	NATIONAL TRANSIT DATABASE SAMPLING MANUAL
U.S. Department of Transportation **Federal Transit Administration**	**March 31, 2009**

TABLE OF CONTENTS

SECTION 10 – GENERAL DIRECTIONS

§ 10.01 What is the purpose of this Sampling Manual?
    (a) It suggests procedures for obtaining annual data on unlinked passenger trips (UPT) and passenger miles traveled (PMT) for the National Transit Database (NTD) through random sampling according to the requirements in the NTD Reporting Manual.
    (b) In the event of a conflict between the requirements in the Reporting Manual and this Sampling Manual, the requirements of the Reporting Manual are definitive.
    (c) When it is possible to obtain annual UPT and PMT data according to the requirements in the Reporting Manual by using other methods not specified in this Sampling Manual, then you may do so.

§ 10.03 What procedures does this Sampling Manual cover?
    (a) Development of sampling plans with two options:
        (1) Section 40 on ready-to-use sampling plans.
        (2) Section 50 on agency-developed sampling plans with agency sample data.
    (b) Collection of sample data in Section 60.
    (c) Estimation of annual service-consumed data with two options:
        (1) Both UPT and PMT if you do not report 100% counts of UPT.
        (2) PMT if you report 100% counts of UPT.
    (d) Figure 10.01 show these procedures and options.

Figure 10.01. Flow Chart of Procedures and Options
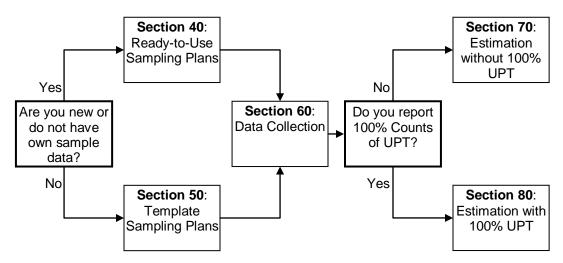
§ 10.07 May I continue using the sampling plans in Circulars 2710.1A and 2710.2A?
    (a) You may continue using these sampling plans until they are withdrawn.

§ 10.09 May I use alternative sampling plans?
    (a) You may use alternative sampling plans if qualified statisticians have certified that estimates from them meet 95% confidence and 10% precision levels.

SECTION 40 – READY-TO-USE SAMPLING PLANS

Subsection 41 – General Directions

§ 41.01 Under what conditions may I use ready-to-use sampling plans?
(a) New Mode – If you will be sampling and reporting for the first time this current report year for a particular mode that you do not already operate. For example, you would meet this condition if you will add light rail (LR) service this year, but you have not operated this service previously, or

(b) New Type of Service – If you will be sampling and reporting this current report year for a particular type of service for the first time. For example, you would meet this condition if you previously directly operated all of your motorbus (MB) service, but will contract out part or all of that service to a private entity for this year, or

(c) No Sample Data – If you have reported your service to the NTD before through random sampling, but no longer have the original raw sample data.

§ 41.03 If I am using a ready-to-use sampling plan this year, may I use it again for my next report year?
(a) You should not use it again if your next report year is your mandatory sampling year. After you have collected the sample data from this year, you should develop a template sampling plan with that sample data for your next report year.

(b) You may use it again for the next report year if that year is not a mandatory sampling year.

§ 41.05 For what modes are ready-to-use sampling plans available?
(a) For non-scheduled services, they are available for demand responsive (DR) and commuter vanpool. You should not use the ready-to-use sampling plans for commuter vanpool if your vanpool service does not serve commuters exclusively.

(b) For scheduled services, they are available for bus services (motorbus (MB) and trolleybus (TB)), commuter rail (CR), and other rail modes.

§ 41.07 What sampling options are available?
(a) The available sampling options vary in:
(1) the unit of sampling and measurement,
(2) efficiency options, and
(3) sampling frequency.

(b) The particular unit of sampling and measurement used in these ready-to-use sampling plans varies by mode and whether the service is scheduled (Table 41.01).
(1) For non-scheduled services, the unit is in vehicle days.
(2) For bus services (MB and TB), separate sampling plans are available with units in one-way trips and in round trips.
(3) For commuter rail, the unit is in one-way car trips.
(4) For other rail modes, separate sampling plans are available in units of one-way car trips and one-way train trips.

Table 41.01. Options for Unit of Sampling and Measurement

Service	Mode	Units of Sampling and Measurement
Non-Scheduled	Demand Response (DR)	Vehicle days
	Commuter Vanpool	Vehicle days
Scheduled	Bus (MB, TB)	One-way trips, round trips
	Commuter Rail (CR)	One-way car trips
	Other Rail Modes	One-way car trips, one-way train trips

(c) Three efficiency options are provided:
  (1) Base Option – you must estimate both UPT and PMT through random sampling.
  (2) APTL Option – you must report a 100% count of UPT, estimate the average passenger trip length (APTL) through random sampling, and obtain annual PMT by multiplying the 100% UPT with the estimated APTL.
  (3) Grouping Option – you must divide your bus routes into two groups by route length.
(d) Three options are provided for sampling frequency—quarterly, monthly, or weekly. You may choose whichever of these options is best suited for your agency. One factor to consider is that the annual realized sample size may be larger at a lower sampling frequency due to rounding. Another factor is that a lower sampling frequency means a larger annual number of acts for random sampling.

Subsection 43 – Sampling Plans

§ 43.01 What sampling plans are available for non-scheduled services?
  (a) Table 43.01 shows the sampling plans available for demand response (DR) and commuter vanpool, respectively.
  (b) Sample size is stated in the number of vehicle days.
  (c) Separate sampling plans are available for the base option and the APTL option.
  (d) Sample size is shown for the entire year and for the relevant period for each frequency.

Table 43.01. Ready-to-Use Sampling Plans for Non-Scheduled Services

Sampling Frequency	Sample Size	Demand Response (DR)		Commuter Vanpool	
		Reporting 100% UPT (APTL Option)	Not Reporting 100% UPT (Base Option)	Reporting 100% UPT (APTL Option)	Not Reporting 100% UPT (Base Option)
Quarterly	Vehicle Days for a Quarter	12	22	31	45
	Total Sample Size for Year	48	88	124	180
Monthly	Vehicle Days for a Month	4	8	10	15
	Total Sample Size for Year	48	96	120	180
Weekly	Vehicle Days for a Week	1	2	2	4
	Total Sample Size for Year	52	104	104	208

§ 43.03 What ready-to-use sampling plans are available for bus services?

(a) Table 43.03 shows the available ready-to-use sampling plans for bus services, including motorbus (MB) and trolleybus (TB).

Table 43.03. Ready-to-Use Sampling Plans for Bus (MB and TB) Services

Sampling Frequency	Sample Size for Period and Year	One-Way Trips			Round Trips		
		Reporting 100% UPT (APTL Option)		Not Reporting 100% UPT (Base Option)	Reporting 100% UPT (APTL Option)		Not Reporting 100% UPT (Base Option)
		With Route Grouping	Without Route Grouping		With Route Grouping	Without Route Grouping	
		(1)	(2)	(3)	(4)	(5)	(6)
Quarterly	Trips for a Quarter	52	78	138	39	59	103
	Total Sample Size for Year	208	312	552	156	236	412
Monthly	Trips for a Month	18	27	46	13	20	35
	Total Sample Size for Year	216	324	552	156	240	420
Weekly	Trips for a Week	4	6	11	3	5	8
	Total Sample Size for Year	208	312	572	156	260	416

(b) Sampling plans are provided separately for one-way trips and round trips.

(c) The number of one-way trips in a sampling plan based on round trips is about 50% greater than the number of one-way trips in a sampling plan based on one-way trips. A sampling plan based on round trips requires a larger number of one-way trips because the pair of one-way trips making up a round trip are not selected randomly or independently.

(d) If you choose the base option:
   (1) use column (3) to find the sample size in one-way trips, and
   (2) use column (6) to find the sample size in round trips.

(e) If you choose the APTL option, you may choose one of two options:
   (1) With Route Grouping – Use column (1) to find the sample size in one-way trips and column (4) to find the sample size in round trips. In using this option, you must divide your routes into two groups on the basis of route length and do sampling and estimation separately for each group. For example, if you operate 10 routes, put the 5 routes with the shortest route distances in the group of short routes and the other 5 routes in the group of long routes.
   (2) Without Route Grouping - If you prefer not to deal with grouping your routes, use column (2) to find the sample size in one-way trips and use column (5) to find the sample size in round trips.

§ 43.05 How does grouping of my bus routes affect sampling and estimation procedures?

(a) You must do your sampling and estimation separately for individual route groups. For details, refer to:
   (1) Subsection 63 on sampling.
   (2) Subsection 83 on estimation.

§ 43.07 What sampling plans are available for commuter rail?
    (a) Table 43.05 shows the available ready-to-use sampling plans for commuter rail (CR).
    (b) Sample size is in one-way car trips.
    (c) Separate sampling plans are available for the base option and the APTL option.

Table 43.05. Ready-to-Use Sampling Plans for Commuter Rail (CR)

Sampling Frequency	Sample Size for Period and Year	Reporting 100% UPT (APTL Option)	Not Reporting 100% UPT (Base Option)
Quarterly	One-Way Car Trips for a Quarter	8	80
	Total Sample Size for Year	32	320
Monthly	One-Way Car Trips for a Month	3	27
	Total Sample Size for Year	36	324
Weekly	One-Way Car Trips for a Week	1	7
	Total Sample Size for Year	52	364

§ 43.09 What sampling plans are available for other rail modes?
    (a) Table 43.07 shows the available ready-to-use sampling plans for other rail modes, including light rail (LR), heavy rail (HR), monorail (MR), and automated guideway (AG).
    (b) Separate sampling plans are available for one-way train trips and one-way car trips.
    (c) Separate sampling plans are available for the base option and for the APTL option.

Table 43.07. Ready-to-Use Sampling Plans for Other Rail Modes

Sampling Frequency	Sample Size for Period and Year	One-Way Train Trips		One-Way Car Trips	
		Reporting 100% UPT (APTL Option)	Not Reporting 100% UPT (Base Option)	Reporting 100% UPT (APTL Option)	Not Reporting 100% UPT (Base Option)
Quarterly	Trips for a Quarter	6	45	12	72
	Total Sample Size for Year	24	180	48	288
Monthly	Trips for a Month	2	15	4	24
	Total Sample Size for Year	24	180	48	288
Weekly	Trips for a Week	1	4	1	6
	Total Sample Size for Year	52	208	52	288

SECTION 50 – TEMPLATE SAMPLING PLANS

Subsection 51 – General Directions

§ 51.01 Under what conditions should I develop a template sampling plan for next year?
 (a) If you have previously been using a ready-to-use sampling plan and the next report year is your mandatory sampling year;
 (b) If you have previously been using a sampling plan, but it is not based on the conditions of your service;
 (c) If you have previously been using a template sampling plan, but you must revise it for your next sampling year according to Subsection 56; or
 (d) If you previously have been using an alternative sampling plan, but would like to:
  (1) improve your sampling efficiency,
  (2) change the unit of sampling and measurement, or
  (3) use a different sampling frequency.

§ 51.03 Does this Manual have a companion tool that I may use?
 (a) Yes, this companion tool is an Excel template, "The NTD Sampling Template.xls."
 (b) It is specifically designed for you to develop template sampling plans.
 (c) You may download a copy of this template from the NTD homepage at www.ntdprogram.gov.

§ 51.05 What is the scope of this template?
 (a) You may use it for any mode of transit service, such as motorbus (MB), that is explicitly recognized by the NTD.
 (b) You may use it for any type of service, such as directly operated (DO), that is explicitly recognized by the NTD.
 (c) You may use it with sample data in any unit of sampling and measurement.

§ 51.07 Do I need to have knowledge of statistics to use this template?
 (a) You do not need any knowledge of statistics to use this template.
 (b) You must follow the steps exactly as described.

Subsection 52 – Options

§ 52.01 What types of options does this template provide in its sampling plans?
 (a) Unit of sampling and measurement – the unit of service at which you do sampling, data collection, and estimation.
 (b) Efficiency options – ways to reduce your annual sample size.
 (c) Sampling frequency – how frequently you do sampling.

§ 52.03 Must I pick a specific unit of sampling and measurement to use this template?
 (a) You must pick a specific unit of sampling and measurement before you start using this template. The type of sample data you have available will often dictate your choice of a unit for sampling and measurement.

(1) For non-scheduled services, such as demand response (DR) or vanpool (VP), the unit of sampling and measurement is typically the vehicle day.

(2) For bus services, including motorbus (MB) and trolley bus (TB), you must decide if the unit will be a one-way bus trip or a round-trip bus trip. It is a common practice to use a one-way bus trip as the unit of sampling and measurement.

(3) For rail services, you must decide if the unit will be a one-way car trip, a round-trip car trip, a one-way train trip, or a round-trip train trip. It is a common practice to use one-way passenger car trip as the unit of sampling and measurement.

(b) The sample data you enter into this template will all be in this unit.

(c) The resulting sampling plan from this template will also be in this unit.

(d) The expansion factors you are going to use to expand your sample will also be in this unit if you are going to estimate both UPT and PMT with your sample data.

§ 52.05 What options does this template provide on sampling frequency?

(a) This template provides you with three options for sampling frequency – quarterly, monthly, and weekly. For example, if weekly sampling requires 4 one-way bus trips per week, you must select at least 4 one-way bus trips at random from the full list of one-way bus trips that you expect to operate during a particular week.

(b) You may choose whichever sampling frequency option is best for your agency.

§ 52.07 What should I consider in choosing a sampling frequency?

(a) Your cycle of minor schedule changes during a year. For example, quarterly sampling may be appropriate if you routinely adjust your schedule every three months.

(b) The scale of your operation and the method you will be using to select a sample. For example, it may become difficult to select a sample for an entire quarter if the number of service units involved in a quarter is too large for a spreadsheet to handle.

(c) The realized annual sample size. The realized annual sample size can be larger than the initial annual sample size due to rounding in allocating the initial annual sample to each frequency level. This is particularly true for weekly sampling when the initial annual sample size is relatively small. For example, if the initial annual sample size is 55 and you choose weekly sampling, the weekly sample size would be 2 and the realized annual sample size would be 104.

§ 52.09 What efficiency options does the template include?

(a) The template includes a number of options for you to consider in improving your sampling efficiency:

(1) The base option.

(2) The APTL option.

(3) The PPMT option.

(4) The grouping option.

(b) You may use the base option if you are going to estimate both UPT and PMT (i.e., you will not be using 100% counts for either UPT or PMT), and

(c) Any of the other three options has the potential to improve your sampling efficiency over the base option:

(1) Sampling plans under the APTL option are based on how APTL in absolute terms varies across your service units.

(2) Sampling plans under the PPMT option are based on how APTL relative to average route length varies across your service units.

(3) Sampling plans under the grouping option are based on the idea that relevant statistical variation may be smaller across service units within sub-segments of your service than across all service units of your entire service.

(d) Additional options become available when service grouping is combined with each of the other three efficiency options.

§ 52.11 Which of these efficiency options are available to me?

(a) The base option is available to you if you have data on PMT from your sample. But it is not recommended in most cases if a 100% count of annual UPT is available and reliable.

(b) The APTL option is available to you if you meet the following two criteria:

(1) you are going to report a 100% count of annual UPT, and

(2) you have data on both UPT and PMT from your sample data.

(c) The PPMT option is available to you if you meet all of the following criteria:

(1) you are going to report a 100% count of annual UPT,

(2) you have data on both UPT and PMT from your sample data,

(3) your service is a fixed-route service,

(4) you have your 100% count of annual UPT for each route, and

(5) you have data on annual total vehicle revenue miles and annual total vehicle revenue one-way trips for each route.

(d) The grouping option is available to you as long as you have some basis for dividing your service into two or more groups.

§ 52.13 How do I divide my scheduled service if I want to consider the grouping option?

(a) Grouping is usually by route when there is a small number of routes or by groups of routes that are similar.

(b) You are going to determine the similarity of service units on your expectations from your prior knowledge of your service.

(c) The most efficient grouping depends on other efficiency options you consider:

(1) If your sampling plan follows the base option, define groups so that within each group, they are similar with respect to PMT per service unit. For example, you may group heavily used long routes separately from lightly used shorter routes.

(2) If your sampling plan follows the APTL option, define your groups so that within each group they have similar APTL. For example, if your express route customers travel particularly long distances, you may separate your express and local services as two groups. As another example, if some of your local routes are particularly longer than the other local routes, you may further divide your local service into two groups.

(3) If your sampling plan follows the PPMT option, define your groups so that the routes within each group are similar with respect to the fraction of a route's length that passengers typically ride. For example, if on some routes passengers tend to ride most of length of the route (as is the case for some express routes) while on other routes passengers tend to ride for only a small part of the route's full length, separate those routes into different groups. Consider another example. If a system has a mix of radial routes (routes with one end in the downtown), diagonal routes (routes that pass through the downtown), and crosstown routes (routes that don't pass through the

downtown), the average fraction of route length that passengers ride tends to be smaller on the diagonal and crosstown routes and longer on the radial routes. In this case, radial routes could be grouped separately from diagonal and crosstown routes.

§ 52.15 How do I group my vanpool service if I serve commuters only?
(a) You should base the grouping of your service on the registered round-trip distance of each vanpool.
(b) In most cases you will only need two groups with the longer routes in one group and the shorter routes in another group.

§ 52.17 What should I consider in general when I consider grouping my service?
(a) Strike a balance between the number of groups and the potential reduction in necessary sample size. In most cases, you will only want to deal with two or three groups.
(b) You may try different ways of grouping your service and choose one particular grouping based on its efficiency improvement and your administrative convenience.
(c) The grouping option may be used for administrative convenience alone:
    (1) You may treat your different contractors of service for a given mode as separate groups when each is responsible for sampling and collecting data.
    (2) You may treat your operational divisions as separate groups if each is responsible for sampling and collecting data.
    (3) You may treat your commuter vanpool separately from your other vanpool services.

Subsection 53 – Input Data

§ 53.01 What data must I have to use this template?
(a) You must have a set of sample data collected recently from your service for the mode and type of service for which you would like to have a new template sampling plan.
    (1) The sample data must be at the unit of sampling and measurement you have chosen for your sampling plan. For example, if your sampling plan is in one-way bus trips, the sample data should show the UPT and PMT and other identification information for each one-way bus trip in your sample.
    (2) Follow the instructions in the template for details on data items required and how they should be entered into the template.
(b) You should use your NTD sample if it is available and you have not made major changes to your service since the data were collected.
(c) Otherwise, you may use data that have been collected for non-NTD purposes:
    (1) One good source of non-NTD sample data for scheduled services is a comprehensive operational analysis (COA). Typically, all trips or a large portion of all trips on your schedule are checked by ride-checkers or by APCs during a concentrated period.
    (2) Make sure that the non-NTD source of sample data has the required information for using this template. For example, between-stop distances often are not collected during COA ride checks, and the resulting ride check data would not be useful if you do not have pre-determined between-stop distances for your entire service.
(d) If you do not have a set of sample data recently collected from your service for the mode and type of service, then you should use one of the other types of sampling plans, such as ready-to-use sampling plans.

§ 53.03 What other data do I need to use this template?
    (a) If you want to consider the grouping option, you must have data:
        (1) on the size of each service group in the number of service units operated during the period for which the sample data were collected, and
        (2) on the expected size of each service group for future sampling years.
        (3) Follow the instructions in the template on how you should enter the information on group size.
    (b) If you want to consider combining the grouping option with the APTL option, you must enter into the template whether you will have reliable 100% counts of UPT for each service group for estimating your annual PMT. Follow the instructions in the template on where you should enter this information. Your input affects several things:
        (1) The efficiency of your sampling plan. In general your sampling plan is more efficient if you will have reliable 100% counts of UPT by service group.
        (2) How you should estimate your annual PMT. For example, you will need to estimate your annual PMT separately for each service group if you have 100% counts of UPT by service group. Refer to Subsection 83 for more guidance on estimation.
        (3) The information you need to get from the template for determining whether you need to revise your template sampling plan. Refer to Subsection 56 for more guidance on revision of sampling plans.

§ 53.05 What sample data should I use to develop template sampling plans for next year?
    (a) If you are not sampling this year, you should use the sample data from your most recent previous sampling year.
    (b) If you are sampling this year, you should use the sample data from this year. It is critical that you process your sample data as they become available. The objective is that you can apply the companion template of this Manual to the cumulative sample data any time during this year. Refer to Section 60 for processing your sample data.
        (1) If you are familiar with the companion template of this Manual, you should wait until a couple of weeks before the end of this year to use the template. It is fine if you miss a few service units in your annual NTD sample for this purpose. Note that you will still need to use the full sample to estimate your annual service-consumed data for NTD reporting.
        (2) If you are not familiar with the companion template, you should start learning to use the companion template with your sample data from this year. Once you become familiar with the template, you should still wait until a couple of weeks before the end of this year to use the template.

§ 53.07 How does this template deal with fluctuations in sample data from one year to another for a given service?
    (a) The measured statistical variation in APTL or any relevant characteristic of your service fluctuates from one year to another.
    (b) Such fluctuations can occur from minor changes in your service or changes in how people use your service even if you do not adjust your service.
    (c) Fluctuations can also occur due to errors in data collection as a result of sampling.
    (d) This template has built in a 25% margin of safety against such fluctuations.

(e) This margin of safety is equivalent to increasing the minimum precision level from 10% to 9% at the same 95% confidence level.

§ 53.09 Why do such annual fluctuations in sample data require a margin of safety?
(a) FTA's 95% confidence and 10% precision levels are imposed on your estimates of annual service-consumed data.
(b) The template, on the other hand, can only impose these requirements on your template sampling plans, but not on the estimates you develop with data collected according to your template sampling plans.
(c) Whether the estimates of annual service-consumed data from the sample data collected according to the template sampling plans meet FTA's requirements depends on how the sample data fluctuate over time:
   (1) If the statistical variation is greater in the sample data used to develop your template sampling plan, your estimates will meet FTA's requirements.
   (2) If the statistical variation is smaller in the sample data used to develop your template sampling plan, your estimates may not meet FTA's requirements. The margin of safety is built in to prevent such violations from happening.

Subsection 54 – Usage and Output

§ 54.01 How do I use this template?
(a) You must choose **Enable Macros** upon opening the template.
(b) You must follow the instructions provided in the template.
(c) This template is illustrated with actual sample data in "The NTD Sampling Template with Sample Data.xls."
(d) This illustrated template is available for download at the NTD webpage: www.ntdprogram.gov.

§ 54.03 What does the template output include?
(a) The output includes a set of several sampling plans as a result of the input data you have entered.
(b) The sampling plans in this set differ in their efficiency options and sampling frequency.
(c) The number of sampling plans in this set varies with the efficiency options that your input data allow. It ranges from 3 sampling plans if you only consider the base option to 18 sampling plans if you consider all four efficiency options.
(d) The set of sampling plans changes when you change some or all of your input data.

Subsection 55 – Selecting a Sampling Plan

§ 55.01 What should I consider in selecting one from the set of template sampling plans?
(a) You should consider all four elements of a sampling plan:
   (1) unit of sampling and measurement,
   (2) efficiency options,
   (3) sampling frequency, and
   (4) necessary sample size.

(b) You should consider tradeoffs among the following characteristics of sampling plans:
    (1) sampling cost – it is closely related to the necessary sample size and to the unit of sampling and measurement.
    (2) complexity of sampling plans – the grouping and PPMT options, for example, make sampling and estimation more complex.
    (3) administrative convenience – how a sampling plan matches your institutional arrangements for sampling purposes.

§ 55.03 Should I keep a copy of the used template that contains my sample data and my chosen template sampling plan?

(a) Yes, you should keep a copy of the used template that contains your sample data and the final sampling plans, including the sampling plan you have chosen. It is useful later for several purposes.

(b) You may need it for NTD requirements on record keeping.

(c) You may also need it for the following purposes:
    (1) Get information about the sample data for determining whether you need to revise your template sampling plan. Refer to Subsection 56 for guidance on that.
    (2) Remind you what you have entered into the template on whether you will have reliable 100% count of UPT by service group if your template sampling plan is based on the APTL option with service grouping. Refer to Subsection 83 for guidance on estimation under the APTL option.

§ 55.05 How does my choice of efficiency options affect my choice of estimation methods?

(a) Your choice of an efficiency option determines your method of estimation.

(b) Follow the guidance on estimation in:
    (1) Section 70 if you choose the base option.
    (2) Subsection 83 if you choose the APTL option.
    (3) Subsection 85 if you choose the PPMT option.

§ 55.07 May I change template sampling plans from one report year to another?

(a) Suppose that:
    (1) you have developed a set of final template sampling plans with sample data from a previous sampling year, and
    (2) you are using one of these template sampling plans this year.

(b) The answer depends on whether you are required to revise your current sampling plan for next year. Refer to Subsection 56 on how you may determine the need for revision.

(c) You may change to a different sampling plan from the current set of final template sampling plans if you are not required to revise your current sampling plan.

(d) You must not change to a different sampling plan from the current set of final template sampling plans if you are required to revise your current sampling plan.

§ 55.09 May I change sampling plans during a report year?

(a) You should not change sampling plans during the same report year if you have not made major changes to your service.

(b) You should increase the necessary sample size by 50% with the same template sampling plan you used during the first part of the year if you have made major changes to your

service. For example, if you were sampling 4 one-way bus trips each week before the major changes, you should change to sample 8 one-way bus trips each week after those changes.

(c) Table 55.01 shows this guidance in a tabular format.

Table 55.01. Tabular Guidance on Changing Sampling Plans in a Report year

If you	then you should	by
have not made major changes to your service	not change your sampling plan during a report year	
you have made major changes to your service	adjust your sampling plan during a report year	increasing the necessary sample size by 50%

§ 55.11 How should I implement a template sampling plan?

(a) You must not implement a template sampling plan at a unit that is smaller than the unit used in developing the original sampling plan. For example, if your plan is to sample 3 round trips per week, you must not implement it by sampling 3 one-way trips per week.

(b) You may choose to sample and measure at a unit that is greater than the unit used in developing the original template sampling plan. For example, if your plan is to sample 4 one-way trips per week, you may implement it by sampling 4 round trips per week instead.

(c) You may only want to do (b) during the first year of implementing a template sampling plan. For example, once you have the sample data in round trips from the first year, you should use the sample data from the first year to develop a new template sampling plan in round trips for future years.

Subsection 56 – Revision

§ 56.01 When does this subsection apply to me?

(a) When you have used a template sampling plan for at least one year, or

(b) When you have been using a template sampling plan for the first time this year.

§ 56.03 Why do I need to consider revision?

(a) Your service and the traveling habits of your customers change naturally over time.

(b) The sampling plans produced by this template are only certified to meet FTA's requirements of 95% confidence with 10% precision for certain sampling cycles, presuming no major changes in your service.

(c) After this time, or after major changes in your service, a new template sampling plan must be developed to maintain certification of compliance with the FTA requirements.

§ 56.05 Under what conditions should I revise my template sampling plan?

(a) If your next sampling year is your mandatory revising year, or

(b) If you have made major changes to your service since you started using the current template sampling plan.

§ 56.07 How do I know if next year is a mandatory revising year for me?
    (a) If you are required to sample every year, every 6th year is your mandatory revising year. For example, if you used your 2008 NTD sample to develop a template sampling plan, report year 2014 is your mandatory revising year.
    (b) If you are required to sample every 3rd year, every 9th year is your mandatory revising year. For example, if you used your 2008 NTD sample to develop a template sampling plan, report year 2017 is your mandatory revising year. In other words, you may use a template sampling plan for a maximum of 8 years without considering whether you need to revise your template sampling plan.
    (c) Follow the Reporting Manual to determine when it is your mandatory revising year.

§ 56.09 What are considered major changes to my service?
    (a) A major change is any change you make to your service that is likely to lead to major changes in the statistical variation in a relevant quantity of your service.
    (b) The relevant quantity of your service varies with the sampling options you choose. It is PMT if you choose the base option, APTL if you choose the APTL option, etc.
    (c) The following are examples of a major change:
        (1) Making transfers fare free for all passengers.
        (2) Adding or cutting express routes to the base of all local service.
        (3) Expanding or contracting your service by at least 25% in vehicle revenue miles.
        (4) Service restructuring that affects at least 25% of your service in vehicle revenue miles.

§ 56.11 What information do I need to determine whether I must revise my current template sampling plan?
    (a) You need information from two samples:
        (1) The base sample is what you used in developing your current template sampling plan. Suppose it is 2008 and you are using a template sampling plan you developed with your 2006 NTD sample. Your 2006 NTD sample in this case is the base sample.
        (2) The current sample is what you would use to develop a new template sampling plan if you must revise your current template sampling plan. Suppose it is 2008, you are sampling this year, and you are going to use your 2008 NTD sample to develop a new template sampling plan. Your 2008 NTD sample in this case is the current sample.
    (b) You will need two pieces of information from each of these two samples:
        (1) The annual sample size, and
        (2) The statistical variation that is the basis of your template sampling plans. For example, if your template sampling plan is based on the APTL option, the statistical variation in APTL is what you need to get from the two samples.

§ 56.13 How do I get these two pieces of information from my samples?
    (a) How you obtain these pieces of information depends on the sampling options in the two related sampling plans as mentioned above. To distinguish the two sampling plans, they are repeated here:
        (1) Your current template sampling plan from the base sample.
        (2) The new template sampling plan that you could develop with your current sample.

(b) Use "Template for the NTD Sampling Manual.xls" that you used to develop your current sampling plan with your base sample. This template must have the data from your base sample that you entered when developing your current sampling plan.

   (1) Use the Revision Worksheet in this template.

   (2) The sample size you need from the Revision Worksheet is located in cell D5. For example, the sample size in the example shown in Figure 56.01 is 549.

   (3) The statistical variation you need from the Revision Worksheet depends on the efficiency options you have chosen for the current template sampling plan. For example, you must use the value in cell D12 of Figure 56.01 (=1,195) if your template sampling plan is based on the APTL option with service grouping and if you have chosen to use your 100% UPT count by group in developing your sampling plan.

Information for Considering Plan Revision

A. Sample Size

Sample Size	549

B. Statistical Variation by Efficiency Options

Efficiency Options	No Grouping	Grouping
Base Option	6,986	5,683
APTL Option - 100% UPT Total	1,373	1,215
APTL Option - 100% UPT by Group	N/A	1,195
PPMT Option	2,316	1,334

Notes:
1. APTL Option - 100% UPT Total applies if cell M52 = 0 in the Input Worksheet.
2. APTL Option - 100% UPT by Group applies otherwise.

Figure 56.01. Layout of Revision Worksheet

(c) Enter your current sample into the companion template as if you were going to develop a new template sampling plan. Once you have applied the companion template to your current sample, the steps you should take to get the two pieces of information are identical to (b) above.

(d) You must use the statistical variation for the same efficiency options for both samples. For example, if your current sampling plan is based on the base option with no grouping, you must get the statistical variation for this combination of efficiency options for both samples.

§ 56.15 How should I use these two pieces of information?

(a) Calculate the ratio of the statistical variation for the current sample in the numerator to the statistical variation for the base sample in the denominator.

(b) If the calculated ratio is smaller than 1.00, you may continue using the current sampling plan for your next sampling year.

(c) If the ratio is greater than 1.00, you must locate a critical value in Table 56.01 corresponding to the sample sizes of your base and current samples. The rows correspond to the sample size for the base sample, and the columns correspond to the sample size for the current sample.

    (1) If the ratio does not exceed the critical value, you may continue using the current customized sampling plan for your next sampling year.

    (2) If the ratio is greater than the critical value, you must use the current sample to develop a new customized sampling plan for your next sampling year.

Table 56.01. Critical Values by Base and Current Sample Sizes

Size of Base Sample	Size of Current Sample												
	25	30	35	40	45	50	75	100	150	200	300	400	600
25	1.98	1.95	1.92	1.90	1.88	1.86	1.82	1.80	1.78	1.77	1.76	1.75	1.74
30	1.90	1.86	1.83	1.81	1.79	1.78	1.73	1.71	1.69	1.67	1.66	1.66	1.65
35	1.84	1.80	1.77	1.75	1.73	1.72	1.67	1.65	1.62	1.61	1.60	1.59	1.58
40	1.80	1.76	1.73	1.70	1.69	1.67	1.62	1.60	1.57	1.56	1.55	1.54	1.53
45	1.77	1.73	1.69	1.67	1.65	1.64	1.59	1.56	1.53	1.52	1.51	1.50	1.49
50	1.74	1.70	1.67	1.64	1.62	1.61	1.56	1.53	1.50	1.49	1.47	1.47	1.46
75	1.67	1.62	1.59	1.56	1.54	1.52	1.47	1.44	1.41	1.39	1.38	1.37	1.36
100	1.63	1.58	1.55	1.52	1.50	1.48	1.42	1.39	1.36	1.34	1.33	1.32	1.31
150	1.59	1.54	1.51	1.48	1.46	1.44	1.38	1.35	1.31	1.29	1.27	1.26	1.25
200	1.57	1.52	1.49	1.46	1.44	1.42	1.36	1.32	1.28	1.26	1.24	1.23	1.22
300	1.55	1.51	1.47	1.44	1.42	1.40	1.33	1.30	1.26	1.23	1.21	1.20	1.18
400	1.54	1.50	1.46	1.43	1.41	1.39	1.32	1.28	1.24	1.22	1.19	1.18	1.16
600	1.54	1.49	1.45	1.42	1.40	1.38	1.31	1.27	1.23	1.20	1.18	1.16	1.14

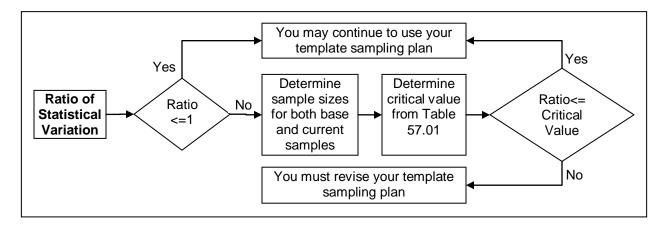(d) Figure 56.03 shows these steps in a flow chart format.

Figure 56.03. Flow Chart on Plan Revision

17

(e) Table 56.03 shows three examples of how these steps work:
  (1) In example 1, the ratio of current to base statistical variations (0.90) is smaller than 1.00. In this case, you may continue using your current customized sampling plan.
  (2) In example 2, the ratio (1.04) is greater than 1.00 but smaller than the critical value (1.34). The critical value is for a base sample of 100 and a current sample of 200. You may continue using your current customized sampling plan.
  (3) In example 3, however, the ratio (1.20) is greater than the critical value (1.18). You must use your current sample to develop a new customized sampling plan.

Table 56.03. Illustrative Examples of Determining the Need for Revision

Measure	Sample	Example 1	Example 2	Example 3
Sample Size	Base	558	100	400
	Current	208	245	400
Statistical Variation	Base	13,829	6,250	2,500
	Current	11,000	6,500	3,000
Ratio of Current to Base Statistical Variations		0.90	1.04	1.20
Critical Value		N/A	1.34	1.18
Ratio > Critical Value		N/A	No	Yes

Subsection 57 – Certification

§ 57.01 How do I certify my template sampling plan?
  (a) You must certify that that your template sampling plan meets FTA's 95% confidence and 10% precision levels through your annual reporting process.
  (b) You should follow the current Reporting Manual on how exactly you may do that.
  (c) This certification of your template sampling plan through the annual reporting process is conditional:
    (1) Your template sampling plan must use the 25% margin of safety according to Subsection 53.
    (2) You revise your template sampling plans over time according to Subsection 56.

SECTION 60 – DATA COLLECTION

Subsection 61 – General Directions

§ 61.01 What are the basic elements of collecting sample data?
(a) Selecting a sample at random according to your sampling plan (Subsection 63).
(b) Collecting data from the random sample (Subsection 65).
(c) Identifying and correcting any errors in the sample data (Subsection 67).

§ 61.03 What criteria does this section cover to ensure that estimates of annual service-consumed data meet FTA's 95% confidence and 10% precision levels?
(a) Your sampling process covers your entire service.
(b) You select your sample at random.
(c) Your data-collection process is designed to avoid errors from happening.
(d) Your data-collection is designed to identify and correct errors when they occur.

Subsection 63 – Selecting a Sample at Random

§ 63.01 What are the basic elements of selecting a sample at random?
(a) Choosing a method with which you select a sample at random.
(b) Developing lists of service units that you expect to operate:
    (1) A single list of all services if your sampling plan is not based on service grouping.
    (2) One list for each service group if your sampling plan is based on service grouping.
(c) Selecting a sample at random from each list with the chosen method.

§ 63.03 What method may I use for random sampling?
(a) You may use the commonly used method based on a table of random numbers.
(b) You may use any other method for random sampling as long as it meets these two criteria:
    (1) sampling under the method is random.
    (2) sampling under the method is without replacement. Without replacement means that the method will not select the same service unit more than once.

§ 63.05 What is a table of random numbers?
(a) It is a list of integers whose frequency and sequence of appearance in the list have been determined entirely by chance.
(b) For convenience and simplicity in use, published tables of random numbers usually appear in the form of separate columns of five-digit numbers. Both rows and columns may be consecutively numbered for easy reference. Table 63.01 shows an example.
(c) Appendix 98 is a comprehensive table of random numbers you may use for random sampling if you choose to use this method.

Table 63.01. Example of a Table of Random Numbers

Rows	(1)	(2)	(3)	(4)	(5)
1	10480	15011	01536	02011	81647
2	22368	46573	25595	85393	30995
3	24130	48360	22527	97265	76393
4	42167	93093	06243	61680	07856
5	37570	39975	81837	16656	06121

§ 63.07 What is the list of all service units that I expect to operate?

(a) It is the amount of revenue service that you expect to operate.
(b) It is measured with the following characteristics:
   (1) It is in the unit of sampling and measurement of the sampling plan you have chosen.
   (2) It is for the period corresponding to the sampling frequency that you have chosen for your sampling plan.
   (3) It is for each of the service groups you have defined if your sampling plan is based on service grouping.
(c) For scheduled services, the list must include:
   (1) all service units that are listed on the schedule, and
   (2) all service units that are not on the schedule but are expected to be operated, such as trippers, shuttles, and other special operations.
(d) It would be the number of one-way bus trips you expect to operate in a week by your express routes, for example, if:
   (1) you have chosen weekly sampling for motorbus (MB),
   (2) your sampling plan involves service grouping, and
   (3) you use express routes as one of the groups.

§ 63.09 How do I develop the list of all service units for using a table of random numbers?

(a) Suppose that:
   (1) you have chosen weekly sampling for your vanpool service,
   (2) your sampling plan requires 2 vanpool-days per week,
   (3) you want to select a random sample for next week, and
   (4) you have 101 vanpools and each of them is expected to operate every day next week.
(b) One way to develop the list would be to assign a serial number of four-digits to each vanpool-day for all 707 combinations of vanpools and service days. The first digit would represent the day of week with 1 for Monday and 7 for Sunday. The other three digits would represent vanpool numbers ranging from 001 through 101.
(c) The vanpool numbers may differ from what you use for your internal purposes. Make sure that you have a one-to-one list between the internal vanpool numbers and the new serial numbers if they differ.
(d) The serial numbers on a given day must be consecutive without any gaps.
(e) Write down just the first and the last for each day of week so that you will know the range of numbers. For example, the range for Monday is 1001-1101.
(f) You should summarize these serial numbers in a summary table as in Table 63.03.

Table 63.03. Example of a Summary Table of Serial Numbers

Day of Week	Range of Serial Numbers
1 (Monday)	1001-1101
2	2001-2101
3	3001-3101
4	4001-4101
5	5001-5101
6	6001-6101
7	7001-7101

§ 63.11 How do I use a table of random numbers?
   (a) Suppose that:
       (1) you have 101 vanpools that are expected to operate every day of next week,
       (2) you have numbered the vanpool days for all vanpools as shown in Table 63.03, and
       (3) your sampling plan for your vanpool service requires 2 vanpool days per week.
   (b) You must work with a constant length of digits from a table of random numbers for sampling. This constant length is given by the number of digits in the longest serial number you have assigned to members of the list of all service units.
       (1) This constant length would be 4 for the example in Table 63.03 because all serial numbers are four-digits long.
       (2) This constant length would be 5 if your serial numbers vary in length, ranging from one to five digits.
   (c) You must combine adjacent digits from the table of random numbers as needed to obtain a two-, three-, or four-digit number, or any other length number from the table.
       (1) You may choose to work with rows or columns in combining adjacent digits. You may start with any row if you choose to work with rows. You may start with any column if you choose to work with columns. You may also choose to work from right to left or from left to right if you choose to work with rows.
       (2) If you choose to work with rows and to start with row 1, for example, the first 9 four-digit numbers from Table 63.01 would be:

       1048, 0480, 4801, 8015, 0150, 1501, 5011, 0110, and 1101.

   (d) You must continue forming four-digit numbers until you find two four-digit numbers from the table of random numbers that are in the summary table of serial numbers (Table 63.03). In the above example, these two numbers are 1048 and 1101. That is, you should select vanpools 48 and 101 and collect sample data from them on Monday of next week.
   (e) Once you are done sampling for a week, you should mark where you stopped forming four-digit numbers in the table of random numbers. For example, the symbol, $, has been inserted between digits 1 and 5 in row 1 and column 3 of Table 63.01. You should start the above process for a later week after that mark.
   (f) Once you are done sampling for a year, you should mark where you stopped forming four-digit numbers in the table of random numbers.

(1) If you number your service units exactly as for a previous sampling year, you should start the above process for a new sampling year after the last mark of your previous sampling year.
(2) If you number your service units with a different approach, you may start the above process anywhere in the table of random numbers.

§ 63.13 What are the pros and cons of using a table of random numbers?
(a) Using a table of random numbers for random sampling has the following advantages:
   (1) It is applicable to all situations.
   (2) You do not need to list explicitly all service units.
(b) It has the following disadvantages:
   (1) You must number your service units consecutively without gaps, at least within each subset of your service units. Subsets are formed by route, type of service days, etc.
   (2) You may not be able to take advantage of the serial numbers you have already assigned to your service units for internal purposes.
   (3) It can be difficult to use if the serial numbers have a large number of digits.

§ 63.15 What information should I keep from my sampling process?
(a) You should have an auditable record of your sampling process. That record should cover the following:
   (1) A written description of the sampling plan.
   (2) A written procedure for your method of selecting a sample at random.
   (3) The list of all service units from which you selected a sample at random for each act of sampling. For example, you should have 52 such lists if you did weekly sampling for an entire year.
   (4) The random sample.

Subsection 65 – Collecting Data from the Random Sample

§ 65.01 What method may I use to collect the sample data?
(a) One common method involves one or more ride checkers observing and recording passenger activities while riding in a transit vehicle.
(b) An increasingly common method uses APCs to record passenger activities instead.
(c) You may use one of these or any other method to collect the data from each service unit of your random sample as long as your method meets these criteria:
   (1) it obtains data from direct measurement or direct observation without passenger intercept,
   (2) it provides data you must have to determine PMT for each service unit, and
   (3) it meets the requirements on measurement accuracy in the NTD Reporting Manual.

§ 65.03 What approach may I use to determine PMT for each service unit of my sample?
(a) You may use the load-based approach. It determines PMT by multiplying the number of passengers onboard a transit vehicle between each pair of consecutive stops by the distance between these stops.
(b) You may also use the distance-based approach. It determines PMT by keeping track of the distance traveled by each passenger carried by a service unit of your random sample.

§ 65.05 What data items must I collect to use the load-based approach for scheduled services?

(a) You must collect the required data items separately for each one-way vehicle trip in your service unit.

    (1) If your service unit is a round-trip bus trip, for example, it has two one-way vehicle trips.

    (2) If a service unit is a one-way train trip with three passenger cars, for example, it has three one-way vehicle trips.

(b) The following data items are required for each one-way vehicle trip:

    (1) the number of people who boarded at each stop,

    (2) the number of people who alighted at each stop,

    (3) the distance between any pair of consecutive stops at which boardings or alightings occurred,

    (4) the number of people onboard the vehicle between any pair of consecutive stops,

    (5) the number of people who stayed on from the previous one-way vehicle trip, and

    (6) the number of people who remained on the vehicle at the last stop.

§ 65.07 What data must I collect to use the load-based approach for non-scheduled services?

(a) For commuter vanpool, the following data items are required for each direction of commuting:

    (1) the number of people who boarded at each pick-up location,

    (2) the number of people who alighted at each drop-off location, and

    (3) the distance between any pair of consecutive stops at which pick-up or drop-off occurred.

(b) For demand response, you must collect the required data items continuously during the entire vehicle day sampled:

    (1) the odometer reading at each pick-up location,

    (2) the number of people onboard between each pair of consecutive locations at which pick-up or drop-off occurred, and

    (3) the odometer reading at each drop-off location.

(c) You should treat non-commuter vanpool as demand response for data collection.

§ 65.09 How should I determine between-stop distances for the load-based approach?

(a) You should avoid using maps to estimate between-stop distances under all circumstances.

(b) For services without designated stops, including demand response (DR), jitney (JT), vanpool (VP), or fixed-route services without designated stops:

    (1) If available, you should always use the onboard odometer to determine the between-stop distances for each service unit in your random sample. You should make sure that the vehicles for the sampled service unit have a working odometer onboard before they start for the sampled service unit.

    (2) If your vehicle does not have an onboard odometer, you should determine the distance by retracing the path and the stops by automobile.

    (3) You should record your odometer readings at least to one-tenth of a mile.

(c) For ferryboat (FB), aerial tramway (TR) and all rail services, you may want to pre-determine the between-station distances for all routes and directions.

(d) For fixed-route services with designated stops, you should use one of two approaches:
  (1) pre-determine the between-stop distances for all routes and directions, or
  (2) record the onboard odometer readings at individual stops.

(e) You may use different methods to pre-determine the between-stop distances:
  (1) use an up-to-date GIS of your network of routes and stops, or
  (2) record the odometer readings while you drive through all of your routes and related deviations and directions.

(f) If you pre-determine between-stop distances, you must keep them updated to reflect any changes in your services.

§ 65.11 What additional data should I collect to identify each service unit of my sample?
  (a) You must record the date and the type of service days for all cases.
  (b) For commuter rail (CR), heavy rail (HR), and light rail (LR), you must also record the weekday time period that you will be reporting to the NTD for weekdays.
  (c) If your sampling plan is based on the PPMT option, you must record route identification.
  (d) If your sampling plan is based on service grouping, you should also record information that is necessary to determine group membership of each service unit in the random sample.

§ 65.13 When do I use the different approaches to determining PMT?
  (a) The load-based approach is applicable to all circumstances. Under conditions of heavy loads or high boarding volumes, however, extra care must be taken to maintain the required level of measurement accuracy.
  (b) The distance-based approach is useful under several circumstances. For examples:
  (1) All passengers board and alight at the same locations, such as inclined plane (IP), tramways (TR), and most ferryboat (FB) operations.
  (2) Services with a small number of passengers who board and alight at a small number of stops, such as demand response.
  (3) Services with a small number of frequent passengers who board and alight at a small number of stops, such as commuter vanpool.
  (4) Any service with a ticketing system that keeps track of the origin and destination for every boarding with a known distance.

§ 65.15 What instrument should I use to collect the data for the distance-based approach?
  (a) You may use any instrument that you have designed as long as you can use it to record the required data items correctly.
  (b) If you use human ride checkers, the instrument may be a piece of paper and a pencil or it may be a hand-held device.
  (c) Appendix 92 provides an example of both blank and filled-out paper instruments for the distance-based approach.

§ 65.17 What instrument should I use to collect data for the load-based approach?
  (a) You may use any instrument that you have designed as long as you can record the required data items correctly.

(b) If you use APCs, the instrument would be computer software and hardware that records the counts and other data items transmitted from the APCs.

(c) If you use human ride checkers, the instrument may be a piece of paper and a pencil or it may be a hand-held device.

(d) If you use a hand-held device, it is critical that the unit accepts counts of boardings and alightings that may not be equal for a one-way vehicle trip.

(e) The instrument you design may take slightly different formats for different services. Three examples of blank and filled-out instruments are shown as appendices:
(1) demand response – Appendix 93.
(2) commuter vanpool – Appendix 94.
(3) fixed-route services – Appendix 95.

(f) If you are going to use one of these example instruments, you should study it carefully before reading the following guidance.

§ 65.19 What pre-survey procedures should I follow if I use a paper instrument and human ride checkers?

(a) You should use an appropriate survey sheet for each service unit selected in the sample. This survey sheet may be one of those from the appendices or one that you have designed, but it is important that you select a survey sheet that is designed for the service to be surveyed.

(b) For non-scheduled services, including demand response (DR) and vanpool (VP), a survey sheet should be used for each driver of the survey vehicle during an entire day.

(c) For scheduled services, a survey sheet should be used for each one-way vehicle trip of your service unit that you have chosen for your sampling plan.

(d) The ride checker(s) should carry several extra survey sheets in the event that extra sheets are needed.

(e) You should learn about the likely load and boarding volumes for each service unit to be surveyed.
(1) You may need to use more than one ride checker under conditions of high loads and high boarding volumes.
(2) If more than one ride checker is used, the separate survey sheets should also be identified with the door(s) that each ride checker is responsible for.

(f) If you rely on the onboard odometer to determine the between-stop distances, make sure that it works properly. If you cannot fix a malfunctioning odometer in time for a ride check, use a different vehicle with a working odometer.

(g) Before going into the field, the survey supervisor should fill in the data items that identify the service unit to be surveyed. If your service unit has more than one one-way vehicle trips, identify each one-way vehicle trip separately.

(h) If you rely on pre-determined between-stop distances, the survey supervisor should also use the survey sheet(s) in Appendix 95 to:
(1) Fill in the stop numbers in column (7) and stop descriptions in column (8) for all stops.
(2) Cross out column (9) to avoid confusion in the field.

(i) You should write the page numbers in the box in the lower right-hand corner of each survey sheet if you use more than one survey sheet for a given one-way vehicle trip.

§ 65.21 What manual survey procedures should I follow for demand response (DR) with the distance-based approach?

(a) You may use the survey sheet for the distance-based approach in Appendix 92.

(b) You must record individual trips by each pair of origin and destination. The filled-out form in Appendix 92 illustrates three cases of pick-up and drop-off patterns:

    (1) The first pick-up illustrates the "one origin-many destinations" case. The driver picked up 16 passengers at 1020 J Street. He immediately distributed these passengers according to their three drop-off destinations under item (8).

    (2) The second pick-up illustrates the "one origin-one destination" case. 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.

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

(c) You must record the odometer readings for each pick-up and drop-off.

    (1) Item (7), "Pick-Up Odometer Reading," should be recorded immediately upon picking up the passenger(s).

    (2) Item (8), "Drop-Off Odometer Reading," should be recorded immediately upon dropping off the passengers.

    (3) You should also record the odometer readings to at least one-tenth of a mile when the odometer allows.

(d) You should use additional pages if a service unit involves more stops than are given on a page. You should write the page numbers in the box in the lower right-hand corner.

(e) As an alternative to data recording by the driver, the driver can call in the information to the dispatcher if you have two-way radio communications on all vehicles.

    (1) When the driver arrives at a pick-up point, he can call in items (5)-(8).

    (2) When he arrives at each destination, he can call in item (9) and verify how many passengers were dropped off at that destination.

§ 65.23 What manual survey procedures should I follow for demand response (DR) with the load-based approach?

(a) You may use the survey sheet for the load-based approach for demand response in Appendix 93.

(b) For each pick-up or drop-off, you must record the following:

    (1) whether it is a pick-up or drop-off in column (5),

    (2) a description of the location in column (6),

    (3) the odometer reading in column (7), and

    (4) the leaving load in column (8).

(c) The filled-out form in Appendix 93 shows the recorded information for the example shown in Appendix 92. The leaving load at the last drop-off location should be 0.

(d) You should record the odometer readings to at least one-tenth of a mile.

(e) You should use additional pages if a service unit involves more stops than are given on a page. You should write the page numbers in the box in the lower right-hand corner.

(f) As an alternative to data recording by the driver, the driver can call in the information to the dispatcher if you have two-way radio communications on all vehicles. Before leaving each pick-up or drop-off location, the driver can call in items (5)-(8).

§ 65.25 What manual survey procedures should I follow for commuter vanpool with the load-based approach?

(a) Suppose that you have chosen to sample on a monthly basis.

(b) Before a new month starts, you should communicate with the driver of each sampled vanpool about the days on which he must collect sample data during the new month.

(c) For each sampled vanpool day, the driver should fill in the identification data before he leaves home, including the date, the day of week, and the vanpool number.

(d) The driver is required to record the travel data, including the van odometer reading whenever any rider gets on or off the van along with the number of riders who get on the van and the number of riders who get off the van. This recording is to be done separately for travel to work and travel from work. The filled-out form in Appendix 94 shows the travel data for a vanpool of 6 riders with a round-trip-distance of 78 miles. The driver picks up all 5 riders at a single location but drops them off at three different locations in the morning. In the afternoon, the process reverses itself.

    (1) Once the driver gets on the van in the morning, he should enter 1 in the ON column (6) and record the odometer reading at 29,366.0 in column (8).

    (2) He then leaves for picking-up 5 fellow vanpoolers at another location. Once they get on the van, he should enter 5 in (6), and record the odometer reading at 369.1 in (8) before departing that location.

    (3) At the first drop-off location, 3 vanpoolers get off. Before leaving, the driver should enter 3 in the OFF column (7), and record the odometer reading at 395.3 in (8).

    (4) One vanpooler gets of the van at each of the next two drop-off locations. Before leaving these locations, the driver should enter 1 in the OFF column, and record the odometer reading at 396.8 and 397.5, respectively.

    (5) Finally, the driver arrives at his own destination. Before he leaves the van, he should record the odometer reading again at 405.0.

(e) The day after each sample day, you should communicate with each driver involved in collecting sample data to determine if he actually recorded the sample data. Sample data may be not recorded for a variety of reasons.

    (1) If the data were collected, the driver should send the filled-out survey sheet immediately,

    (2) If the driver forgot to collect the data, he should be asked to collect the data next day,

    (3) If the driver refused to collect the data or the vanpool has been terminated, a replacement vanpool day should be selected at random.

§ 65.27 What instructions should I give my ride checkers if I do not use pre-determined between-stop distances for fixed-route services?

(a) Take enough copies of the survey sheet in Appendix 95 or an alternative sheet.

(b) Use separate survey sheets for separate one-way vehicle trips if your service unit has more than one one-way vehicle trip.

(c) Use additional survey sheets if needed for a given one-way trip.

(d) Board the transit vehicle at the beginning point of the service unit and position yourself so that you can observe the doors for which you are responsible.

(e) Before the vehicle leaves the beginning point, record:

    (1) Stop #1 in column (7),

(2) stop description of the beginning point in column (8),
(3) odometer reading to at least one-tenth of a mile in column (9),
(4) number of passengers who have stayed onboard from the last trip (13), and
(5) number of passengers boarded in (10), including the passengers who have stayed onboard from the last trip in (e)(4).
(f) When the vehicle leaves the beginning point, record the number of passengers onboard in column (12), including any passengers who have stayed onboard from the last trip.
(g) Only at points where the vehicle stops during the service unit, record:
(1) stop number in (7),
(2) stop description in (8),
(3) odometer reading (from the driver) in (9),
(4) passengers boarded in (10), and
(5) passengers alighted in (11).
(h) Between stops, count the number of passengers on board (12). You should record this number as the leaving load. For example, between stops 2 and 3 you should record this number in the row for stop 2 rather than in the row for stop 3.
(i) At the end point of each one-way trip, record the number of passengers who will stay on board to the next trip in column (14) and in column (11) as passengers alighted.

§ 65.29 What steps should I take if I fail to collect the sample data from a particular unit?
(a) You may fail to collect the required sample data from any particular unit in your sample:
(1) The unit may be canceled for a variety of operational reasons.
(2) The rider checker(s) may fail to show up for the unit.
(3) The rider checker(s) may fail to collect the data.
(b) You must replace the missed unit as soon as possible on the same type of service days:
(1) If the rest of the sampling period (a week, a month, or a quarter) has at least one service day of the same type as the missed service unit, select one service unit from the next service day of the same type. For example, if the missed service unit is on the second Monday of a month and your sampling is monthly, you should get a replacement unit from the third Monday of the month.
(2) If the rest of the sampling period does not have any service day of the same type left, select one service unit from the first service day of the same type during the next sampling period. For example, if the missed service unit is on a Monday and your sampling is weekly, you should get a replacement unit from the next Monday.
(c) The replacement unit must be selected at random in all cases.

Subsection 67 – Correcting Errors in the Raw Sample Data

§ 67.01 What steps should I take after I have collected the sample data?
(a) Design a format for recording your sample data.
(b) Enter the raw data.
(c) Process the entered data.
(d) Identify errors in the entered data.
(e) Identify sources of the data errors, if any.
(f) Correct the data errors, if any.

(g) What you should do within each step depends on your situation. To be specific, the following example is used for the rest of this subsection:
   (1) you collect sample data with human ride checkers from one-way bus trips with designated stops,
   (2) you use the load-based approach to determining PMT,
   (3) you use pre-determined between-stop distances, and
   (4) you have collected sample data from a route whose longest one-way trip is 4 miles.

§ 67.03 What should I consider in designing the format for data recording?
(a) The data items you have collected to determine PMT. The exact data items depend on your service and the approach you have taken to determine PMT.
(b) The data items that identify the service units in your sample.
(c) A format that is easy for data analysis.
(d) Suppose that you have designed a format in Table 67.01. With this format, you enter the field data (7)-(14) as they appear on the field survey sheet shown in the filled-out form in Appendix 95. Item (8) is not shown due to space limit. The identification data items at the top of the survey sheet (1)-(6) are repeated for each stop of this one-way trip.

Table 67.01. Example Format for Data Recording

Date	Day of Week	Time Period	Route No.	Trip No.	Direction	Stop Sequence	Distance to Next Stop	No. of Pass. Boarded	No. of Pass. Alighted	No. of Pass. On Board (Leaving Load)	No. of Pass. from Previous Trip (Stop 1 only)	No. of Pass. Continuing to Next Trip (Last Stop only)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)	(10)	(11)	(12)	(13)	(14)
10/13/05	Thur	Midday	11	408	Outbound	1	0.3	20	0	20	2	
10/13/05	Thur	Midday	11	408	Outbound	2	0.7	2	1	21		
10/13/05	Thur	Midday	11	408	Outbound	3	0.6	0	2	19		
10/13/05	Thur	Midday	11	408	Outbound	4	0.3	1	3	17		
10/13/05	Thur	Midday	11	408	Outbound	5	0.5	1	10	8		
10/13/05	Thur	Midday	11	408	Outbound	6	0.8	0	2	6		
10/13/05	Thur	Midday	11	408	Outbound	7	0.2	0	1	5		
10/13/05	Thur	Midday	11	408	Outbound	8	0.1	0	2	3		
10/13/05	Thur	Midday	11	408	Outbound	9	0.1	0	2	1		
10/13/05	Thur	Midday	11	408	Outbound	10	0.3	0	0	1		
10/13/05	Thur	Midday	11	408	Outbound	11	0.1	0	0	1		
10/13/05	Thur	Midday	11	408	Outbound	12	0.0	0	1	1		1

§ 67.05 When should I enter my sample data?
(a) You should have the sample data from each service unit entered immediately after your ride checker(s) has come back from the field.
(b) This has a number of advantages:
   (1) reducing the chance of loss of information,
   (2) increasing the chance of correcting data errors, if any,
   (3) being ready to use the cumulative sample data any time during the sampling year, and
   (4) minimizing the rush at the end of the year.

§ 67.07 How should I process the entered data?

    (a) You should process the data as follows immediately after you have entered them. If your service unit has more than one one-way vehicle trip, you should process the data for individual one-way vehicle trips:

        (1) Sum the number of passengers boarded at individual stops in column (10) of Table 67.01 to get the total number of passengers boarded. It is 24 in this case.

        (2) Sum the number of passengers alighted at individual stops in column (11) of Table 67.01 to get the total number of passengers alighted. It is 24 in this case.

        (3) Calculate the load between every pair of two consecutive stops. Table 67.03 shows an example and the formulas for calculating leaving loads and arriving loads.

        (4) Calculate PMT for each pair of consecutive stops by multiplying the calculated load with the between-stop distance. Table 67.03 also shows the calculation of PMT with both leaving loads and arriving loads.

        (5) Calculate total PMT. It is 47.8 miles in this case.

        (6) Divide total PMT by the total number of passengers boarded to get APTL. It is 1.99 miles in this case.

        (7) Calculate vehicle trip length by summing up the pre-determined between-stop distances in column (9). It is 4.0 miles in this case.

    (b) If your sampling plan is based on the PPMT option, you should also process the data as follows immediately to calculate the ratio of PMT to PPMT for each service unit:

        (1) Calculate the average route length for each route.

        (2) Calculate PPMT by multiplying UPT by average route length.

        (3) Divide PMT by PPMT to get the ratio for each service unit.

        (4) Follow Subsection 85 on calculating average route length and PPMT.

§ 67.09 How may I use the processed data to identify potential errors in the sample data?

    (a) Compare vehicle trip length with the longest actual length of the route. Vehicle trip length must not exceed the longest route length.

    (b) Compare APTL with vehicle trip length and route length. APTL must not exceed either.

    (c) Compare the total number of passengers boarded with the total number of passengers alighted. They must be equal.

    (d) Examine the calculated load at the end point of the trip. It must be zero for leaving loads.

    (e) If calculated, examine the PMT to PPMT ratio for each service unit. It must not exceed 1.

§ 67.11 How do I identify the sources of any errors?

    (a) If you have identified any error from the previous step, you should start with the calculations you did in processing the sample data to determine if an error is a calculation error or an error in the sample data.

    (b) Check if you have correctly calculated loads, PMT, and APTL.

    (c) Check if you have used between-stop distances and loads consistently:

        (1) If you use leaving loads, you must use the distance to the next stop. The distance should be zero for the ending point of a one-way trip.

        (2) If you use arriving loads, you must use the distance from the previous stop. The distance should be zero for the beginning point of a trip.

    (d) Check the pre-determined between-stop distances you entered.

    (e) Compare your calculated load with the observed load from the field.

Table 67.03. Calculation of Loads and PMT

Load Type	Stop Sequence	Distance to Next Stop	No. of Pass. Boarded	No. of Pass. Alighted	No. of Pass. from Previous Trip	Calculated Load	PMT
Leaving Load	1	0.3	20	0	2	20	6.0
	2	0.7	2	1		21	14.7
	3	0.6	0	2		19	11.4
	4	0.3	1	3		17	5.1
	5	0.5	1	10		8	4.0
	6	0.8	0	2		6	4.8
	7	0.2	0	1		5	1.0
	8	0.1	0	2		3	0.3
	9	0.1	0	2		1	0.1
	10	0.3	0	0		1	0.3
	11	0.1	0	0		1	0.1
	12	0.0	0	1		0	0.0
	Total	4.0	24	24	2	N/A	47.8
	Load for Stop 1 =		Current Boarding				
	Load for Other Stops =		Previous Load + Current Boarding - Current Alighting				

Load Type	Stop Sequence	Distance from Previous Stop	No. of Pass. Boarded	No. of Pass. Alighted	No. of Pass. from Previous Trip	Calculated Load	PMT
Arriving Load	1	0.0	20	0	2	0	0.0
	2	0.3	2	1		20	6.0
	3	0.7	0	2		21	14.7
	4	0.6	1	3		19	11.4
	5	0.3	1	10		17	5.1
	6	0.5	0	2		8	4.0
	7	0.8	0	1		6	4.8
	8	0.2	0	2		5	1.0
	9	0.1	0	2		3	0.3
	10	0.1	0	0		1	0.1
	11	0.3	0	0		1	0.3
	12	0.1	0	1		1	0.1
	Total	4.0	24	24	2	N/A	47.8
	Load for Stop 1 =		0				
	Load for Other Stops =		Previous Load + Previous Boarding - Previous Alighting				

§ 67.13 How do I correct any errors?

(a) Table 67.05 shows an example of sample data for a one-way trip where PMT is based on calculated leaving loads. The first row of Table 67.07 shows the vehicle trip length, PMT, UPT, APTL, and the ratio of PMT/PPMT for this trip.

(b) It has the following errors:

(1) Vehicle trip length > route length.

(2) APTL > route length.
(3) Total boardings in column (10) < total alightings in column (11).
(4) The load at the end stop < 0.

(c) Error (b)(1) clearly indicates errors in the pre-determined between-stop distances. If you check what you have entered in column (9), you would notice the 7 miles from stop 3 to stop 4. Correct the data-entry error by replacing 7 by 0.7. After this change,
(1) vehicle trip length matches the route length,
(2) APTL becomes smaller than the route length, and
(3) PMT is reduced to 34.7 with an APTL of 1.58 miles.

(d) To identify the source of error (3), compare the calculated loads with the observed loads. You may notice that the calculated load is lower by 2 at the first stop. It appears that the ride checker did not include the number of passengers from the previous trip in the number of boardings at the first stop. With this correction,
(1) Boardings become greater than alightings.
(2) PMT is increased to 42.7 miles with an APTL of 1.78 miles.

Table 67.05. Example of Correcting Data Errors

Stop Sequence	Distance to Next Stop	No. of Pass. Boarded	No. of Pass. Alighted	Observed Leaving Load	No. of Pass. from Previous Trip (Stop 1 only)	No. of Pass. Continuing to Next Trip (Last Stop only)	Calculated Leaving Load	PMT
(7)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1	0.0	18	0	20	2		18	0.0
2	0.3	2	1	21			19	5.7
3	7.0	0	2	19			17	119.0
4	0.6	1	3	17			15	9.0
5	0.3	1	9	8			7	2.1
6	0.5	0	2	6			5	2.5
7	0.8	0	1	5			4	3.2
8	0.2	0	2	3			2	0.4
9	0.1	0	2	1			0	0.0
10	0.1	0	0	1			0	0.0
11	0.3	0	0	1			0	0.0
12	0.1	0	1	1		1	-1	-0.1
Total	10.3	22	23		2	1	N/A	141.8

(e) To identify why boardings are still larger than alightings, compare the re-calculated loads with the observed loads again. You may notice that the re-calculated load starts deviating from the observed load at stop 5. Since the calculated load is one passenger too big, increase the number of alighted passengers at stop 5 by 1 from 9 to 10. With this correction,
(1) Boardings equal alightings,
(2) The leaving load at the end stop is 0, and
(3) PMT is further reduced to 40.3 with an APTL of 1.68 miles.

(f) You should also check the consistency between between-stop distances and the calculated loads. Column (9) is based on the distance from the previous stop, but the calculated load is the leaving load. Correcting this error leads to a final PMT of 47.8 with an APTL of 1.99 miles.

(g) Table 67.07 also shows vehicle trip distance, PMT, UPT, APTL, and ratio PMT/PPMT for the cumulative corrections in (c), (d), (e), and (f).

Table 67.07. Impacts of Correcting Errors

Error Corrections	Vehicle Trip Length	PMT	UPT	APTL	PMT/PPMT
No corrections	10.3	141.8	22	6.45	0.63
§69.13 (c)	4.0	34.7	22	1.58	0.39
§69.13 (c) + (d)	4.0	42.7	24	1.78	0.44
§69.13 (c) + (d) + (e)	4.0	40.3	24	1.68	0.42
§69.13 (c) + (d) + (e) + (f)	4.0	47.8	24	1.99	0.50

§ 67.15 What should I do if I fail to correct the data errors for a particular service unit?
(a) You should treat the service unit as if it were missed for data collection.
(b) You should follow the guidance in §65.29 for getting a replacement unit.

§ 67.17 What steps should I take after I have identified and corrected errors in my data?
(a) You should stack the corrected sample data from the field as shown in Table 67.01 in one or more worksheets. These worksheets along with the survey sheets become an auditable record of your sample data.
(b) You should enter the summary data at the level of your unit of sampling and measurement in a separate worksheet. These summary data are ready for developing new sampling plans or for estimating service-consumed data for the NTD.
(c) Table 67.09 shows how that summary worksheet looks with the column headings and the summary sample data for one service unit.

Table 67.09. Example of Summary Sample Data

Date	Day of Week	Time Period	Route No.	Trip No.	Direction	Vehicle Trip Length	UPT	PMT
(1)	(2)	(3)	(4)	(5)	(6)			
10/13/05	Thur	Midday	11	408	Outbound	4.0	24	47.8

SECTION 70 – ESTIMATION WITHOUT 100% UPT

Subsection 71 – General Directions

§ 71.01 What service-consumed data must I estimate without 100% UPT?
   (a) You must estimate both UPT and PMT.
   (b) The following table shows the data items you must estimate.

Table 71.01. Service-Consumed Data Items without 100% UPT

If your mode is	you must estimate
commuter rail (CR), heavy rail (HR), or light rail (CR)	• annual total UPT and PMT • average daily UPT and PMT by type of service days • annual total UPT by weekday time period
Any other mode	• annual total UPT and PMT • average daily UPT and PMT by type of service days

§ 71.03 What do I need to do in general to get estimates of these data items?
   (a) You must determine sample averages.
   (b) You must determine expansion factors.
   (c) You must combine the expansion factors and sample averages to get the corresponding estimates of service-consumed data.

§ 71.05 What is a sample average?
   (a) A sample average is the sample total divided by the number of service units in the sample.
   (b) It may be calculated for the entire annual sample, by the type of service day, or for specific weekday time periods.
   (c) Sample averages are used to estimate service-consumed data when your sampling plan is based on the base option.

§ 71.07 What is an expansion factor?
   (a) A measure of actual services operated during a given period.
   (b) It is used to convert sample averages to totals in the given period. The total number of one-way bus trips operated during an entire report year is an example of an expansion factor in actual services operated; when multiplied by sample average PMT per one-way bus trip, it yields a measure of annual total PMT.

§ 71.09 How is the guidance organized?
   (a) The guidance is separate in three subsections for three modal groups to reduce confusion over the different units of sampling and measurement that are typically used for these three modal groups:
     (1) Non-scheduled services, including demand response (DR), vanpool (VP), jitney (JT), or público (PB) (Subsection 73).

(2) Rail services, including heavy rail (HR), commuter rail (CR), light rail (LR), monorail (MR), automated guideway (AG) (Subsection 75).

(3) Bus services, including motorbus (MB) or trolley bus (TB) (Subsection 77).

(b) Subsection 79 contains the guidance on combining expansion factors and sample averages to get estimates of service-consumed data.

Subsection 73 – Non-Scheduled Services

§ 73.01 What expansion factor should I use for non-scheduled service?

(a) You should use your 100% count of vehicle days as the expansion factor.

(b) For estimating annual total PMT and UPT:

(1) Use annual total count of vehicle days if your sampling plan is not based on grouping.

(2) Use annual total count of vehicle days by group if your sampling plan is based on grouping.

(c) For estimating average daily PMT and UPT by type of service days, use annual total count of vehicle days by type of service days.

§ 73.03 What sample average should I use for non-scheduled service?

(a) You must use the ratio of sample total PMT over sample total vehicle days as the sample average to estimate PMT.

(b) You must use the ratio of sample total UPT over sample total vehicle days as the sample average to estimate UPT.

(c) For estimating annual total PMT and UPT:

(1) Use the sample averages for the entire sample if you do not group your service.

(2) Use the sample averages for each group if your sampling plan is based on grouping.

(d) For estimating average daily PMT and UPT by type of service days, use the sample averages by type of service days.

§ 73.05 How do I determine annual vehicle days actually operated for non-scheduled services?

(a) You should use a spreadsheet or some other mechanism to record the daily number of passengers carried by individual vehicles in your fleet for an entire year.

(a) Figure 73.01 shows an example of such a spreadsheet with the following assumptions:

(1) your fiscal year runs from July 1 through June 30,

(2) you operate every day, and

(3) your fleet has 100 vehicles.

(b) Once you have such a spreadsheet, you can easily determine the daily number of vehicles operated by type of service days in two steps:

(1) For any one operating date, count the number of vehicles in the fleet that carried at least one passenger on that date.

(2) Summarize the daily number of vehicles operated by type of service days.

(c) You can also use such a spreadsheet to determine the number of vehicles operated for each group if your sampling plan is based on service grouping.

	B	C	D	E	F	G	H	I	J	...	CZ	DA
1	Date	Month	Day of Week	Daily Passengers Carried by Vehicle No.								
2				1	2	3	4	5	6	...	100	Total
3	7/1/09	July	Wed									
4	7/2/09	July	Thu									
5	7/3/09	July	Fri									
6	7/4/09	July	Sat									
...	...	...	...									
367	6/30/10	June	Wed									
368	Total											

Figure 73.01. Daily Passenger Count Worksheet for Non-Scheduled Services

Subsection 75 – Rail Services

§ 75.01 What expansion factor should I use for rail services?
(a) The unit of sampling and measurement you have chosen for your sampling plan determines the expansion factor you should use.
(b) While you could have chosen any unit of sampling measurement for your sampling plan, it most likely is one of the following:
  (1) One-way car trips.
  (2) One-way train trips.
  (3) Round-trip car trips.
  (4) Round-trip train trips.
(c) The following assumes that your sampling plan is based on one-way car trips.
(d) For estimating annual total PMT and UPT:
  (1) Use annual total one-way car trips if your sampling plan is not based on grouping.
  (2) Use annual total one-way car trips by group if your sampling plan is based on grouping.
(e) For estimating average daily PMT and UPT by type of service days, use annual total one-way car trips by type of service days.
(f) For estimating annual total UPT for heavy rail (HR), commuter rail (CR), light rail (LR) by weekday time period, use annual total one-way car trips by weekday time period.

§ 75.03 What sample average should I use for rail services?
(a) The unit of sampling and measurement you have chosen for your sampling plan determines the sample average you should use.
(b) While you could have chosen any unit of sampling measurement for your sampling plan, it most likely is one of the following:
  (1) One-way car trips.
  (2) One-way train trips.
  (3) Round-trip car trips.
  (4) Round-trip train trips.
(c) Assuming that your unit of sampling and measurement is in one-way car trips, Table 75.01 shows the sample averages you should use.

Table 75.01. Sample Averages for Rail Services

If the service-consumed measure is	and if the measure is	and if your sampling plan is	and if your mode is	then you should calculate the following sample average
UPT	for annual total	not based on grouping		UPT/one-way car trip
		based on grouping		UPT/one-way car trip by group
	for daily average			UPT/one-way car trip by type of service days
	by weekday time period		commuter rail (CR), heavy rail (HR), or light rail (LR)	UPT/one-way car trip by weekday time period
PMT	for annual total	not based on grouping		PMT/one-way car trip
		based on grouping		PMT/one-way car trip by group
	for daily average			PMT/one-way car trip by type of service days

§ 75.05 What steps should I follow to calculate sample averages?

(a) Aggregate the field sample data to the individual service units in your sample after you have identified and corrected any errors in the data.

(b) If the unit of sampling and measurement for your sampling plan is one-way car trips, sum these quantities over individual one-way car trips in the sample to get sample totals:
  (1) by type of service days,
  (2) by weekday time period, and
  (3) by group if your sampling plan is based on service grouping.

(c) Count the number of one-way car trips in the sample:
  (1) by type of service days,
  (2) by weekday time period, and
  (3) by group if your sampling plan is based on service grouping.

(d) Divide sample totals by the number of one-way car trips by type of service days, by weekday time period, or by service group if applicable.

§ 75.07 How should I determine annual services actually provided as expansion factors?

(a) You should measure annual services actually provided in the unit of sampling and measurement you have chosen for your sampling plan.

(b) For estimating annual totals of service-consumed data, you should follow these steps:
  (1) Start with your schedule.
  (2) When the schedule is changed by policy or by emergency conditions, the count from the schedule must be adjusted accordingly.
  (3) You must also include added services such as trippers and other special operations.

(4) If your sampling plan is based on service grouping, you must also count annual services actually provided for each group.

(c) For estimating service-consumed data by type of service days, you should also start your schedule, and exclude scheduled services on atypical days.

(d) For estimating annual total UPT for commuter rail (CR), heavy rail (HR), or light rail (LR) by weekday time period, you should start with your weekday schedule, and exclude scheduled services on atypical weekdays.

Subsection 77 – Bus Services

§ 77.01   What expansion factor should I use for bus services?

(a) The unit of sampling and measurement you have chosen for your sampling plan determines the expansion factor you should use.

(b) While you could have chosen any unit of sampling measurement for your sampling plan, it most likely is in one-way bus trips or in round-trip bus trips.

(c) The following assumes that your sampling plan is based on one-way bus trips.

(d) For estimating annual total PMT and UPT:

(1) Use annual total one-way bus trips if your sampling plan is not based on grouping.

(2) Use annual total one-way bus trips by group if your sampling plan is based on grouping.

(e) For estimating average daily PMT and UPT by type of service days, use annual total one-way bus trips by type of service days.

§ 77.03   What sample average should I use for bus services?

(a) The unit of sampling and measurement you have chosen for your sampling plan determines the sample average you should use.

(b) While you could have chosen any unit of sampling measurement for your sampling plan, it most likely is in one-way bus trips or in round-trip bus trips.

(c) Assuming that your unit of sampling and measurement is in one-way bus trips, Table 77.01 shows the sample averages you should use.

Table 77.01. Sample Averages for Bus Services

If the service-consumed measure is	and if the measure is	and if your sampling plan is	then you should calculate the following sample average
UPT	for annual total	not based on grouping	UPT/one-way car trip
		based on grouping	UPT/one-way car trip by group
	for daily average		UPT/one-way car trip by type of service days
PMT	for annual total	not based on grouping	PMT/one-way car trip
		based on grouping	PMT/one-way car trip by group
	for daily average		PMT/one-way car trip by type of service days

§ 77.05 What steps should I follow to calculate sample averages?
  (a) Aggregate the field sample data to the individual service units in your sample after you have identified and corrected any errors in the data.
  (b) If the unit of sampling and measurement for your sampling plan is one-way bus trips, sum these quantities over individual one-way bus trips in the sample to get sample totals:
    (1) by type of service days,
    (2) by group if your sampling plan is based on service grouping.
  (c) Count the number of one-way bus trips in the sample:
    (1) by type of service days,
    (2) by group if your sampling plan is based on service grouping.
  (d) Divide sample totals by the number of one-way bus trips by type of service days or by service group if applicable.

§ 77.07 How should I determine annual services actually provided as expansion factors?
  (a) You should measure annual services actually provided in the unit of sampling and measurement you have chosen for your sampling plan.
  (b) For estimating annual totals of service-consumed data, you should follow these steps:
    (1) Start with your schedule.
    (2) When the schedule is changed by policy or by emergency conditions, the count from the schedule must be adjusted accordingly.
    (3) You must also include added services such as trippers and other special operations.
    (4) If your sampling plan is based on service grouping, you must also count annual services actually provided for each group.
  (c) For estimating service-consumed data by type of service days, you should also start with your schedule, and exclude scheduled services on atypical days.

Subsection 79 – Estimating Service-Consumed Data

§ 79.01 How should I estimate the annual total of my service-consumed data?
  (a) If your sampling plan is not based on service grouping, you should multiply your sample average for the entire sample with the annual total of your corresponding expansion factor to get an estimate of the annual total.
  (b) If your sampling plan is based on service grouping, you should take a two-step approach:
    (1) Multiply your sample average with your corresponding expansion factor for each group, and
    (2) Sum the above products across all groups to get your annual total.

§ 79.03 How should I estimate average daily of service-consumed data by type of service days?
  (a) If you operate your service only on weekdays, all you need to do is to divide your estimated annual total by the number of typical weekday days of service.
  (b) If you operate your service on Saturdays, Sundays, or both as well, you should take the following two steps:
    (1) Multiply your sample average(s) for each type of service days with the corresponding expansion factor to get the annual total for each type of service days.

(2) Divide the annual total for each type of service days by the corresponding number of typical days for each type of service days.

§ 79.05 How should I estimate annual total UPT for each weekday period for commuter rail, heavy rail, and light rail?

(a) For each of the weekday periods, you should simply multiply the sample average you have calculated for that period by the corresponding expansion factor to get an estimate of the annual total for that weekday period.

SECTION 80 – ESTIMATION WITH 100% UPT

Subsection 81 – General Directions

§ 81.01 What service-consumed data must I estimate with 100% UPT?
(a) You must estimate PMT.
(b) The following table shows the data items you must estimate.

Table 81.01. Service-Consumed Data Items with 100% UPT

If your sampling plan is based on the	you must estimate
APTL option	• annual total PMT • average daily PMT by type of service days
PPMT option	• annual total PMT • average daily PMT by type of service days

§ 81.03 What do I need to do in general to get estimates of these data items?
(a) You must determine expansion factors.
(b) You must determine sample ratios.
(c) You must combine the expansion factors and sample ratios to get the corresponding estimates of service-consumed data.

§ 81.05 What is a sample ratio?
(a) A sample ratio is the ratio between the sample total of one measure of service-consumed and the sample total of another measure of service-consumed. This Sampling Manual uses two sample ratios:
   (1) The ratio of sample total PMT over sample total UPT gives the sample APTL.
   (2) The ratio of sample total PMT over sample total PPMT gives the sample PMT/PPMT ratio.
(b) They may be calculated for the entire annual sample, or by the type of service day, or for specific weekday time periods.
(c) Sample ratios are used to estimate annual PMT for the APTL option and the PPMT option.

§ 81.07 What is an expansion factor?
(a) A measure of actual services consumed during a given period.
(b) It is used to convert sample ratios to totals in the given period. A 100% count of UPT consumed during an entire year is an example of an expansion factor in service consumed; when multiplied by sample APTL, it yields a measure of annual total PMT.

Subsection 83 – APTL Option

§ 83.01 What expansion factor should I use for the APTL option?
(a) You must use your 100% count of UPT as the expansion factor.
(b) For estimating average daily PMT by type of service days, use your annual total 100% count of UPT by type of service days.
(c) For estimating annual total PMT:
  (1) Use your annual total 100% count of UPT if your sampling plan is not based on grouping.
  (2) Use your annual total 100% count of UPT by service group if your sampling plan is based on grouping and you have reliable 100% counts of UPT by service group and have entered information into the template accordingly in developing your current template sampling plan. Refer to cell M52 of the Input Worksheet in the template you used in developing your current template sampling plan, and it should be 1.
  (3) Use your annual total 100% count of UPT if your sampling plan is based on grouping but you do not have reliable 100% counts of UPT by service group and you have entered information into the template accordingly in developing your current template sampling plan. Refer to cell M52 of the Input Worksheet in the template you used in developing your current template sampling plan, and it should be 0.

§ 83.03 What sample ratio should I use for the APTL option?
(a) You must use the sample APTL as the sample ratio.
(b) Use sample APTL by type of service days for estimating average daily PMT by type of service days.
(c) For estimating annual total PMT:
  (1) Use sample APTL for the entire sample if you do not group your service.
  (2) Use sample APTL for each group if your sampling plan is based on grouping and you have reliable 100% counts of UPT by service group and have entered information into the template accordingly in developing your current template sampling plan. Refer to cell M52 of the Input Worksheet in the template you used in developing your current template sampling plan, and it should be 1.
  (3) Use weighted sample APTL for the entire sample if your sampling plan is based on grouping but you do not have reliable 100% counts of UPT by service group and you have entered information into the template accordingly in developing your current template sampling plan. Refer to cell M52 of the Input Worksheet in the template you used in developing your current template sampling plan, and it should be 0.

§ 83.05 How should I determine the APTL from my sample?
(a) You must determine the sample APTL for a given sample as the ratio of sample total PMT over sample total UPT for the following cases:
  (1) for the entire sample,
  (2) by type of service days, or
  (3) by service group.
(b) You must not determine the sample APTL as the average of the APTL across individual service units in the sample.

(c) To determine the weighted sample APTL for an entire sample as required by question **§83.03(c)(3),** you should follow these steps:

(1) Determine each group's size in the number of service units actual operated.

(2) Compute each group's share of the number of service units actually operated. These shares must sum to 1.

(3) Determine each group's sample size in the number of service units in the sample.

(4) Determine each group's sample total UPT.

(5) Determine each group's sample total PMT.

(6) Compute each group's sample average for UPT.

(7) Compute each group's sample average for PMT.

(8) Sum the product of each group's share of the number of service units actually operated and its sample average UPT

(9) Sum the product of each group's share of the number of service units actually operated and its sample average PMT

(10) Compute the ratio of the result from (9) to the result from (8). This ratio gives the weighted sample APTL.

(11) Table 83.01 shows these steps with an example.

Table 83.01. Example of Estimating Weighted Sample APTL

Step	Description	Service Groups		
		Short Routes	Medium Routes	Long Routes
1	Group size in service units	109,685	331,033	35,325
2	Group size in shares	0.2304	0.6954	0.0742
3	Sample size	116	386	47
4	Sample total UPT	1,157	8,181	1,592
5	Sample total PMT	3,989	42,966	7,003
6	Sample average UPT	10.0	21.2	33.9
7	Sample average PMT	34.4	111.3	149.0
8	Weighted sample average UPT	19.55		
9	Weighted sample average PMT	96.38		
10	Weighted sample APTL	4.93		

§ 83.07 How should I estimate annual total PMT for the APTL option?

(a) If your sampling plan is not based on service grouping, you should multiply your sample APTL for the entire annual sample with your corresponding annual expansion factor (i.e., 100% count of annual UPT) to get an estimate of the annual total PMT.

(b) You should take a two-step approach if your sampling plan is based on service grouping and you have reliable 100% counts of UPT by service group:

(1) Multiply your sample APTL with your corresponding expansion factor for each group, and

(2) Sum the above products across all groups to get your annual total PMT.

(c) If your sampling plan is based on service grouping but you do not have reliable 100% counts of UPT by service group, you should multiple your weighted sample APTL as computed in question §83.05 with your 100% count of annual UPT.

(d) If your sampling plan is based on service grouping, refer to cell M52 of the Input Worksheet in the template you used in developing your template sampling plan for what you have entered into cell M52 on whether you have reliable 100% count of UPT by service group.

§ 83.09 How should I estimate average daily PMT by type of service days?
(a) If you operate your service only on weekdays, all you need to do is to divide your estimated annual total PMT by the number of typical weekday days of service.
(b) If you operate your service on Saturdays, Sundays, or both as well, you should take the following two steps:
  (1) Multiply your sample average APTL for each type of service days with the corresponding 100% count of UPT to get the annual total PMT for each type of service days.
  (2) Divide the estimated annual total PMT for each type of service days by the corresponding number of typical days for each type of service days.

Subsection 85 – PPMT Option

§ 85.01 What expansion factor should I use for the PPMT option?
(a) You must use your 100% count of PPMT as the expansion factor.
(b) For estimating annual total PMT:
  (1) Use annual total PPMT if your sampling plan is not based on grouping.
  (2) Use annual total PPMT by group if your sampling plan is based on grouping.
(c) For estimating average daily PMT by type of service days, use annual total PPMT by type of service days.

§ 85.03 How do I determine annual total PPMT?
(a) Suppose that:
  (1) Your unit of sampling and measurement is one-way bus trips, and
  (2) You are going to estimate annual total PMT.
(b) You should do the following for each route:
  (1) Determine the annual number of vehicle revenue miles for the report year.
  (2) Determine the annual number of vehicle revenue one-way trips for the report year.
  (3) Divide the annual number of vehicle revenue miles by the annual number of vehicle revenue one-way trips to get the average route length.
  (4) Multiply your route-level 100% counts of UPT with the calculated average route length to get route-level PPMT.
(c) You should sum the calculated route-level PPMT across all routes to get your annual PPMT for all routes.
(d) Table 85.01 illustrates how you may accomplish (b) and (c).

Table 85.01. Calculating Annual Total PPMT for All Operating Routes

Route Number	Route Name	Annual Revenue Trips	Annual Revenue Miles	Average Route Length	100% UPT	100% PPMT
90	Blue Line	3,869	9,975	2.58	22,866	58,952
50	Red Line	3,286	10,310	3.14	23,634	74,148
14	Prospect	1,643	10,690	6.51	24,506	159,446
12	Beechcrest	1,643	11,835	7.20	27,131	195,435
17	College	3,286	30,666	9.33	70,298	656,036
37	Park 100	1,325	22,733	17.16	52,112	894,068
8	Washington	3,392	61,077	18.01	140,012	2,521,072
19	Castleton	1,696	32,916	19.41	75,457	1,464,491
26	Keystone	1,378	28,505	20.69	65,344	1,351,666
10	10th St.	3,339	69,897	20.93	160,231	3,354,198
Total						10,729,514

(e) If your sampling plan is based on service grouping, you must also determine PPMT for each group. Suppose, for example, that you have grouped your short routes into one group and your longer routes into another. Table 85.03 illustrates how you may use route-level information on annual revenue miles, annual revenue trips, and annual UPT to determine PPMT for each group.

Table 85.03. Calculating Annual Total PPMT by Route Group

Route Group	Route Number	Annual Revenue Trips	Annual Revenue Miles	Average Route Length	100% UPT	100% PPMT
Short Routes	90	3,869	9,975	2.58	22,866	58,952
Short Routes	50	3,286	10,310	3.14	23,634	74,148
Short Routes	14	1,643	10,690	6.51	24,506	159,446
Short Routes	12	1,643	11,835	7.20	27,131	195,435
Short Routes	17	3,286	30,666	9.33	70,298	656,036
Short Routes	Total					1,144,018
Long Routes	37	1,325	22,733	17.16	52,112	894,068
Long Routes	8	3,392	61,077	18.01	140,012	2,521,072
Long Routes	19	1,696	32,916	19.41	75,457	1,464,491
Long Routes	26	1,378	28,505	20.69	65,344	1,351,666
Long Routes	10	3,339	69,897	20.93	160,231	3,354,198
Long Routes	Total					9,585,496

§ 85.05 How should I get the sample total of PPMT for each service unit?
   (a) You should follow the guidance for question **§ 85.03** to determine the average route length for each route.

(b) Identify the route for each one-way trip in your service units in the sample.

(c) Multiply the sample UPT by the average route length for each one-way trip to get sample PPMT for each one-way trip.

(d) Sum the trip-level PPMT for all one-way trips in a service unit to get sample PPMT for each service unit.

§ 85.07 What sample ratio should I use for the PPMT option?

(a) You must use the ratio of sample total PMT over sample total PPMT as the sample ratio.

(b) For estimating annual total PMT:

(1) Use sample PMT/PPMT ratio for the entire sample if you do not group your service.

(2) Use sample PMT/PPMT for each group if your sampling plan is based on grouping.

(c) For estimating average daily PMT by type of service days, use the sample PMT/PPMT ratio by type of service days.

§ 85.09 How should I determine the PMT/PPMT ratio for a sample?

(a) You must determine the sample PMT/PPMT ratio for a given sample as the ratio of sample total PMT over sample total PPMT.

(b) You must not determine the sample ratio as the average of the PMT/PPMT ratio for individual service units in the sample.

§ 85.11 How should I estimate annual total PMT for the PPMT option?

(a) You should multiply your sample PMT/PPMT ratio for the entire annual sample with the annual total of your PPMT to get an estimate of the annual total PMT if your sampling plan is not based on service grouping, or

(b) You should take a two-step approach if your sampling plan is based on service grouping:

(1) Multiply your sample PMT/PPMT ratio with your corresponding annual total PPMT for each group, and

(2) Sum the above products across all groups to get your annual total PMT.

§ 85.13 How should I estimate average daily PMT by type of service days?

(a) If you operate your service only on weekdays, all you need to do is to divide your estimated annual total PMT by the number of typical weekday days of service.

(b) If you operate your service on Saturdays, Sundays, or both as well, you should take the following two steps:

(1) Multiply your sample PMT/PPMT ratio for each type of service days with the corresponding annual total PPMT to get the annual total PMT for each type of service days.

(2) Divide the annual total PMT for each type of service days by the corresponding number of typical days for each type of service days.

SECTION 90 – APPENDIXES

Appendix 91 – Definitions

§ 91.01 What do the sampling-related terms mean?
Alternative sampling plan. A sampling plan that reflects the conditions of your service, and is independently developed and certified by a qualified statistician to meet FTA's 95% confidence and 10% precision levels. It is one of two forms of customized sampling plans. The other form is template sampling plans.

Base sample. The sample data that you used in developing your current customized sampling plan.

Confidence level. The chance of an estimate of service-consumed data obtained through random sampling falling within a particular range of the true value. FTA requires a minimum level of 95% confidence for estimates of annual UPT and annual PMT reported to the NTD. A particular confidence level is only meaningful when it is stated with a particular precision level.

Current sample. The sample data that you are collecting with your current customized sampling plan and you may use to develop a new customized sampling plan for your future sampling years.

Customized sampling plan. A sampling plan that reflects the conditions of your service and meets FTA's 95% confidence and 10% precision levels. It is either a template sampling plan or an alternative sampling plan. It differs from a ready-to-use sampling plan or a transitional sampling plan in that it takes account of the specific characteristics of your service.

Efficiency option. A characteristic of a sampling plan that affects its sampling efficiency.

Initial annual sample size. The annual necessary sample size of a template sampling plan that is determined from the companion spreadsheet template before it is allocated to each quarter, month, or week. This can differ from the realized annual sample size for a given set of sample data.

Mandatory revising year. A report year for which you must consider whether you need to revise your customized sampling plan.

Mandatory sampling year. A report year for which you must estimate a measure of annual service-consumed data through random sampling if you do not report a 100% count of that measure.

Margin of safety. A percent increase in the statistical variation of your sample data in developing a customized sampling plan. For example, if the statistical variation of your sample is S and the margin of safety is 25%, you must use $1.25S$ as the statistical variation in

developing your customized sampling plan. A margin of safety of 25% is used automatically for all template sampling plans. If you develop alternative sampling plans, you should also use this margin of safety. The objective is to counter the potential fluctuations in the statistical variation in a sample from one year to another due to sampling and other reasons.

Major change to a service. Any change to your service that is likely to lead to major changes in how your customers use your service. Examples of major changes include making transfers fare free; adding or cutting express routes; expanding or contracting your service by more than 25% in vehicle revenue miles; or restructuring your service affecting more than 25% of your service in vehicle revenue miles.

Necessary sample size. The sample size that meets FTA's minimum 95% confidence and 10% precision levels and uses a 25% margin of safety.

Precision level. The degree of errors in an estimate of service-consumed data obtained through random sampling that is stated in percentage terms relative to the true value. FTA requires a minimum of 10% precision for estimates of annual service-consumed data reported to the NTD. A particular precision level is only meaningful if it is stated with a particular confidence level.

Qualified statistician. An individual who has an adequate working knowledge and education in statistics for determining if an alternative sampling plan meets FTA's 95% confidence and 10% precision levels.

Random sampling. Selection of one or more service units at random from a list of service units to be operated.

Ready-to-use sampling plan. A sampling plan that has been developed specifically for this Sampling Manual with sample data from a variety of transit agencies. It does not necessarily reflect the conditions of your service. Ready-to-use sampling plans have limited applicability.

Realized annual sample size. The annual necessary sample size of a template sampling plan that is based on quarterly, monthly, or weekly sampling. For example, if you choose weekly sampling and your template sampling plan requires 3 one-way trips per week, the realized annual sample size would be 156 one-way trips.

Sample size. The number of service units that are sampled, and for which unlinked passenger trips and passenger miles traveled are measured.

Sampling efficiency. The degree to which a sampling plan minimizes the necessary sample size for meeting FTA's confidence and precision levels. Sampling plans that take advantage of certain characteristics of your service can sometimes require a smaller necessary sample size. A smaller necessary sample size reduces the time and cost of sampling, data collection, and data processing.

Sampling frequency. The number of times per year that a sample is drawn; in this Manual, sampling frequency is quarterly, monthly, or weekly. For example, if your sampling plan requires 10 service units per month, before the current month ends you must select at least 10 at random from the full list of all service units to be operated during the next month.

Sampling plan. A plan for selecting service units at random, for collecting sample data, and for estimating annual service-consumed data that meets FTA's 95% confidence and 10% precision levels. Each sampling plan consists of four elements: a unit of sampling and measurement, a set of efficiency options, a sampling frequency, and a necessary sample size.

Sampling without replacement. Selection of a sample of service units at random without the chance of a single service unit being selected more than once.

Sampling year. Any report year for which you obtained annual UPT, annual PMT, or both through random sampling that meet FTA's 95% confidence and 10% precision levels. It can be a mandatory sampling year or an intermediate report year for which you choose to sample.

Service grouping. One efficiency option for which you divide your service into two or more groups with the objectives of reducing within-group differences and increasing between-group differences. For example, separating your bus routes into express routes and local routes is likely to reduce differences in average passenger trip length across one-way bus trips within each group.

Service unit. An amount of revenue travel by a single transit vehicle, a set of transit vehicles, or a component of a transit vehicle. For non-scheduled services, it is typically one vehicle day. For scheduled bus services it is typically either a one-way bus run or else a round-trip bus run. For rail services, it is either a one-way car run, a one-way train run, or a round-trip car run or a round-trip train run.

Statistical variation. The degree of differences in a quantity across the full list of service units operated during a given period, such as differences in PMT across all one-way trips of a bus service in a full report year. A larger variation requires a greater sample size to meet given confidence and precision levels.

Table of random numbers. A list of integers whose frequency and order of appearance in the list have been determined entirely by chance. It is the basis of a commonly used method of random sampling.

Template sampling plan. A sampling plan that is developed with the companion template of this Sampling Manual.

Transitional sampling plan. A sampling plan for bus services that you may use within the first 6 years of implementing this Manual to help you with the transition from UMTA C 2710.1A.

Unit of sampling and measurement. A service unit you choose for your sampling plan.

§ 91.03   What do the data-collection terms mean?

Arriving load. The number of passengers onboard a transit vehicle as it arrives at a stop.

Automatic passenger counter. An automated means of counting passengers as they board or alight transit vehicles with treadle mats, infrared beams, or other devices placed by the doors of a transit vehicle.

Calculated load. The number of passengers onboard a transit vehicle as it arrives at or leaves a stop that you calculate from data on boardings and alightings at individual stops. It should equal the observed load.

Commuter vanpool. A common form of vanpool service (VP) that comprises vans, small buses and other vehicles operating as a ridesharing arrangement, providing transportation to a group of workers commuting directly between their homes and their regular work sites within the same geographical area. The vehicles would not be in revenue service during the working hours of the participating workers.

Distance-based approach. A method to obtain PMT that keeps track of the distance traveled by every passenger.

Hand-held device. A small electronic device that may be used by ride-checkers to enter sample data while onboard a transit vehicle.

Internal sample. A sample of service units you select at random according to a sampling plan that meets your own statistical requirements. Typically such an internal sample is collected to estimate monthly UPT for internal planning purposes.

Leaving load. The number of passengers onboard a transit vehicle as it leaves a stop.

Load-based approach. A method to obtain PMT that is based on the boardings and alightings at individual stops.

NTD sample. The sample of service units you select at random according to your sampling plan that meets FTA's 95% confidence and 10% precision levels for reporting to the NTD.

Observed load. The number of passengers onboard a transit vehicle as observed directly by a ride-checker while onboard that transit vehicle.

Ride check. A method of collecting sample data with one or more persons observing and recording passenger activities while riding in a transit vehicle.

Stop. Any spatial location at which a transit vehicle allows passengers to board or alight from the vehicle.

Vehicle trip length. The total distance traveled by a transit vehicle during a one-way trip for scheduled services. For example, the cumulative distance traveled from the beginning point

to the end point of a particular alignment of a route is the vehicle trip length for this trip. The vehicle trip length may vary by direction and alignment for a given route.

§ 91.05 What do the estimation-related terms mean?

100% count. A method of obtaining service-consumed data. This term also often refers to the results of a 100% count. For UPT, it involves counting passengers each time they board a transit vehicle in revenue service, such as through a registering farebox. For PMT, it involves recording the distance traveled by all passengers. A 100% count of PMT is typically only possible for systems that have only two stops, for rail systems that record entry and exit from the system, or for rail systems that rely upon destination-based tickets.

Average passenger trip length (APTL). The average distance traveled for an unlinked passenger trip. It is calculated as PMT divided by UPT.

Average route length. The average length of a route actually traveled by vehicles in scheduled services. It is calculated by dividing the annual vehicle revenue miles by the number of annual vehicle revenue one-way trips for that route.

Expansion factor. A measure of actual services operated or consumed during a given period. It is used to convert a sample average to the total of service-consumed data during that period. It varies with sampling plans. The total number of one-way bus trips operated during an entire report year is an example of an expansion factor; when multiplied by the sample average PMT per one-way bus trip derived from annual NTD sample, it yields a measure of annual total PMT.

Passenger miles traveled (PMT). The total distance traveled by all passengers during a given period.

Potential passenger miles traveled. The maximum number of passenger miles that could have been traveled by all passengers along a given fixed route during a year (or some other time period.) It is calculated by multiplying a 100% count of UPT times the average route length of that route during that period.

Sample average. The sample total divided by the number of service units in the sample. It may be calculated for the entire annual sample, or by the type of service day, or for specific weekday time periods. For example, dividing the total PMT in an annual NTD sample by the total number of one-way bus trips in the annual NTD sample gives a sample average PMT.

Sample data. The data collected from a sample of service units according to a sampling plan that meets FTA's 95% confidence and 10% precision levels.

Sample ratio. The ratio of the sample total for one measure of service-consumed over the sample total for another measure of service-consumed. For example, the ratio of the sample data for PMT over the sample total for UPT gives the sample APTL. It may be calculated for the entire annual sample, or by the type of service days, or for individual service group if your sampling plan is based on service grouping.

Sample total. The sum total of all data across the service units in a random sample. For example, if you are sampling for PMT, the PMT sample total is the sum of the PMT collected for each of the one-way bus trip in the sample. It may be calculated for the entire annual sample, or by the type of service day, or for specific weekday time periods.

Service-consumed data. Passenger miles traveled and unlinked passenger trips.

Type of service days. Weekdays, Saturdays, or Sundays. For scheduled services, service days in a report year are classified according to the schedule operated on that day. If a weekday that is a holiday is served with a Sunday schedule, that weekday is considered to be a Sunday. For non-scheduled services, service days are the actual days of a week regardless of whether they are a holiday or not.

Typical day. For your scheduled services, it is a day on which you operate your normal, regular schedule and there are no anomalies such as extra service added for a special event or reduced service as a result of weather or interruption. For your non-scheduled services, it is any day of operation.

Unlinked passenger trips (UPT). The number of passengers who board transit vehicles in revenue service. Passengers are counted each time they board a vehicle, no matter how many vehicles they use to travel from their origin to their destination.

Weekday time periods. Weekday AM Peak, Weekday Midday, Weekday PM Peak, and Weekday Other. The Reporting Manual instructs how you should define the start and end points of each period.

§ 91.07 What do the reporting terms mean?
Auditable record. Documentation of information collected and processes used in collecting that information that demonstrates your compliance with NTD requirements. Such

documentation may also help quality control within your agency when your NTD staff change over time.

First-time reporting. Reporting of a particular service to the NTD for the first time.

Intermediate report year. A report year for which you are not required to estimate annual service-consumed data through random sampling.

§ 91.09 What abbreviations for general terms are used in this Manual?
APTL. Average passenger trip length in miles

APC. Automatic passenger counter

FTA. Federal Transit Administration

NTD. National Transit Database

PMT. Passenger miles traveled

PPMT. Potential passenger miles traveled

UPT. Unlinked passenger trips

§ 91.11 What abbreviations for NTD modes are used in this Manual?
AG. Automated guideway

CR. Commuter rail

DR. Demand response

HR. Heavy rail

JT. Jitney

LR. Light rail

MB. Motorbus

MR. Monorail

PB. Público

VP. Vanpool

Appendix 92 – Distance-Based Survey Sheet

Distance-Based Survey Sheet				
(1) Survey Date _____		(2) Day of Week _____		
(3) Survey Vehicle No. _____		(4) Driver No. _____		
(5)	(6)	(7)	(8)	(9)
No. of Pass.	Pick-UP Location	Pick-UP Odometer Reading	Drop-Off Location	Drop-Off Odometer Reading

Page [   ]

Distance-Based Survey Sheet

(1) Survey Date _____2-26-2008_____   (2) Day of Week _____Thursday_____

(3) Survey Vehicle No. _____45_____   (4) Driver No. _____15_____

(5)	(6)	(7)	(8)	(9)
No. of Pass.	Pick-UP Location	Pick-UP Odometer Reading	Drop-Off Location	Drop-Off Odometer Reading
2	1020 J Street	38,452.0	450 L Street	38,453.5
3	"	38,452.0	380 Alaska	38,454.0
11	"	38,452.0	Fenton + Colesville Rd.	38,454.7
17	506 10th Street	38,456.0	Silver Spring Station	38,459.4
2	13th + K	38,465.0	Walter Reed Hospital	38,470.0
1	655 M Street	38,468.8	"	38,470.0

Page [   ]

Appendix 93 – Load-Based Survey Sheet for Demand Response

Load-Based Survey Sheet for Demand Response

(1) Survey Date _____   (2) Day of Week _____

(3) Vehicle No. _____   (4) Driver No. _____

(5) Activity	(6) Location Description	(7) Odometer Reading	(8) Leaving Load

Page _____

Load-Based Survey Sheet for Demand Response			

(1) Survey Date _____2/26/2008_____ (2) Day of Week _____Thursday_____

(3) Vehicle No. _____54_____ (4) Driver No. _____15_____

(5)	(6)	(7)	(8)
Activity	Location Description	Odometer Reading	Leaving Load
Pick-up	1020 J Street	38,452.0	16
Drop-off	450 L Street	38,453.5	14
Drop-off	380 Alaska	38,454.0	11
Drop-off	Fenton + Colesvill Rd	38,454.7	0
Pick-up	506 10th Street	38,456.0	17
Drop-off	Silver Spring Station	38,459.4	0
Pick-up	13th + K	38,465.0	2
Pick-up	655 M Street	38,468.6	3
Drop-off	Walter Reed Hospital	38,470.0	0

Page _____

Appendix 94 – Load-Based Survey Sheet for Commuter Vanpool

Load-Based SURVEY SHEET for Commuter Vanpool				
(1) Date _____ (2) Day of Week _____ (3) Vanpool No. _____				
(4)	(5)	(6)	(7)	(8)
Direction	Pickup/Drop-off	#of people who got **ON** the Van	# of people who got **OFF** the Van	Van odometer reading when people got **ON/OFF** the Van
TO WORK	**Van Starts**			
	1st Pickup			
	2nd Pickup			
	3rd Pickup			
	4th Pickup			
	5th Pickup			
	6th Pickup			
	1st Drop-off			
	2nd Drop-off			
	3rd Drop-off			
	4th Drop-off			
	5th Drop-off			
	6th Drop-off			
	Van Parks			
FROM WORK	**Van Starts**			
	1st Pickup			
	2nd Pickup			
	3rd Pickup			
	4th Pickup			
	5th Pickup			
	6th Pickup			
	1st Drop-off			
	2nd Drop-off			
	3rd Drop-off			
	4th Drop-off			
	5th Drop-off			
	6th Drop-off			
	Van Parks			

Page [_____]

Load-Based SURVEY SHEET for Commuter Vanpool

(1) Date ____2-26-2008____ (2) Day of Week _____Thursday_____ (3) Vanpool No. _____28706_____

(4) Direction	(5) Pickup/Drop-off	(6) #of people who got ON the Van	(7) # of people who got OFF the Van	(8) Van odometer reading when people got ON/OFF the Van
TO WORK	Van Starts	1		29,366.0
	1st Pickup	5		369.1
	2nd Pickup			
	3rd Pickup			
	4th Pickup			
	5th Pickup			
	6th Pickup			
	1st Drop-off		3	395.3
	2nd Drop-off		1	396.8
	3rd Drop-off		1	397.5
	4th Drop-off			
	5th Drop-off			
	6th Drop-off			
	Van Parks		1	405.0
FROM WORK	Van Starts	1		29,405.0
	1st Pickup			
	2nd Pickup			
	3rd Pickup			
	4th Pickup	1		412.5
	5th Pickup	1		413.2
	6th Pickup	3		414.7
	1st Drop-off			
	2nd Drop-off			
	3rd Drop-off			
	4th Drop-off			
	5th Drop-off			
	6th Drop-off		5	440.9
	Van Parks		1	444.0

Page [   ]

61

Appendix 95 – Load-Based Survey Sheet for Fixed-Route Service

Load-Based Survey Sheet for Fixed-Route Service							
(1) Date _____ (2) Day of Week _____ (3) Time Period _____ (4) Route No. _____ (5) Trip No. _____ (6) Direction _____							
(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Stop ID	Stop Description	Odometer Reading (to 10th of a mile)	No. of Pass. Boarded	No. of Pass. Alighted	No. of Pass. On Board (Leaving Load)	No. of Pass. from Previous Trip (Stop 1 only)	No. of Pass. Continuing to Next Trip (Last Stop only)

Page [   ]

	Load-Based Survey Sheet for Fixed-Route Service

(1) Date ____10-13-2005____ (2) Day of Week _____Thursday_____ (3) Time Period _____Midday_____

(4) Route No. _____11_____ (5) Trip No. _____408_____ (6) Direction _____Outbound_____

(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Stop ID	Stop Description	Odometer Reading (to 10th of a mile)	No. of Pass. Boarded	No. of Pass. Alighted	No. of Pass. On Board (Leaving Load)	No. of Pass. from Previous Trip (Stop 1 only)	No. of Pass. Continuing to Next Trip (Last Stop only)
1	Plaza	41,214.8	20	0	20	2	
2	City Hall	215.1	2	1	21		
3	Bloxham / Adams	215.8	0	2	19		
4	FAMU # 1	216.4	1	3	17		
5	FAMU # 2	216.7	1	10	8		
6	FAMU # 3	217.2	0	2	6		
7	Lake Bradford / Kissimmee	218.0	0	1	5		
8	Indian River / Levy	218.2	0	2	3		
9	Hillsborough / Levy	218.3	0	2	1		
10	Alumin Village / Levy	218.4	0	0	1		
11	Iamonia / Levy	218.7	0	0	1		
12	Iamonia / McCaskill	218.8	0	1	1		1

Page [ ]

Appendix 96 – Daily Log Sheet for Commuter Vanpool

Daily Log Sheet for Commuter Vanpool

(1) Month __August 2008_____ (2) Vanpool No. ____578_____

(3)	(4)	(5)	(6)
Date	No. of Riders to Work	No. of Riders from Work	Total One-Way Trips
1	///// //	///// /	13
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Appendix 97 – Full Table of Contents

Appendix 98 – Table of Random Numbers

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	10480	15011	01536	02011	81647	91646	69179	14194	62590	36207
2	22368	46573	25595	85393	30995	89198	27982	53402	93965	34095
3	24130	48360	22527	97265	76393	64809	15179	24830	49340	32081
4	42167	93093	06243	61680	07856	16376	39440	53537	71341	57004
5	37570	39975	81837	16656	06121	91782	60468	81305	49684	60672
6	77921	06907	11008	42751	27756	53498	18602	70659	90655	15053
7	99562	72905	56420	69994	98872	31016	71194	18738	44013	48840
8	96301	91977	05463	07972	18876	20922	94595	56869	69014	60045
9	89579	14342	63661	10281	74553	18103	57740	84378	25331	12566
10	85475	36857	53342	53988	53060	59533	38867	62300	08158	17983
11	28918	69578	88231	33276	70997	79936	56865	05859	90106	31595
12	63553	40961	48235	03427	49626	69445	18663	72695	52180	20847
13	09429	93969	52636	92737	88974	33488	36320	17617	30015	08272
14	10365	61129	87529	85689	48237	52267	67689	93394	01511	26358
15	07119	97336	71048	08178	77233	13916	47564	81056	97735	85977
16	51085	12765	51821	51259	77452	16308	60756	92144	49442	53900
17	02368	21382	52404	60268	89368	19885	55322	44819	01188	65255
18	01011	54092	33362	94904	31273	04146	18594	29852	71585	85030
19	52162	53916	46369	58586	23216	14513	83149	98736	23495	64350
20	07056	97628	33787	09998	42698	06691	76988	13602	51851	46104
21	48663	91245	85828	14346	09172	30168	90229	04734	59193	22178
22	54164	58492	22421	74103	47070	25306	76468	26384	58151	06646
23	32639	32363	05597	24200	13363	38005	94342	28728	35806	06912
24	29334	27001	87637	87308	58731	00256	05834	15398	46557	41135
25	02488	33062	28834	08751	19731	92420	60952	61280	50001	67658
26	81525	72295	04839	96423	24878	82651	66566	14778	76797	14780
27	29676	20591	68086	26432	46901	20849	89768	81536	86645	12659
28	00742	57392	39064	66432	84673	40027	32832	61362	98947	96067
29	05366	04213	25669	26422	44407	44048	37937	63904	45766	66134
30	91921	24618	64117	94305	26766	25940	39972	22209	71500	64568
31	00582	04711	87917	77341	42206	35126	74087	99547	81817	42607
32	00725	69884	62797	56170	86324	88072	76222	36086	84637	93161
33	69011	65795	95876	55293	18988	27354	26575	08625	40801	59920
34	25976	57948	29888	88604	67917	48708	18912	82271	65424	69774
35	09763	83473	73577	12908	30883	18317	28290	35797	05998	41688
36	91567	42595	27958	30134	04024	86385	29880	99730	55536	84855
37	17955	56349	90999	49127	20044	59931	06115	20542	18059	02008
38	46503	18584	18845	49618	02304	51038	20655	58727	28168	15475
39	92157	89634	94824	78171	84610	82834	09922	25417	44137	48413
40	14577	62765	35605	81263	39667	47358	56873	56307	61607	49518

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
41	98427	07523	33662	64270	01638	92477	66969	98420	04880	45585
42	34914	63976	88720	83765	34476	17032	87589	40836	32427	70002
43	70060	28277	39475	46473	23219	53416	94970	25832	69975	94884
44	53976	54914	06990	67245	68350	82948	11398	42878	80287	88267
45	76072	29515	40980	07391	58745	25774	22987	80059	39911	96189
46	90725	52210	83974	29992	65831	38857	50490	83765	55657	14361
47	64364	64712	33339	31926	14883	24413	59744	92351	97473	89286
48	08962	88358	31662	25388	61642	34072	81249	35648	56891	69352
49	95012	68379	93526	70765	10592	04542	76463	54328	02349	17247
50	15664	10493	20492	30391	91132	21999	59516	81652	27195	48223
51	16408	81899	04153	53381	79401	21438	83035	92350	36693	31238
52	18629	81953	05520	91962	04739	13092	97662	24822	94730	06496
53	73115	35101	47498	87637	99016	71060	88824	71013	18735	20286
54	57491	16703	23167	49323	45021	33132	12544	41035	80780	45393
55	30405	83946	23792	14422	15059	45799	22716	19792	09983	74353
56	16631	35006	85900	98275	32388	52390	16815	69298	82732	38480
57	96773	20206	42559	78985	05300	22164	24369	54224	35083	19687
58	38935	64202	14349	82674	66523	44133	00697	35552	35970	19124
59	31624	76384	17403	53363	44167	64486	64758	75366	76554	31601
60	78919	19474	23632	27889	47914	02584	37680	20801	72152	39339
61	03931	33309	57047	74211	63445	17361	62825	39908	05607	91284
62	74426	33278	43972	10119	89917	15665	52872	73823	73144	88662
63	09066	00903	20795	95452	92648	45454	09552	88815	16553	51125
64	42238	12426	87025	14267	20979	04508	64535	31355	86064	29472
65	16153	08002	26504	41744	81959	65642	74240	56302	00033	67107
66	21457	40742	29820	96783	29400	21840	15035	34537	33310	06116
67	21581	57802	02050	89728	17937	37621	47075	42080	97403	48626
68	55612	78095	83197	33732	05810	24813	86902	60397	16489	03264
69	44657	66999	99324	51281	84463	60563	79312	93454	68876	25471
70	91340	84979	46949	81973	37949	61023	43997	15263	80644	43942
71	91227	21199	31935	27022	84067	05462	35216	14486	29891	68607
72	50001	38140	66321	19924	72163	09538	12151	06878	91903	18749
73	65390	05224	72958	28609	81406	39147	25549	48542	42627	45233
74	27504	96131	83944	41575	10573	08619	64482	73923	36152	05184
75	37169	94851	39117	89632	00959	16487	65536	49071	39782	17095
76	11508	70225	51111	38351	194444	66499	71945	05422	13442	78675
77	37449	30362	06694	54690	04052	53115	62757	95348	78662	11163
78	46515	70331	85922	38329	57015	15765	97161	17869	45349	61796
79	30986	81223	42416	58353	21432	30502	32305	86482	05174	07901
80	63798	34995	46583	09785	44160	78128	83991	42865	92520	83531

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
81	82486	84846	99254	67632	43218	50076	21361	64816	51202	88124
82	21885	32906	92431	09060	64297	51674	64126	62570	26123	05155
83	60336	98782	07408	53458	13564	59089	26445	29789	85205	41001
84	43937	46891	24010	25560	86355	33941	25786	54990	71899	15475
85	97656	63175	89303	16275	07100	92063	21942	18611	47348	20203
86	03299	01221	05418	38982	55758	92237	26759	86367	21216	98442
87	79626	06486	83574	17668	07785	76020	79924	25651	83325	88428
88	85636	68335	47539	03129	65651	11977	02510	261113	99457	68645
89	18039	14367	61337	06177	12143	46609	32989	74014	64708	00533
90	08362	15656	60627	36478	65648	16764	53412	09013	07832	41574
91	79556	29068	04142	16268	15387	12856	66227	38358	22478	73373
92	92608	82674	27072	32534	17075	27698	98204	63863	11951	34648
93	23982	25835	40055	67006	12293	02753	14827	23235	35071	99704
94	09915	96306	05908	97901	28395	14186	00821	80703	70426	75647
95	59037	33300	26695	62247	69927	76123	50842	43834	86654	70959
96	42488	78077	69882	61657	34136	79180	97526	43092	04098	73571
97	46764	86273	63003	93017	31204	36692	40202	35275	57306	55543
98	03237	45430	55417	63282	90816	17349	88298	90183	36600	78406
99	86591	81482	52667	61582	14972	90053	89534	76036	49199	43716
100	38534	01715	94964	87288	65680	43772	39560	12918	86537	62738
101	13284	16834	74151	92027	24670	36665	00770	22878	02179	51602
102	21224	00370	30420	03883	94648	89428	41583	17564	27395	63904
103	99052	47887	81085	64933	66279	80432	65793	83287	34142	13241
104	00199	50993	98603	38452	87890	94624	69721	57484	67501	77638
105	60578	06483	28733	37867	07936	98710	98539	27186	31237	80612
106	91240	18312	17441	01929	18163	69201	31211	54288	39296	37318
107	97458	14229	12063	59611	32249	90466	33216	19358	02591	54263
108	35249	38646	34475	72417	60514	69257	12489	51924	86871	92446
109	38980	46600	11759	11900	46743	27860	77940	39298	97838	95145
110	10750	52745	38749	87365	58959	53731	89295	59062	39404	13198
111	36247	27850	73958	20673	37800	63835	71051	84724	52492	22342
112	70994	66986	99744	72438	01174	42159	11392	20724	54322	36923
113	99638	94702	11463	18148	81386	80431	90628	52506	02016	85151
114	72055	15774	43857	99805	10419	76939	25993	03544	21560	83471
115	24038	65541	85788	55835	38835	59399	13790	35112	01324	39520
116	74976	14631	35908	28221	39470	91548	12854	30166	09073	75887
117	35553	71628	70189	26436	63407	91178	90348	55359	80392	41012
118	35676	12797	51434	82976	42010	26344	92920	92155	58807	54644
119	74815	67523	72985	23183	02446	63594	98924	20633	58842	85961
120	45246	88048	65173	50989	91060	89894	36036	32819	68559	99221

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
121	76509	47069	86378	41797	11910	49672	88575	97966	32466	10083
122	19689	90332	04315	21358	97248	11188	39062	63312	52496	07349
123	42751	35318	97513	61537	54955	08159	00337	80778	27507	95478
124	11946	22681	45045	13964	57517	59419	58045	44067	58716	58840
125	96518	48688	20994	11090	48396	57177	83867	86464	14342	21545
126	35726	58643	76869	84622	39098	36083	72505	92265	23107	60278
127	39737	42750	48968	70536	84864	64952	38404	94317	65402	13589
128	97025	66492	56177	04049	80312	48028	26408	43591	75528	65341
129	62815	08075	09788	56350	76787	51591	54509	49295	85830	59860
130	25578	22950	15227	83291	41737	79599	96191	71845	86899	70694
131	68763	69576	88991	49662	46704	63362	56625	00481	73323	91427
132	17900	00813	64361	60725	88974	61005	99709	30666	26451	11528
133	71944	60227	63551	71109	05624	43836	58254	26160	32116	63403
134	54684	93691	85132	64399	29182	44324	14491	55226	78793	34107
135	25946	27623	11258	65204	52832	50880	22273	05554	99521	73791
136	01353	39318	44961	44972	91766	90262	56073	06606	51826	18893
137	99083	88191	27662	99113	57174	35571	99884	13951	71057	53961
138	52021	45406	37945	75234	24327	86978	22644	87779	23753	99926
139	78755	47744	43776	83098	03225	14281	83637	55984	13300	52212
140	25282	69106	59180	16257	22810	43609	12224	25643	89884	31149
141	11959	94202	02743	86847	79725	51811	12998	76844	05320	54236
142	11644	13792	98190	01424	30078	28197	55583	05197	47714	68440
143	06307	97912	68110	59812	95448	43244	31262	88880	13040	16458
144	76285	75714	89585	99296	52640	46518	55486	90754	88932	19937
145	55322	07598	39600	60866	63007	20007	66819	84164	61131	81429
146	78017	90928	90220	92503	83375	26986	74399	30885	88567	29169
147	44768	43342	20696	26331	43140	69744	82928	24988	94237	46138
148	25100	19336	14605	86603	51680	97678	24261	02464	86563	74812
149	83612	46623	62876	85197	07824	91392	58317	37726	84628	42221
150	41347	81666	82961	60413	71020	83658	02418	33322	66036	98712
151	38128	51178	75096	13609	16110	73533	42564	59870	29399	67834
152	60950	00455	73254	96067	50717	13878	03216	78274	65863	37011
153	90524	17320	29832	96118	75792	25326	22940	24904	80503	38928
154	49897	18278	67160	39408	97056	43517	84426	59650	20247	19293
155	18494	99209	81060	19488	65596	59787	47939	91225	98768	43688
156	65373	72984	30171	37741	70203	94094	87261	30056	58124	70133
157	40653	12843	04213	70925	95360	55774	76439	61768	52817	81151
158	51638	22238	56344	44587	83231	50317	74541	07719	25472	41602
159	69742	99303	62578	83575	30337	07488	51941	84316	42067	49692
160	58012	74072	67488	74580	47992	69482	58624	17106	47538	13452

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
161	18348	19855	42887	08279	43206	47077	42637	45606	00011	20662
162	59614	09193	58064	29086	44385	45740	70752	05663	49081	26960
163	75688	28630	39210	52897	62748	72658	98059	67202	72789	01869
164	13941	77802	69101	70061	35460	34576	15412	81304	58757	35498
165	96656	86420	96475	86458	54463	96419	55417	41375	76886	19008
166	03363	82042	15942	14549	38324	87094	19065	67590	11087	68570
167	70366	08390	69155	25496	13240	57407	91407	49160	07379	34444
168	47870	36605	12927	16043	53257	93796	52721	73120	48025	76074
169	79504	77606	22761	30518	28373	73898	30550	76684	77366	32276
170	46967	74841	50923	15339	37755	98995	40162	89561	69199	42257
171	14558	50769	35444	59030	87516	48193	02945	00922	48189	04724
172	12440	25057	01132	38611	28135	68089	10954	10097	54243	06460
173	32293	29938	68653	10497	98919	46587	77701	99119	93165	67788
174	10640	21875	72462	77981	56550	55999	87310	69643	45124	00349
175	47615	23169	39571	56972	20628	21788	51736	33133	72696	32605
176	16948	11128	71624	72754	49084	96303	27830	45817	67867	18062
177	21258	61092	66634	70335	92448	17354	83432	49608	66520	06442
178	15072	48853	15178	30730	47481	48490	41436	25015	49932	20474
179	99154	57418	09858	65671	70655	71479	63520	31357	56968	06729
180	08759	61089	23706	32994	35426	36666	63988	98844	37533	08269
181	67323	57839	61114	62192	47547	58023	64630	34886	98777	75442
182	09255	13986	84834	20764	72206	89393	34548	93438	88730	61805
183	36304	74712	00374	10107	85061	69228	81969	92216	03568	39630
184	15884	67429	86612	47367	10242	44880	12060	44309	46629	55105
185	18745	32031	35303	08134	33925	03004	59929	95418	04917	57596
186	78934	40086	88292	65728	38300	42323	64068	98373	48971	09049
187	17626	02944	20910	57662	60161	38579	24580	90529	52303	50436
188	27117	61399	50967	41399	81636	16663	15634	79717	94696	59240
189	93995	18678	90012	63645	85701	85269	62263	68331	00389	72571
190	67392	89421	09623	80725	62620	84162	87368	29560	00519	84545
191	04910	12261	37566	80016	21245	69377	50420	85658	55263	68667
192	81453	20283	79929	59839	23875	13245	46808	74124	74703	35769
193	19480	75790	48539	83703	15537	48885	02861	86587	74539	65227
194	21456	13162	74608	81011	55512	07481	93551	72189	76261	91206
195	09406	20912	46189	76376	25538	87212	20748	12831	57166	35026
196	09866	07414	55977	16419	01101	69343	13305	94302	80703	57910
197	86541	24681	23421	13521	28000	94917	07423	57523	97234	63951
198	10414	96941	06205	72222	57167	83902	07460	69507	20600	08858
199	49942	06683	41479	58982	56288	42853	92196	20632	62045	78812
200	23995	68882	42291	23374	24299	27024	67460	94703	40937	16961

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
201	78994	36244	02673	25475	84953	61793	50243	63423	69309	80308
202	04909	58485	70686	93930	34880	73059	06823	80257	44193	08337
203	46582	73570	33004	51795	86477	46736	60460	70345	37322	19987
204	29242	89792	88634	60285	07190	07795	27011	85941	01852	43096
205	68104	81339	97090	20601	78940	20228	22803	96070	10251	62711
206	17516	02182	82504	19880	93747	80910	78260	25136	62018	62919
207	50711	94789	07171	02103	99057	98775	37997	18325	88281	61091
208	39449	52409	75095	77720	39729	03205	09313	43545	43786	70443
209	75629	82729	76916	72657	58992	32756	01154	84890	04107	17469
210	01020	55151	36132	51971	32155	60735	64857	35424	25257	93844
211	08337	89989	24260	08618	66798	25889	52860	57375	52815	43539
212	76829	47229	19706	30094	69430	92399	98749	22081	52564	90431
213	39708	30641	21267	56501	95182	72442	21445	17276	90344	33199
214	89836	55817	56747	75195	06818	83043	47403	58266	52630	75573
215	25903	61370	66081	54076	67442	52964	23823	02718	28786	06121
216	71345	03422	01015	68025	19703	77313	04555	83425	46763	95315
217	61454	92263	14647	08473	34124	10740	40839	05620	62418	73374
218	80376	08909	30470	40200	46558	61742	11643	92121	22294	26648
219	45144	54373	05505	90074	24783	86299	20900	15144	26506	53770
220	12191	88527	58852	51175	11534	87218	04876	85584	78465	82182
221	62936	59120	73957	35969	21598	47287	39394	08778	38036	30140
222	31588	96798	43688	12611	01714	77266	55079	24690	84716	77732
223	20787	96048	84726	17512	39450	43618	30629	24356	05294	34236
224	45603	00745	84635	43079	52724	14262	05750	89373	79088	38088
225	31606	64782	34027	56734	09365	20008	93559	78384	99219	61747
226	10452	33074	76718	99556	16026	00013	78411	95107	10786	44886
227	37016	64633	67301	50949	91298	74968	73631	57397	08632	04762
228	66725	97865	25409	37498	00816	99262	14471	10332	19035	21695
229	07380	74438	82120	17890	40963	55757	13492	68294	87170	49468
230	71621	57688	58256	47702	74724	89419	08025	68519	95188	54788
231	03466	13263	23917	20417	11315	52805	33072	07723	87876	75258
232	12692	32931	97387	34832	53775	91674	96549	37635	91118	31062
233	52192	30941	44998	17833	94563	23062	95725	38463	03665	49189
234	569691	72529	66063	73570	86860	68125	40436	31303	79330	59083
235	74952	43041	53869	15677	78598	43520	97521	83248	52173	17636
236	18752	43693	32867	53017	22661	39610	03796	02622	78267	24503
237	61691	04944	43111	28325	82319	65589	66048	98498	46941	81427
238	49197	63948	38947	60207	70667	39843	60607	15328	09528	17277
239	19436	87291	71684	74859	76501	93456	95714	92518	10683	75617
240	39143	64893	14606	13543	09621	68301	69817	52140	03976	48795

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
241	82244	67549	76491	09761	74494	91307	64222	66592	67270	38593
242	55847	56155	42878	23708	97999	40131	52360	90390	73108	40475
243	94095	95970	07826	25991	37584	56966	68623	83454	49461	97707
244	11751	69469	25521	44097	07511	88976	30122	67542	54825	03274
245	69902	08995	27821	11758	64989	61902	32121	28165	21326	97375
246	21850	25352	25556	92161	23592	43294	10479	37879	21825	11453
247	75850	46992	25165	55906	62339	88958	91717	15756	78817	35541
248	29648	22086	42581	85677	20251	390641	65786	80689	49066	14456
249	82740	28443	42734	25518	82827	35825	90288	32911	79666	52959
250	36842	42092	52075	83926	420875	71500	69216	01350	92846	84792
251	89429	26726	15563	94972	78739	04419	60523	31022	23728	37647
252	43427	25412	25587	21276	44426	17369	29010	45337	90245	92053
253	58575	81958	51846	02676	67781	95137	88430	78260	66962	31812
254	61888	71246	24246	23487	78639	92006	63846	92263	33212	26516
255	73891	47025	40937	71907	26827	98865	38882	25757	26662	91441
256	40938	73894	40854	15997	55293	95033	31736	75068	91314	75293
257	98053	43567	17292	86908	71364	06089	92394	73691	57883	09983
258	59774	29138	46993	39836	99596	59050	25419	04130	54632	17223
259	09765	07548	63043	59782	81449	13652	94420	74460	46707	94303
260	38991	64502	24770	29209	82909	66610	84418	66214	26001	78685
261	25622	27100	56128	62145	82388	45197	97609	83942	01120	71717
262	21864	74120	66231	82306	91784	33177	17681	18963	07216	49288
263	81171	75639	60863	49562	28846	81581	10249	23190	53440	32357
264	69874	52803	28544	51569	56090	44558	42095	92311	57915	13368
265	27848	51107	05761	02159	53911	01952	59273	32250	39647	29908
266	69407	69736	75375	31488	67528	84234	76462	13628	21286	13736
267	29418	03091	06364	13151	40663	43633	87954	69800	24773	62596
268	38222	31231	79415	44558	62490	26936	49682	16307	98535	44822
269	94720	83796	93251	03568	62484	29140	14152	37044	90398	92042
270	45275	16852	02284	41361	73733	61486	33189	08907	41159	08147
271	97260	09552	82626	42915	45847	87401	13339	53850	34931	00602
272	01990	65259	60684	78175	43825	45211	86287	78190	02431	66251
273	24633	42314	81192	50253	67516	59076	92006	65676	87343	89231
274	98071	52677	74920	74461	52266	26967	68284	31612	40335	28865
275	34101	79442	88403	48541	13010	16596	72001	38546	76305	22119
276	77186	93967	25918	66403	73837	73445	86663	15929	08237	05647
277	23114	05481	42335	51396	60823	22680	50459	05429	35227	92559
278	59988	49944	41038	99977	16348	41119	51548	19511	90148	65604
279	11852	42254	82304	05588	75165	20179	94198	25700	33473	59554
280	59992	87922	56299	01700	07003	97507	69260	53349	86947	27517

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
281	42116	86593	22828	41422	18176	03250	06079	85467	32052	56922
282	39663	61401	24171	42702	70588	53144	27087	05591	57759	51394
283	53542	72009	96296	68908	58657	87117	21483	28879	20480	57309
284	25996	76108	98476	36397	89457	19577	65877	04802	61938	25032
285	91106	26450	11451	50328	29084	32332	08635	25192	31337	20249
286	37133	88924	27845	13024	90687	23726	11212	30414	42185	49224
287	13982	25736	10087	16762	02564	27250	79316	83848	38684	20552
288	26663	36187	81688	25005	46677	75851	73938	73044	05132	61204
289	62572	08275	16313	24936	81680	53829	40412	01479	24241	58488
290	65925	95455	08383	24643	72962	08172	37824	87587	40698	34964
291	97978	74676	08942	48919	51592	71196	48534	16955	25759	95645
292	01914	42524	67820	47985	91773	10383	89514	07557	02084	16736
293	68565	44811	39238	70394	78555	33539	56310	40809	63204	14479
294	54370	31672	03893	32423	54092	69375	63308	08016	28407	98287
295	79954	89601	23881	46951	69084	33477	87968	15639	82409	34125
296	55479	01059	44229	56975	06785	80930	26443	44892	77561	51123
297	38114	70330	42157	86699	46212	74692	92603	91306	58558	57280
298	29766	83452	66202	02488	72704	97821	70614	53616	39050	30355
299	31771	70640	34779	41831	33456	53194	19602	74194	61154	51774
300	77322	87188	83577	99067	83235	48662	31503	54829	54723	13177
301	64670	10396	82981	58320	71478	08143	48294	42631	45464	58092
302	25771	02205	73984	28436	88192	11470	11775	67385	66360	59884
303	25771	13537	54984	89406	88326	33993	92324	13249	35271	60400
304	91224	22417	44820	26189	57541	87558	45835	28461	54835	92411
305	75179	64320	71523	67868	38883	09674	27645	76240	47587	01677
306	64654	91085	65818	03313	39273	46384	66677	14148	87552	38383
307	98059	81123	67832	04102	66188	78200	67466	46043	65406	22834
308	38765	63585	18810	95805	11414	58096	00295	82626	42683	44518
309	01921	03564	71754	10213	80383	13473	94128	62199	59411	46782
310	16211	93671	27704	66778	96307	06732	63750	04191	40003	51653
311	70832	86076	61527	56123	48514	53935	86784	42351	67586	07432
312	22332	94265	67627	85815	00394	75271	98385	53697	56378	50592
313	81333	45965	64171	84367	15052	37965	03122	81914	69381	70034
314	39333	47453	66174	04546	10594	64271	61026	39471	55981	18628
315	29195	20825	50878	80273	26285	90070	79586	12449	77293	36577
316	74420	64037	06960	52109	08821	60143	34485	19257	29417	72713
317	22763	16508	24866	13177	07464	51790	65802	95718	28560	11332
318	72919	54618	40616	33287	51274	78491	53604	66742	97777	64468
319	91285	42402	15922	90033	21555	31647	22288	75692	20592	84620
320	85431	19857	97246	46118	71222	82744	67892	77155	10785	00344

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
321	40778	12451	14921	51464	45331	75822	46859	66829	35803	27645
322	88903	46592	60637	65231	08778	86813	47819	19218	46837	89671
323	29830	24899	85457	19548	83355	52479	77801	01596	48890	56104
324	22832	47422	08073	10107	46772	92299	42975	86376	27869	52954
325	75159	14809	11930	83531	51239	86298	72661	63015	98804	98491
326	99390	08217	56276	09263	82685	30451	25742	41105	74711	42007
327	68622	80897	08902	10867	91379	30068	84289	45020	92459	03831
328	92393	95901	41179	72129	72502	91097	09488	84896	37720	68104
329	53122	66033	38229	51879	29925	45574	53938	72801	64067	76328
330	43251	11941	86631	93264	53433	70281	55000	24550	74751	32855
331	16613	24901	34866	75002	55163	68300	20070	36953	39378	71191
332	12010	60852	92603	70393	17989	95755	14672	58786	41996	02893
333	85528	97879	27814	08219	02908	71582	31439	00360	72264	87245
334	32590	55079	33556	83169	92087	77939	53792	78795	58159	86394
335	91934	30650	16449	15805	61551	38689	59179	85485	18537	70496
336	80614	10150	09389	61892	79477	14522	40270	45744	29582	29717
337	62398	12034	90764	52872	22285	50592	42505	80560	38213	18917
338	02222	46811	05145	67916	15184	02636	59078	57773	21259	86090
339	08690	31785	61664	61322	24149	21471	23328	03093	31266	14840
340	61187	73897	66168	12885	73191	89432	65414	41886	75911	35708
341	12324	61149	85643	64999	63738	46671	25408	69313	54455	04917
342	47635	42279	98620	70677	52386	50904	97403	03931	42090	28179
343	70965	00390	08878	75373	70276	71889	86953	37931	23286	20508
344	58764	15262	96814	54548	00042	19721	78869	85937	36639	29135
345	07429	05609	31207	50254	68389	07714	92268	64698	32823	60122
346	15665	28659	54952	53217	76898	88931	25786	55912	85269	29212
347	64208	53232	99459	43605	04553	48451	68154	49436	49891	65524
348	17952	73276	52567	48489	64264	24220	55498	97548	98437	26033
349	60531	43217	39999	38615	97195	76928	87688	99010	90189	12522
350	76692	39999	43254	68110	88053	88727	14187	98623	84225	78440
351	06433	80674	24520	18222	10610	05794	37515	48619	62866	33963
352	39298	47829	72648	37414	75755	04717	29899	78817	03509	78673
353	89884	59651	67533	68123	17730	95862	08034	19473	63971	37271
354	61512	32155	51906	61662	64130	16688	37275	51262	11569	08697
355	99653	47635	12506	88535	36553	23757	34209	55803	96275	26130
356	95913	11085	13772	76638	48423	25018	99041	77529	81360	18180
357	55864	44004	13122	44115	01601	50541	00147	77685	58788	33016
358	35334	82410	91601	40617	72876	33967	73830	15405	96554	88265
359	57729	88646	76487	11622	96297	24160	09903	14047	22917	60718
360	86648	89317	63677	70119	94739	25875	38829	68377	43918	77653

NTD Sampling Manual   Appendix 98

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
361	30574	06039	07967	32422	76791	39725	53711	93385	13421	67957
362	81307	13114	83580	79974	45929	85113	72268	09858	52104	32014
363	02410	96385	79007	54939	21410	86980	91772	93307	34116	49516
364	18969	87444	52233	62319	08598	09066	95288	04794	01534	92058
365	87863	80514	66860	62297	80198	19347	73234	86265	49096	97021
366	68397	10538	15438	62311	72844	60203	46412	65943	79232	45702
367	28529	45247	58729	10854	99058	18260	38765	90038	94209	04055
368	44285	09452	15867	70418	57012	72122	36634	97283	95943	78363
369	86229	22510	33571	23309	57040	29285	67870	21913	72958	75637
370	84842	05748	90894	61658	15001	94055	36308	41161	37341	81838
371	56970	10799	52098	04184	54967	72938	56834	23777	98392	31417
372	83125	58077	60490	44369	66130	72936	69848	59973	08144	61070
373	55503	21383	02464	26141	68779	66388	75242	82690	74099	77885
374	47019	06683	33203	29608	54553	25971	69573	83854	24715	48866
375	84828	61152	79526	29554	84580	37859	28504	61980	34997	41825
376	68921	31331	79227	05748	51276	57143	31926	99915	45821	97702
377	36458	28285	30424	98420	72925	40729	22337	48293	86847	43186
378	95752	96065	36847	87729	81679	59126	59437	33225	31280	41232
379	26768	02513	58454	56958	20575	76746	49878	06846	32828	24425
380	42613	72456	43636	58085	06766	60227	96414	32671	45587	79620
381	95457	12176	65482	25596	02678	54592	63607	82096	21913	75544
382	95276	67524	63564	95958	39750	64379	46059	51666	10433	10945
383	66954	51574	64776	92345	95110	59448	77249	54044	67942	24145
384	17457	44151	14113	62462	02798	54977	48349	66738	60184	75679
385	03704	23322	83214	59337	01695	60666	97410	55064	17427	89180
386	21538	16997	33210	60337	27976	70661	08250	69599	60264	84549
387	57178	16739	98310	70348	11317	71623	55510	64756	87759	92354
388	31048	40058	94953	55866	96283	46620	52087	80817	74533	68407
389	69799	83300	16498	80733	96422	58078	99643	39847	96884	84657
390	90595	65017	59231	17772	67831	33317	00520	90401	41700	95510
391	13570	34761	98939	78784	09977	29398	93896	78227	90110	81378
392	15340	88760	57477	13898	48431	72936	78160	87240	52716	87697
393	64079	07733	36512	56186	99098	48850	72527	08486	10951	26832
394	63491	84886	67118	62063	74958	20946	28147	39338	32169	03713
395	92003	76568	41034	28260	79708	00770	88643	21188	01850	69689
396	52360	46658	66511	04172	73085	11795	52594	13287	82531	04388
397	74622	12142	68355	65635	21828	39539	18988	53609	04001	19648
398	04157	50979	61343	64315	70836	82857	35335	87900	36194	31567
399	86003	60070	66241	32836	27573	11479	94114	81641	00496	36058
400	41268	80187	20351	09636	84668	42486	71303	19512	50277	71508

NTD Sampling Manual   Appendix 98

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
401	05073	90103	85167	53900	19720	41488	57476	39458	16621	69774
402	93320	80269	56684	39192	53220	74539	26393	00787	94490	23386
403	18806	70257	96424	13606	14356	76599	25390	63236	04513	16358
404	22253	45923	29815	18578	23316	30896	64771	11220	86218	75956
405	93640	45982	40011	74142	29106	45729	43406	21457	04301	39651
406	47630	45980	76619	57138	57492	00030	77897	76236	64990	35985
407	01781	55061	07455	47083	71870	90597	10151	59606	96919	31174
408	69694	45054	33587	03664	95007	31567	25334	26433	75002	67607
409	51236	05052	26503	94651	29874	73492	88941	08488	09418	08173
410	89445	51039	73837	26720	38650	47322	68474	95047	20404	41577
411	40867	96834	02162	41517	88937	26099	56047	49164	35127	64916
412	92946	56944	93407	05010	54896	33173	30548	23667	43171	47849
413	75898	02275	90768	31902	52114	36634	46803	97970	92216	55398
414	22729	21695	90824	80500	09332	54667	46696	38166	02005	24615
415	28733	62663	23644	16416	47135	39137	62190	31032	58702	03805
416	51323	37770	42114	79742	59905	38480	25293	32993	36946	62701
417	69325	65551	49927	68073	56979	49454	79451	60753	70872	07422
418	11333	60801	36992	76128	27959	41306	93543	15926	99159	27102
419	86347	03703	36778	72501	95229	65735	14269	50220	77270	68604
420	73452	36179	82893	92262	43850	31888	71151	40682	49775	63628
421	75483	74009	73699	05870	36804	89338	73891	40740	98753	74566
422	73302	84917	75122	34085	86208	98399	79433	61960	01720	87458
423	42785	24350	05933	65282	12832	75382	29826	33197	81781	53542
424	40429	33209	58622	09308	38098	55947	12001	73526	23170	13721
425	92876	58271	99325	12301	72957	22690	62705	73892	01974	77759
426	32951	39844	99126	94838	48715	36586	42076	15283	19280	29166
427	099772	28139	48130	73301	35915	90923	19255	75242	84655	30163
428	78459	91322	50072	77941	65046	78363	21951	42319	46472	67617
429	14419	96517	99075	43664	81119	63487	95589	51785	07398	23245
430	97769	50967	24427	21011	92226	44380	23422	10654	43617	80504
431	09175	37545	39088	06879	21277	05153	81855	84043	35307	59465
432	52062	95519	54087	14072	50953	63477	64635	34552	75243	70222
433	70558	85169	01086	97202	10390	01819	88167	21851	87837	85287
434	22553	61317	08968	67521	16627	48855	97263	94242	93354	72446
435	95216	75263	60351	02643	00063	20824	67468	89441	84055	47035
436	49087	61399	47781	32173	96672	04528	15881	46764	20115	03226
437	24808	79068	70787	43106	97133	37236	77888	48451	20788	44648
438	89879	79942	43781	05069	80143	59176	47392	70372	26899	16228
439	61178	79295	58926	21977	28435	32631	23062	31822	70462	05965
440	37444	56047	23208	34710	12147	28558	58817	98807	56776	08129

NTD Sampling Manual   Appendix 98

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
441	99633	00363	16853	20789	87674	03938	36077	41012	08813	51168
442	87363	59239	42023	78056	51254	95644	90527	41398	74996	94977
443	23923	87269	85277	34727	78036	74471	12157	11655	25194	47557
444	45610	26370	13094	34500	36750	54517	85011	26567	04021	32485
445	44166	80095	08286	38126	48834	73423	13617	08853	16286	16023
446	81876	27486	53925	22330	37168	97954	11967	03309	97096	64221
447	79400	83852	52174	42577	18553	14023	69629	61913	41050	69689
448	42799	46647	36718	49704	17150	07935	62372	39933	20838	27652
449	09302	36408	64569	93033	95645	56791	14830	81699	45057	85796
450	88078	81456	17242	84590	93660	34619	51965	85618	36558	54410
451	85018	23508	91507	76455	54941	72711	39406	94620	27963	96478
452	11904	73678	08272	62941	02349	71389	45605	60947	60775	73181
453	75344	98489	86268	73652	98210	44546	27174	27499	53523	63110
454	65566	65614	01443	07607	11826	91326	29664	01603	23156	89223
455	51872	72294	95432	53555	96810	17100	35066	00815	01552	06392
456	03805	37913	98633	81009	81060	33449	68055	83844	90942	74857
457	21055	78685	71250	10329	56135	80647	51404	06626	10042	93629
458	48977	36794	56054	59243	57361	65304	93258	56760	63348	24949
459	93077	72941	92779	23581	24548	56415	61927	64416	29934	00755
460	84533	26564	91583	83411	66504	02036	02922	63569	17906	38076
461	11338	12903	14514	27585	45068	05520	56321	22693	35089	07694
462	23858	68500	92274	87026	99717	01542	72990	43413	59744	44595
463	94096	74920	25822	98026	05394	61840	83089	09224	78530	33996
464	83160	82362	09350	98536	38155	42661	02363	67625	34683	95372
465	97425	47335	69709	01386	74319	04318	99387	86874	12549	38369
466	83951	11954	24317	20345	18134	90062	10761	54548	49505	52685
467	93085	35203	05740	03206	92012	42710	34650	73236	66167	21788
468	33762	83193	58045	89880	78101	44392	53767	15220	66319	72953
469	49665	85397	85137	30496	23469	42846	94810	16151	08029	50554
470	37541	82627	80051	72521	35342	56119	97190	43635	84249	61254
471	22145	85304	35348	82854	55846	18076	12415	30193	42776	85611
472	27153	08662	61078	52433	22184	33998	87436	37430	45246	11400
473	00301	49425	66682	25442	83668	66236	79655	88312	93047	12088
474	43815	43272	73778	63469	50083	70696	13558	98995	58159	04700
475	14689	86482	74157	46012	97765	27552	49617	51734	20849	70198
476	16680	55936	82453	19532	49988	13176	94219	88698	41755	56216
477	86938	60429	01137	86168	78257	86249	46134	51865	09836	73966
478	33944	29219	73161	46061	30946	22210	79302	40300	08852	27528
479	16045	67736	18608	18198	19468	76358	69203	02760	28625	70476
480	37044	52523	25627	63107	30806	80857	84383	78450	26245	91763

NTD Sampling Manual   Appendix 98

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
481	61471	45322	35340	35132	42163	69332	98851	50252	56911	62693
482	47422	21296	16785	66393	39249	51463	95963	07929	66728	47761
483	24133	39719	14484	58613	88717	29289	77360	09030	39605	87507
484	67253	67064	10748	16006	16767	57345	42285	56670	88445	85799
485	62382	76941	01635	35829	77516	98468	51686	48140	13583	94911
486	98011	16503	09201	03523	87192	66483	55649	36764	86132	12463
487	37366	24386	20654	85117	74078	64120	04643	14351	71381	28133
488	73587	83993	54176	05221	94119	20108	78101	81276	00835	63835
489	33583	68291	50547	96085	62180	27453	18567	55524	86088	00069
490	02878	33223	39199	49536	56199	05993	71201	78852	65889	32719
491	91498	41673	17195	33175	04994	09879	70337	11861	69032	51915
492	91127	19815	30219	55591	21725	43827	78862	67699	01009	07050
493	12997	55013	18662	81724	24305	37661	18956	50064	39500	17450
494	96098	13651	15393	69995	14762	69734	89150	93126	17700	94400
495	97627	17837	10472	18983	28387	99781	52977	01657	92602	41043
496	40064	47981	31484	76603	54088	91095	00010	13800	76690	75133
497	16239	68743	71374	55863	22672	91609	51514	98135	42870	48578
498	58354	24913	20435	30965	17453	65623	93058	08313	99293	00990
499	52567	65085	60220	84641	18273	49604	47418	90974	83965	62732
500	06236	29052	91392	07551	83532	68130	56970	33273	61993	88407
501	88188	99345	94118	40373	50387	24802	81352	61640	56614	71506
502	05200	50533	59428	02797	16833	10038	18901	40743	99449	49825
503	82828	41316	92617	31346	89263	06589	07121	07151	23905	98435
504	71006	99318	19269	35233	79183	78538	06326	62715	28701	52809
505	05937	00875	32264	82808	00229	03868	71072	11519	44876	34508
506	06021	04370	93070	90737	05354	68427	25554	11165	00123	80338
507	54789	10960	44023	57857	56556	83993	70787	28193	65872	33723
508	90400	05707	29128	14859	84117	72206	53740	00464	51853	78852
509	51424	01651	99970	73521	82356	03297	36288	93531	69269	84798
510	79743	88757	43370	86536	07166	06401	14413	23643	21527	91902
511	77418	00322	98854	51507	00565	33066	65791	47857	32483	38493
512	17580	49302	16408	05678	75532	46218	74359	77556	82242	00134
513	15489	45559	28548	64330	42126	43145	81287	73884	69312	03395
514	56342	66773	18536	32600	73958	75993	84250	19254	06677	54192
515	20202	19216	23762	47856	04623	70728	86657	70801	53719	25214
516	84877	51708	69357	67914	55372	97225	52837	46723	00256	96221
517	01647	00311	44989	21900	96079	15793	13148	01433	78721	02647
518	45652	89311	45302	74539	32045	86727	40595	55953	93448	07805
519	79975	06153	08932	59185	71386	19070	87098	19392	13899	56096
520	49744	54713	37053	77467	15348	03383	96086	93295	12413	55774

Rows	Columns									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
521	40922	94903	29638	46870	14108	84391	87313	65969	43349	85142
522	53319	48020	77444	51447	07916	99506	83504	22290	63835	45589
523	76682	10559	85446	56236	85919	76388	59850	03262	60347	31077
524	48869	97229	69581	84581	71728	45150	16901	88717	62688	24822
525	95961	19279	38078	17473	43945	21562	90937	52140	73771	56084
526	16521	25945	94076	91281	92272	41233	58614	18912	58454	34011
527	78282	26332	44072	55104	16895	98311	56005	23331	21939	03463
528	43473	39179	53174	43498	72674	13087	54261	01844	45738	93150
529	06513	31352	09177	21367	64725	23784	18125	74873	83971	92678
530	48734	39737	03448	99009	98136	34562	30339	93143	07350	94289
531	54832	70111	48339	75270	11652	41697	43277	58089	70520	96997
532	55844	69515	22658	75438	83086	41325	04694	40359	28351	53492
533	42829	54398	93338	90705	00626	87752	93482	27726	51835	23966
534	81128	63461	10925	44382	73365	98875	77605	27351	49177	36914
535	62885	26354	10368	78026	00186	46783	02059	98892	98061	15330
536	19525	10375	27010	42791	49471	90607	98103	31752	04842	13693
537	26570	99202	73924	59888	01827	93314	63949	35394	12989	05867
538	04772	17749	01537	96036	02102	02622	06007	52239	61201	57415
539	49129	12491	62552	64323	44856	29045	76871	80449	81351	73642
540	19937	75104	57780	95871	94547	53541	77723	54114	90290	62627
541	52571	67962	72775	28480	87411	12075	45177	08796	99297	48807
542	54943	80723	81195	84069	28144	48106	04169	16575	62665	97861
543	16375	88048	29625	08111	92924	53335	09525	88290	17679	08945
544	38745	91458	30363	95005	55854	38628	13599	73065	40870	82576
545	09937	17776	86425	88916	80594	28347	08092	64255	55604	78635
546	30097	47192	27960	15937	42080	61048	14358	44508	72683	51088
547	02410	60124	62825	42947	74590	89730	16073	28184	30078	92578
548	44804	80165	19442	72194	76910	40274	93861	06568	92482	70037
549	37352	79142	51032	58844	03167	57351	51850	92810	35331	78995
550	60640	14199	48263	71533	94235	42431	44114	90993	41149	06159
551	91610	78188	70960	63990	75601	40719	30421	61611	99904	32812
552	33703	90322	64835	44919	05944	55157	21524	15227	96909	44592
553	30613	74952	51132	01915	92747	64951	17012	64161	18296	22851
554	29975	89868	94738	17752	35156	35749	10367	07684	36188	18510
555	28551	90707	88916	19509	25625	58104	32586	86679	50720	94953
556	20969	99570	91291	90700	21916	81825	44394	42880	01547	85590
557	52666	19174	39615	99505	63213	21069	10634	12952	12234	90511
558	30680	19655	63348	58629	18425	84903	42508	32307	84115	27156
559	00849	74917	97758	16379	58678	44947	05585	56941	85104	20285
560	14110	06927	01263	54613	16439	11458	18593	64952	29372	74461