The door lock removal technique was particularly popular with GM cars since among the "big three" domestic manufacturers, their ignition locks are the most difficult to remove. It should also be noted that this approach to auto theft is especially serious in Chicago (Reference 4). Starting with the 1974 model year, General Motors introduced a design change that made the door lock different from the ignition lock. This change made the door lock removal technique impossible with the cars involved. Whether or not a drop in the theft rate of post-1973 model GM cars resulted has not yet been established. The Michigan survey data (Reference 5) do not show a significant decrease in the theft rate of GM automobiles for post-1973 models. But then, the door-lock theft technique is not common in Michigan. Also, data are not yet available from Chicago to indicate whether or not the theft rate of GM automobiles has been lowered by the door lock change.

5. *Security alarms.* There is a wide variety of security alarm devices available for virtually every make and model car. They range in price from about $30 per unit for owner-installed devices to about $130 per unit for seller or factory-installed devices. In general, the system consists of a sensor or set of sensors and an alarm to indicate attempted theft. Some sensors utilize door, hood, or trunk switches to activate the alarm. Others involve current draw, wheel rotation or ultra-sonic sensing. The alarm may be a horn or siren at the car or may involve a more elaborate system involving a transmitter-receiver to remotely monitor the vehicle ($300 installation cost).

A telephone survey was made by the authors of this report of several "big-three" dealerships in the Washington, D.C. area to determine the availability for 1975 models of factory-installed security alarm systems. The results of this survey are summarized in Table 17.
The "big-three" manufacturers all provide security alarm systems as factory-installed options for their full-size cars. However, only Ford provides similar options for intermediate and compact models as well.

There is no consistency among manufacturers concerning the content and complexity of the factory-installed option. It may include only the alarm or may involve various combinations of security devices, includ-

Table 17–Availability of Factory-Installed Security Alarm Systems For 1975 Model Year

Manufacturer	*Full Size*	*Intermediate*	*Compact*	*Sub-Compact*
Chrysler	X			
Ford	X	X	X	
General Motors	X			

Table 18–Alarm-Equipped Passenger Cars Reported Stolen
(Reference 5)

Total thefts reported in survey		*3401*
Number equipped with security devices		108
—alarm on at time of theft	43	
—alarm off at time of theft	65	

ing wheel locks, spare tire lock, interior hood release, power door locks, etc. For those models which do not have factory-installed systems available, most dealerships will arrange for local installation of a system prior to vehicle delivery at prices comparable to those for factory-installed equipment.

Auto theft survey data on the deterrent effect of security alarm systems are meager. Some information is available in the Michigan survey (Reference 5) and those statistics are summarized in Table 18. The specific types of alarm involved are not known.

The proportion and distribution by manufacturer and model year of security-alarm-equipped cars on the road in Michigan is unknown. Thus it is impossible to state whether the presence of an alarm actually deters vehicle theft. There is, moreover, some question concerning whether the thief even recognizes a car equipped with a security alarm. What can be stated is that security alarms are expensive compared to the estimated cost of an improved lock and that their effectivenss is completely dependent upon activation by the driver when he leaves the car. The data in Table 18 suggests that a large percent of the drivers of alarm-equipped cars do not consistently activate the alarm upon leaving their cars. Moreover, the data also suggests that an activated alarm does not necessarily deter theft of the auto.

6. *Steering wheel brake pedal locking fixture.* There are several ways of locking the steering wheel to the brake pedal in order to prevent the steering wheel from being turned. The most prominent device in this category is marketed under the name of Krook-Lok at a price of approximately $17.00. It hooks the steering wheel to the brake pedal and is then locked in position. It releases only when unlocked by key. The use of such a device is generally for cars which do not have a steering column lock, but it can also be used with cars which do. There are no available statistics on the effectiveness of such devices. The 1974 Massachusetts study (Reference 10) noted that the effectiveness of such anti-theft devices can be voided in several different ways in about 15 seconds using elementary tools. An alternate way of locking the steering wheel to the brake pedal involves a padlock and a length of chain. However, this too can be defeated. The drawback that such devices share is the need for the driver to activate and deactivate them, and the inconvenience involved discourages their use.

7. *Electronic ignition system.* Ignition lock security can be improved by the use of an electronic, keyless ignition lock. One such commercially available unit is the "Auto-Guardian" system which costs approximately $40, not including installation. The system consists of a 10-digit keyboard wired to the starter motor. The proper 4-digit code combination must be played on the keyboard in order to activate the starter. Such a system will eliminate those thefts where a key-type ignition lock is forced, where the ignition key has been left in the lock, where the door lock is removed in order to acquire a key that fits the ignition lock, or where the ignition key has been acquired by robbery or burglary. There is no currently available data on the theft experience of cars equipped with such devices.

8. *Other protective devices.* There are numerous other anti-theft devices used by individual car owners. These include, for example, wheel locks, kill switches, fuel line locks and timed fuse switches.

The wheel lock attaches to one of the studs retaining the wheel and prevents unauthorized removal of the wheel and its tire.

Kill switches are on-off switches wired to the electrical circuit and hidden on the inside of the car, but within the driver's reach. Upon leaving the car, the driver turns off the ignition switch and the kill switch. If a thief removes or forces the ignition switch, the car cannot be started until the kill switch is activated.

The fuel line lock is similar to the kill switch but operates on the fuel line instead of the electrical circuit.

The fuse switch is a variation of the kill switch. If the car is started with the fuse switch activated, the fuse is soon overloaded and breaks the ignition circuit, thus stopping the car.

The are no statistics at present on the anti-theft effectiveness of such devices.

B. Larceny Prevention Devices

There are three areas of a passenger car to which controlled accessibility is desired. These are the engine compartment, the trunk, and the passenger compartment. There are at present no legal regulations on the manufacturer governing unauthorized accessibility to any of these areas.

1. *Passenger Compartment.* Unauthorized entry into the locked passenger compartment of an automobile without removing the door lock or fabricating a key usually involves one of three techniques:

- breaking a window
- release of the locking knob
- activation of the door handle (older cars only)

With regard to entry through a broken window, it would appear that thieves are reluctant to break glass. Estimates based on the 1974 Michigan survey (Reference 5) indicated that only 4% of the recovered cars which had been originally locked were unlocked by breaking a glass window. The comparable figure for the 1974 FBI special survey (Reference 4) is 3%.

One of the authors of this report states that, from his experience:

> Most unauthorized entry into a locked passenger compartment is by means of a wire coat hanger or specially adapted tools made from common, readily available materials. The wire or tool is inserted between the glass window of the door and window seal, hooked on to the door locking knob, and the knob raised, thereby unlocking the door. The same approach can be used to hook on to the interior door handle. Designs that utilize rubber stripping as a window seal appear to be especially vulnerable. Those designs which provide metal grooves as a frame around the window are much more difficult to penetrate. Also, entry would be further deterred if the release motion for the locking knob was not a simple upward pull. A more complex releasing motion and a less available location of the locking knob to outside access provide effective means for increasing the difficulty of unauthorized passenger compartment access.

2. *Engine Compartment.* Most engine compartment hoods are released by a latch activator on the outside of the car. Some cars are, however, equipped with a release located within the passenger compartment. In the latter case, either the passenger compartment must be accessible or some method involving force must be employed to release the hood. There is no information available at present on the difference in the incidence of theft from locked and unlocked engine compartments.

3. *Trunk.* The trunk compartment of passenger cars is usually secured with a key lock. Some manufacturers use a duplicate of the door lock, so that the same key opens both the truck and the passenger compartment. Others use the same lock on the trunk and glove compartment so that a single key can be used to open either of these compartments. A small proportion of cars, usually in the luxury class, have an electrically activated lock with the release switch in the glove compartment.

The most common way used by thieves to violate a locked trunk is to remove the lock with a dent puller then manually release the latch. The 1974 Michigan study (Reference 5) of recovered cars indicates that 75% of the cars whose trunks had been forcibly opened had the lock removed; the other 25% had been pried open. There were no statistics presented on electric trunk switch cases.

If a thief gets into the passenger compartment of a car equipped with an electrical trunk switch, he may be able to activate the switch release. However, he may also be able to defeat the switch by attacking the circuit at several critical locations.

C. Summary

The following observations result from the assessment of automobile anti-theft devices:

1. The effectiveness of specific anti-theft devices provided in response to Standard No. 114 is dependent upon the design ingenuity and the quality of the device.

2. The absence of a minimum acceptable performance requirement in Standard No. 114 has led to the development of steering column ignition locks which are often easily defeated.

3. Data on recovered vehicles suggest that anti-theft devices which require driver cooperation (responding to a buzzer key-removal reminder) or driver activation (security alarm) are often ignored or not used at all.

4. Cars with an ignition key buzzer are stolen with a key left in the ignition lock about as frequently as cars not equipped with a buzzer.

5. Other anti-theft devices (not required by Standard No. 114) may have a beneficial effect on deterring theft, but available data is not adequate to confirm any trend.

6. Devices for the prevention of automobile-related larceny are not required by Federal Standards. The devices provided do not appear to be adequate in preventing larceny.

V. TRUCK AND MOTORCYCLE THEFT

Some mention should be made of truck and motorcycle theft and a perspective provided relative to automobile theft. Data from the FBI general survey (Reference 3) and from the U.S. Department of Transportation (Reference 6) have been combined and are presented in Table 19.

These data reveal that the theft rate for trucks and buses is very much lower than for passenger cars, whereas their recovery rate is about the same. Motorcycles, on the other hand, have both a much higher theft rate and a much higher permanent loss rate than passenger cars. The motorcycle owner appears twice as likely as the car owner to have his vehicle stolen; and once it is stolen, he is half as likely as the car owner to ever get it back. An analysis of these statistics is beyond the scope of this report, but a few observations are appropriate.

Currently available devices to protect motorcycles and light trucks from theft are relatively unsophisticated. Both have ignition locks, and motorcycles sometimes have a fork lock to keep the front wheel locked at an angle and to prevent straight riding.

Frequently the ignition locks found in many light trucks and multi-purpose vehicles are of a type that proved unsatisfactory in pre-1970 automobiles. The engines can be hotwired and the ignition locks can be removed with a dent puller.

The fork lock on motorbikes is also inadequate. The lock is not automatic and requires activation by the cyclist each time he parks. Moreover, on some makes the front wheel can be forced out of its locked position by simply twisting the handlebars. The problem of preventing the motorcycle from being physically lifted into a truck is being met with a variety of alarms and chains. There is little data on the effectiveness of these procedures.

It appears that some effort should also be devoted to assessing the light-truck and motorcycle theft problems and that an assessment of appropriate anti-theft deterrents be made. Moreover, although beyond the scope of this report, some consideration might also be given to the theft problem of farm, construction, and recreational vehicles as well.

Table 19—Current Theft and Recovery Rate Estimates by Vehicle Type
(References 3 and 6)

	Thefts		*Recoveries*
Vehicle Type	*Estimated Annual Thefts*	*Theft Rate per 1000 Registered*	*Recovery Rate Relative to Number Stolen*
Passenger Cars	730,000	8	70%
Trucks and Buses	55,000	2	67%
Motorcycles	73,000	15	42%

VI. EFFECT OF MOBILE DIGITAL COMMUNICATIONS

Advances during the last decade in microminiaturized electronics and digital communications technology have led to the development of mobile computer terminals for patrol vehicles as well as hand-held units for foot-patrol use. Thus, information transmission can be compressed into a very small fraction of the time required by real-time voice communication. In addition, the storage and retrieval of information also can be expedited and time-consuming manual search eliminated.

In the context of auto theft, this capability is particularly useful for rapid identification of auto theft suspects as well as the suspected stolen vehicle itself. Inquiries on suspect or vehicle identification can be processed in a matter of seconds rather than the minutes required for voice communication. If a central base computer file is not involved and the subsequent information search is by manual methods, an additional response delay is introduced (see Reference 11). A significant number of jurisdictions already use computer data storage, and as reported in Reference 3, police were assisted through a "computer hit" in establishing possible cause and thus permitting them to make 34% of all arrests of persons in actual possession of stolen vehicles.

Isolated individual jurisdictions have already been equipped with a complete mobile terminal/central computer file system for experimental use and evaluation. It would be expected that in those jurisdictions this capability would lead to both improved car thief apprehensions as well as stolen vehicle recoveries. To determine whether the national trend in apprehensions and recoveries has as yet been affected by the anticipated improvement within these individual jurisdictions, data were compiled from the FBI Uniform Crime Reports (Reference 1) on auto theft offense dispositions. Data on arrests, convictions, and vehicle recoveries are summarized in Table 20 as a percent of the total number of auto theft offenses for each year from 1968 to 1973.

The arrest figures upon which Table 20 is based include juveniles. However, conviction data refer to adult offenders only, since arrested juveniles are referred to juvenile court for processing.

The data show a slight but persistent overall decline in each category. Thus, at least on a national basis, the full impact of mobile, remote computer access on auto theft clearance rates has not yet been felt. Obviously, the local jurisdictions which are so equipped would be expected to show beneficial results. In Cleveland, Ohio, the use of remote, mobile terminals during a 13-month period averaged 36 inquiries per terminal per 8 hour shift, a frequency which greatly exceeds the number of voice channel inquiries. Although the Department has not yet completed a formal evaluation, the directors of the project reported that the system had a decidedly positive impact on arrests and vehicle recoveries (Reference 12).

In Oakland, California, the police department reported that their use of remote, mobile computer terminals had been responsible for both increases in arrests and vehicle recoveries as well as a reduction in the workload imposed by voice channel procedures. More significantly, the overall program was determined to have been cost-effective (Reference 13).

Neither Cleveland nor Oakland were able to provide quantitative results on the effectivenss of their systems. A report on the effectiveness of the Oakland system is, however, nearing completion and publication is expected in the near future.

Table 20—Disposition of Auto Theft Offenses

	'68	*'69*	*'70*	*'71*	*'72*	*'73*
Clearance Rate (Arrests)	19%	18%	17%	16%	17%	16%
Recoveries	86%	84%	84%	82%	*	*
Convictions	4.5%	3.9%	3.9%	3.5%	4.1%	3.5%

VII. POSSIBILITIES FOR NEW/IMPROVED THEFT DETERRENTS

Anti-theft devices and procedures for achieving a dramatic decrease in the auto theft rate in the immediate future must operate on the existing automobile population. Deterrents which are introduced on newly manufactured models become significantly effective only after the changeover involves the major part of the operating fleet. As much as 10 years may be required to achieve significant auto theft reductions if the latter course is exclusively pursued. A realistic approach must, therefore, include both short-term as well as long term anti-theft measures. Undoubtedly, additional hardware concepts and designs can be developed, but this would be pointless without more adequate knowledge of the effectiveness of available systems. Moreover, there is no generally agreed upon single anti-theft device identified as in need of development which would provide the desired dramatic reduction in auto-theft.

The following short-term measures are believed to represent a more effective method of achieving an early reduction in the auto theft rate. Action programs, such as automobile owner and operator educational campaigns, police incentive and training programs, and juvenile counseling, are recommended. A more effective, broadly based vehicle theft information system as well as improved procedures for identifying stolen autos or their components are needed. Uniformity in vehicle titling laws and a means for crosschecking scrapped autos against active registrations should be established. Export control as well as other programs designed to decrease the profit achieved by stealing and stripping cars will also impact the frequency of auto theft. A concentrated effort by the law enforcement agencies with whom the specific responsibility rests to develop innovative measures appears appropriate.

There are additional short-term measures not involving law enforcement agencies which can also be taken. Insurance cost incentives can be provided for cars equipped with both standard and optional anti-theft devices determined to have deterrent value. Conversely, insurance penalties can be imposed on auto theft cases where the key was left in the ignition or the car left unlocked. Procedures could also be initiated to assure that parts used in insurance-reimbursed repairs have not been stolen. The parts supplier could be required to certify that the part comes from a legitimate source, and if a used or rebuilt part is involved, to provide the serial number of the vehicle from which it had been removed.

In addition to such direct short-term measures, additional longer term measures, such as more stringent Federal Standards or voluntary action by the automotive industry, should be encouraged. As one phase of this study, all major U.S. automobile manufacturers were queried for information on actions under consideration for improving auto theft resistance. As of this date, a response from the Ford Motor Company advised that a redesigned ignition/steering lock will be introduced in the 1976 model year. The information provided by AMC and Chrysler was of a historical nature and did not address future plans.

Obviously, door locks can be made sturdier and doors designed to prevent entry if the door lock is removed. Similarly sturdier ignition locks and an inoperable ignition system if the ignition lock is forcibly removed are relatively inexpensive improvements. An optional keyless lock system is also feasible. (The trial use of one keyless ignition lock system by one major U.S. auto manufacturer proved unacceptably inconvenient to the user).

Informal discussions between the authors of this report and representatives of the Department of Transportation and U.S. auto manufacturers revealed a distinct need for improved information flow on how auto anti-theft devices are being defeated and how to advance the auto theft deterrent state-of-the-art. A systematic method for timely feedback on the effectiveness of current designs to form a basis for future action is badly needed. There are several organizations presently trying to meet this need. These include: Society of Automotive Engineers, International Association of Chiefs of Police, National Auto Theft Bureau, Motor Vehicle Manufacturers Association, and American Association of Motor Vehicle Administrators. In time, the problem will be resolved. It does, however, appear that if given reliable information, the auto manufacturers would continuously assess and improve their own theft-deterrent equipment in order to maintain their competitive position.

In summary, it appears that new or improved equipment alone cannot be expected to reduce the magnitude of the auto theft problem to an acceptable level in the near term. The most promising results will come from more effective use of already available anti-theft devices, increased cooperation is the use of these devices among auto operators, and improving the procedures used to collect and monitor auto theft information.

VIII. CONCLUSIONS

Examination and analysis of data available from both Federal and state sources on auto theft and the effectiveness of anti-theft devices leads to the following conclusions:

1. The requirement for protecting passenger cars from theft, as mandated by Standard No. 114, is valid.

2. The effectiveness of specific anti-theft devices required under Standard No. 114 is dependent upon the design ingenuity and the quality of the device. The absence of minimum performance requirements in Standard No. 114 has led to a wide range in the effectivenss of the required devices.

3. Additional, more stringent national theft protection standards will not have an immediate, dramatic effect on auto theft. Only after a significantly large portion of the active auto fleet has been influenced can a meaningful result be expected.

4. The accident rate for stolen cars is many times greater than that of vehicles that are not stolen.

5. Auto theft is primarily a youthful offender problem with joy-riding as a major motivation.

6. The availability of detailed data on auto theft is poor. A systematic method for timely feedback on the effectivenss of current devices to form a basis for further action is needed.

7. More attention needs to be given to the trends in light truck and motorcycle theft, and anti-theft requirements and standards also established for these vehicles.

8. The widespread use of mobile computer terminals to provide improved police patrol communication capability can be expected to exert a favorable effect on the national levels of auto thief apprehension and stolen vehicle recovery.

IX. RECOMMENDATIONS

1. It is recommended that the DOT Vehicle Safety Standard No. 114 be amended to include minimum performance guidelines established through a cost effectiveness research program and also be amended to apply to other vehicles, as appropriate. Based on current studies, these guidelines should give special attention to ignition locks that can withstand torquing action and removal from their housing.

2. The development of standards to prevent larceny from the passenger compartment, engine area, and the trunk of non-commercial motor vehicles should also be undertaken.

3. A more effective information system than currently exists should be implemented in order to allow continuous monitoring of motor vehicle theft trends and routine distribution of results to the public, law enforcement agencies, and manufacturers.

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11. *Police*. National Advisory Commission in Criminal Justice Standards and Goals. 1973.
12. Telephone contact with Cleveland, Ohio, Police Department Representative, July 9, 1975.
13. Telephone contact with Oakland, California, Police Department Representative, July 9, 1975.

APPENDICES

APPENDIX A

ANNOTATED BIBLIOGRAPHY

The following sources were found to contain useful, reliable information on the incidence of auto theft, and the effect of various anti-theft devices. While there are undoubtedly other sources, these sources were the most pertinent to the task of this report. The order of listing is identical to the listing in the "References" section.

1. **Crime in the United States (UCR 1968 through 1973)**

The annual summary by the FBI contains gross figures for the number of vehicles stolen, by various reporting jurisdictions. Also contained are historical theft figures and arrest data for the entire U.S., as well as for various smaller jurisdictional sub-units.

Source: Federal Bureau of Investigation, U.S. Department of Justice
Author: Uniform Crime Reporting Division, FBI

2 **California Vehicle Theft Study—Final Summary Report (1972)**

This report and the interim supporting reports present the results of a study on vehicle theft in the State of California. Such data as the number of vehicles stolen during the 1970–71 time period and the number recovered during this same time period are included. Also indicated are the recovery time, distance (jurisdiction) the vehicle was found from the place of theft, arrest statistics, and the accident frequency of stolen vehicles. Information on motorcycle theft is also presented and estimates are provided on the economic losses caused by auto theft.

Source: California Highway Patrol, 2611 26th Street, Sacramento, California 95822
Author: A.D. Young and Co., 520 Capital Mall, Sacramento, California 95814

3. **Motor Vehicle Thefts—A Uniform Crime Reporting Survey (1975) (Preliminary Copy)**

A broad survey of stolen vehicle statistics from jurisdictions producing 85% of the annual theft reports in the U.S. is presented. Thefts are analyzed by time, location, and age of the stolen car. Also treated are the car condition at time of theft, age of the persons arrested, and the number of cars recovered during the survey period. A breakdown of the vehicles stolen into passenger cars, trucks, buses, motorcycles, and other motor vehicles is also included.

Source: Federal Bureau of Investigation, U.S. Department of Justice
Author: Uniform Crime Reporting Division, FBI

4. **A Special Motor Vehicle Theft Survey Report, September—October 1974**

A study of 10,014 recovered cars from jurisdictions which annually report 51% of the U.S. auto thefts. Detailed analysis is presented for American cars only. The technique for entry and mobilization of cars is indicated. Also included is an analysis of parts that were stripped, a count of the number of cars involved in accidents, and the consequent injuries and fatalities.

Source: (Restricted to law enforcement and auto manufacturers only). Federal Bureau of Investigation, U.S. Department of Justice
Author: Uniform Crime Reporting Division, FBI

5. **Michigan Stolen Vehicle Analysis System (1975)**

This reference contains data in print-out form and without analysis. Seven groupings of data, including condition of car when stolen, where found, where and when stolen, method used to enter and start the car, and the parts stolen. The data are listed by make and year of car, and other useful categories. This compilation represents the most comprehensive collection and presentation of detailed data available to date, and is a model of how data should be summarized.

Source: Sgt. Frank Heckaman, Michigan State Police, Lansing, Michigan
Author: Michigan State Police

6. Not applicable

7. Not applicable

8. **Measuring Auto Theft and the Effectiveness of Auto Theft Control Programs (1970)**

This source is an informal report prepared as part of a course sponsored by Washington University in St. Louis, Missouri. Included are estimates of the direct costs of auto theft as well as auto theft distribution by geographical area and the time of theft. Recovery rates are also given. The data were drawn primarily from 1967 auto theft reports in St. Louis, Missouri

Source: Authors
Authors: Robert Frese, Dept. of Applied Math and Computer Science, Washington University, St. Louis, Missouri; Nelson Heller, St. Louis Police Department

9. **Automotive News, 1975 Almanac Issue**

Miscellaneous registration and production totals for cars and trucks are tabulated. Their source is R.L. Polk & Co. and the auto makers. These statistics may differ from other vehicle registration totals, perhaps because of the time when each source polls the registration files in various states.

Source: Automotive News, 965 E. Jefferson, Detroit, Michigan 48207
Author: Automotive News, 965 E. Jefferson, Detroit, Michigan 48207

10. **Report on Causes and Prevention of Auto Theft in Massachusetts (1974)**

This document contains data on auto thefts and recoveries, by make and year. This is the only available study which includes data on theft rates (according to the number of cars registered) broken down by make and year. The report also contains a detailed description of how to defeat various steering column locks and outlines the various design weaknesses of the locks. The relation between lock design weaknesses and enhanced theft rates is emphasized. The profiles of several typical car thieves are included, and loss estimates due to auto theft are also given.

Source: Massachusetts Consumers' Council, 100 Cambridge St., Boston, Mass.
Author: David Barry, 146 Winthrop Road, Brookline, Mass. 02146

APPENDIX B

ACCIDENT RATE OF CAR THIEVES AS COMPARED WITH THE GENERAL PUBLIC

Three separate studies have calculated the accident rate among stolen cars that were recovered, and each of these gives an independent basis for estimating the accident rate for car thieves, as compared with the general public. The calculation based on the 1975 UCR General and Special surveys (references 3 and 4) gives the most representative estimate for the nation. The calculation is illustrative of the estimates from all three studies.

The UCR General Survey (reference 3) reported that 63% of the recovered cars were found within 48 hours of the theft. For the purposes of this calculation, it will be assumed that the average time that a thief keeps a car before the police recover it is 2 days. This figure is probably longer than thieves actually keep their cars, but the effect will be under- rather than over-estimate the actual theft rate.

In the UCR Special Survey (reference 4) it was found that 429 of the 10,014 recovered cars had been involved in traffic accidents. This represents an accident rate of 43 accidents per 1000 recovered stolen cars. Since these accidents occurred while the thieves kept the cars for an average of 2 days, the accident rate for 1000 recovered stolen cars if the thieves kept them for only one day would be about 22 accidents. Thus, if the thieves kept them for an entire year, the number of accidents that would occur with 1000 recovered stolen cars would be 22 x 365 days = 8030 accidents. However, this figure represents the accident rate of the thieves driving cars which are recovered. There is no information on the accident rate of the thieves driving cars which are not recovered. Hence, the accident rate of the thieves driving cars which are not recovered will conservatively be estimated to be zero. Therefore, since the recovered cars in the UCR General Survey (reference 3) were 69% of all the cars that were stolen, the overall accident rate for car thieves would be estimated at 8030 x 69% = 5541 accidents per year for 1000 stolen cars. The National Safety Council has estimated that the public suffers an average of 118 accidents each year for every 1000 registered cars. Thus, the accident rate for car thieves is 5541 ÷ 118 = 47 times as great as for the general public.

The accident and fatality rates are shown below in Table B–1. The calculation for the fatality rates is the same process as the accident rates. The meaning of the figures is that if equal numbers of car thieves and people from the general public each drove cars for an entire year, the car thieves would find themselves in nearly 50 times as many accidents as members of the general public. However, since car thieves actually keep each stolen car for only about two days, and since only 1% of the cars are stolen each year, car thieves find themselves in only about 1 accident for every 350 that the general public has.

Table B–1–Ratio of Estimated Yearly Accident Rate of Auto Thieves To Yearly Accident Rate of General Public

Incident	*Ratio*	*Reference*
Accidents	47	3 & 4
Fatalities	63	
Accidents	59	5
Fatalities	1025	
Accidents	125	2

APPENDIX C

SUMMARY OF LEAA GRANTS RELATED TO THE DETERRENCE OF AUTO THEFT

Since its inception, LEAA has awarded numerous grants to aid in the effort to control and reduce crime. The LEAA Grants Management Information System (GMIS) was queried and asked to identify those grants which had the reduction of auto theft as one of the objectives. The results of the query, which cover the period from 1969 to 20 May 1975 are summarized in Table C–1. The information presented include the gross amount in thousands of dollars devoted each calendar year to the specific grant categories listed as well as the number of grants involved (in parentheses).

The dollar amount of individual grants which also sought to reduce other crimes in addition to auto theft could not be apportioned to that amount devoted only to auto theft. The full amount was therefore included in the dollar values given in the table. In addition, individual grants often cover more than one crime deterrence category. In this latter case, the grant was considered to fall under the category which predominated the GMIS grant summary.

The grants in the following listings are grouped in the same categories used in Table C–1 of Appendix C and each grouping is preceded by a short statement describing the category.

Table C–1–LEAA Grants Relating To Auto Theft Deterrence

Crime Deterrence Category	*Dollars (thousands) (Number of Grants)*							
	1969	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*	*Total*
Juvenile Delinquency	–	$ 15	$ 11	$ 100	$ 323	$ 91	$ –	$ 540
		(1)	(2)	(1)	(3)	(2)		(9)
Police Dept. Improvements	–	625	352	758	1032	921	186	3,874
		(21)	(11)	(17)	(10)	(14)	(4)	(77)
Vehicle Theft Info. Systems	–	123	80	245	920	44	–	1,412
		(5)	(1)	(7)	(7)	(3)		(23)
Vehicle Theft Inspection	–	–	–	–	1503	–	–	1,503
					(3)			(3)
Programs to Decrease Profit Motive	–	–	–	110	277	96	–	483
				(1)	(2)	(2)		(5)
Public Awareness Campaign	7	10	1768	52	488	788	–	3,113
	(1)	(1)	(6)	(2)	(13)	(8)		(31)
TOTALS	$7	$ 773	$2211	$1265	$4543	$1940	$186	$10,925
	(1)	(28)	(20)	(28)	(38)	(29)	(4)	(148)

Juvenile Delinquency

The grants in this category were generally for additional personnel to deal with juvenile delinquents. There are also some grants included which cover training programs for police officers who specialize in juvenile delinquency assignments.

70A0210210
70AS370133
70AS420098
73AS060088
72DF060049
73ED050013
73AS173373
75AS180002
73AS270163

Police Department Improvements

The grants placed in this category were primarily for the training of police officers already on the force, the hiring of additional police officers, and the purchase of equipment. Often, individual grants involved more than one of these activities, combined to address a specific auto theft problem.

71AS010115
71AS040216
71AS051002
69AS060016

69AS5065300

71AS064663
71AS090219
70AS190116

71AS223327
69AS250025
70AS290059
70AS290060
72AS262215
74AS260015
74AS260035

75AS260076
75AS260092
72AS282098

72AS282118
74AS370160
73AS350023

73AS350058
72AS360938

70DF040071
71DF090509
71DF010565
70DF050179
72DF07S003
70DF040428
70DF080157

70AS290062
71AS290273
70AS371274
71AS370078

71AS370316
70AS380077
70AS360306
70AS360314
71AS361096

71AS310061
70AS390394
70AS400316
71AS400174
73AS361591
72AS310235
73AS390523

72AS720011
73AS420189
73AS420843

74AS420177
72AS470583
73AS480301

74AS490012
75AS490008

72DF060045
70DF020180
70DF080280
71DF060506
71DF080464
72DF030009

70AS460105
70AS470213
71AS480798
71AS540039

73AS060085
73AS090239
72AS121712
74AS130250
74AS130350

72AS150139
74AS170152
72AS189009
72AS250090
73AS540157
74AS540124
74AS540151

74AS560153

Vehicle Theft Information Systems

These grants cover computer facilities useful in handling auto theft information or the additional personnel needed to organize auto theft files and make them amenable to computer storage and retrieval.

71AS250197
70AS350034
71AS360741
70AS390133

70AS510099
70AS510100
73AS060086
73AS060089

72AS090037
72AS171474
72AS171489
72AS171491

70AS420072

73AS060090

72AS171494

73AS250143
74AS250107
74AS250124

72AS250046

73AS260112
73AS260218
73AS260219
73DF040039

Vehicle Theft Inspection

The grants in this category generally involved programs to facilitate identification of stolen autos and stripped parts.

72AS010030
73AS060011
73AS060087

Programs to Decrease Profit Motive

These grants address the control of fencing, the exportation of stolen vehicles, and programs to have convicted thieves reimburse the theft victim.

73AS060340
74AS130123
74AS130280
73AS260217
72AS270030

Public Awareness Programs

The grants under this category include those used to finance educational programs, to appeal for greater public/police cooperation, and to finance billboard reminders to take the key out of the ignition after parking the car.

71AS290166
70AS390551
71AS391087
71AS391326

71AS391412
73AS060084
73AS060091
73AS060345

74AS260173
72AS290192
74AS290040

72AS390291
73AS390784
73AS415639

74AS490059
73AS540028

69NI990006
71DF090677
71NI990120
72DF090066

73AS060354
74AS060012
74AS060053
73AS090077

73AS090078
73AS090087
73AS090089
74AS120100
72AS173245

73AS173223
73AS173361

The grants listed under the preceding tabulations do not include any dealing with the theft of farm equipment. The one grant identified which does deal with that subject was:

Grant No. 75–SS–99–6021 for $82,002.

This grant is titled "Farm Equipment Theft" and is intended to address the following:

1) Ways in which farm equipment is identified.
2) Local law enforcement procedures for dealing with theft of farm equipment.
3) Pertinent state legislation.
4) Manner by which NCIC files handle stolen farm equipment.
5) Development of a tractor identification booklet.
6) Development of model regulatory legislation.

APPENDIX D

MOTOR VEHICLE SAFETY STANDARD NO. 114

Theft Protection—Passenger Cars

S1. Purpose and scope. This standard specifies requirements for theft protection to reduce the incidence of accidents resulting from unauthorized use.

S2. Application. This standard applies to passenger cars.

S3. Definitions. "Combination" means one of the specifically planned and constructed variations of a locking system which, when properly actuated, permits operation of the locking system.

"Key" includes any other device designed and constructed to provide a method for operating a locking system which is designed and constructed to be operated by that device.

S4. Requirements.

S4.1 Each passenger car shall have a key-locking system that, whenever the key is removed, will prevent—

(a) Normal activation of the car's engine or other main source of motive power; and

[(b) Either steering or forward self-mobility of the car, or both. (34 F.R. 9342—June 13, 1969)]

S4.2 The prime means for deactivating the car's engine or other main source of motive power shall not activate the deterrent required by S4.1(b).

S4.3 The number of different combinations of the key locking systems required by S4.1 of each manufacturer shall be at least 1,000, or a number equal to the number of passenger cars manufactured by such manufacturer, whichever is less.

[**S4.4** A warning to the driver shall be activated whenever the key required by S4.1 has been left in the locking system and the driver's door is opened. The warning to the driver need not operate—

(a) after the key has been manually withdrawn to a position from which it may not be turned;

(b) when the key-locking system is in the "on" or "start" position; or

(c) after the key has been inserted in the locking system and before it has been turned. (34 F.R. 9342—June 13, 1969)]

33 F.R. 6472
April 27, 1968

[1] Promulgated by the National Highway Traffic Safety Administration, U.S. Department of Transportation.

☆U.S. GOVERNMENT PRINTING OFFICE: 1976 O—212-834

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