B. COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS

B1. DESCRIBE THE POTENTIAL RESPONDENT UNIVERSE AND ANY SAMPLING OR OTHER RESPONDENT SELECTION METHODS TO BE USED.

B1.1 Potential Respondent Universe

The sampling frame is the set of all police-reported traffic crashes that include motorcycles in the United States. An ideal sample would be drawn randomly from the 103,000 such police reported crashes that occur each year (NHTSA, Traffic Safety Facts, 2005). However, such a sampling plan would require research teams to respond to a randomly drawn sample of those 103,000 different crash locations, something beyond the budget for this project. Alternatively, a clustered sampling plan could be used similar to that used in the National Automotive Sampling System. However, this also is well beyond the budget allotted by Congress for this study. Therefore, operational considerations dictate that a limited geographic area be selected from which to draw the crash sample. The plan is to draw from police jurisdictions in a single geographic area. This area will cover diverse demographic and geographic characteristics and experience substantial numbers of motorcycle operators year-round. Orange County, California has been selected as the data collection region because of the large number of motorcyclists with diverse population and geographic characteristics. Furthermore, the pilot study was successfully conducted in this region and a relationship with local law enforcement has already been established. Precedents exist for performing studies on vehicle crashes from investigations conducted in a single geographic location. Nevertheless, it is recognized that this study is not nationally representative, although it is anticipated that the most common crash types and most common antecedent conditions leading up to the acquired crashes will be represented in the study. Nonetheless, the single location will be considered as a limitation when using crash data collected from this study and as a result, language will be included in reports and analyses that use this data to acknowledge this limitation:

> "The Motorcycle Crash Causation Study chose southern California as the data collection site because of previous successes in collecting crash data in this region, in addition to climate and budgetary considerations. This single data collection location is a limitation of the study in that the distribution of causative factors in motorcycle crashes in southern California may not represent the entire United States."

B1.2 Crash Sample Acquisition

The pilot study developed and evaluated data collection forms, field methods, coding instructions, training materials and crash notification systems that will be used in the main study. The research samples for the pilot study and for the full-scale study include all police reported, motorcycle-related crashes that occur in the selected police jurisdictions within the study period. For the pilot study, 53 crash notifications were received during a three-month period. Only 6 out of the 53 cases were dropped due to a lack of cooperation, resulting in an 89% response rate. For the main study, a maximum of 1200 crash investigations are planned, along with 2,400 matched case controls. It is assumed that the main study will see a response rate similar to that of the pilot study.

A sample size of 1200 was chosen because it is anticipated that this size sample can be acquired within the geographic area, and a sample this size can be acquired in a single large jurisdiction in

a two-year period. Furthermore, the power analysis was conducted based on the data collected from two previous studies (Hurt, 1981 and MAIDS, 2004) with the same or similar data collection methodologies. The power used to determine the necessary sample size was considered to be the standard β=0.80 while the level of desired statistical significance was set at α=.05. Based on the data obtained from the Hurt study, conducted in Southern California, and the MAIDS study, conducted with the OECD data collection methodology, it was determined that a maximum of 1200 cases with 2400 controls would be sufficient to provide statistically significant results for many or all of the desired analyses.

The acquisition of motorcycle-related crashes will be identified through cooperative agreements with the selected police jurisdictions. The crash investigators will be notified by police dispatchers when an applicable crash is reported, and will initiate their investigations on-scene in concert with first responders. Crashes of all severities from minor property damage to fatality will be included.

An advantage that was not available in the Hurt study is that the data elements for this study that are in common with those collected by National Automotive Sampling System and the National Motor Vehicle Crash Causation Study have been identified so that they can be cross-referenced. This allows the results from the current study to be compared to the in-common nationally representative data from these other NHTSA programs. This study is anticipated to provide more detailed information on motorcycle crashes and motorcyclist characteristics than is available in the other programs because of the unique data elements that will be collected pertaining to motorcycle and operator factors. Examples include operator training, experience and behaviors, and specific motorcycle features and condition.

B1.3 Control Sample Acquisition

The collection of control data also has antecedents in passenger vehicle safety research projects and motorcycle research projects. The current study will use a more stringent procedure than either of these studies for acquiring similarly at risk motorcyclists by capturing data from non-crash involved motorcyclists and passenger vehicle drivers (control subjects) matched on location, travel direction, and day of week, and time of day as the selected crash-involved parties. Acquiring data on controls matched this way (that is, similarly-at-risk controls) allows for the calculation of relative risks that can be used for developing countermeasures. In the Hurt study in the 1970s, this approach identified several significant risk factors for crashes. One was that riders who had received formal training were less likely to be involved in a crash or to suffer serious injury. Also, crash involved motorcyclists used daytime headlamps only about half as often as did those in the control group.

B2. <u>DESCRIBE COLLECTION OF INFORMATION PROCEDURES.</u>

The OECD identifies two complementary procedures to be performed for acquiring the data needed to understand the causes of motorcycle crashes. The first of these is the traditional in-depth crash investigation that focuses on the sequence of events leading up to the crash, and on the motorcycle, rider, and environmental characteristics that may have been relevant to the crash. The second procedure, known as the case-control procedure, complements the first. It requires the acquisition of matched control data to allow for a determination of the extent to which rider and driver characteristics, and pre-crash factors observed in the crash vehicles, are present in similarly-at-risk, non-crash involved control vehicles.

Such a dual approach offers specific advantages to the understanding of crashes and the development of countermeasures. The in-depth study of the crash by itself allows for analysis of the events antecedent to the crash, some of which, if removed or altered, could result in a change in subsequent events that would have led to a non-crash, or reduced crash severity outcome. For example, an in-depth crash investigation may reveal that an automobile approaching an intersection was in a lane designated for straight through traffic only, but the motorist proceeded to make a left turn from that lane into the path of an oncoming motorcycle. That finding can, by itself, be used to develop countermeasures, and does not require matched control data. However, acquiring matched control data from similarly-at-risk riders and drivers provides additional critical information about crash causes that cannot be obtained if only crashes are examined. Perhaps the crash-involved motorcycle operator was not using daytime running lights, but the matched controls both used such conspicuity features.

B2.1 Crash Investigation Procedures

Once a crash notification has been received, several activities are initiated by the research team. Crash investigators immediately locate, visit, measure, and photograph the crash scene (while the vehicles are still there, to the extent possible). They locate, inspect, and photograph all involved vehicles. The investigators conduct an in-person or telephone interview with each involved person or surrogate. Because inclusion in the research is strictly voluntary, the investigators will use a script similar to the following:

"Hello, we are conducting a study of motorcycle safety for the NHTSA/FHWA and would like to ask you a few questions. This is expected to take about 25 minutes of your time. All information that you provide will be kept strictly confidential. We do not include any names, addresses or other personal identifiers in our records".

Injury information from hospital or emergency room records or medical examiner reports is obtained and encoded for all injured victims. Surrogate interviews are used when a person is not able to be interviewed because of hospitalization or incarceration. Note that participation in the study is completely voluntary and the confidentiality safeguards described in Section A above will be strictly followed. During each activity the researchers record information on the appropriate crash, vehicle, and environment data forms. No personal identifiers are ever entered into any system of records.

B2.2 Control Data Collection Procedures

For the control data, researchers will interview motorcycle operators and motor vehicle drivers who pass by the site of a selected crash either for one hour immediately following the crash occurrence, or at one week after the crash at the same time of day. The timing of the control data collection effort will be determined by the current circumstances at each site (traffic congestion, police permission, and crash-data availability). Priority will also be given to obtaining crash data as rapidly as possible before it can be affected by traffic, weather or clean-up activities. If weather (or other) conditions differ substantially on the week following the crash, then the control sample collection will be moved to the week following.

Police help may be enlisted in asking motorcyclists and motor vehicle drivers to participate in the study if the police jurisdiction determines that this is necessary, or the site characteristics make such data collection tasks risky. Vehicles will be selected by type (passenger cars, trucks,

etc. similar to those involved in the fatal crash). Interviews will be conducted with the operators of the motorcycle and the drivers of the targeted other vehicles. Motorcycle inspections will also be conducted so that the type and condition of the vehicle can be recorded. Two control motorcyclist interviews will be captured for each single vehicle motorcycle crash. For two-vehicle crashes, one control motorcyclist and one control motor vehicle driver (similar to the crash-involved vehicle) will be interviewed. The number of controls captured per crash is relatively small because increasing the control sample size beyond the size of the crash sample yields diminishing returns on statistical power. One general problem these kinds of studies face is response bias. This problem is recognized and will be acknowledged in the final report.

B3. DESCRIBE METHODS TO MAXIMIZE RESPONSE RATES AND TO DEAL WITH ISSUES OF NON-RESPONSE.

Motorcycle operators, passengers and the drivers of other involved vehicles will be interviewed at the scene of the crash whenever possible. If these individuals have been medically transported, arrested or are otherwise not available for immediate interview, follow-up efforts will be initiated. Occupants will be contacted by telephone to arrange for an in-person interview if one can be arranged. Telephone interviews will be conducted only when necessary. Several methods are used to maximize response rates. Researchers call at varying hours (often in evenings or on weekends) until they have located the driver, operator, or passenger sought. When the person is unavailable (for medical or legal reasons), other family members or witnesses may be contacted to provide whatever limited information is available to them. Each researcher is given special training in interviewing. This increases the possibility that crash-involved persons will cooperate once they have been located and contacted. At least four follow-up phone calls will be made to reach necessary respondents.

Attempts will be made to recruit control drivers for interviewing at site-time matched locations (see Section 2.1.2). During the designated time period, the recruitment effort will continue until a control driver has agreed to participate, or the matched time period has ended. In the latter case, the same recruitment effort will be repeated at the same location during a second time period a week later, and if needed in subsequent weeks. We note that even if a motorcyclist does not cooperate, Westat will be able to identify the approximate size and type, the rider's approximate age and gender by observation, and so Westat might also be able to match non-responding riders to crash-involved riders on a few key variables such as use of protective equipment, riding speed, etc.

It is anticipated that some information items may not be obtained even for riders who are willing to participate in the research. Westat plans to impute such missing item responses using traditional methods of imputation such as the hot deck.

Regarding the problem of refusals and bias that may be introduced by non-responders, it should be noted that response rates have been exceptionally high in the pilot study as well as other crash investigation research projects and therefore non-response bias is not expected to be a problem in this project. In the most important prior motorcycle crash study conducted in the US, (Hurt, Ouellette, Thom, 1981) refusal rates for both crash and control motorcyclists were near zero (personnel communication, Ouellette, 2007). However for drivers of cars involved in crashes with motorcycles they were about 25%. In a more recent automotive crash study focused on alcohol involvement that was conducted by NHTSA (see Compton, R. P., Blomberg, R. D.,

Moskowitz, H., Burns, M., Peck, R. C., & Fiorentino, D., Crash Risk of Alcohol Impaired Driving, in D. R. Mayhew and C. Dussault (Eds.), *Proceedings of the 16th International Conference on Alcohol, Drugs*) refusal rates were 7.55% for crash drivers and 2.12% for control drivers. For NHTSA's National Automotive Sampling System (NASS) annual crash study, refusal rates in 2006 were in the 26% range). However, most NASS interviews are conducted by telephone, and refusal rates in this current study are expected to be much lower as interviews will be conducted at the crash scenes. The pilot study experienced a response rate of 89% and it is expected that the main study will see a similar result. Regarding the matter of analyses to be performed on sub samples, FHWA and NHTSA recognize that the matter of non-response is to be given careful attention with respect to the potential of bias when sample sizes are effectively reduced in sub sample analyses.

B4. DESCRIBE ANY TESTS OF PROCEDURES OR METHODS TO BE UNDERTAKEN.

The NHTSA Pilot Study served as a test of the procedures to be used for the Main study. It was found that the OECD procedures were very applicable to the U.S. environment. Minor modifications to the methodology were made to accommodate differences in the units of measurement and language, but as a whole, the methods to be employed in the main study will be those outlined in the OECD methodology.

B5. PROVIDE THE NAME AND TELEPHONE NUMBER OF INDIVIDUALS CONSULTED ON STATISTICAL ASPECTS OF THE DESIGN AND THE NAME OF THE AGENCY UNIT, CONTRACTOR(S), GRANTEE(S), OR OTHER PERSON(S) WHO WILL ACTUALLY COLLECT AND/OR ANALYZE THE INFORMATION FOR THE AGENCY.

B5.1 Statisticians Consulted

Ms. Roya Amjadi, Safety Research and Development, reviewed the statistical approach for FHWA. She can be reached at 202.493.3383

Paul Zador, Ph.D, Senior Statistician, Westat Corporation provided consulting services. Tel. 301.294.2825.

Abe Ahmad, Ph.D. Head of Statistics, Oklahoma State University provided analyses regarding power and sample size. He can be reached at 405.144.9659.

B5.2 Agency, Contractors, Grantees

NHTSA

Maria Vegega, Ph.D, Office of Behavioral Safety Research, National Highway Traffic Safety Administration (NHTSA) overall was responsible for the Pilot Study and for NHTSA recommendations regarding the Main Study. She can be reached at 202.366.2668

FHWA

Carol Tan, Ph.D, Office of Safety Research and Development, Federal Highway Administration (FHWA), is responsible for the large-scale study. She can be reached at 202.493.3315.

Contractors
The contract for the Pilot Study–Motorcycle Crash Causes and Outcomes, contract DTNH22-05-C-05079, was awarded to Westat in September, 2005. Ms. Frances Bents was the Project Director. She can be reached at 240.314.7557.

The cooperative agreement for the Motorcycle Crash Causation Study (DTFH61-06-H-00034) was awarded to the Oklahoma Transportation Center (OTC). Dr. Samir Ahmed is the Project Director and Principal Investigator. He can be reached at 405.744.5261.

OTC has named Westat as the subrecipient under the cooperative agreement. Ms. Frances Bents is the Project Manager for data collection. She can be reached at 240.314.7557.

Westat
1600 Research Blvd.
Rockville, Maryland 20850

Westat has the following subrecipients under its award:

Dynamic Science, Incorporated (DSI). Mr. James Perry is the Field Manager for data collection. Michael Kaszubowski is the Director of Contract Management. He can be reached at: 602.995.3700

Dynamic Science, Inc.
8433 N. Black Canyon Highway
Phoenix, Az. 85021

James Oullette, consultant, will assist with training, data quality control, and helmet inspection. He can be reached at: 310.306.9194

James Oullette
8117 Manchester Ave. #668
Playa Del Rey, Ca. 90293

Dynamic Research, Incorporated (DRI). Dr. Terry Smith, principal scientist, will assist with training, data quality control, and OECD coding. He can be reached at: 310.212.5211

Dynamic Research
355 Van Ness Ave.
Torrance, Ca. 90501

CI-Dynamics, Incorporated. Helmet testing will be conducted by CI-Dynamics. David Thom is the Principal Scientist. He can be reached at: 310.414.0449

CI-Dynamics
149 Sheldon St.
El Segundo, Ca. 90245