



U.S. Department
of Transportation

Urban Mass
Transportation
Administration

CIRCULAR

UMTA C 2710.2A

Subject: SAMPLING PROCEDURES FOR OBTAINING DEMAND July 22, 1988
RESPONSIVE BUS SYSTEM OPERATING DATA REQUIRED
UNDER THE SECTION 15 REPORTING SYSTEM

1. PURPOSE. This circular details a suggested alternative sampling technique for collecting Demand Responsive system (DRS) operating data required under the Section 15 Uniform System of Accounts and Records Reporting System.
2. CANCELLATION. This circular cancels UMTA Circular 2710.2, "Sampling Procedures for Obtaining Demand Responsive Bus System Operating Data Under the Section 15 Reporting System," dated 2-22-78.
3. REFERENCES.
 - a. Urban Mass Transportation Act of 1964, as amended.
 - b. Uniform System of Accounts and Records and Reporting System; Clarification of Procedures for Addressing Noncompliance with Reporting Requirements; Final Rule (52 FR 36182) (49 CFR 630), dated 9-25-87.
 - c. Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System: Volume I - General Description, dated 1-77; Volume II - Uniform System of Accounts and Records, dated 1-77; and Reporting Manual and Sample Forms (All Reporting Levels), dated 2-88.
 - d. UMTA Circular 2710.1A, "Sampling Procedures for Obtaining Fixed Route Bus Operating Data Required Under the Section 15 Reporting System," dated 7-18-88.
 - e. UMTA Circular 2710.4A, "Revenue Based Sampling Procedures for Obtaining Fixed Route Bus Operating Data Required Under the Section 15 Reporting System," dated 7-22-88.
 - f. UMTA Circular 9030.1A, "Section 9 Formula Grant Application Instruction," dated 9-18-87.
4. BACKGROUND. The Federal Register of September 25, 1987, specifies that certain operating data should be collected as part of the Section 15 Uniform System of Accounts and Records and Reporting System. The Urban Mass Transportation Administration developed several suggested sampling techniques for collecting annual estimates of unlinked passenger trips and passenger miles. The technique in this manual is one of these suggested techniques which will yield sample data at the required levels of precision and accuracy.

A transit agency may use a technique other than the UMTA recommended techniques as long as it meets the prescribed precision and confidence levels. Implementation of a sampling procedure that has not been confirmed in writing by UMTA as meeting the prescribed statistical requirements may result in adjustments to future Section 9 formula apportionments if the data are found to be unreliable.

Additional copies of the forms contained in this circular for collecting transit service consumed data can be reproduced by the user, or obtained from:

Urban Mass Transportation Administration
Office of Grants Management
Audit Review and Analysis Division
400 Seventh Street, S.W., Room 9315
Washington, D.C. 20590

Alfred A. DelliBovi
Administrator

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CHAPTER I

INTRODUCTION

1. PURPOSE OF MANUAL. The Section 15 Reporting System requires that transit properties offering demand response services (e.g., dial-a-bus, dial-a-ride) shall report the following service consumed data elements annually:

- a. Total Passengers 1
- b. Total Passenger Miles.

These estimates are to be obtained by random sampling procedures according to specific confidence and precision levels unless.²² The primary purpose of this manual is to provide the detailed sampling procedures that will conform to these specifications.

2. DEFINITION OF DEMAND RESPONSE SYSTEM. A demand response system is one where passenger trips are generated by calls from passengers or their agents to the transit operator, who then dispatches a vehicle to pick the passengers up and transport them to their destinations. The operation is characterized by the following:

- a. The vehicles do not operate over a fixed route or on a fixed schedule except, perhaps, on a temporary basis to satisfy a special need.
- b. Typically, the vehicle may be dispatched to pick up several passengers at different pick-up points before taking them to their respective destinations and may even be interrupted en route to these destinations to pick up other passengers.
- c. The following types of operations fall under the above definitions provided they are not on a scheduled fixed-route basis:
 - (1) Many origins – many destinations--The typical operation described above.
 - (2) Many origins – one destination--For example, a pre-arranged handicapped or senior citizen operation which picks up the passengers at their homes and takes them to a shopping or recreation center.
 - (3) One origin – many destinations--For example, a vehicle meets a commuter train, picks up the passengers, and drives them to their homes.
 - (4) One origin – one destination--For example, a group of senior citizens is transported from a nursing home to a recreation center and returned.

3. SUMMARY OF PROCEDURES. The manual is organized to provide you with step-by-step procedures without entering into any technical discussions. If followed carefully, these procedures satisfy the Section 15 reporting system requirements. Throughout the Manual, the initials "DRS" stand for Demand Response System.

¹ The Reporting System specifies "unlinked" passenger trips. Demand response systems seldom involve passenger transfers so that the distinction between linked and unlinked passenger trips is unnecessary.

² Passenger miles are to be estimated with confidence and precision levels of 95% and 10%, respectively.

Chapter II presents the procedure for selecting the sample. Here it is recommended that you select one demand response vehicle on one day each week and identify all demand response trips made by that vehicle during that day. A method for randomly selecting the vehicle is also described.

Once you have selected the sample, the next step is to collect the data. Chapter III provides you with the detailed forms and procedures. If there is close cooperation between the dispatcher and the driver(s) of the survey vehicle, the burden of collecting the data is minimal.

It is strongly recommended in Chapter IV that you record the sample results immediately after each survey is taken. A single form for this purpose is provided in Appendix C. The form provides columns for accumulation of the data on a survey day basis and over the entire year so that at the end of the year you will have all the information needed for the annual report to UMTA.

Chapter V discusses the Annual Report to UMTA. Here we ask that you send UMTA the accumulated numbers as well as the calculated values. This provides UMTA with additional sampling information that it needs to evaluate the procedures in the manual.

CHAPTER II

SELECTING THE SAMPLE

1. GENERAL PROCEDURE. The sample selection procedures involve two steps:
 - a. Throughout the year, select one day each week to perform the survey.
 - b. Select, at random, a DRS vehicle that will be in operation on that day.
2. SELECTING THE SURVEY DAYS. The main error to avoid in selecting the survey days is an over-representation of particular days of the week. It is recommended, therefore, that after you have selected the survey day for the first week in your fiscal year, simply select every eighth day from that date. For example, if your fiscal year starts January 1, 1987, and you select Wednesday, January 4, as your first survey day, then Thursday, January 12, will be the next survey date, and so on. In other words, just advance one day each week.

If a survey date falls on a day when you do not provide service (e.g., Sundays, holidays), advance to the next day when there is service.

Record the date and day of week as items (1) and (2), respectively, on the DRS Vehicle Trip Sheet (see Appendix A).

3. RANDOM SELECTION OF VEHICLE. On or before the survey day, one vehicle that is to be used in your demand response operation should be selected at random. Random selection means that each vehicle must have the same probability of being selected. The following is one method that will ensure randomness:
 - a. Purchase enough poker chips to cover the number of vehicles that you use in your demand response operation.³
 - b. Write the vehicle numbers on small gummed labels and stick them on the chips. Put the chips in a sturdy container that can be used regularly for random drawing.
 - c. Mix the chips in the container thoroughly and draw one chip out. The vehicle number is the survey vehicle for this day. If this vehicle is not in service this day, draw another chip until you have a vehicle that is in service.
 - d. Record the selected vehicle number as item (3) on the DRS Vehicle Trip Sheet (see Appendix A).
 - e. Important: Return all chips into the container for the next week's drawing.

There are many other ways to select a random sample, but if you have a small fleet of vehicles, this is probably the easiest method. A method that you should not use is to select a vehicle that appears to provide "representative" trips without giving the other vehicles the same chance of being drawn. By doing this you may inadvertently introduce biases that

³ Some stationary stores carry metal labeling discs which have a surface that can be written on directly.

cannot be evaluated by standard statistical methods. If you use a process other than that described above, be sure that you can demonstrate that it is a random process.

CHAPTER III

COLLECTING THE DATA

1. DEMAND RESPONSE SYSTEM VEHICLE TRIP SHEET. At this point, please turn to the DRS Vehicle Trip Sheet in Appendix A. It is suggested that you study this form carefully before reading the following instructions. The filled-out example will also be referred to in the discussion.
2. PRE-SURVEY PROCEDURES. A trip sheet should be used for each driver of the survey vehicle during the day. If more trips are taken than allowed for on a page, additional pages should be used, and the page numbers should be written in the upper right hand corner. The driver should carry extra sheets with him in the event that this occurs.

Before the vehicle is pulled out, the survey supervisor should fill in the following items:

- a. Item 1. Survey Date—See Chapter II, page II-1.
 - b. Item 2. Day of Week—See Chapter II, page II-1.
 - c. Item 3. Survey Vehicle Number—See Chapter II, page II-2.
 - d. Item 4. Driver Number—This is the driver number of the survey vehicle. If more than one driver is used during the day, a separate sheet should be filled out for each driver.
 - e. Item 5. Vehicle Total Capacity--This is the normal full load (seated plus standing) as determined by your loading policy. If your policy is not to allow standing passengers it is your maximum seated load.
 - f. Item 6. Vehicle Seated Capacity—This is the maximum seated load.
3. SURVEY PROCEDURES. Item (7) through (13) on the trip sheet are the only data items to be recorded by the driver at the time of the trip. It is assumed below that the driver will record the data and that the dispatcher or survey supervisor will check the driver's entries using the dispatcher's records. In some cases, however, it may be possible to record most of the information from the dispatcher's records.

For example, the dispatcher may record in advance the number of passengers, pick-up addresses, and drop-off addresses; and the driver can record the actual odometer readings. The driver can also verify the items recorded by the dispatcher. Much depends upon the particular operating set-up, but in every case close cooperation is needed between the dispatcher and the driver.

- a. Need to Record Individual Trips. An important point that needs emphasis here is that in order to calculate the two required data elements (total passengers and passenger miles), it is necessary to track individual trips. For this reason, when a passenger or group of passengers is picked up at a particular pick-up address, the driver should immediately determine and record the number of passengers going to various destinations under item (11), "Drop-Off Addresses."

An illustration of the procedure is given in the DRS Vehicle Trip Sheet example. The circled figure indicates that the driver picked up 16 persons at 1020 J Street. He immediately distributed these according to their three drop-off destinations under item (11).

At the next pick-up address, 506 10th Street, 17 passengers boarded and all were driven to the same destination. Here a single line records all the necessary information.

The last three pick-ups illustrate a "many origin-one destination" case. Here the driver records the pick-up addresses and repeats the destinations; that is, he handles each as an individual trip.

- b. Pick-Up Reading. Item (9) "Pick-Up Odometer Reading" should be recorded immediately upon picking up the passengers.
 - c. Drop-Off Reading. Item (12) "Drop-Off Odometer Reading" should be recorded immediately upon discharging the passengers.
 - d. Alternative Procedure. If adequate 2-way radio communications are available, the driver's recording burden can be eliminated and probably the recording accuracy improved if the driver calls in the information to the dispatcher or survey superintendent. When he arrives at the pick-up point, the driver can call in items (7), (8), (9), and (11). When he arrives at each destination, he can call in item (12) and verify how many passengers were dropped off at that destination.
4. POST SURVEY PROCEDURES. The remaining columns and totals should be completed as soon as possible after the survey day, because if any questions arise, the drivers' and dispatchers' memories will still be fresh.
- a. Determine the trip distances, item (14), by subtracting the pick-up odometer reading, item (9), from the drop-off odometer reading, item (12). If, for some reason, odometer readings could not be obtained, use a map to estimate the distances. This, however, is a relatively laborious and inaccurate process that should be avoided.
 - b. Compute passenger miles, item (15) by multiplying the trip distances, item (14), by the number of passengers, item (7).
 - c. Now sum all the columns specified by the number in parentheses at the bottom of the trip sheet. If more than one trip sheet is used for a driver, use the spaces on the first sheet as subtotals and get the final total on the next page.
 - (1) Item 18. Total passengers in sample—This is the sum of the entries under item (7).
 - (2) Item 19. Total vehicle trips--This is a count of the number of individual trips taken regardless of how many passengers took the trip. It is obtained by counting the number of drop-off addresses, including repeats where several individual pick-ups were made for transport to the same drop-off point.

- (3) Item 20. Total trip distance--This is the sum of all the individual trip distances under item (14).
 - (5) Item 21. Total passenger miles--This is the sum of all the individual passenger mile entries under item (15).
 - (6) Item 24. Capacity miles--Compute this by multiplying total trip distances, item (20), by vehicle total capacity, item (5).
 - (7) Item 25. Seat miles--Compute this by multiplying total trip distance, item (20), by vehicle seated capacity, item (6).
- d. If more than one driver is assigned to the survey vehicle during the day, perform the above tasks for his survey trip sheet.

Item (18) through (25) are next recorded on the DRS Summary Sheet described in the next Chapter.

CHAPTER IV

RECORDING AND ACCUMULATING SURVEY RESULTS

It is strongly recommended that you maintain a weekly tabulation of your survey results. In addition, an exact count of the total number of passengers hauled by your demand response operation during the year is needed. Procedures for recording and accumulating the necessary information are presented in this section.

1. DEMAND RESPONSE SYSTEM SUMMARY SHEET. A blank DRS Summary Sheet for recording and accumulating the weekly survey totals appears in Appendix B with an example of a partially filled out sheet. Please refer to the latter form when reading the following material.
2. RECORDING THE SURVEY RESULTS. The DRS Summary Sheet is designed to record for each survey day the totals on the individual DRS Vehicle Trip Sheets. This is demonstrated by the first line of the DRS Summary Sheet example in Appendix B, which records the totals at the bottom of the DRS Vehicle Trip Sheet example in Appendix A. If there is more than one driver of the vehicle on the survey day, the results on each driver's trip sheet can be recorded as shown. In the example, the 1+4+78 survey vehicle had two drivers (#15 and #22), and each driver filled out a DRS Vehicle Trip Sheet for his shift. On the next survey day (1/12/78) there was only one driver of survey vehicle #10, and so on.

It is likely that more than one Summary Sheet will be needed to record a full year's survey results. It is suggested that page totals be forwarded to the next page as shown in the example.

The "comments" column is useful for recording any special events that might have occurred on a survey day that might have influenced service. This helps in evaluating the overall results.

When a full year of survey results has been recorded, the annual totals should be computed. These are the totals that will be reported to UMTA in the Annual Report discussed in Chapter 4.

3. DEMAND RESPONSE SYSTEM WEEKLY PASSENGER COUNT. In order to compute the annual estimates of passenger miles, it is essential to have a complete count of passengers in the demand response operation for the same period covered by the surveys. The form in Appendix C is designed for this purpose.

The form is generally self-explanatory. The main points that need emphasis are:

- a. The weekly counts should be complete counts for the week, not just for the survey day.
- b. Week Number 1 should be the same week that the first survey was made. The remaining 51 weeks should be successive weeks after that first week even though you might have missed a survey during a particular week.
- c. The total though the fourth quarter is the annual total to be included in the Annual Report to UMTA discussed in the next chapter.

CHAPTER V

ANNUAL REPORT TO UMTA

A sample form (Form 406B) for the Annual Report to UMTA is provided in Appendix D. This report must be included along with the other reports required under Section 15.

If you have accumulated your sample data using the DRS Summary Sheets, lines 1 through 6 can be copied directly from the "Totals for the Year" for items (18) through (25). You may obtain annual total passengers, line 8, directly from the annual total on the DRS Weekly Passenger Count Sheet.

You may obtain annual total passenger miles by a two-step process:

1. Divide the sample total passenger miles (line 4) by the sample total passengers (line 1) to get average trip distance (line 7).
2. Multiply average trip distance (line 7) by annual total passengers (line 8) to get total passenger miles (line 9).

Appendix A
DEMAND RESPONSE SYSTEM
VEHCILE TRIP SHEET

DRS VEHICLE TRIP SHEET Example

(1) Survey Date 1/4/78 (2) Day of Week Wed. (3) Survey Vehicle Number 54
 (4) Driver Number 15 (5) Vehicle Total Capacity 24 (6) Vehicle Seated Capacity 17

							(15)
Number of Pass.	Pick-Up Address	Pick-Up Odometer Reading	Drop-Off Address(es)	Drop-Off Odometer Reading	Trip Distance (12) - (9)	Passenger Miles (7) x (14)	
(16) 2	1020 J Street	38,452	450 L Street	38,454	1.5	3.0	
3	"	"	380 Alaska	454	2.0	6.0	
11	"	"	Fenton + Colesville Rd.	455	2.7	29.7	
17	506 10 th Street	456	Silver Spring Station	459	3.4	57.8	
1	13 th + K	605	Walter Reed Hospital	610	4.9	4.9	
1	13 th + K	606	"	"	3.5	3.5	
1	655 M Street	606	"	"	3.2	3.2	

36	(18) Total Passengers in Sample	7	(19) Total Vehicle Trips	21.2	108.1
508.8	(24) Capacity Miles	360.4	(25) Seat Miles	(20)	(21)

Appendix B
DEMAND RESPONSE SYSTEM
SUMMARY SHEET

Appendix C
DEMAND RESPONSE SYSTEM
WEEKLY PASSENGER COUNT SHEET

Appendix D
ANNUAL REPORT TO UMTA

Form 406B
ANNUAL REPORT TO UMTA -- DEMAND RESPONSE

Transit ID

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Fiscal Year End

--	--	--	--	--	--

Month *Day* *Year*

Level

--

Mode

--

Type of Service*

--

<i>a</i> Line No.	ITEM	<i>b</i> TOTAL, ALL SAMPLES
	ACCUMULATIONS FROM DRS SUMMARY SHEET	
01	(18) Total passengers in sample	<input style="width: 100%; height: 20px;" type="text"/>
02	(19) Total trips	<input style="width: 100%; height: 20px;" type="text"/>
03	(20) Total trip distance	<input style="width: 100%; height: 20px;" type="text"/>
04	(21) Total passenger miles	<input style="width: 100%; height: 20px;" type="text"/>
05	(24) Total capacity miles	<input style="width: 100%; height: 20px;" type="text"/>
06	(25) Total seat miles	<input style="width: 100%; height: 20px;" type="text"/>
	SAMPLE ESTIMATES	
07	Average passenger trip distance (4/1)	<input style="width: 100%; height: 20px;" type="text"/>
	ANNUAL TOTALS	
08	Total passengers (<i>From weekly count sheet</i>)	<input style="width: 100%; height: 20px;" type="text"/>
09	Total passenger miles (<i>8 X 7</i>)	<input style="width: 100%; height: 20px;" type="text"/>

*DO = Directly Operated PT = Purchased Transportation Service

Date Prepared _____ Date Updated _____