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Examination of the Feasibility of Alcohol Interlocks for Motorcycles

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16. Abstract <p>In 2011 some 30 percent of the 4,612 motorcycle operators involved in fatal crashes had blood alcohol concentrations (BACs) of .08 g/dL or higher. Although alcohol ignition interlocks are a common sanction to deter impaired driving, they are not typically used on motorcycles. This report reviews information on alcohol ignition interlocks to help determine whether they can be an appropriate DUI countermeasure when installed on motorcycles operated by convicted DUI offenders. The report summarizes issues of perceived liability, technical barriers, statutory or legislative barriers, and other factors related to this issue.</p> <p>Information was collected from a variety of sources. Findings reflect discussions with senior executives from interlock companies operating in the United States, government authorities knowledgeable of their State's interlock program and existing laws and practices, interlock installers, end-user DUI offenders, and an analysis of the breathe test data from interlocks used by 407 motorcyclists.</p> <p>Reported liability and safety concerns about motorcycle interlocks usually center on the running (often rolling) retests. Retesting in a moving automobile involves some risk; retesting while operating a motorcycle is an even greater safety hazard if the cycle is in motion. Technical concerns usually center on protection of the hardware from weather exposure and the added time needed for custom installation. The low volume of business does not justify investing in design improvements; and State interlock standards – written for passenger vehicles– complicate safety issues for motorcycles.</p> <p>The authors conclude that there are no technical barriers to the more widespread use of interlocks on motorcycles; however, at present, there is little incentive for manufacturers to build an interlock ideally suited to the motorcycle environment, and that most State standards, which call for regular testing while the motorcycle is running, pose a credible safety hazard that needs to be overcome.</p>			
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Executive Summary

This report reviews information on alcohol ignition interlocks to help determine whether they can serve as an appropriate DUI countermeasure when installed on motorcycles operated by offenders convicted of driving under the influence of alcohol. While most licensed motorcycle operators can also drive a regular passenger vehicle, there are some riders that either do not own cars or that prefer to ride a motorcycle at least some of the time during their interlock stipulated period. The report also summarizes findings uncovered in the process of trying to understand and disentangle issues of perceived liability, technical barriers, statutory or legislative barriers, and other factors related to motorcycle interlock usage.

The number of motorcyclist fatalities from 2002 to 2011 increased from 3,270 to 4,612, and peaked at 5,312 in 2008 (NHTSA, 2013b). A large portion of fatal motorcycle crashes are associated with alcohol impairment. In 2010 some 28 percent of motorcycle riders involved in fatal crashes were alcohol impaired with blood alcohol concentrations (BACs) of .08 grams per deciliter or higher. In 2011 this increased to 30 percent of motorcycle riders with BACs of .08 grams per deciliter or higher in fatal crashes. The role of alcohol in fatal motorcycle crashes is greater than for any other vehicle type. This has resulted in an increased focus upon reducing impaired motorcycle operation. In recent years, alcohol ignition interlock devices have been used to curb impaired operation of passenger vehicles. It may be that these devices could be usefully extended to help reduce impaired riding, as well.

Today, the average efficacy of interlock programs – estimated from a dozen studies and pertaining only to the period while the interlock is installed on the vehicle – has been estimated as a 64-percent reduction of DUI recidivism (Willis, Lybrand, & Bellamy, 2004; Marques, 2009; Elder et al., 2011). All the evidence bearing on efficacy and effectiveness of interlocks as a DUI countermeasure, and nearly all of the installations have been on 4-wheeled passenger vehicles or light trucks. Motorcycle interlocks are relatively uncommon and have never been subjected to an efficacy evaluation.

The apparent potential of ignition interlocks to reduce impaired riding suggested the need for an independent study to understand the feasibility of alcohol ignition interlocks for motorcycles. However, as of June 2010, the majority of manufacturers and installation-only service providers did not install their interlock devices on motorcycles, and/or interpret State regulations as disallowing motorcycle installation. On the other hand, at least two of the major manufacturers *will* allow their devices to be installed at service centers if staff members there are familiar with motorcycle wiring. Those companies that do permit installation require some form of liability waiver signed by the motorcycle operator. There are States with laws and policies that prohibit the installation of interlocks on motorcycles, and other States that permit or even require companies to install interlocks on motorcycles.

Objectives

The central objective of this project was to determine the feasibility of using alcohol ignition interlocks in motorcycles. The project also sought to determine and describe the state of the practice of motorcycle interlocks, which involved examining the following factors.

- The number of motorcycle interlocks in use
- The number of manufacturers and suppliers of motorcycle interlocks
- Manufacturers' experiences using motorcycle interlocks
- State highway officials' experiences and opinions of motorcycle interlocks as a tool to deter/punish impaired riding
- Analysis of breath test logs from riders using motorcycle interlocks
- Experiences of motorcycle riders operating motorcycles with interlocks

To meet the objectives of the project, the researchers acquired information on motorcycle interlocks from the following sources.

- Manufacturer and/or installer discussions
- Discussions with officials in States with high-volume interlock programs
- Analysis of breath test log files of motorcyclists with interlocks installed
- Discussions with motorcyclists who have operated with interlocks

Methodology

General installation and operational issues have been gleaned from discussions with informed parties at both the supplier and governmental levels. An estimation of the State-by-State penetration of interlocks when this study began in 2009 (both the total number of units in service and the per capita number of devices) is provided in graphic and tabular form in Appendix C. This accounting of penetration at the State level guided the project's selection of States in which to conduct conversations with knowledgeable professionals about their State interlock programs, and the States' position on interlocks and motorcycles.

We identified major suppliers and installers of interlocks to determine the approximate numbers of devices installed annually in all vehicles, including motorcycles, and asked them whether they installed on motorcycles in the past or whether they were willing to currently install their equipment on motorcycles. While there are two manufacturers (Draeger Safety and Lifesafar Interlock) that permit installations on motorcycles, there were once six willing to do so; those who no longer are willing to do so reported having had problems with equipment loss, malfunction, breakage, rider dissatisfaction, and the need for additional staff time to complete installations. On the other hand, we learned that if States require a motorcycle option, suppliers must be willing to install interlocks on motorcycles as a condition of operating in the State. Under such circumstances, most manufacturers seem willing to reconsider their positions.

Findings

The findings from this project are summarized in four major subsections covering information learned from (1) manufacturers and installers, (2) government officials from States with the highest rates of interlock use, (3) analysis of breath test records from 407 motorcycle

interlock users accumulated from November 2003 to June 2010, and (4) DUI offenders who had interlocks installed on their motorcycles (end users).

Discussions With Interlock Companies

The executives and installers from interlock companies differ on the question of how much safety risk is involved in operating a motorcycle with an interlock. To the extent that a safety risk is perceived, it primarily involves the performance of retests.¹ The technical barriers in manufacturing a motorcycle specific device can be overcome, but it does not appear that there is enough potential motorcycle interlock business to warrant the investment at this time. Two manufacturers currently accommodate motorcycle rider DUI offenders using the existing automobile interlocks, which can be made to work adequately well on a motorcycle. A variety of compromises are necessary to adapt automobile interlocks to motorcycles related to issues such as weather exposure (e.g., moisture, dust), vibration, secure storage, operator notification for retesting with auditory signals, and power draw. A rough estimate suggests that motorcycle interlocks likely represent less than 0.1 percent of all interlocks in service.

Discussions With State Officials

We contacted States having 2,000 or more interlocks as well as States that exceeded the estimated mean rate of interlock installations per capita in an attempt to understand their laws and policies. As of 2009, when this study began, there were 19 States with at least 2,000 interlocks and 27 States with more than 1,000 interlocks in service.²

State laws differ on the extent to which motorcycles are addressed in operating standards for interlocks. We contacted the 19 States with more than 2,000 interlocks, the 17 States with more than the national average of interlocks on a per capita basis, and 2 States with smaller interlock programs to obtain information on their interlock laws with regard to motorcycles.

Some States require offenders to equip all vehicles they own, rather than just those they drive. Of the 38 States examined 15 had such laws, 16 did not, 4 had laws requiring this in certain cases and 3 of the experts speaking on behalf of their States could not comment on their laws regarding motorcycles. Of the 38 States that were asked to provide information, 2 States require owners of motorcycles to equip them with interlocks, 5 States specifically disallow the installation of interlocks, 8 States specifically allow them, 8 States have laws that require motorcycle owners to install motorcycle interlocks but don't enforce them, 14 States have no policy regarding motorcycle interlocks, and there was 1 State for which the contact could not provide information about the States' policies. Regarding the prevalence of motorcycle interlocks among those 38 States, 22 States reported having no interlocks on motorcycles, 11 States reported having some and there were 5 States for which we were unable to determine the prevalence, again due to a lack of information available from the State contact. The acquired information is summarized in Appendix A: State Laws, Policies, and Practices Regarding Motorcycle Interlocks.

¹ Retests are sometimes referred to as running retests.

² This study's methodology used the 2009 estimates provided in Appendix C, which were the most current interlock penetration estimates available at the time of the study. As of 2012 there were 31 States with at least 2,000 interlocks and 33 States with more than 1,000 interlocks (Roth, 2012).

Discussions With Riders Who Had Used Motorcycle Interlocks

We held discussions with four motorcyclists who rode with interlocks about their experiences using the interlocks and their perceptions of safety hazards, if any. Three were male and one female; three used cruiser motorcycles and one rode a sport bike. Two performed rolling (moving) retests, two retested while stopped. Each of the four had to make a concerted effort to get the devices installed on their motorcycles, and all were pleased that they could legally operate a motorcycle by using an interlock, and at a relatively little perceived safety risk. For them the conveniences and pleasures of riding legally outweighed the burdens of testing and retesting. The riders who performed rolling retests stated that retesting in stop-and-go traffic posed a more significant safety risk than retesting on the open road.

Analysis of Interlock Breath Test Logs

Data from motorcycle rider breath test logs spanning approximately 7 years of installations were made available by Draeger Safety Interlock. This provided an opportunity for us to examine operator performance data. The data represented 407 different motorcycle interlock user episodes of a median installed period of 7 months. The patterns in the data were similar to analyses from interlocks installed on passenger cars except that, over comparable periods of time, the number of startup BAC tests from motorcycle interlocks was about 1/3 the number found with automobiles. This result is as expected since motorcycles, in general, log fewer travel miles than passenger vehicles. As found with car interlock data, more than 99 percent of all BAC tests at startup are passed and about 40 percent of riders did not log failed BAC tests (a finding that is comparable to that reported in Marques, Voas, Roth, & Tippetts [2010] in New Mexico). About 25 percent of the motorcycle riders, those with the highest rates of failed interlock BAC tests, fail most often on an initial start attempt.

Background

The purpose of this project is to review issues germane to the feasibility of alcohol ignition interlocks for motorcycles. It provides background information on issues related to the historical development of the alcohol ignition interlock, the use of motorcycles by impaired operators, and the current status of motorcycle interlocks in the United States.

The number of motorcyclist fatalities from 2002 to 2011 increased from 3,270 to 4,612, and peaked at 5,312 in 2008 (NHTSA, 2013b). Alcohol has been involved in a higher proportion of those crashes than for any other vehicle type, resulting in an increased focus upon reducing impaired motorcycle operation. In recent years the use of alcohol ignition interlock devices to curb impaired operation of passenger vehicles has increased substantially. It may be that these devices could be usefully extended to help reduce impaired riding, as well. However, there are States with laws and policies that prohibit the installation of interlocks on motorcycles, and other States that permit or even require companies to install interlocks on motorcycles.

Early Development of Alcohol Interlocks

The first interlock was developed by the Borg Warner Company, an affiliate of General Motors, in 1969. After performance-based interlocks were tried and rejected in the 1970s, alcohol-sensing devices, initially using non-specific alcohol sensors, became the standard through the 1980s. These semiconductor type (Taguchi) interlocks were sturdy and got the field moving but did not hold calibration very well, were sensitive to altitude variation, and reacted positively to non-alcohol sources. Commercialization and more widespread adoption of the device was delayed pending improvement of systems for preventing circumvention. By the early 1990s, the industry began to produce second-generation interlocks with more reliable and accurate fuel cell sensors.

Alcohol ignition interlock devices were used more widely in the United States after passage of the 1986 Farr-Davis Driver Safety Act in California, which provided for a pilot test in a few California counties. Soon after, other States enacted legislation that supported use of this technology. As legislation expanded through the late 1980s, NHTSA, in an effort to assist the States, published guidelines, referred to as Model Specifications for Breath Alcohol Ignition Interlock Devices (hereafter Model Specifications), for States to evaluate and certify the adequacy of the interlock hardware and/or for interlock companies to certify their products (NHTSA, 1992).³ The Model Specifications served to organize the development of State laws, but other than a companion document (Voas & Marques, 1992) published under the same NHTSA contract, too little was known to provide authoritative recommendations on interlock law and how to develop interlock programs.

³ NHTSA's Model Specifications were updated in 2013.

Interlock Features and Effectiveness

Basic Device Characteristics: Interlocks currently used in automobiles have at least four core elements:

- a breath alcohol sensor in the vehicle and a control unit under the hood that measures the driver's BAC and, if alcohol is detected above a specified limit (e.g., .025 g/dL or higher), the car will not start;
- a retest system that requires at least one retest after the car is started, but in most automobile applications a retest is required every 30 to 45 minutes while driving (alerted by an auditory signal)—the purpose of the retests is to discourage a non-occupant from starting the car and also discourages drinking once the car is underway;
- a tamper-proof system for mounting the engine part of the unit that, either electronically or via visual inspection, precludes circumvention and can detect hotwiring or other means that bypass the interlock (a feature of considerable importance in any motorcycle interlock due to the comparative ease with which some motorcycles can be started without using a starter motor); and
- a data-recording system that logs the BAC results, tests compliance, engine operation, and writes a record to ensure that the offender is actually using the vehicle with the interlock as expected and not simply parking it while driving another vehicle.

Evidence for Automobile Interlock Program Effectiveness: By the mid-1990s, a few evaluation studies published in State reports and conference proceedings suggested a possible beneficial effect of interlock programs on recidivism reduction. The first two large interlock outcome studies were both published in 1999, both in highly regarded, peer-reviewed journals (Beck, Rauch, Baker, & Williams, 1999, based on Maryland data in the *American Journal of Public Health*, and Voas, Marques, Tippetts, & Beirness, 1999, based on Alberta data, in *Addiction*). Both studies showed strong significant reductions in recidivism during the installed period and a near complete return to control levels of recidivism after removal. There are now about 15 studies of interlock effectiveness in the literature. These efficacy evaluations are summarized in the NHTSA's 2010 report, *Evaluation of the New Mexico Ignition Interlock Program* (Marques, Voas, Roth, & Tippetts, 2010). The evidence demonstrates 35 to 90 percent reductions in recidivism while installed. A meta-analysis by Willis, Lybrand, and Bellamy (2004) found that across studies, while installed, the interlock reduced the average relative risk of DUI recidivism by 64 percent, and that the recidivism rate after device removal returns to the level of similar offenders who did not install interlocks. Thus, interlocks appear to be temporarily effective.

Barriers to Better Program Effectiveness: A major limitation on the safety impact of interlocks has been the weakness of interlock laws, the voluntary nature of many programs, the reticence of some judges to impose interlocks, and the resistance of some offenders to installing them. Also, some localities lack interlock providers. By contrast, judicial programs that routinely order interlocks for all DUI offenders can attain high installation rates (e.g., Santa Fe County, New Mexico, attained a 71 percent installation rate [Roth, Voas, & Marques, 2009] and Hancock County, Indiana, attained a 62 percent installation rate [Voas, Blackman, Tippetts, & Marques,

2002]). In both jurisdictions, the courts were able to encourage election of the interlock by using “house arrest” via electronic monitoring bracelets as the alternative. In many States with interlock laws, fewer than 15 percent of offenders eligible for interlock programs install them.

Number of Interlocks Installed: In recent years the rate of interlock installation has been increasing as a growing number of States now actively enforce programs of mandatory interlocks for all offenders as a condition of reinstatement. There is no nationwide database of the numbers of installed interlocks in the United States. Richard Roth of Impact DWI, a non-profit citizen action group in Santa Fe, has been surveying interlock providers to collect data used to estimate the number of interlocks in use. Estimates based on data supplied by 14 ignition interlock distributors and 42 States estimates suggest that there were 212,000 interlocks installed nationwide in 2010, which is an increase of 18 percent from the estimate of 180,000 installed interlocks in 2009. In 2012 the estimated number of installed interlocks had increased to 279,000 interlocks in 47 States and the District of Columbia (Roth, 2012).

Alcohol Ignition Interlocks on Motorcycles

As of June 2010 the majority of manufacturers and installation-only service providers did *not* install their interlock devices on motorcycles. On the other hand, at least two of the major manufacturers allow their devices to be installed at service centers if the center has a staff member who is familiar with motorcycle wiring. The companies that do permit installation require a liability waiver signed by the motorcycle operator.

Since few States maintain current information about interlocks, previous interlock research projects have determined that the most efficient method for gaining information on interlock installation issues is talking with people in the business: interlock manufacturers and service providers. While State device certification authorities and State program managers are often well-informed and can provide useful program information about enabling legislation and routine practice in four-wheeled vehicle interlock programs, they are less likely to be attuned to either the number of units installed at any time, or to routine installation procedural difficulties concerning motorcycles. In addition, information about interlock installations or interlock problems documented by court-based interlock programs often does not get reported back to a central State administrative authority for inclusion in a repository of interlock problems, installations, and removals. Information flow within and between States is often inconsistent.

There were 12 interlock suppliers doing business in the United States in 2010. Each supplier manufactures its own unique equipment. They generally lease their equipment through several different business models. For example, SmartStart Inc. has a franchise business model and brings its franchisees from different States and nations in for annual meetings to discuss topics of mutual interest, and provides equipment to local or regional service providers who install, calibrate and oversee monthly or bimonthly data downloads. Some of those regional franchisees oversee the business of local installers, some of whom may have other types of automotive businesses as well.

Some manufacturers own and manage their own local service providers; at least one manufacturer does a mail swap of the in-vehicle component of the interlocks with customers on a monthly or bimonthly basis. In some cases, the manufacturer makes arrangements with local aftermarket suppliers of auto services or installers of other automotive equipment, such as stereos, windshields, or auto alarms. In addition to the manufacturers, there are a few multistate

high volume installers whose sole business is to install and service interlocks supplied by an exclusive arrangement with one manufacturer.

Methodology

There were four primary sources of information collection for this project, interlock manufacturers and service providers, State authorities managing interlock programs, DUI offenders riding interlock-equipped motorcycles, and performance log data from motorcycle interlocks.

Interlock manufacturers and service providers were asked to help clarify questions about the feasibility of interlocks on motorcycles. The State authorities who manage interlock programs were asked to provide an understanding of how State statutes either support or dissuade the use of interlocks on motorcycles. DUI offenders who are actually riding motorcycles with interlocks helped us to understand how the actual implementation of this technology works. And finally, an analysis of the performance logs of the motorcycle interlocks helped us to characterize whether the patterns and frequencies of BAC tests are similar or different from users of interlocks in passenger cars.

As noted previously, we were interested in determining several aspects of current State policies concerning motorcycle interlocks. To accomplish this objective, project personnel notified the relevant NHTSA Region offices to inquire who, in each State in a region, might be most knowledgeable about the current status of laws regarding motorcycle interlocks. With an initial list of names, we worked through referral chains until the person with the most significant knowledge was reached and could take the time to have a conversation about their interlock program. Nearly all of these conversations were open-ended telephone discussions without firm structure. In the course of these discussions we attempted to learn:

- What, if anything, a State vehicle code said specifically about motorcycle interlocks.
- Whether the State law requires interlocks on all vehicles owned by the interlock-stipulated offender.
- What the State's policy or practices are regarding motorcycle interlocks.
- The prevalence of motorcycle interlocks in the State.
- Whether States have asked providers for motorcycle interlocks.

We conducted interviews with officials in States that had more than 2,000 installed interlocks, or those with more than the per capita average number of interlocks, but included other States as well.

The project team interviewed senior executives of the major manufacturers of interlocks and three of the multi-state installation-only companies that work with equipment provided by a major manufacturer. The team followed a set of discussion items developed in the work plan that focused on company policy and experiences regarding the use of interlock products in motorcycles. The interviews sought to understand key topical issues and were primarily focused on understanding industry views on the feasibility of motorcycle interlocks as a business opportunity, as well as problems encountered or expected to be encountered if the interlock installation business was extended to motorcycles.

Findings

Interlock Manufacturers and Suppliers

Table 1 lists the interlock companies that we contacted, the point of contact, whether we held a discussion with the contact on motorcycle interlocks, the total number of interlocks installed by the company, and whether the company did install and continues to install motorcycle interlocks. Note that three of the major installers using Lifesafer devices are listed under that company even though the companies are independent. In addition, Table 1 notes whether we were able to discuss motorcycle interlocks with someone knowledgeable enough to speak for the company. The table also includes an estimate of the annual installations per year, whether the company installed devices on motorcycles in the past, and whether they still do so. We were unable to have discussions with anyone from two providers (Autosense and Interceptor), but based on information from other sources, we believe their proportion of the total interlock business to be in the range of 5 percent or less. The sum of estimated interlocks installed, based on our queries for this report, falls in the range of the 180,000 units believed to be in service in 2009 (see Appendix C), which was used to develop our data collection plan for this study, and the 279,000 estimated by Roth for 2012.

Of the 12 manufacturers and 3 installers, 6 have experience installing motorcycle interlocks. But today, interlocks are installed on motorcycles primarily by Draeger, using its XT unit, and Advantage and Affordable Interlock installers, who use Lifesafer FC100 devices. Although 6 sources provided commentary about their experiences installing interlocks on motorcycles, only 3 of these continue to pursue this business. Nonetheless, nearly all the manufacturers had opinions about motorcycle interlocks and many offered useful suggestions as to what might help develop the market in a safe and dependable way. And, more importantly, even those manufacturers and installers who profess no interest in the motorcycle market are nearly all prepared to do these installations if States require it.

Table 1 Interlock Manufacturers and Major Installers Operating in the United States

Company / Device	Point of Contact	Discussion Held	Approximate Number of Installs 2010	Installed Motorcycle Interlocks in the Past/ Currently
ACS	CEO	Yes	10,000	No/No
ADS	CEO	Yes	4,000	No/No
Alco Alert	State Installer	Yes	2,500	No/No
Autosense	CEO	No	7,500	No reply
B.E.S.T. Interlocks	CEO	Yes	250	No/No
CST Inc.	Senior Mgr	Yes	25,000	Yes/No
Draeger	Interlock Chief	Yes	35,000	Yes/Yes
Guardian	Co-owner	Yes	35,000	Yes/No
Interceptor	CEO	No	450	No/No
Monitech	CEO	Yes	8,400	No/No
Lifesafer	CEO	Minimal	see 3 installers (not total)	
Advantage/Lifesafer	Install. CEO	Yes	4,000	Yes/Yes
National/Lifesafer	Install. CEO	Yes	15,000	No/No (soon)
Affordable/Lifesafer	Local Installer	Yes	local WA	Yes/Yes
SmartStart	President	Yes	45,000	Yes/No

In addition to North America, Europe and Australia, particularly the Australian state of Victoria and New South Wales, also have active interlock programs. One supplier in Australia is Guardian Interlock Australia (GIA), a company independent of both Guardian Interlock USA and Guardian Interlock Systems of Canada. Australia's GIA specializes in service and installation and, in 2010, exclusively used ACS devices. SmartStart and Draeger also operate in Australia. Unlike northern European nations with interlock programs, Australia's warm climate suits a high rate of motorcycle use relative to cars, and therefore, based on consumer and government interest, has had considerably more motivation to find—and apparently more success in solving—the problems associated with motorcycle interlocks.

How Many Motorcycle Interlocks Are Out There?

When interlock researchers wanted to estimate the penetration of vehicle interlocks by State around the United States, the only consistent sources available for this information were the manufacturers/installers since, in many States, there is no central repository for this type of information. All the motorcycle interlocks installed in 2009 are embedded in the initial estimate of 180,000 devices reported in Appendix C. It is not likely that there are more than 0.1 percent (279) to 0.2 percent (558) of interlocks installed on motorcycles in 2012. This is because the majority of devices installed on U.S. motorcycles appear to be the Draeger XT and the Lifesafer FC100. The two installers of Lifesafer devices (Affordable, Advantage) that are willing to install on motorcycles are only doing so in 4 or 5 States. The State with the most devices is likely New

Mexico, where devices of both manufacturers are installed. The prevalence of Draeger and Lifesafer units relative to those of other manufacturers does not appear to be due to a unique design feature of these devices, but rather a corporate policy of willingness to meet the needs of customers, and possibly the willingness of some States to forego retests when the devices are installed on motorcycles. In Texas current practices allow the motorcycle interlock to be programmed to bypass the retest requirement used with other vehicle types.

Preliminary Discussions With Manufacturers

During the initial telephone conversations with manufacturers, we asked the manufacturers for their views about motorcycle interlocks. These telephone discussions helped identify some of the key issues of concern to the interlock business community, which are summarized below.

Nearly all U.S. interlock manufacturers or installers have considered the issue of motorcycle interlocks at one time or another. Today, there are two or three manufacturers that install interlocks on motorcycles, namely, Draeger and Lifesafer (and possibly Guardian in Virginia). Others did at one time, but not any longer (SmartStart, CST), and others have considered it, but ultimately rejected it (Monitech, ACS, ADS, Interceptor, Alco-Alert). Two manufacturers (Alcosense, B.E.S.T. Interlocks,) have either not discussed it or we were unable to discuss it with them. Those who did not install interlocks at the time of this project stated that they would do so if a State has a future requirement for suppliers to install interlocks on motorcycles. For example, the requirement for motorcycle interlocks in Virginia is motivating more interlock companies (and installers) who operate in Virginia to reconsider their positions.

The key reasons to not pursue the motorcycle interlock business fall into the following categories:

- Potential liability for the interlock company related to rider safety associated with State regulations that require interlock retests on motorcycles just like with four-wheel vehicles,
- Potential equipment damage due to environmental exposure (weather, dirt, vibration from the motorcycle)
- Greater time needed for installation relative to automobiles, and
- A small potential market for motorcycle interlocks, which limits the incentive to devise an interlock more appropriate to motorcycles

Most of the companies stated that the unique engineering issues involved in motorcycle interlocks could be overcome if there was a sufficient incentive to do so. At least one manufacturer has a written policy stipulating that its franchisees may not install its devices on motorcycles. Reasons for not providing interlocks for motorcycles generally reflect a variety of bad experiences at some point in the past and, probably most importantly, the lack of a clear profit model.

In addition to litigation concerns arising from potential safety risks, many commented on the small storage capacity of motorcycle batteries that can leave a cyclist with no reserve power to start the engine since the devices require a small trickle of power when not in use (to maintain

settings, time etc.). Another frequently cited problem was the difficulty of finding a secure place to install the device on some motorcycles. A representative of one U.S. interlock provider reported that the company will install automotive interlocks on motorcycles if a State permits it and a rider requests it, but generally States do not encourage the practice. The representative of this one installer company estimated that there may be about 100 of his company's interlocks installed on motorcycles. Another company (one that does not install on motorcycles) noted that the control module and sampling head on its new device is now weather proof and weather resistant and would be ready to install on motorcycles if States require it. A third company noted that it had recently revised the firmware controlling its devices so they can now require an engine-off dismount test (taken at the conclusion of a trip), a safer alternative for the retest. For that approach to be acceptable States would have to permit this alternative under existing laws.

By way of summary and introduction to our findings that appear later in this document, the following list identifies some of the possible problems with motorcycle interlocks that we heard during discussions held with installers and manufacturers. We will revisit these topics and others in more detail in the Section 5 Findings of this report.

Possible Problems With Motorcycle Interlocks Identified by Company Contacts

- Danger associated with performance of retests may result in increased exposure to liability for the company.
- Exposure to weather exposure might damage the devices.
- Dust and vibration exposure might damage the devices.
- A motorcycle battery stores very little energy and the interlock drains it quickly, especially in cold weather when the sampling head must be heated.
- Motorcycle electrical systems and electric power generation is not stable.
- Some motorcycles have limited space in which to install the device.
- Kick or bump starting is much easier on motorcycles than on automobiles and, therefore, can more easily circumvent the device.
- Motorcycles must have a key start system (no kick starters).
- Riders cannot hear the auditory signal calling for retest.
- No business model yet makes sense to develop a motorcycle-specific interlock.

Possible Solutions for Motorcycle Interlock Feasibility

The following summarizes *possible solutions* that might overcome the above problems. This list was compiled before the study began based on preliminary discussions with interlock company executives and formed a basis for some of the discussion with key informants. These issues will also be revisited in the Findings section as we summarize what we have learned during this study.

- Design a motorcycle-specific interlock that is protected from environmental damage and can avoid draining battery capacity needed for an ignition key start up.
- Alternatively, use a weatherproof container for automobile interlocks that can be used in the motorcycle environment.

- *Always* require the rider to dismount to control safety risk during retests. Do this by making clients agree to the procedure and/or by installing the device in some protected location that is sufficiently inconvenient that it would *require* the rider to dismount in order to test.
- Require fully certified auto electrical technicians to provide installation. This may help overcome the problem of unstable motorcycle electronics.
- Mount a LED flasher on the handlebar to signal the need for a retest
- Devise motorcycle-subsets of State interlock certification standards that allow for longer intervals between retests (current retest intervals have never been subjected to efficacy evaluations).
- Require dismount retests that take place upon engine shutdown at the destination rather than by retests while the motorcycle en route.
- Devise a motorcycle interlock that has a transdermal sensor for retests, thereby avoiding the problem of active breath sampling retest altogether.
- Establish motorcycle interlock standards that might help manufacturers design a compliant device.
- Develop a system to assure the operator provides the breath sample. Reportedly, all interlock manufacturers either have or are developing photo identification systems to positively identify the person providing the interlock BAC test sample. This might strengthen the certainty that the stipulated operator has taken the test rather than having been started by a non-operator.

In-Depth Discussions With Manufacturers and Installers

In this section, we summarize our conversations with the manufacturers and installers willing to share their expertise. The companies that provided information are shown in Table 1. In addition to having had the benefit of telephone discussions with manufacturer executives and some of the direct installers, this report also includes information gathered during six hours at the Draeger facility in Irving, Texas, near Dallas, for on-site discussions and an interlock installation demonstration on a motorcycle.

Conversations conducted with a mix of interlock business experts, including executives and installers, provided a wealth of information on motorcycle interlocks issues. Because some of the information provided was given in confidence and because the purpose of this section is to generally characterize the opinions of those in the business rather than to discuss specific businesses, names of individuals are not identified in this summary.

Perspectives of Manufacturers

The primary obstacles to companies pursuing motorcycle interlock business with more zeal than they currently do reflect a number of factors, few of which are technical barriers. There is no doubt that the motorcycling environment is a less congenial one for measuring BAC, given wind and weather, but much as police officers measure BAC at the roadside, there is nothing inherently problematic about taking a BAC test on a motorcycle operator. For these companies to

pursue this business, however, it needs to be more than technically feasible. It needs to be both responsible and feasible from a business standpoint, and those seem to be the key problems. In the course of conversations with interlock executives and installers, the following topics emerged as germane to the question of feasibility and may help explain why more companies do not pursue this business more actively, and why, if they do or will pursue it, caution is needed. In cases where an alternative view or approach was adopted by other manufacturers, it is summarized as well.

- **Liability:** Some manufacturers and installers perceive that there is an unknown degree of liability exposure if there is a crash of an interlock-equipped motorcycle, particularly by someone performing a retest while riding. This is the major reason cited by the majority of the interlock companies for not pursuing this business, or for being very wary of it. By contrast, other manufacturers and installers believe the liability risks are controllable by requiring riders to sign liability waivers. Liability and safety are two sides of the same coin and many of the following topics relate to one or both.
- **Retests During Operation:** If States require the same standard of retests for motorcycles as with passenger vehicles, there is an enhanced crash potential that poses a liability concern for the company in addition to potentially unfavorable press for interlocks in general and, of course, potentially serious injury or death of the rider. This has led some States to allow installers to forego the requirement of retests for interlocks on motorcycles (despite there not being written statutory support in the vehicle code). Some States appear ready to accept an exception for motorcycles that allows for an engine-off test upon dismount rather than a retest while en route, whereas other States advise that all retests should be performed with the vehicle stopped, even though they know it may not be routinely done that way. One manufacturer believed that the risk element could be potentially removed if retests were implemented through a transdermal skin sensor that detects alcohol vapor. Others felt that this was impractical at least on a cost basis since it requires adding a second alcohol sensor for a product that is, at best, for a very low volume of customers.
- **Secure Storage:** Without a secure locking compartment, there is a possibility of equipment theft and/or damage due to weather. It is difficult to keep the unit completely dry when always exposed to the outdoors; moisture will eventually seep in and lead to corrosion and early device failure. It is possible to build in weather resistance, but to develop a true weather-proof interlock means the cost of equipment will be much higher. In addition to secure storage on the motorcycle, one manufacturer believed it was important to have an interlock with a removable handset (the sampling unit) to preclude theft when the motorcycle is left unattended. This same manufacturer also noted that dropping a handset on asphalt will likely cause significant damage (unlike dropping it on the floor of a passenger car).
- **Installation:** It may require a longer time (sometimes more than 2 hours) to install an interlock on motorcycles since there seems to be more variation between motorcycles in wiring systems and other configuration aspects (e.g., location of batteries, storage compartments). Unlike for automobiles, motorcycle schematics are not readily

available for installers. In addition to having to learn to install on so many different systems, some modern motorcycles have an electronic control unit (ECU) or onboard computer that must be queried and informed of the new equipment much like automobiles, but unlike automobiles, telephone support may be less available from motorcycle manufacturers.

- **Business Volume:** Together with the added installation challenges, most installers believed too few people will want this special interlock installation service on motorcycles and, therefore, on a cost-basis, believed it does not warrant the staff training investments needed. Companies willing to install on motorcycles do not pursue this business but will do the installations when there is (a) a request from an owner, (b) a motorcycle skilled technician available at one of its service centers, and (c) a State that allows it.
- **Retest Alerts:** Riders cannot easily hear the auditory tone that signals a need for a retest. It was noted that using a supplemental visual cue (a flasher) mounted on the handlebars, instead of an auditory one, is not a foolproof solution because it requires the rider to often look down to see if the signal is lit, potentially adding a safety hazard. One installer that does not provide a visual cue relies on an increasingly louder auditory signal that, in the absence of a response from the operator, eventually activates the horn to notify riders it is time to retest. An installer noted that motorcyclists who ride with interlocks sometimes prefer open face helmets.
- **Battery Power:** Interlocks draw power (about 20 to 50 mA) from the battery, whether the motorcycle is running or not. This necessitates some kind of battery trickle charger when the motorcycle is not used for several days because the storage capacity of the motorcycle battery is smaller than an automobile's (about one tenth). This view of limited power was not shared by all manufacturers and some thought it could be overcome by altering the equipment design. In addition to the issue of power availability on a motorcycle charging system, one senior technical person mentioned that power fluctuations, electrical noise, and transient spikes, unlike in automobiles, are common in motorcycle electrical systems, and these could be designed around a motorcycle specific device, but existing interlocks cannot easily meet these power-related challenges. There was a suggestion, as well, that more sophisticated auto-electrics training would prepare installers to overcome these problems more easily. In the past, manufacturers of vehicles to which interlocks are connected have stated that interlocks should not draw more than 5mA.
- **Special Devices and Standards:** To make a motorcycle interlock program both safe and technically ideal, a motorcycle-specific device and special State certification standards would be needed that, for example, alter the type or frequency of retests that have been devised for use with passenger vehicle interlocks and/or create devices that are more resistant to the elements. These things would be practical only if there was sufficient business (or demand by a State) to warrant the development costs, and if the State statutes were revised to recognize the issues involved in using interlocks in this unique operating environment. One manufacturer has revised its firmware to request engine-off dismount tests rather than running tests. Another manufacturer stated that, in order for a motorcycle interlock to not be a safety hazard, it would have

to be stipulated in State certification regulations that it never be used unless a rider is completely stopped. It is also worth noting that while the NHTSA 2013 Interlock Model Specifications provide certification standards for automobile interlock vibration resistance (among other factors), the current equipment that is certified in a State for use in cars and small trucks was never designed for the vibration, power, moisture, and environmental factors to which motorcycles are exposed. A true motorcycle interlock would be a different device and, ideally, would require different device standards.

- NHTSA opinion: One manufacturer stated that, unless NHTSA issues an opinion on motorcycle interlocks, there is no incentive for manufacturers to pursue that business with specially designed equipment. NHTSA could facilitate this process by issuing motorcycle interlock guidelines. Among the provisions of any new interlock guidelines specific to motorcycles should be the requirement for motorcycle specific video training programs for operators.
- State Prerogatives: In the absence of national guidelines, some States specifically prohibit motorcycle interlocks (i.e., California, Colorado, Illinois, Wisconsin, West Virginia) in different ways. It is not clear that these approaches would be changed unless there was better safety data and a clear, and possibly a Federal, recommendation. For California, the inadequacy of the device is the problem and California does not recognize any device as suited to the motorcycle environment at this time. Wisconsin restricts its interlocks to specific classes of vehicles (not including motorcycles). Florida is reexamining (or already has ended) its earlier restriction. There was some discrepancy between manufacturers and key informants from States about whether a State specifically prohibits installation of interlocks on motorcycles.
- Switch Starters: Interlocks can only be installed on motorcycles that have an electrical switch starter. While these are the majority for motorcycles, they are rarer on motor-scooters. Also, there are now hybrid gas-electric motorcycles that might complicate installation for reasons beyond simple switch circuitry. Some motorcycles have both switch starters and kick starters. Kick starting would bypass the interlock, but be recorded as a circumvention event.
- Types of Motorcycles: The two most common types of motorcycles on the road are cruisers and sport bikes. Installer commentary suggested that interlocks are primarily installed on cruiser type motorcycles. Where riders are allowed to retest while riding, it was suggested that cruiser riders are more likely to install interlocks because the riding position is more conducive to retesting than on sport bikes. It was also suggested that cruisers have more areas in which interlock equipment can be installed. It may also be the case that the demographics of the drinking driver/rider are such that they are more likely to choose cruisers as their favored motorcycle type.
- Mount Location: Installers work with the riders to determine where the testing/sampling unit will be located, and whether riders would like access to the interlock breath sampling unit while riding or whether they prefer a location that requires pulling over. Installers will mount where the customer wants, but at least two

did not see moving retests to be at all safe. A simple solution to this problem would be the requirement that riders always test when stopped.

- **Higher Circumvention Potential:** Because motorcycles can be set rolling more easily than automobiles, they can be more easily push started (especially if parked on a hill). This would make them easier to circumvent (to bypass the starter circuit). Any motorcycle with a kick start option (even if there is also a switch starter) could be easily bypassed by the rider, though this would be recorded as a circumvention event.

The commentary taken from business leaders can be interpreted in different ways, but a general theme identified by those companies that do not pursue this business is that liability issues are a significant concern and the biggest source of that concern relates to State requirements for retests (that are often implemented as moving retests). Supplemental concerns are the potential for equipment damage that might occur as a result of cold, wet weather and dusty, hot operating environments, theft, handset damage, a poor electrical system for the interlock equipment, and the risk of circumventions due to push starting, kick starting or roll starting. Whether motorcyclists would abide by new retesting requirements cannot be known at this time, but it is an empirical question that could be addressed by future research.

Perspectives of Installers

As part of the study, interviews were conducted with three people who install and maintain motorcycle interlocks. One interviewee installed Lifesaver devices for Affordable Ignition Interlock in Washington State, one installed Draeger devices in Texas and one was affiliated with Draeger in Virginia. The Washington State installer had been doing installations for about 10 years. The Draeger representative in Virginia estimated that the company had been installing motorcycle interlocks at his location for about 4 years. The Draeger installer in Texas was the senior technician for motorcycle installations for at least the past 5 years.

The Washington State installer said that the decision to install interlocks on motorcycles arose from asking “Why not?” rather than “Why should they do it?” He believed that the low demand for motorcycle interlocks has remained unchanged over the years despite the fact that administrative suspensions have increased. Part of the reason for this change, he said, is that interlock assignments that used to come from the courts are now being issued as administrative suspensions. This likely reflects changes in Washington’s legislation in 2007 and 2008. In 2012 Washington State was the second highest interlock-volume State.

All installers noted that few devices are being put on motorcycles and that those installers who do begin installing on motorcycles often become the company’s “go-to” person for future motorcycle installations in that area. Riders may travel from areas served by other offices to have interlocks installed by the local motorcycle expert. They may then have routine maintenance and downloads performed at an office more convenient to them. Compared to the information available for automobiles, installers have limited access to information on motorcycle wiring schemes, and generally have to determine the wiring (color codes, locations, etc.) and how best to configure the interlock for each new motorcycle. As noted earlier, this adds to the installation time on motorcycles relative to automobiles. Installers noted that, initially, there was considerable trial and error involved in learning how to install interlocks on motorcycles. Installations become easier and more predictable with experience. Over time, they judged their prior experience with certain motorcycle models as valuable in understanding how to install

interlocks on similar motorcycles. Motorcycle installers in different regions may share expertise regarding certain models. The Draeger installers in Texas maintain a notebook on motorcycle installations in order to share with other installers.

We learned that installers of Lifesafer interlocks have not modified their current interlock hardware for motorcycles, but they have made a firmware change that will soon be implemented for allowing a dismount engine-off test to be used in States that will allow it. However, the current retest notification system starts with a flashing light on the head unit and auditory signals increasing in volume, escalated up to sounding the vehicle's horn. If motorcycle clients can't hear the first signals or see the light, they react to the horn blowing. Draeger interlocks are being installed with LED light panels mounted on the handlebars to notify riders of the need to retest. Neither company reported using any special housing to protect the equipment from the elements. They endeavor to install it in protected areas of the motorcycle, such as under the seat, under side panels, behind fairings and in saddlebags and handlebar bags. They depend on owners to store motorcycles in protected areas or under covers, which has generally been the case. One installer told a story about a client who kept his motorcycle outside unprotected, and who came in regularly for replacement of ruined interlock components. The company eventually told him they would no longer provide him with an interlock and removed it. This serves as somewhat of an extreme case of the weather exposure problems for motorcycle interlocks.

None of the hands-on installers considered electrical systems to be a problem for installing interlocks on motorcycles. All the motorcycles they have encountered have been 12-volt systems, so the devices install in the same manner as for automobiles, once the wiring system is understood. However, since the interlock is always placing some demand on the system, and since the capacity of the motorcycle battery is smaller than that of an automobile, there is a potential that the motorcycle battery may run down too far to start the motorcycle. This is primarily a function of how often, and for how long, the motorcycle is ridden.

Installers agreed that the retest issue is a safety concern. At least two installers expressed the opinion that retesting while riding is not a very safe practice and they would not do it themselves. Nonetheless, installers in Washington, Oregon, Virginia, and Texas are installing the handset testing unit in a location where it can be used while the vehicle is running. In Washington, the installer said that the decision of where to install the mouthpiece (head unit) is left up to the client, as is the decision of whether to retest while riding. In Virginia, clients are instructed not to retest while riding. The person we interviewed in Virginia has spoken with motorcycle interlock clients who said that they were not retesting while riding and he is inclined to believe them, though he acknowledges the possibility that they may just be saying what he wants to hear. And in Texas, as noted previously, the State does not require retests for motorcycles, so retesting while riding is not an issue there.

Installers did not believe that circumvention is much of a problem. Most of the motorcycles they encounter do not have kick starters, only electrical starters. Affordable Ignition Interlock will only install on motorcycles without kick starters. The ignition switch has to be on to start the motorcycle but, as with an automobile, the electrical starting mechanism is disabled until a successful breath test is supplied. If the rider turns on the ignition, compression-starts the motorcycle (via kick- or bump-starting), and runs it without a test, the device will require a retest in a few minutes. If the test is passed, there is no problem, and the motorcycle will start. However, the device will record events when the client provides a positive BAC sample over the threshold. This situation would be similar to having someone with a zero BAC blow to start the

motorcycle and a rider providing a high BAC sample upon retest. Additionally, if the data log is being monitored, it will be apparent to the reviewing authority that someone has been compression-starting the vehicle. Not all States are equally attentive to the interlock log data. We were told by an installer that in Washington, administratively-ordered interlocks are not being monitored by the State even though the company sends regular performance logs to them. If this is true, it means it would be possible for someone to circumvent the interlock by using a kick starter or push starting to operate the motorcycle without passing a BAC test. This class of circumvention would be recorded in a log file and reported in a performance report, but without review by an authority, there would be no deterring the behavior. Installers said that most of the motorcycles on which they install interlocks are heavy enough that it would be difficult to push start them without a hill to roll down.

The Washington installer reported hearing of cases in which riders who have been ordered to only use interlock-equipped vehicles have reportedly been stopped by police while riding non-interlock motorcycles and released without sanction, apparently because the officer did not understand the law and believed the rider was operating legally because it would not be possible to put an interlock on a motorcycle. Note that these comments have not been confirmed from other sources.

An observation of an installation of an interlock on a motorcycle is presented in Appendix B.

Interviews With State Officials

In addition to manufacturers and installers, experts from State divisions that supervise certification testing of interlocks and intercede between the interlock companies and the State authority provided their perspective on motorcycle interlocks as a means to deter and sentence impaired riding offenders.

There are few States with motorcycle exceptions or special motorcycle provisions in their interlock statutes.

Beyond a State's willingness or disinterest in the motorcycle interlock business, requests for motorcycle interlocks often come from the motorcycle owners themselves. Reasons for requesting a motorcycle interlock can be summarized as (1) a State requires interlocks on all vehicles owned by an offender, including motorcycles; (2) an offender owns a motorcycle, wants to ride it, and must therefore install an interlock on it; and (3) an offender's only transportation is a motorcycle, and he/she must use it to maintain mobility. In some cases, since motorcycles are a seasonal vehicle in many parts of the United States, some DUI offenders request that the devices be installed if the lease fees can be suspended during the cold months when motorcycles are not used. At least one manufacturer complies with such requests. In such cases, the owner is advised to keep a trickle charger or similar device to help maintain the battery charge.

The problem presented by offenders with only a motorcycle (and no alternative vehicle) was mentioned as a concern of State officials during the interviews for the *Update of Vehicle Sanction Laws and Their Application* report (Voas et al., 2008). As for the feasibility of accommodating motorcyclists who want interlocks, the Australian installer (GIA) commented that he has installed interlocks on motorcycles since 2003 without difficulty. Accordingly, based on the limited experience both in the United States and Australia, it appears there are solutions to some of the problems. The most significant barriers may be less technical than those brought on

by safety and liability concerns – concerns that loom ever larger when the company does not see a path to profit for including motorcycles as part of its interlock business.

State Vehicle Code

In general, States do not have specific references to motorcycles in their State codes. In most cases, motorcycles are included in the definition of “motor vehicles,” but for the purposes of interlock laws, there is no explicit mention of motorcycles and interlocks. Only California and Illinois specifically mention motorcycles in the vehicle codes related to the interlock. Under Illinois Administrative Code, Title 92, there is a section that defines “vehicles” for the purposes of the interlock law. Under this law, motorcycles are forbidden from having interlocks installed. California requires interlocks on all vehicles owned by offenders assigned an interlock; however, a recent modification to the vehicle code states that “‘vehicle’ does not include a motorcycle until the State certifies an ignition interlock device that can be installed on a motorcycle,” and that “any person subject to an ignition interlock device restriction shall not operate a motorcycle for the duration of the ignition interlock device restriction period.”

Many States’ interlock laws require offenders to have an interlock on any vehicle they operate. Per Federal mandate, several States modified their interlock laws to require interlocks on all vehicles owned or operated by the offender. This often is interpreted to mean that the law requires offenders to install interlocks on motorcycles. Some State officials acknowledge that laws requiring interlocks on all vehicles are not being strictly enforced, especially for motorcycles.

When States do not require interlocks on motorcycles, it is often due to a perceived lack of availability of motorcycle interlocks and/or policies that prevent or discourage motorcycle interlocks. In some cases, State officials have acknowledged an apparent conflict between a law requiring interlocks for all vehicles and policies that either do not enforce the law for motorcycles or specifically prevent or discourage motorcycle interlocks. In one case, an official stated that, (1) the law officially requires offenders to put interlocks on motorcycles, and (2) the law was being enforced and that this would theoretically require many motorcycles to be equipped with interlocks, but (3) very few motorcycle interlocks were in use in the State. The official was not prepared to speculate how this could happen. In States that require interlocks on all vehicles, but cannot provide or will not allow them for motorcycles, there is a possibility that motorcycle owners would be forced to sell their motorcycles to comply with the law. No State officials queried had the impression that their State’s policies were forcing offenders to give up ownership of their motorcycles. Some suggested that motorcycle owners may be voluntarily selling their motorcycles or transferring their titles to others to avoid the requirements to install interlocks on them. If so, this is not unique to motorcycles, since offenders often do this with passenger vehicles as well. Officials pointed out that motorcycle owners who did not put interlocks on vehicles they own were prohibited by law from operating the motorcycles and risked being sanctioned under State laws if they were caught doing so. As with automobiles, an offender required to use an interlock and found driving without one is often charged as a driving while suspended after DUI.

State Policies

There is a spectrum of approaches to motorcycle interlock policies among the States interviewed. Some States do not have interlock laws, or have laws giving responsibility for the

assignment of interlocks to the courts. Some States make little or no use of interlocks and, of course, such States are less likely to have motorcycle-specific interlock policies. Among States that do have interlock laws and/or significant interlock use, some have specific policies regarding motorcycle interlocks and others do not. Where there are no policies, it is often because the subject of interlocks for motorcycles has never come up. In some cases, where the subject has come up, the State may have decided that there is insufficient information or insufficient need for a policy. It seems that most often, when there is no policy, the State leaves the decision to the providers and passively permits installation on motorcycles since there is no policy that prevents it. In one case, that was found to work the other way, too; an official stated if there is no policy, there is therefore nothing that allows it, therefore it is disallowed.

Most States that have considered the issue have gotten information from manufacturers and providers, and have proceeded based on the industry's advice. As was evident from the preceding section, that advice varies because the manufacturers differ widely on whether or not to accept motorcycle interlock business. In at least one case, a vendor's refusal to provide motorcycle interlocks led to an official State policy that motorcycle interlocks will not be allowed. When there is a policy actively preventing or discouraging motorcycle interlocks, the reasons cited were primarily safety concerns and uncertainty regarding the effectiveness of interlocks on motorcycles. In States in which motorcycles are theoretically required to have interlocks but which are unavailable, some States take formal actions, such as nullifying the motorcycle registration for the period of the interlock requirement or requiring riders to show evidence that the vehicle has been immobilized. Other States apparently rely on offenders being dissuaded from riding by knowledge of the sanction for being caught doing so.

Requests for Motorcycle Interlocks

Some States that have had requests from citizens for a motorcycle interlock option have asked interlock providers to determine whether it would be possible. Virginia is the only State we identified that has a policy requiring interlock providers operating within its borders to make interlocks available for motorcycles. This is a relatively new policy and is undergoing gradual implementation. Two manufacturers (Draeger and Lifesaver) install interlocks on motorcycles in Virginia. It appears that requests for motorcycle interlocks started with requests from offender-riders themselves to State officials. Requests may be made directly from riders to State officials, or indirectly through interlock providers. Generally, there are two reasons offenders request motorcycle interlocks: (1) offenders claim that their only form of transportation is a motorcycle and that the interlock law unfairly forces them to buy a car or go without personal transportation, and (2) offenders enjoy riding motorcycles and request motorcycle interlocks so they can continue to ride legally during the period they are assigned interlocks. Riders interviewed as part of this study fell into both categories. There is no way to tell the extent to which these riders are representative of the larger motorcycle interlock user population, or whether riders who claim that their only vehicle is a motorcycle are being honest.

Prevalence of Motorcycle Interlocks

In States where there have been motorcycle interlocks in use, officials do not generally have solid information on how many there are, or how many had previously been installed. In most cases, they have a sense that there have been very few. Most reported that it would be

difficult or impossible to determine from State records how many interlocks had been installed on motorcycles. In some States, interlocks are assigned by courts rather than State agencies. These courts do not necessarily have information on the types of vehicles equipped with interlocks, and what information is kept is distributed across many court systems, making it difficult to determine the prevalence of motorcycle interlocks through the courts. The common wisdom among State officials is that the best way to understand the prevalence of motorcycle interlocks is to talk to the interlock providers. Appendix C provides State-by-State statistics for numbers of interlocks installed in 2009, when data collection for this project began.

Summary of Laws, Policies and Prevalence

In the course of this study, we chose to restrict discussions to officials in those States that have active interlock programs. We ultimately collected information from 38 States, shown in Appendix A. Highlights are summarized below.

- Regarding State laws requiring offenders to equip all vehicles they own, rather than just those they drive: 15 States had such laws, 16 did not, 4 had laws requiring this in certain cases (the status for 3 State was unknown).
- Regarding State policies about motorcycle interlocks: 2 States require owners of motorcycles to equip them with interlocks, 4 States specifically disallow the installation of interlocks on motorcycles, 8 States specifically allow them, 8 States have laws that theoretically require motorcycle owners to install motorcycle interlocks but don't enforce them, 14 States have no policy regarding motorcycle interlocks, and our contact for 1 State could not describe current practices.
- Regarding the prevalence of motorcycle interlocks: 22 States reported having none, 11 States reported having some and there were 5 States for which we received no information. This accounting is in accordance with data shown in the following section that suggests that at least 18 States have had at least one motorcycle with a Draeger interlock.

Analysis of Breath Test Event Records from Motorcyclists

We analyzed breath test performance data from Draeger Safety interlocks installed on motorcycles. At our request, Draeger Safety provided the data, having ensured that the data did not include personally identifiable information. We analyzed the data at the Subject (i.e., Offender) level and at the Event level.

Subject Level Analysis of Motorcycle Interlock Data

Draeger Safety provided motorcycle interlock data from 447 offenders. After excluding records with missing or invalid data, we analyzed motorcycle interlock data from a total of 407 riders.

Table 2 shows the distribution of the study sample, which consisted of 407 people with motorcycle interlocks in 13 known States; State data from 4 participants were not coded. More than half are from New Mexico. After New Mexico, Texas and Virginia are the only other States with more than 10 percent of the total. By adding Washington and Pennsylvania, these 5 States account for over 95 percent of the Draeger interlocks that have been in service on motorcycles from November 2003 to 2010.

Table 2 Motorcycle Interlock Data, Participants by State

State	Number of Study Participants	Percentage of Total	Mean Number of Interlock Days
Unknown	4	1.0	57
AR	5	1.2	214
AZ	2	.5	46
DE	1	.2	143
LA	3	.7	148
MD	2	.5	277
MI	3	.7	129
MO	1	.2	39
NM	219	53.8	292
OK	2	.5	240
PA	24	5.9	284
TX	58	14.3	347
VA	54	13.3	206
WA	29	7.1	188
Total	407	100.0	Mean Days = 273

Table 3 shows the general description of the 407 cases that have been compiled at the subject level. The variable labels are mostly self-explanatory. We define “start tests” here as episodes of attempted motorcycling that begin with a breath test - sometimes passed; sometimes failed. Retests can occur after a failed test, whether at startup or while underway. These variables are labeled separately. When operators did not comply with the interlock’s request for a retest, the event is flagged as a refusal. The table shows that the average duration of installation (days_interlock) was 273 days (median 229 days) with a maximum of 1,421 days (just short of 4 years). The interlock duration was 7.5 median months or 9 mean months. The minimum was 1 day; there were three people with a week or less of interlock time.

Table 3 also shows the average motorcycle interlock usage (days_use) was 106 days, or roughly 38 percent of the days during which it was installed. During those days, an average of 520 discrete start tests occurred. One rider had over 6,000 start attempts. Because some States, like Texas, do not require retests on motorcycles (as discussed previously), the minimum number of retest is zero, whereas the maximum is over 5,400. The histogram figure (Figure 1) shows that “days_interlock” is skewed beyond about one year. The distribution is roughly tri-modal with most lasting for only about 1 month (first mode = 27 days), followed by a relatively flat peak that extends out to about one year. Each bar represents about 60 days.

Table 3 Descriptive motorcycle interlock statistics at the subject level.

	N	Minimum	Maximum	Median	Mean	Std. Error	Std. Dev
days_interlock	407	1	1,421	229	273.05	11.205	226.06
days_use	407	1	999	67	106.36	5.691	114.81
start tests	407	2	6,082	293	520.30	32.770	661.10
Retests	407	0	5,401	109	269.05	22.644	456.83
attempted#_BAC_tests	407	1	10,976	390	740.91	51.143	1,031.77
testrefusal_start	407	0	2,278	12	41.91	6.790	136.98
testrefusal_retest	407	0	243	1	6.54	.893	18.01
BAC_max	407	.00	.50	.014	.037	.003	.06740
fail .025_start	407	0	133	.00	3.14	.500	10.09
hifail .040_start	407	0	40	.00	1.44	.199	4.02
veryhifail .080_start	407	0	18	.00	.29	.060	1.20
superhifail .15+_start	407	0	6	.00	.08	.022	.43
fail.025_retest	407	0	79	.00	.38	.197	3.98
hifail.040_retest	407	0	18	.00	.11	.047	.942
veryhifail.080_retest	407	0	6	.00	.03	.016	.331
disconnect_violate	407	0	99	.00	2.89	.479	9.67
Lockouts	407	0	103	.00	2.71	.434	8.75

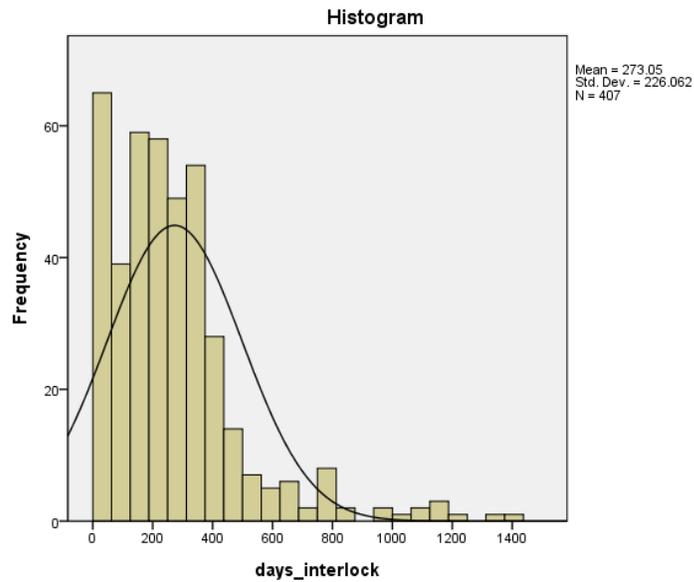


Figure 1 Duration of Motorcycle Interlock Installed Period in the Analysis File

The average rider had 740 total BAC tests, considerably less than most passenger vehicle interlocks that, with an average installation of a similar duration (7 to 9 months), run about 2,100+ in jurisdictions studied. Not surprisingly, over comparable periods of installation, automobiles with interlocks log about 3 times as many tests. The maximum number of motorcycle interlock installed days runs 3.8 years, and the number of tests was nearly 11,000 for that rider. For automobile interlocks, extended installation periods like this are usual for third or fourth time offenders or for offenders considered to be at higher risk.

The 'testrefusal_start' variable in Table 3 represents an event when the rider fails a test when attempting to start the vehicle and does not take a subsequent BAC test. A 'testrefusal_retest' represents an event in which the rider does not provide a retest after the motorcycle is running. Usually these events are logged as procedural failures. In many cases, the testrefusal_retest may represent a rider's decision to not bother with a retest since his/her destination is near. In some jurisdictions, they may not be regarded as significant a violation of the terms of their interlock agreement.

The next 8 variables in the sequence refer to BAC levels (i.e., the results from the test). The average BAC_max is .037 g/dL (i.e., the mean of all maximum BACs logged for riders). However, the modal BAC_max is zero because 40 percent of the riders had no positive BAC tests. The median BAC_max is .014 g/dL. This means that over half of the motorcyclists did have a positive BAC at least once during their interlock period, which is a similar rate to that found in most passenger vehicle interlock programs. For example, Marques, Voas, and Tippetts (2003a), Marques, Voas, Roth, and Tippetts (2010) and Marques, Tippetts, Allen, et al., (2010) reported that 15 to 40 percent of interlock users in automobiles had zero positive BAC tests. The highest BAC_max shown in Table 3 for the motorcycle interlock users was .5 g/dL (probably due to mouth alcohol; a "true" BAC that high is usually fatal).

Because the 407 subjects are from different States and because different States lock out at different set points, the definition of a failed BAC test has been used as a convention by Draeger in this file to reflect the 1992 NHTSA Model Specifications⁴ recommended fail level of .025 g/dL, which were in effect at the time of this study. Most States establish their set point in the range of .025 to .03 g/dL. With that note, the average user among these motorcycle interlock riders had 3.14 failed BAC tests at .025 or above; 1.4 failed tests at .04 g/dL or above, and .29 tests at .08 g/dL or above. At the extreme end, one rider had 18 BAC tests \geq .08 g/dL, and one rider had six failed tests above .15 g/dL. Figure 2 shows the average number of failed BAC tests for the three failed test intervals: \geq .025, \geq .04, \geq .08 g/dL discussed here.

A failed retest often comes about when a rider passes an initial test appropriately (or had help from another person with the initial test), but after some time, alcohol levels rise in circulation to levels above the interlock cutoff. The failed retest categories shown in Table 3 are listed separately for values at or above .025, .04, and .08 /dL. These are less frequent than startup fails, but nonetheless, the average rider had .38 failed retests (i.e., about one out of three riders had a failed retest at least once). One extreme outlier participant had 79 failed retests (10-fold higher than the next highest), but that rider had an interlock installed for more than 3 years and had taken twice as many retests as any other rider. The frequency of the failed retests at higher BAC levels declines. This person and one other accounted for all the maximum levels in Table 3,

⁴ The NHTSA Model Specifications were updated in 2013.

which included 103 lockouts and 6 retests above the .08 g/dL limit. While these extreme values are interesting, as always, the mean and median values are more useful estimates of group behavior. The median number of failed tests and retests are all zero. Nonetheless, program monitors should be aware of the specific individuals in the program that are having the greatest difficulty controlling alcohol use.

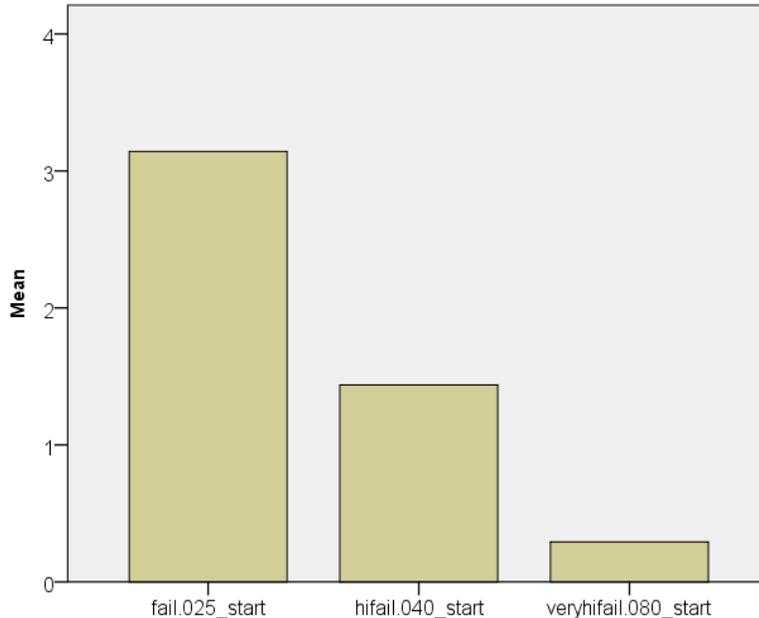


Figure 2: The average/offender number of failed BAC tests per fail \geq to category shown.

The interlock data record discussion so far has noted some outliers, but mostly has covered the means and medians of the group of all riders without adjustment for the interlock usage (start tests or days on interlock). In order to distinguish between those with patterns of BAC test failures relative to: (1) the amount of BAC tests taken to start the motorcycle or (2) days of motorcycle use, the number of failed events must be divided with one of those variables set as the denominator. Doing so identifies specific individuals (noted by case number in the chart) who are outliers. See the two boxplots (Figure 3 and Figure 4) below. Boxplots reflect the interquartile interval (the 25th to 75th percentiles) as a box. Therefore, all the numbered cases in each category and chart reflect those above or below the 75th percentile. Most of the numbers visible in the charts are well above the 75th percentile. Figure 3, on the top, is a plot of failed tests at each of three intervals divided by the number of starts logged. Figure 4, is a plot of failed tests at each of three intervals divided by the number of days the motorcycle was used. In the upper plot, the case numbered 282 is at the top or near the top of each interval with about 15 percent, 11 percent, and 5 percent of all tests in those intervals failed. In the lower plot, reflecting days of interlock use, he/she is only among the highest; not the highest. Since these plots are based on rate of failed BAC tests, the most extreme outliers here are not the same person discussed above with 3+ years on interlock. That person is labeled here as case 407 and can be found toward to bottom of the rate_starts_.025 category in Figure 3.

Those with the highest rates of failed BAC tests relative to days on interlock (second box plot chart) have fails over 50 to 60 percent of the days the motorcycle is used. That is a strikingly high proportion. It appears evident that numbers 69, 282, 104, and a dozen or more others are having exceptional difficulty controlling their drinking.

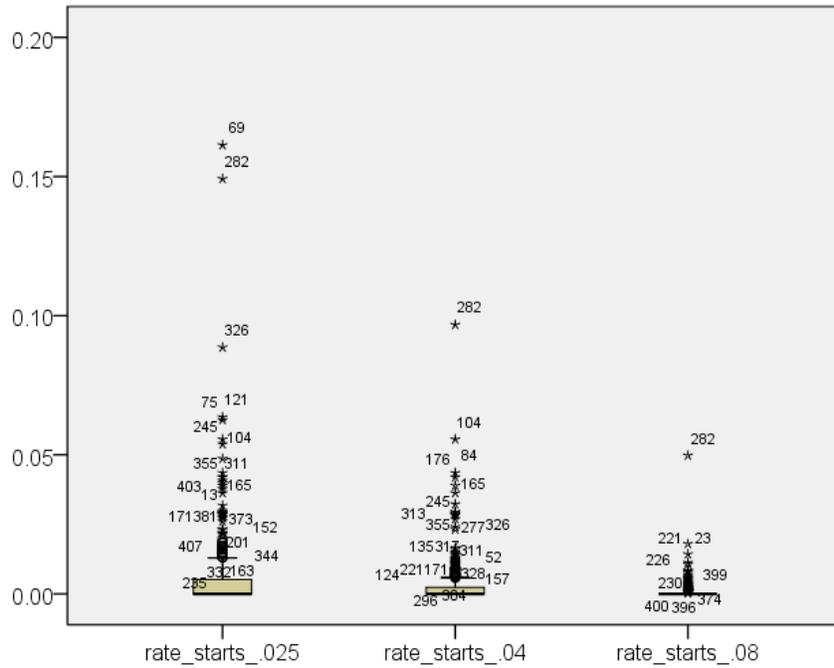


Figure 3: ID of motorcycle interlock operators' failed BAC tests per start attempts

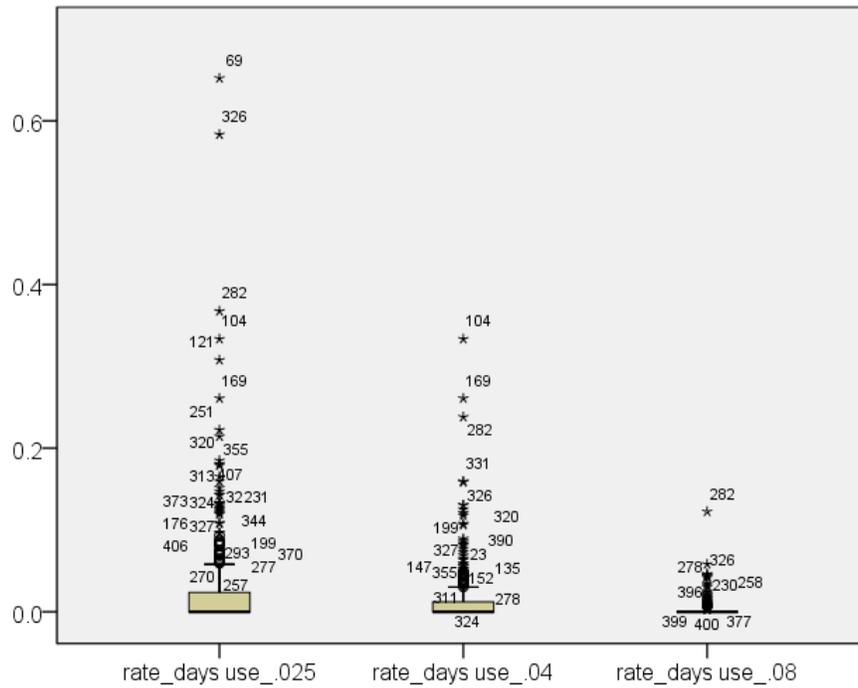


Figure 4: ID of motorcycle interlock operators' failed BAC tests per days of interlock use

Event Level Analysis of Motorcycle Interlock Data

In addition to characterizing the motorcycle interlock data at the subject level, we also summarize it at the event level, independent of which offenders provided the test. Of the startup BAC tests taken, the majority passed. Table 4 shows 99.4 percent of all tests taken are passed with a BAC below the nominal lockpoint of .025. This rate is similar to those found in passenger vehicle interlocks. The other three categories of BAC are different levels of failed startup tests, totaling 1,265 failed starts.

Table 4: BAC ranges and frequency from Motorcycle Interlock Data

BAC Range	Number of BAC Tests	Percent	Valid Percent	Cumulative Percent
.000-.0249	193,442	99.4	99.4	99.4
.025-.0399	740	.4	.4	99.7
.040-.0799	406	.2	.2	99.9
.080+	119	.1	.1	100.0
Total	194,707	100.0	100.0	

There are 194,707 startup tests represented in Table 4. To see patterns of drinking emerge from the interlock data, it is necessary to select only results that are $\geq .025$ g/dL. Figure 5 represents failed BAC startup tests logged only on Monday through Friday, the regular working weekdays. The pattern that emerges is somewhat similar to the findings from interlock event patterns studied in passenger vehicle interlock studies when millions of breath tests are available for analysis (Marques, Tippetts, Voas, & Beirness, 2001, Marques, Voas, & Tippetts, 2003b, Marques et al., 2003a). In this case, with motorcycles, as with cars, the early morning (in this case, 6 to 8 a.m.) on working weekdays usually has the highest number of failed BAC tests with a secondary peak that often occurs toward the end of the working weekday. Also, similar to passenger vehicle interlock data, the Saturday and Sunday pattern shows a characteristic pattern with a slowly rising peak that begins in late morning as shown in Figure 6.

The pattern of fail rates based on day of the week was reported in 1999 (Marques, Voas, Tippetts, & Beirness, 1999) with passenger vehicle interlocks in Alberta (subsequently reported for New Mexico as well). We also find that, with motorcycle interlocks in 2010, the number of startup BACs overall that are elevated above .025 g/dL have a strong peak on Saturday and a lowest number on Tuesday (about half as many as Saturday). This is shown in Figure 7. This is interesting because the actual number of BAC tests taken differ little by day of the week. The fewest, 12.6 percent of all weekly tests taken, occur Sunday, while 16.4 percent, the most of all tests taken, occur on Friday. By contrast, when selecting only the BAC tests that are failed, just 9.8 percent of all failed BAC tests occur on Tuesday, while 21.8 percent of all failed BAC tests occur on Saturday, more than twice the rate. The similarity to the New Mexico data, which was based on about 11 million total BAC tests (Marques et al., 2011), is evident in Figure 8. Similar patterns have been reported in Quebec (18 million tests) and Alberta (5 million tests) as well. These interlock daily fail patterns are similar to the pattern of alcohol crash fatality found in FARS (Fatality Analysis Reporting System) data. Figure 9 shows the 2007 crash death data from FARS when driver BAC $\geq .08$ g/dL. The lowest rate is Tuesday and the highest rate is Saturday. Accordingly, it can be argued that interlocks, including those on motorcycles, may be reducing impaired operating most on the days when the death toll from drinking is highest.

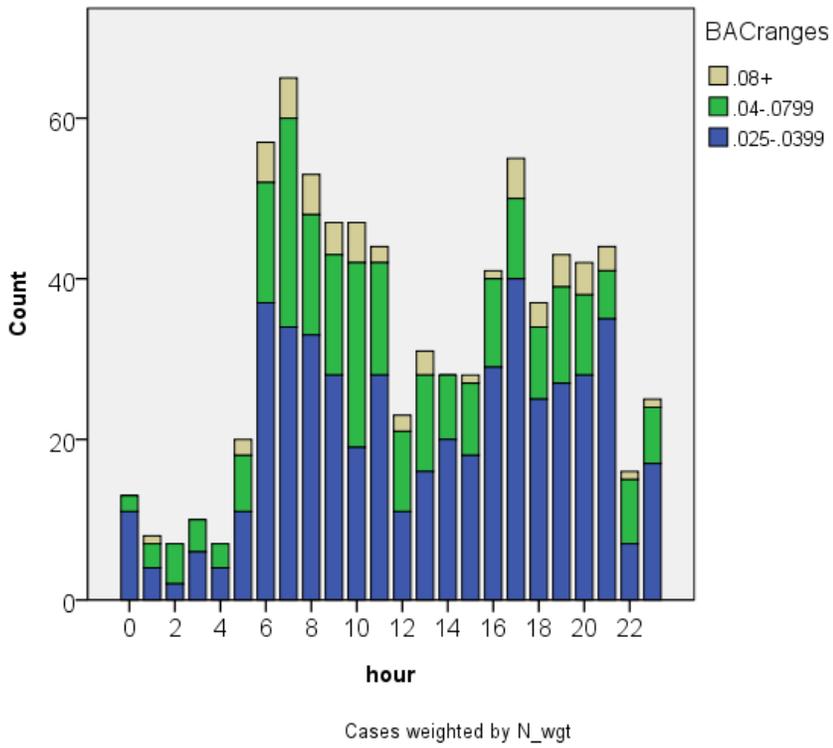


Figure 5: Monday through Friday motorcycle interlock BAC tests ($\geq .025$ g/dL) by hour

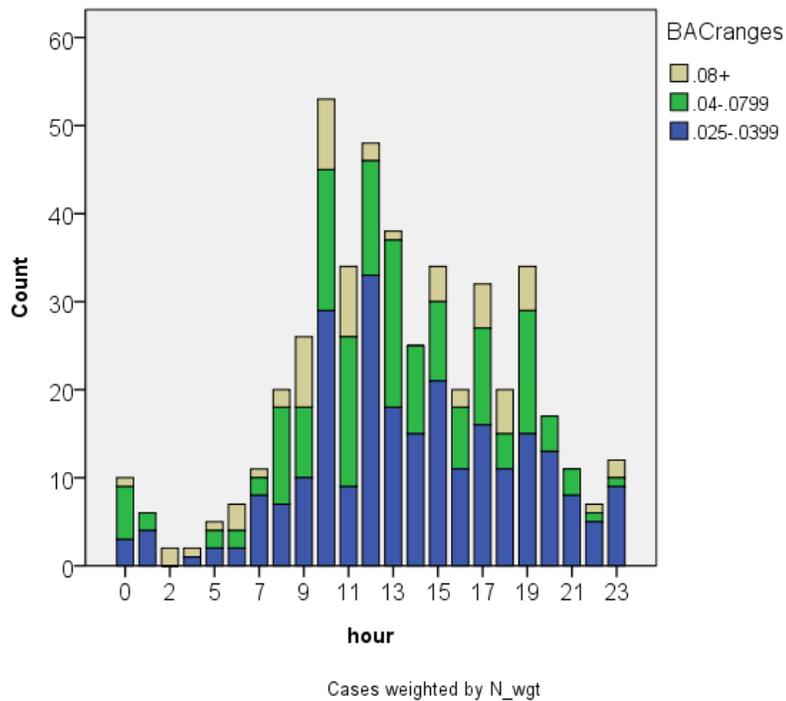


Figure 6: Saturday through Sunday motorcycle interlock BAC tests ($\geq .025$ g/dL by hour

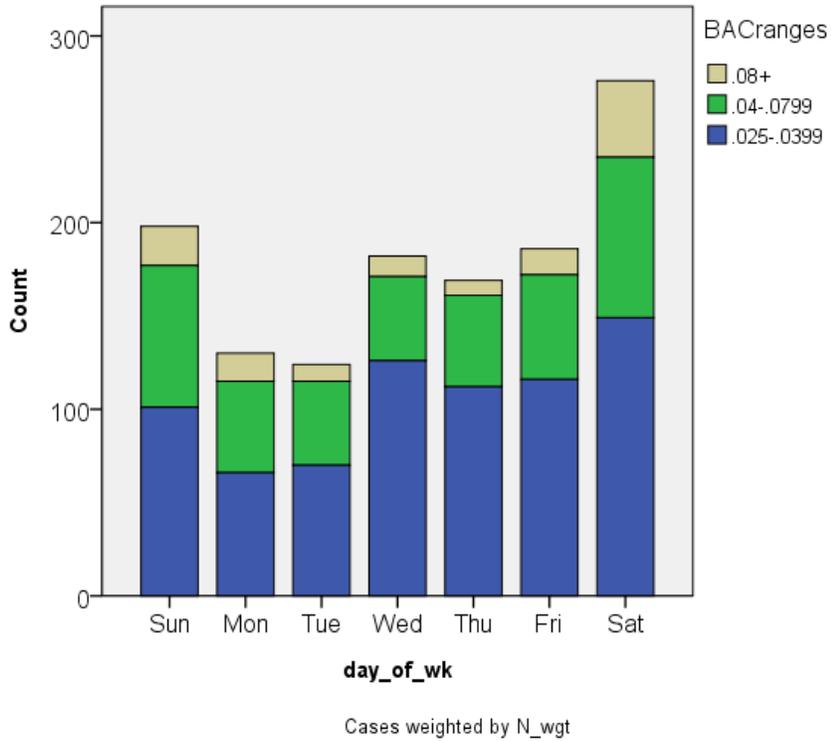


Figure 7: Failed motorcycle interlock BAC tests ($BAC \geq .025$ g/dL) by day

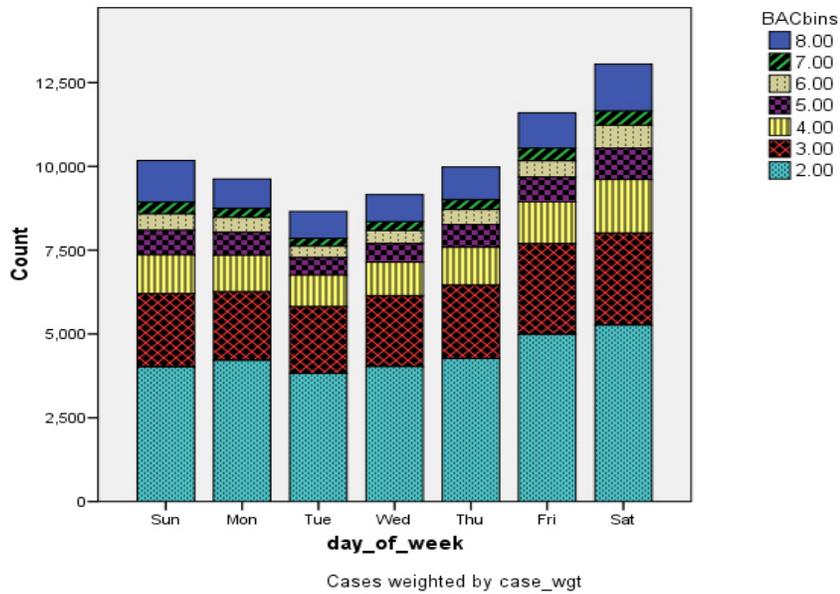


Figure 8: Failed automobile interlock BAC tests ($BAC \geq .025$ g/dL) by day in New Mexico

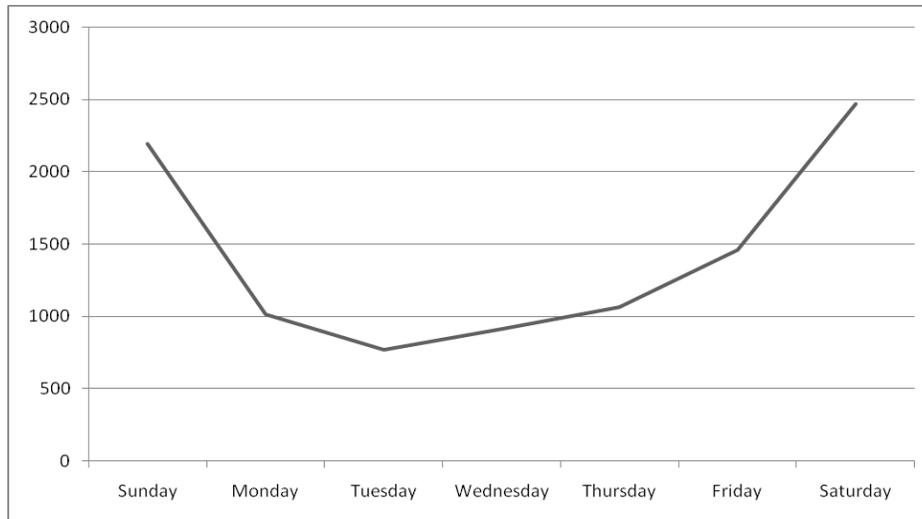


Figure 9: Fatal Alcohol Crashes With Driver BAC \geq .08 by Day of Week; N=9,884 (U.S. 2007 data)

Morning Failed BAC Tests

Survival analyses of interlock BAC test data have shown that the rate of all BAC tests that are failed, and the occurrence of failed BAC tests in the morning hours, are strong predictors of repeat DUI. Evidence published in 2003 (Marques et al., 2003b) found that the rate of failed BAC tests in the morning hours was a significant predictive factor, even after the overall rate of failed BAC tests was entered into predictive models. The reason appears to be that those who have BAC levels above the set point in the morning probably had consumed high levels of alcohol the night before. It may be that those who drink so much that the BAC is still elevated the next day may be further down an alcohol dependence path such that a future DUI is more likely. Nonetheless, in a few cases, there will probably be different reasons for morning failed tests (e.g., shift worker drinking or morning mouthwash), but our conjecture of heavy evening drinking leading to morning fails is consistent with typical rates of alcohol metabolism (3/4 drink/hour) and the consumption of ten or more drinks in the evening – something that is not uncommon for heavy drinkers. Also, this conjecture of heavy drinking is supported by published studies showing that higher rates of morning BAC fail tests predict future DUI recidivism.

We evaluated the presence of morning failed BAC tests among the 407 subjects in the data file and found that slightly over 25 percent of all riders had at least one failed (BAC \geq .025 g/dL) morning test, but not until the 93th percentile did members of this group have 3 or more failed BAC tests. At the extreme, one person at BAC \geq .025 g/dL failed 58 morning BAC tests. Another rider failed 12 times in the morning at BAC \geq .08 g/dL, and 31 times \geq .025. It appears that while there are extreme outliers within the group of offenders who use interlocks on motorcycles, the majority of the riders are very normative, relative to automobile interlock users, in their rates of overall failed tests, and morning failed tests.

Summary Interlock Data from Motorcycles

While the number of records available for analysis were much fewer than those ordinarily available for analysis with automobile interlocks, the overall patterns were similar. The

opportunity presented by the interlock log data helped identify individual operators who fell outside normal interlock performance patterns.

Discussion With Motorcyclists Who Used Interlocks

In an effort to hear firsthand information from actual end users, the project asked manufacturers and installers to contact their motorcycle interlock clients to determine if any of them would be willing to discuss their experiences. Manufacturers and installers asked clients in Washington, Oregon, Texas, and Virginia if they would be willing to be interviewed. Willing clients then had to contact the research team, or give permission to the interlock providers to have their contact information forwarded to the research team. Interviews were conducted with one motorcyclist from Washington State, one from Virginia and two from Oregon. Three used Lifesaver units. One used a Draeger unit. Three were male, one was female. Three rode cruiser-type motorcycles; one rode a sport bike. All interviews took place by telephone and lasted about 30 to 40 minutes. The incentive for the motorcyclist was a \$50 money order. Discussions included, but were not limited to, riders' experiences finding providers of motorcycle interlocks, installation, retesting, protecting the interlock, problems encountered, and overall impressions of the relative safety of and feasibility of motorcycle interlocks.

Administrative Issues

Each of the four riders chose to install interlocks on their motorcycles. Three of them used a motorcycle as their only form of transportation. One of these chose to sell a car and keep the motorcycle because the car needed expensive repair work. Another owned an old truck but chose to not use it during the period of interlock-only driving. The fourth rider owned a pickup truck that was equipped with an interlock and chose to also equip the motorcycle due to enjoyment of riding. Two riders chose to perform retests while riding. One chose not to. One was forbidden to do so by interlock company policy.

In no cases were riders directed to motorcycle interlocks by State officials. In most cases, the riders themselves sought out interlock companies on the internet, in the yellow pages or State-supplied lists. In one case, a rider in Virginia asked a State representative about motorcycle interlocks and the State representative informed him that she had heard Draeger installed them. He therefore arranged to get an interlock from Draeger.

Operational Issues

None of the users reported having any problems with the equipment related to heat, cold or moisture. All believed that the devices were installed in such a way as to be protected from the elements, though most of them tried to avoid riding in the rain and kept the motorcycle protected while parked, either by keeping it inside or under a cover. One rider from the Pacific Northwest who regularly rode in the rain took steps to protect the head unit from the elements. This included keeping the head unit in a plastic bag inside a pouch on the gas tank and moving it inside his jacket in the rain. This rider found he could keep the head unit in his jacket and perform retests while riding by attaching a length of rubber tubing to the mouthpiece. Another rider also reported keeping the head unit in a plastic bag when rain threatened. No users experienced problems with the equipment due to dust or dirt getting into the devices, or the location in which it was installed.

Riders reported that the devices caused a slight constant drain on the battery that would eventually prevent the motorcycle from being started after sitting a few days. The reported length of time that caused this problem varied from about 3 to 7 days. One rider reported not having this problem, though he had been warned to expect it. Riders reported addressing the problem by connecting a trickle charger, disconnecting the battery, and/or disconnecting the head unit while the motorcycle was parked. It is not clear if disconnecting the head unit is sufficient to prevent a current drain.

Interlock Retests on Motorcycles

Riders generally could not hear the audible alarm of the Lifesafer device, but reported being able to see the lights flash on the head units, which were normally attached to the gas tank far enough forward to be visible in peripheral vision. The Draeger unit was modified by attaching an LED light panel and mounting it on the handlebars. The riders reported that the motorcycle interlocks were not more expensive than passenger car interlocks.

Riding Retests

The riders approached retests in two ways. Two Affordable Ignition Interlock users chose to retest while riding. A third believed that it would be unsafe to retest while riding and chose not to do so. That decision was based, in part, on being a relatively inexperienced rider. The Draeger Interlock rider in Virginia was instructed to pull over out of traffic to retest. None of the riders reported having major difficulties in determining when a test was necessary and testing in the allotted time. The Draeger rider reported that the LEDs were in an ideal location to be seen when flashing and not distracting at other times. Lifesafer users were able to see the lights flashing on the units most of the time. Riders had 6 minutes to retest after the notifications began. This was normally sufficient time to detect the notification, pull out of traffic (if applicable) and retest. Occasionally, one of the Lifesafer riders missed the notification and became aware of the need to retest only when the horn sounded a warning that the operator had failed to retest. Lifesafer riders had been told to be aware that notifications were hard to see and hear on the motorcycle and that the horn sounding may be their first indication of the need to retest. One rider reported that it was easier to detect the lights on the head unit than she had expected, based on warnings from the vendors. Not surprisingly, the greatest difficulty for riders was detecting the lights on the Lifesafer unit when it was in the user's jacket.

The two riders who chose to test while riding reported having little problem doing so, but they noted that the primary problem was testing in stop-and-go traffic – a time when riders need both hands to operate the clutch and throttle nearly constantly. These circumstances required that the rider pull out of traffic to perform the test. One rider had this happen a few times and the other reported that she did not ride in that type of traffic but could imagine that this would cause a problem.

The two riders who chose to retest while riding both wore full-coverage helmets that covered their mouth. One user had a helmet with a chin bar that could be raised up out of the way for testing. The other purchased a helmet with an opening large enough that the chin bar could be pushed down far enough to get the mouthpiece into her mouth through the opening. She reported that there were two types of mouthpieces supplied by the company with slight differences in shape that made one more difficult to use.

Circumvention

Riders believed circumventing the system would be difficult. None of the motorcycles had kick starters. Riders believed that their motorcycles were too heavy to push start them by running with them on a flat surface then engaging the transmission. It would probably be possible to bump start them by coasting down a steep hill; however, they believed, and installers confirmed, that bump starts could be identified on the data log. One rider expressed the belief that it would be easier to find someone to blow for him than to circumvent the system by bump starting. Even if one were successful at starting the engine without blowing, riders understand the logic of the device to be such that it would register a start without a test and require them to perform a test within a short time.

Riders understood that circumvention attempts can be detected. They generally believed that the interlock company was looking at the data, but were uncertain as to whether anyone at the State level was looking closely enough to detect circumvention attempts.

Security

Riders generally were unconcerned about the security of the equipment or the likelihood of others tampering with it. They kept their motorcycles in garages or under covers at night. At work, the motorcycles generally were kept in secure locations where others were not likely to bother them. Some parts of the system were installed in out-of-the-way areas of the motorcycle that others were unlikely to see. Other parts could be kept out of sight in saddle bags and handlebar-mounted bags. Saddle bags could be locked, though depending on where the motorcycle was parked, riders may not have bothered doing so. Some users reported disconnecting the head units of the interlock system and taking them with them when they left the motorcycles. This helped protect them from theft, tampering and the elements. One user reported assuming that this also protected the motorcycle from theft, as it could not be started without the head unit. Riders believed that little of the equipment was visible to others and that others would be unlikely to vandalize the equipment. One user reported that while he was elsewhere, a visitor to his garage decided to turn on the ignition and blow into the device, which resulted in an alcohol-positive reading.

Equipment Malfunctions

Other than the problems related to battery draining, riders reported few problems with the interlocks and most of them were not related to their being installed on motorcycles. One user reported having a device stop functioning so that he was unable to start the motorcycle. The company was near enough to send someone out with replacement equipment. Another time, while the motorcycle was parked at the rider's work location, the device malfunctioned causing the horn to sound until the horn unit failed. The riders interviewed were content with the installation process. Most installations took between one and two hours. On some occasions, it was necessary to leave the motorcycle for much longer. At least one rider had to travel for a long distance to have the installation done. Users generally felt that the installers were competent and professional, though one user believed the installer could have done a neater job of bundling cables, hiding them away and sealing spliced cables against the elements. In discussions with users and installers, it was reported that speed of installation can be significantly affected by installers' familiarity with the wiring and configuration of the motorcycles with which they are working.

Riders reported no problems getting vehicles to the interlock providers for data downloads and maintenance. Only one of the riders interviewed had more than one vehicle equipped with an interlock, limiting the likelihood that this sample of riders would report having difficulties related to getting multiple vehicles to providers. The three users with Lifesafer interlocks were eligible to use the mail swap system, but only one who lived at considerable distance chose that option. The mail option allowed her to receive new head units by mail and send previous units (with all the log data) back by mail. All other users visited service centers for data download.

Motorcycle Interlock Usage

All interviewed users were new to the interlock and most used the motorcycle as their only form of transportation. Two users reported that the added inconvenience may have made them slightly less likely to use the motorcycle for recreational riding. In contrast, another rider who does extensive recreational riding was not dissuaded by the interlock.

Overall, users were positive about their experience using the motorcycle interlock and working with the interlock providers. They experienced few problems with the system. There were suggestions that making the Lifesafer head unit smaller would make it easier to store safely and use while riding, though it was also suggested that the unit was already relatively small, which may be why it worked as well on a motorcycle as it did, compared to other interlock devices. Another Lifesafer user suggested that an externally-accessible switch to cut power to the unit would make it easier to avoid the problem of battery drainage while parked. It should be noted that all users expressed gratitude that a motorcycle interlock was available to them.

While we cannot know if these riders are typical, they do represent the first verbal accounts of end users' experiences with motorcycle interlocks.

Summary and Conclusions

Feasibility

All the manufacturers interviewed said that motorcycle interlocks are technically feasible, but there was considerable difference of opinion as to whether the current equipment is adequate for the task. All believed the retesting requirements in most State standards add a safety complication. All also believed that the retesting constraints, together with the low volume of demand at the current time, makes the business fairly unattractive. The manufacturers that currently offer motorcycle interlocks reportedly do so as a convenience for their customers, but only if a State allows it, if their local staff can install it, and if the user assumes the liability. The motorcycle is far from an ideal platform for an interlock designed for automobiles, but neither is it fundamentally inadequate.

The few installers and riders that we interviewed did not feel particularly concerned about the adequacy of the current equipment. It works for them. The riders felt the ability to use their motorcycles outweighed the limitations of power drain, retesting issues, weather and other considerations. As people with direct motorcycle interlock experience, these users and installers have provided valuable insight. It should be noted, however, that these more tolerant views of the current equipment are from small samples, none of whom are apt to be very objective since one group earns money doing motorcycle interlock installations, and the other group actively pursued

getting interlocks onto their motorcycle and continue to use them. The users interviewed and those we have heard about are people with relatively expensive motorcycles who made an effort to find a way to install an interlock on their motorcycles. They really wanted to ride. Also, these owners are taking good care of their motorcycles and this may reflect how well they care for the interlock as well. It cannot be known to what extent these users may be representative of the larger motorcycle interlock-using population if motorcycle interlock use were to become more widespread.

Cost

Cost seems to be no more of an issue with motorcycles than with automobiles. Offenders pay about the same cost and none of the vendors suggested that there was an additional fee for motorcycle installations.

Safety Considerations

The main safety consideration is retesting while riding. This risk, however, has a context. Is retesting while riding less safe than other motorcycle hazards (e.g., operating in bad weather, cornering on gravel surface, weaving in traffic, speeding)? All interviewees agreed retesting while riding is probably not safe enough. The sole exception to this consensus view was from the two people who are actually doing it, an attitude that is not surprising. If they believed it unsafe, they would be less likely to do it. Alternatively, practice and experience do matter and that does reduce risk. Whatever the user views, these safety topics are empirical questions, which like so many of the topical sidebars for alcohol interlocks, may not be subjected to an evaluation study in the near future. Possibly of greater importance to the interlock providers is whether a rider who crashes while retesting would be apt to file suit against the installer or manufacturer. The safety question is difficult to separate from the liability question. Until there is a court test of whether the liability waivers mean very much, this could remain a gray area. In the meantime, as helmet laws and injury statistics attest, rider safety is not always the foremost consideration in setting State policy.

Program Standards for MC Interlocks

Motorcycles are not automobiles with two wheels. They vibrate more; they are often exposed to windy, wet, hot, dusty weather; they have small power storage systems; they require a different skill set to operate than a car; the riders are more vulnerable in the traffic stream; operator error can have more disastrous consequences for a rider than for a driver; and riders must demonstrate special skills to receive a motorcycle license. On those bases, it may be insufficient to impose interlock standards developed for automobiles to meet the needs of interlocks installed in the motorcycle environment.

Final Note

This report summarizes some of the issues surrounding the question of feasibility of, and possible barriers to, more widespread use of alcohol ignition interlocks on motorcycles. The authors conclude that motorcycle interlocks are feasible, and are currently being used by motorcycle operators in at least 1/3 of the States.

The current interlock devices, programs, and laws specific to motorcycles could (and it seems should) be improved. Perhaps, a few manufacturers may be willing to embrace the

challenge of designing and building an interlock that is more specifically suited for this operating environment. Comments received from manufacturers suggest that companies are unlikely to invest in the development costs of a motorcycle-specific interlock unless the States and NHTSA support the effort. But, in the meantime, there appears to be no engineering barrier to using existing interlock equipment on motorcycles.

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Appendix A: State Laws, Policies, and Practices Regarding Motorcycle Interlocks

State	Interlock Required On All Vehicles*	State Policy Regarding Motorcycle Interlocks	Presence of Motorcycle Interlocks
ALABAMA	X*		
ALASKA	X		
ARIZONA	No	Allowed	Yes
ARKANSAS	No	No policy	No
CALIFORNIA	Yes	Disallowed ⁵	No
COLORADO	Yes	Not required in practice	No
CONNECTICUT	Sometimes ⁶	No policy	Unknown
DELAWARE	Yes	Not required in practice	No
DISTRICT OF COLUMBIA	X		
FLORIDA	Yes	Not required in practice	No
GEORGIA	X		
HAWAII	X		
IDAHO	No	No policy	Unknown
ILLINOIS	Sometimes	Disallowed	No
INDIANA	Yes	Not required in practice	No
IOWA	Yes	Not required in practice	No
KANSAS	Sometimes ⁷	No policy	Unknown
KENTUCKY	No	No Policy	Unknown
LOUISIANA	No	No Policy	Yes
MAINE	X		
MARYLAND	Unknown	No policy	No
MASSACHUSETTS	Yes	Disallowed ⁸	No
MICHIGAN	Yes	Allowed	Yes
MINNESOTA	No	No policy	No
MISSISSIPPI	Yes	Not required in practice	No
MISSOURI	No	Allowed	Yes
MONTANA	Unknown	Unknown	Unknown
NEBRASKA	Yes	Allowed but not required in practice ⁹	Yes
NEVADA	No ¹⁰	No policy	No

⁵ Motorcycles specifically exempted by new law from requirement to equip all vehicles with interlock

⁶ At judge's discretion

⁷ Yes for court cases, no for administrative cases

⁸ MC registrations are voided during interlock period

⁹ No specific policy, therefore considered allowed if the providers are willing

¹⁰ Generally no, in some specific cases (e.g., offenders in intensive supervision programs), yes

State	Interlock Required On All Vehicles*	State Policy Regarding Motorcycle Interlocks	Presence of Motorcycle Interlocks
NEW HAMPSHIRE	X		
NEW JERSEY	Yes	Not required in practice	No
NEW MEXICO	No	Allowed	Yes
NEW YORK	Yes	Not required in practice ¹¹	No
NORTH CAROLINA	Unknown	Disallowed ¹²	No
NORTH DAKOTA	X		
OHIO	No	No policy	No
OKLAHOMA	X		
OREGON	No	Allowed	Yes
PENNSYLVANIA	Yes	Required ¹³	Yes
RHODE ISLAND	No	No policy	No
SOUTH CAROLINA	X		
SOUTH DAKOTA	X		
TENNESSEE	X		
TEXAS	Sometimes ¹⁴	Allowed	Yes
UTAH	No	No policy	No
VERMONT	X		
VIRGINIA	Yes	Required ¹⁵	Yes
WASHINGTON	No	Allowed	Yes
WEST VIRGINIA	Yes	Disallowed ¹⁶	No
WISCONSIN	No ¹⁷	No policy ¹⁸	No
WYOMING	No	No policy	No

*X = Fewer than 2,000 interlocks and fewer than 5 interlocks per 10,000 population.

¹¹ The decision of whether to provide motorcycle interlocks has been left up to vendors who have opted not to provide them, therefore not the requirement to install an interlock is not enforced for MCs

¹² State policy influenced by request of vendors not to allow motorcycle interlocks

¹³ Interlocks officially required on MCs, though the State acknowledges that lack of access to them and other factors are keeping the actual number of installations down.

¹⁴ At court's discretion

¹⁵ Requirement to equip motorcycles is being enforced. Providers are being asked to begin equipping motorcycles with interlocks

¹⁶ Motorcycles are prohibited from having interlocks installed. For the duration of the interlock restriction, the rider's motorcycle endorsement is invalidated. Offenders physically surrender the driver license showing the motorcycle endorsement in exchange for a license with no endorsement and noting the interlock restriction.

¹⁷ The overall law requires offenders to install interlocks on all vehicles they own, but provides a list of *exempt* vehicles. Prior to July 2010, this specifically exempted motorcycles from having interlocks installed. This was interpreted by some as a loophole that allowed interlock-stipulated offenders to operate motorcycles. In July 2010 this law was changed such that motorcycles are not exempted from needing interlocks. However there are currently no motorcycle interlocks available.

¹⁸ No specific policy to forbid motorcycle interlocks, but vendors have decided not to provide them.

Appendix B: Observations of an Installation of a Draeger Safety XT Interlock on a Motorcycle

On May 6, 2010, project personnel and NHTSA staff observed the installation of a Draeger Model XT interlock on a 2008 Honda Shadow motorcycle (Figure 10). This motorcycle has a 12-volt battery located under the rider's seat. The ignition switch and starter button are mounted on the right handlebar. A cable harness was sliced open and ignition control wires identified with a probe. Interlock control wires were spliced into the starter switch wires below the handlebar. After the splice the cable was sealed before it passed rearward below the tank (Figure 11) toward the battery compartment (Figure 12). After wiring the interlock, the sampling head unit was mounted on a utility bag in the middle of the handlebars. Figure 13 shows the storage bag with an interlock and mouthpiece attached. Figure 14 shows the bag with the interlock inside and reasonably secure from the elements. Figure 15 demonstrates the hookup of the interlock unit to the data transfer holster and computer cable when downloading data.



Figure 10: 2008 Honda Shadow Cruiser-type Motorcycle



Figure 11: Wire cable runs beneath the fuel tank toward the battery



Figure 12: Seat removed, battery hookup connectors



Figure 13: Handlebar secure pouch with interlock at rest atop



Figure 14: Handlebar protective pouch closed



Figure 15: Arrangement for download of data to computer via handset

Appendix C: Survey Information on Interlock Penetration

The annual survey of interlock penetration conducted by Richard Roth of Impact DWI, a non-profit citizen action group in Santa Fe, NM, provides the only information available from any source about the interlock activity on a State-by-State basis, the survey information is only available on the impactdwi.org website. The national data represents all (as of then, 12) companies. However, one of the companies will not disclose State-by-State interlock units in service. With that potential error source in mind, the 2009 interlock count by State is shown in Figure 16. It shows that approximately 88 percent of all U.S. interlocks were found in 19 States with 2,000 or more devices. Those 19 States had approximately 63 percent of the national population.

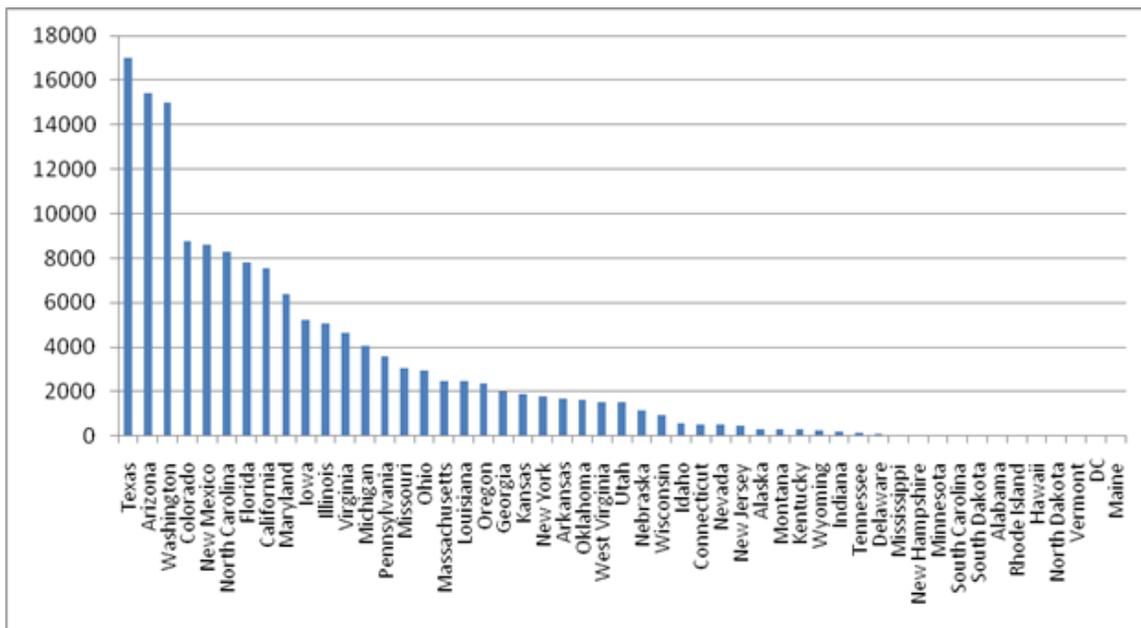


Figure 16. 2009 State-by-State estimates of interlocks installed, based on 11 of 12 companies reporting. Source: R Roth, ImpactDWI.org.

Tabular detail of those 19 States is shown in Table 5 with a breakout of interlocks, population and fatal alcohol crashes. The top row representing the sum of individual States is short of the true U.S. total by approximately 31,000 interlocks (based on the 2009 national number of 180,000) because of the one company that will not provide State level data. That supplier has a large presence in Texas, New Mexico, Washington, and Arizona – States already with the largest number of interlocks – so the top States identified are likely approximately correct. Texas, with at least 17,025 devices, tops the list. Oregon, 19th on the list, has 2,392 devices installed. Texas through Oregon represents those States with at least 2,000 devices.

Other columns in Table 5 show the State populations in 2008 and an estimate of the number of interlock devices installed per 10,000 people. Population is not the most germane denominator for addressing the alcohol road safety, but unlike the imprecise estimates of arrests or convictions, population is based on the U.S. census and therefore estimated under the same methods for each State. Table 5 actually includes 27 total States. The top 19 States based on interlock count are shown above the horizontal line. In addition to the States with more than

2,000 devices, there are 17 States that have a per capita installed rate that exceeds the national average of about five devices per 10,000 residents (4.96 shown in row 1). Twelve of the 17 States that have more devices than the national average based on population also have over 2,000 total devices. These high interlock States are shown in boldface from Texas to Oregon. Below the horizontal line, the table extends to include the additional 5 States (in boldface) that have a higher rate of installation per capita than the national average shown in Row 1.

In addition, using the FARS estimates of fatal alcohol-involved crashes by State (NCSA, 2009a), Roth gives an estimate of the interlocks installed per alcohol related fatality. The interlocks per fatality provide a rough estimate of penetration relative to problem magnitude.

Table 5. 2009 Data: States by Total Interlocks and Interlocks per .08+ Fatalities (Richard Roth, ImpactDWI.org). Boldface States are above national average of interlocks/10,000 population.

	STATE	2008 Population	Estimate of Nine Providers	Interlocks per 10,000	2008 Impaired Driving Fatalities .08+ g/dL	Interlocks per Fatality
	US	300,106,948	148,742	4.96		
	2009 Missing		31,000			
1	Texas	23,747,064	17,025	7.17	1,269	13.42
2	Arizona	6,294,036	15,397	24.46	266	57.88
3	Washington	6,415,660	14,974	23.34	182	82.27
4	Colorado	4,834,550	8,775	18.15	173	50.72
5	New Mexico	1,945,982	8,625	44.32	105	82.14
6	North Carolina	9,365,039	8,303	8.87	423	19.63
7	Florida	18,152,366	7,791	4.29	875	8.90
8	California	36,335,137	7,545	2.08	1,029	7.33
9	Maryland	5,594,699	6,400	11.44	152	42.11
10	Iowa	2,979,785	5,225	17.53	89	58.71
11	Illinois	12,770,508	5,048	3.95	362	13.94
12	Virginia	7,662,305	4,641	6.06	294	15.79
13	Michigan	10,003,565	4,038	4.04	282	14.32
14	Pennsylvania	12,344,825	3,589	2.91	496	7.24
15	Missouri	5,837,947	3,063	5.25	310	9.88
16	Ohio	11,402,240	2,974	2.61	356	8.35
17	Massachusetts	6,415,660	2,488	3.88	124	20.06
18	Louisiana	4,256,836	2,475	5.81	338	7.32
19	Oregon	3,739,935	2,392	6.40	136	17.59
20	Georgia	9,486,663	1,995	2.10	416	4.80
21	Kansas	2,766,943	1,919	6.94	145	13.23
22	New York	19,186,169	1,762	0.92	341	5.17
23	Arkansas	2,827,755	1,704	6.03	171	9.96
24	Oklahoma	3,587,905	1,635	4.56	244	6.70
25	West Virginia	1,793,952	1,503	8.38	128	11.74
26	Utah	2,645,320	1,497	5.66	46	32.54
27	Nebraska	1,763,546	1,136	6.44	55	20.65

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