INFORMATION COLLECTION
SUPPORTING JUSTIFICATION - WORK SCHEDULES AND SLEEP PATTERNS OF TRAIN CREWS IN PASSENGER SERVICE
FRA Form Numbers F 6180.130; F 6180.131

Part B: Collections of Information Employing Statistical Methods

1. DESCRIBE (INCLUDING A NUMERICAL ESTIMATE) THE POTENTIAL RESPONDENT UNIVERSE AND ANY SAMPLING OR OTHER RESPONDENT SELECTION METHODS TO BE USED. DATA ON THE NUMBER OF ENTITIES (E.G., ESTABLISHMENTS, STATE AND LOCAL GOVERNMENT UNITS, HOUSEHOLDS, OR PERSON) IN THE CORRESPONDING SAMPLE ARE TO BE PROVIDED IN TABULAR FORM FOR THE UNIVERSE AS A WHOLE AND FOR EACH OF THE STRATA IN THE PROPOSED SAMPLE. INDICATE EXPECTED RESPONSE RATES FOR THE COLLECTION AS A WHOLE. IF THE COLLECTION HAD BEEN CONDUCTED PREVIOUSLY, INCLUDE THE ACTUAL RESPONSE RATE ACHIEVED DURING THE LAST COLLECTION.

The potential respondent universe is the 5,000 railroad train and engine (T&E) service employees in the United States who work in passenger service. The majority of these T&E employees (4,000) are members of the United Transportation Union (UTU) and the remainder (1,000) are members of the Brotherhood of Locomotive Engineers and Trainmen (BLET). We have not included the Long Island Railroad (LIRR), the largest commuter rail service in the country, because they do not use split assignments, a type of work schedule that is potentially problematic in terms of fatigue and that is a primary focus of this study. We have not included Metro North Railroad because their employees are not represented by a national labor organization, and it would be difficult to identify and survey them.

There are two primary types of schedules for passenger train crews, split assignment (also referred to as split shift) and straight through assignments. Split assignments span more than 12 hours from on-duty time to final release time and include a legally required interim period of release of four hours. FRA has a concern about the potentially fatiguing effects of these split shift schedules. In contrast, a straight through assignment is less than 12 hours and does not have a release period. Other arrangements also exist where an employee has a shorter break period that is included in the on-duty time. Most jobs in commuter operations have two guaranteed days off but some agencies, SEPTA in particular, have some jobs that work six days per week. As is common in other railroad train service work, some employees hold relief jobs where they work a different time each day and possibly on a different route, and some hold extra board positions where they fill in as required for regularly-assigned employees.

Both labor organizations maintain a database with the names, mailing addresses, date of birth, and date joined the union for all of its members. Both the BLET and the UTU have agreed to generate a random sample of their members in accordance with the method

described in the answer to question number two below. The database will be current as of the date that the random sample is drawn. Only actively working (i.e., non-retirees) T&E employees living in the United States and working in commuter service (except for LIRR and Metro North Railroad) will be included in the sampling frame. Full-time union officials and railroad officials who are union members will be excluded. Respondents will be selected randomly from this sampling frame. The number from each labor organization will be proportional to that organization's representation in the sampling frame. The only type of stratified random sampling from the union databases that is possible would be a geographic stratification. However, this study does not seek to look at the characteristics of subpopulations defined by geography. If type of work schedule were available in the union database, then a stratified sample on this basis would have been used.

This collection has not been conducted previously, so the response rate must be estimated from other similar efforts. As described in more detail in the answer to question number three below, the expected response rate is at least 33 percent. (*Note: In the previously approved fatigue study of U.S. T&E employees (OMB Collection No. 2130-0577), the response rate was 33 percent.)*

2. DESCRIBE THE PROCEDURES FOR THE COLLECTION OF INFORMATION INCLUDING:

- **STATISTICAL METHODOLOGY FOR STRATIFICATION AND SAMPLE SELECTION**
- **ESTIMATION PROCEDURE**
- **DEGREE OF ACCURACY NEEDED FOR THE PURPOSE DESCRIBED IN THE JUSTIFICATION**
- **UNUSUAL PROBLEMS REQUIRING SPECIALIZED SAMPLING PROCEDURES, AND**
- **ANY USE OF PERIODIC (LESS FREQUENT THAN ANNUAL) DATA COLLECTION CYCLES TO REDUCE BURDEN**

As described above, the study will employ a random sample of the actively working T&E employees at a subset of U.S. commuter railroads. One of the most important issues in conducting this study is determining how large a sample is necessary for the estimates obtained in the sample survey to be reliable enough to meet the objectives of the study. In general, the larger the sample, the greater the reliability of the resulting estimates, but this must be traded off against the expense of a larger sample. The first step in this process is to specify the level of reliability needed for the resulting estimates.

The purpose of this study is to obtain descriptive information about work hours, sleep, and level of alertness. FRA assumes that 95 percent confidence is adequate for this

purpose. In addition, we assume our estimate should be within 15 (±7.5) percent of the "true" value.

The appropriate sample size, *n*, for estimating the mean daily sleep time can be computed from the following (Levy & Lemeshow):

$$n \geq \frac{(z^2 N V_x^2)}{z^2 V_x^2 + (N - 1)\varepsilon^2}$$

where z = reliability coefficient (1.96 for 95 percent confidence level)
N = population size
V_x = unknown population variance
ε = error tolerance

This estimation for sample size applies as well to other mean values, such as work and commute time, that the study seeks to estimate.

Webb (1992) estimates the standard deviation for daily sleep for the general population is 1 hour (Webb, p. 72). Applying this estimate of standard deviation (and hence V_x, variance) to the T&E population working split assignments (N=1900) and using an ε = .15, there must be 156 split shift workers in the sample. Based on data from several large commuter railroads, FRA estimates that 38% of T&E employees work a job with a split assignment. Assuming the 38% of the sampling frame has a work schedule with a split assignment, the total sample size must be 410 (156/.38) to assure an adequate number of split assignment people.

A simple random sample will be selected from the sampling frame described in the answer to question number one above. The number drawn from each of the two union databases will be proportional to that organization's share of the total number of T&E employees in the sampling frame. Based on our preliminary estimate of the number in each union, 80 percent of the random sample will come from the UTU and the remainder from the BLET. We will use sampling without replacement. Each candidate T&E employee will be assigned a number sequentially from 1 to the total number of candidates, C. Using an integer random number generator, numbers in the range 1 to C will be drawn until the desired number is reached. (*See the answer to question number three for discussion of target number of names to be drawn.*) In the event of a duplicate number, another will be drawn.

FRA plans to limit the analysis of this data to characterizing all T&E employees in commuter service as well as subgroups of those holding jobs with straight thru assignments and those holding jobs that have split assignments. No attempt will be made to establish subgroups based on age, years of work experience, or work or sleep time.

The budget available for this study will not allow for a larger sample size. The error level chosen is consistent with the known variance of daily sleep in the general population (Webb, 1992).

It is not possible to use individual-level administrative records to augment the study data. Individual railroads maintain records of the hours worked by their employees for payroll purposes. However, using this information is not feasible for three reasons. First, participants will not be asked for the name of their employer as the study does not intend to report results by railroad. Second, obtaining actual work hours in this manner would be extremely time consuming and far more expensive to the government than the proposed approach. Third, and perhaps most important, the purposes of this study require information on both work hours and sleep patterns for the same time period. Attempting to coordinate individually recorded data with railroad records would be prone to error.

References

Levy, P. and Lemeshow, S. (1999). *Sampling of Populations: Methods and Applications.* New York: John Wiley & Sons, Inc.

Webb, W. B. (1992). *Sleep, the Gentle Tyrant*. Bolton: Anker Publishing.

3. DESCRIBE METHODS TO MAXIMIZE RESPONSE RATES AND TO DEAL WITH ISSUES OF NON-RESPONSE. THE ACCURACY AND RELIABILITY OF INFORMATION COLLECTED MUST BE SHOWN TO BE ADEQUATE FOR INTENDED USES. FOR COLLECTIONS BASES ON SAMPLING, A SPECIAL JUSTIFICATION MUST BE PROVIDED FOR ANY COLLECTION THAT WILL NOT YIELD "RELIABLE" DATA THAT CAN BE GENERALIZED TO THE UNIVERSE STUDIED.

Since not every BLET and UTU member who is selected to participate in this study will choose to do so, over sampling is necessary. The extent of over sampling is a function of the anticipated response rate. Conservatively, the planned study can likely achieve at least a 33 percent response rate. (As mentioned previously, this estimate for the likely response rate is the response rate achieved in the recently completed survey of all T&E employees.). If 33 percent of the selected individuals in the random sample express interest in participating in the study, then the random sample must be 1,242 (410/.33) to yield 410 participants.

Due to the nature of the railroad industry, FRA doubts that the response rate for this survey will achieve what is possible with other non-railroad populations. Based on experience with other FRA research efforts that sought participation from railroad workers, FRA researchers have found that many of these workers are suspicious of any efforts to collect data, even if the effort has the endorsement of their labor union and the researchers assure the confidentiality of the information. In addition, the proposed survey differs significantly from most mail surveys in that this survey requires responses every day for a 14-day period. The prior survey of all T&E workers achieved only a 33 percent response rate.

The FRA study plan includes several specific actions designed to encourage participation in the study. These actions are based on the Total Design Method, a standard set of mail procedures designed to maximize response rate (Dillman, 1983), and include the following:

- The survey materials will be sent via first class mail with a personally addressed and dated letter printed on high quality paper. The package will contain a cover letter, daily log, background survey, instruction sheet, and a first class postage paid envelope for return of the study materials. (Copies of the survey materials accompany this justification.)
- Ten days after distribution of the materials, a follow-up reminder postcard will be sent to all recipients to encourage them to participate in the study. (text for this postcard provided as postcard1.doc)
- Three weeks after distribution of the materials, a follow-up reminder/thank you postcard will be sent to all recipients to thank those who have participated and to encourage those who have not to participate in the study. (text for this postcard provided as postcard2.doc)
- Both the background questionnaire and the daily log are designed as booklets. The questionnaire is 8.5 x 5.5 in., printed on white paper with no questions on the cover page. The cover page contains only the title "T&E Passenger Service Employee Background Survey" and the participant's I.D. number. The required OMB statement, along with the assigned OMB Control number and confidentiality assurance statement, will be placed on the inside cover page of the background questionnaire booklet and on the inside of the back cover of the daily log book. Both survey instruments are designed to be visually pleasing and easy to read.
- The survey cover letter is from either the BLET or UTU International President, depending upon the participant's affiliation. In addition to explaining the survey procedure, this letter describes the benefits of the study to the union and its members, and encourages members to participate in the study. This letter, as well as an article that will appear in the labor organizations' member newsletters prior to the survey, are intended to familiarize T&E employees with the effort and to legitimize the study.
- Participants will be compensated for their data collection efforts with a $75 gift certificate to a national retail establishment upon return of the survey materials. In addition, each survey packet will include a $5 bill to encourage participation.

In the event that the response rate is below 75 percent, FRA plans to conduct a non-response bias study. From the union membership databases, it is possible to determine the age of each T&E employee. The non-response bias study will involve comparing the age distribution of the survey non-respondents with the age distribution of the respondents. The mean age for each group will be compared. Sleep patterns change with age, so age, which is available in the union databases, is the logical variable for doing the non-response bias analysis. Age, for this population, is also highly correlated with years of experience and hence seniority. Individuals with more seniority tend to work the more desirable straight through work schedules. By using age as the basis for the non-response bias analysis, we are indirectly also considering type of work schedule. There is no other data in the membership database which is suitable for non-response bias analysis.

References

Dillman, D. (1983). Mail and Other Self-Administered Questionnaires. In Rossi, P, Wright, J, and Anderson, A.(eds.) *Handbook of Survey Research.* Orlando:Academic Press, Inc.

Pollard, J. (1996). *Locomotive Engineer's Activity Diary*. (Report No. DOT/FRA/RRP-95/02). Washington, DC: Federal Railroad Administration.

4. DESCRIBE ANY TESTS FOR PROCEDURES OR METHODS TO BE UNDERTAKEN. TESTING IS ENCOURAGED AS AN EFFECTIVE MEANS OF REFINING COLLECTIONS OF INFORMATION TO MINIMIZE BURDEN AND IMPROVE UTILITY. TESTS MUST BE APPROVED IF THEY CALL FOR ANSWERS TO IDENTICAL QUESTIONS FROM 10 OR MORE RESPONDENTS. A PROPOSED TEST OR SET OF TESTS MAY BE SUBMITTED FOR APPROVAL SEPARATELY OR IN COMBINATION WITH THE MAIN COLLECTION OF INFORMATION.

A pilot survey with nine participants will be conducted to refine the data collection procedures and instruments. Because this pilot is designed solely to test the study methods and not for analysis of the data, the BLET and UTU will select the pilot survey participants. Participants will include T&E employees working split assignment jobs as well as those working jobs that have straight through schedules. This pilot survey will collect one week of data. In addition to completing the Background Survey and the Daily Log, pilot participants will also complete a brief Post-Survey Form to provide feedback on the survey instruments and procedures. Similar to the plans for the full survey, participants will be compensated with a $75 gift certificate to a national retail establishment. The T&E Passenger Service Employee Background Survey and T&E Passenger Service Employee's Daily Log that accompany this submission will be revised, as necessary, based on the results of the Pilot Survey. The Daily Log contains pages for 14 days of data, but the pilot survey participants will complete data for only seven days.

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

FRA has engaged the services of QinetiQ North America Technology Solutions Group (TSG), 350 Second Ave., Waltham, MA 02451, for the conduct of this study. TSG will be responsible for data collection, information coding, and analysis.

The QNA primary point of contact for this work is:

Judith Gertler
(781) 684-4270
jgertler@foster-miller.com