

Standard Electronic External Review Form for Division of Safety Research Intramural Projects

A. IDENTIFICATION

Name of Project Officer : Jinhua Guan
Title of Proposed Project: NIOSH Pilot Study of Truck Driver Anthropometric and Workspace Dimensions
Name of Reviewer:
Telephone Number of Reviewer:
Fax Number of Reviewer:
E-mail address of Reviewer:

B. CRITIQUE

1. Significance:

Does this study address an important problem in occupational safety? If the aims of the project are achieved, will scientific knowledge be advanced? Is the effect or impact of this study likely to reduce worker injuries?

This study addresses a very important area of scientific data that underlies product design: anthropometry. Recent small studies and anecdotal reports indicate the older research conducted on behalf of SAE in the early 1980's are now out of date and need to be replaced. The CAESAR data has proved inadequate for application to this specialized population of truck drivers. While it would be difficult to measure the affect of anthropometry on comfort, it is possible to correlate certain injuries to anthropometry. For example, if the anecdotal reports are true, the shape of the population distribution curve for height may have both shifted and changed shape due to a larger proportion of females and Hispanics in the commercial truck driving population. When translated to vehicle design, this will potentially change the location of steps and grab handles for ingress and egress. This will potentially affect the slip and fall rate for the truck driver population. Unfortunately, anthropometry is only one factor and will not affect the driver's psychological state or attitude toward safe practices, so the impact may not be easily measured. It is possible to correlate some crash injuries to anthropometry, such as the distance between the drover's body and the steering wheel or distance of the head from the header. The contribution to each potential injury is small, but adds up across to the cab design to a significant overall contribution to vehicle safety.

2. Approach:

Are the scientific framework, design (including the composition of the study population), methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Does the project officer acknowledge potential methodological limitations?

Yes, the project manager has developed a well thought out and rigorous scientific project. There are questions from the trucking industry about whether such a large data set is necessary or is simply desirable. This industry is fiscally conservative and has often "made do" with whatever was available on a very limited budget instead of being concerned about what would stand up to rigorous scientific scrutiny. The primary driver is cost; therefore, in this case, there will be some questions regarding why data is being collected with both a manual and digital method. It would be beneficial to provide additional explanation as to how correlating the two methods will be of benefit scientifically and practically to the industry. Does this have the potential to allow mathematical conversion of old manually collected data for use in a combined database?

There will be a significant amount of time between the when the driver sits in a cab and when he or she sits in the buck for data collection. This could lead to a consistent error in the workspace data. In the protocol for adjusting the buck, the process should be iterative. The actual process of adjusting a seat in a cab is iterative.

The necessary difference between operational body positions and data collection body positions should be discussed in more detail. For example, in the seated position, the knee will be placed at a 90 degree angle *with the feet in line*

with the thighs. This is not a typical operational position for long haul drivers because they tend to relax their leg muscles so the knees are outside of the feet. However, to my knowledge, this operational driving position has never been quantified only described. To change the body position in this study would isolate the data and render it useless for comparison to data sets for other populations. As a result, I am not suggesting the data collection be changed, only that the issue be discussed in more detail for the benefit of the people who will use the data.

3. Innovation:

Where needed, does the project employ novel concepts, approaches or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?

This pilot study does not need a tremendous amount of innovation in the concept or approach. It is straightforward in responding to the needs of the scientific and engineering communities. The project manager has endeavored to address unique issues such as the specific types of seats, the variety of cabs and foot pedals in the functional positions, and the very important issue of the population composition. The cab buck does not have a shift tower. While shift towers have changed significantly, it does not appear they will be disappearing anytime soon. While the tower should not have an affect on any measurements, it may have a psychological affect on the drivers. Consider questioning participants about this issue or addressing the issue in the pilot study.

One area that has the potential for innovation and cost savings in the follow-on study would be the use of existing anthropometric data to extrapolate new data. This approach would collect a smaller sample of the entire data set. A subset of core data would be collected on the remaining subjects. The smaller sample would be used to develop a model for extrapolating the remaining data from the core data set of the larger group of subjects. Would it be possible to develop a model to apply to the Sanders descriptive data, effectively updating the old data set? This approach has been discussed by some in the industry and is worthy of discussion. Is it possible to evaluate this concept as part of the pilot study? Has it already been evaluated and discarded for some reason?

4. Project Officer (Investigator):

Is the project officer appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the project officer and other researchers (if any)? For new or less experienced NIOSH staff, note if the level of supervision appears adequate.

The project officer has clearly demonstrated the knowledge and experience to complete this work. He has demonstrated an appropriate degree of openness listen to people in the truck design community. He has actively sought the experts in the industry for their possible contributions while developing the project and utilized their advice. I am not quite as certain he has the experience with human modeling to address those issues, but he has demonstrated appropriate supervision and his resourcefulness by contacting and inviting experts in that area to the public meeting.

5. Environment:

Does the scientific environment in which the work will be done contribute to the probability of success? Does the proposed experiment(s) take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Please do not include a description of available facilities or equipment unless important to the evaluation of merit.

The available facilities and experienced personnel at NIOSH provide a significant contribution to the probability of success for this project. The project officer has worked hard to secure collaboration from experienced people in the areas where he is lacking, primarily from the heavy trucking industry human factors community. He has made himself available for industry meetings and has opened the process with a public meeting in April.

I have a question about the length of time for data storage. The proposal indicates the data will be destroyed after three years. The SAE process of developing and modifying standard practices usually required much longer than 3 years. While any identifying data, i.e. the keys to the random number assignments, will not be important, the raw data may be important during that process. Clarify which data will be destroyed after three years. Keep the raw

data for a longer period of time; 5-7 years.

6. Overall Evaluation:

In one paragraph, summarize the most important points of the Critique, suggesting ways to improve any weaknesses of the proposed study.

I am most concerned about using the pilot study data to address the issue of whether human modeling can replace some of the data collection in the follow-on study. No additional statistical analysis is planned for this pilot study, but this needs to be addressed before the follow-on study begins. Minor adjustments to the protocol should resolve most issues

C. OTHER CONSIDERATIONS

7. Gender, Minority, and Children Inclusion (As Relevant)

The increase in females and minorities in the commercial truck driving population is central to the need for new anthropometric data. The project officer has addressed this issue very well. Children are not a consideration in this project.

8. Human Subjects: Are there any issues regarding the safety or welfare of subjects participating in this study? Note that NIOSH projects involving human subjects must obtain separate and independent review and approval from the NIOSH Human Subjects Review Board.

No. The issues have been thoroughly addressed in the proposal.

9. Other (include any other suggestions to improve the proposed research)

My only concern is the recruitment of volunteers. Drivers are normally paid by the mile. \$40.00 per hour is the equivalent of about \$0.80 per mile. This may not be adequate pay to persuade highly experienced active drivers to participate in the pilot study, though it will certainly attract students and unemployed drivers. Is there an adequate supply of these types of drivers in the defined locality for the pilot study?

It would benefit the project greatly to make the effort to ensure some of the pilot study subjects are highly experienced drivers. In particular, these drivers should be interviewed after the data collection process is complete to ask how they might improve the data collection process and for suggestions of recruitment tactics for the follow-on study. For example, would they do this again for the same pay? If they are currently unemployed, would they be willing to give up or delay a paying run in order to participate in this data collection? What will they tell other truck drivers about this project? Would they suggest other drivers participate or skip this project? Is there another type of inducement that might be more effective, such as a fuel card, a gift card, or something else?