

**NCTR**  
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TRANSIT RESEARCH

What do you do now for NTD sampling  
with Circular 2710.1A being withdrawn?


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## What does the webcast cover?

- National Transit Database and requirements
- Circular 2710.1A
- Sampling options for 2710.1A users
- A simple Excel-based tool
- Using the tool to evaluate sampling options
- Access and additional information




- National Transit Database and requirements



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## What is the National Transit Database?

- Public transit agencies that benefit from Federal transit grant programs report their data to the NTD on:
  - Resource used
  - Service provided
  - Service consumed
- Service consumed includes:
  - Unlinked passenger trips (UPT), i.e., boardings
  - Passenger miles traveled (PMT)



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## What does NTD require statistically?

- Only service consumed may be estimated
- Must report 100% counts if having the ability to collect 100% counts reliably
- Typically report 100% UPT but estimated PMT
- When estimating
  - Random sampling, &
  - 10% precision at 95% confidence (annual totals), &
  - Sampling plans
    - Pre-approved by Federal Transit Administration (FTA) or
    - Alternative sampling techniques (pre-certified)




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## How do you collect data for estimating PMT?



- For every trip in your annual sample, collect
  - boardings at every stop
  - alightings at every stop
  - passengers from the previous trip
  - passengers staying on for the next trip
- For every trip in your annual sample,
  - Calculate stop-to-stop passenger load
  - Determine stop-to-stop distance
- Typical methods for data collection
  - Traditional: **onboard ride checkers**
  - Modern: automatic passenger counters (APC)



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- Circular 2710.1A



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## What happened to NTD recently?

- On 04/07/2015, FTA published the final Federal Register notice on its proposed changes to NTD
- FTA has withdrawn its NTD sampling circulars
  - **2710.1A for bus**
  - 2710.2A for demand response
  - Used for almost 40 years
  - Used widely
  - Institutionalized into agency data programs
- FTA has replaced them with the *NTD Sampling Manual*



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## Circular 2710.1A Sampling Plans (referred to as **interval-based**)

Plan Number	Frequency of Sampling	Bus Trips in Sample	Total Sample Size for Year
1	Every Day	2	730
2	Every Second Day	3	549
3	Every Third Day	5	610
4	Every Fourth Day	7	644
5	Every Fifth Day	10	730
6	Every Sixth Day	15	915

**Most popular**

1. Sampling is done for individual sample days (**183 days**)
2. Same number of trips sampled on each sample day (**3 trips**)
3. **Constant interval** between sample days (**1 day**)



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## Commercial Software

- Some agencies do sampling and expansion with commercial software purchased mainly for other purposes
- Software came with 2710.1A sampling plans built in
- Non-interval-based sampling probably requires having software altered
- Examples:
  - Ridecheck Plus
  - Hastus



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## Why was 2710.1A withdrawn?

- **Ideal:** minimize sampling while meeting 10%/95%
- Lead to over-sampling for many agencies
- Lead to under-sampling for some agencies
- Problems got worse in recent years
  - Designed for estimating both UPT and PMT, but most agencies report 100% UPT now
  - Designed for universal applicability, but conditions may have changed




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## What is the *NTD Sampling Manual*?



- Minimize sampling burden while meeting 10%/95% targets by offering
  - Solutions unique to individual agencies
  - A range of sampling methods to minimize sampling size for each unique situation
  - A tool, the *NTD Sampling Template*, for agencies to customize sampling plans
- FTA pre-approves these customized plans
- **Period-based sampling:** weekly, monthly, or quarterly



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- Sampling options for 2710.1A users

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## What sampling options are available for users of 2710.1A?

- General options with manual data collection
  - FTA pre-approved
  - Alternative sampling techniques
    - Original 2710.1A sampling plans
    - Customized interval-based sampling plans
    - Others
- Options considered today
  - Keep using your original 2710.1A plan without change
  - Customize 2710.1a to your conditions
  - Use period-based sampling plans through the *NTD Sampling Manual* (FTA pre-approved)



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## How do you benefit from using 2710.1A or other interval-based sampling plans?

- All potential users
  - Likely easier to staff data collection
  - Much simpler to put together a full list of trips to be operated for sampling
  - Easier to account for frequent changes in schedule
- Current users of 2710.1A
  - Avoid the need to alter purchased software
  - Avoid the need to alter other data processes
  - Avoid any process changes until you start using APC data for NTD reporting



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## What do you need to do to keep using your original 2710.1A plan?

1. Customize interval-based sampling plans
2. Compare sample size
3. May keep using 2710.1A if its sample size is greater than customized plans
4. Cannot use it otherwise
5. Have your results certified



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## What do you need to do to use customized interval-based sampling?

- Need to customize 2710.1A to your conditions
- For example: only need to sample 2 trips rather than the 3 trips in 2710.1A for sampling every other day
- Have your results certified



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## How do you benefit from using period-based sampling plans?

- Do sampling fewer times a year
  - E.g., 12 times for monthly sampling
- Lower sample size due to unique features of developing period-based sampling plans
  - Less rounding
  - More statistical options to take advantage of



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## How do you find out if you may be better off with period-based sampling?

1. Customize 2710.1A to your conditions.
2. Develop period-based sampling plans with the *NTD Sampling Template*.
3. Compare their annual sample size.
4. Consider using period-based sampling if its sampling burden is significantly lower.



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- A simple Excel-based tool



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## How do you evaluate original 2710.1A plans or customize them?

- Hire a qualified statistician before knowing the likely outcomes
- Have your staff do it using an established tool
- NCTR has developed one for you
  - Excel-based template
  - Free, simple, effective
- It is an add-on to the *NTD Sampling Template*



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## How does the tool work?

The screenshot displays the Microsoft Excel interface for the 'Interval-Based Template Sampling Plans' worksheet. The title bar reads 'The\_NTD\_Sampling\_Template\_VERSION 2.0 - May 21 2012 - Microsoft Excel'. The ribbon includes 'File', 'Home', 'Insert', 'Page Layout', 'Formulas', 'Data', 'Review', 'View', and 'Developer'. The worksheet content is as follows:

**Interval-Based Template Sampling Plans**

**What is in the content of this template for developing interval-based sampling plans?**

The content consists of five worksheets:

- IntervalIntro:** You should go over the general directions in this worksheet first.
- IntervalInput:** You must use this worksheet to enter your data.
- IntervalPlans:** You must go there to see the sampling plans you after you have entered your data into **IntervalInput**.
- IntervalCalculations:** It provides a number of characteristics of your service as reflected in the information you enter into **IntervalInput**. A extremely low value on a measure of how closely your UPT and PMT sample data relate to each other in this worksheet can provide an indication of potential errors in your sample data.
- IntervalPrecision:** You may use the information in this worksheet for determining whether you must revise your current template sampling plan after you have made major changes to your service since you started using your current sampling plan.

The status bar at the bottom shows 'Ready'.



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## How do you represent your conditions in the tool?

**Input for Interval-Based Sampling Plans**

**A. Weekly Days of Service & Daily Service Units**

Weekly Days of Service: 7  
 Total Daily Service Units Operated: 500

Maximum if it varies across day types

**B. PMT and UPT Sample Data by Day and Service Unit**

Date	PMT Sample Data by Service Unit										UPT Sample Day by Service Unit										
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	
2-Jan-2006	126.2	248.0	83.8								37	33	23								
4-Jan-2006	58.3	122.7	206.1								13	20	27								
6-Jan-2006	98.6	16.7	34.4								18	4	12								
8-Jan-2006	184.9	111.6	98.9								42	22	19								
10-Jan-2006	19.6	73.5	26.5								2	16	5								
12-Jan-2006	150.3	292.6									35	67									
14-Jan-2006	76.9	16.2	1.6								25	3	5								




## What does the tool provide?



**A. Sample Size by Efficiency Option and Sampling Frequency**

		Plan Number and Sampling Frequency					
		1	2	3	4	5	6
		Every Day	Every 2nd Day	Every 3rd Day	Every 4th Day	Every 5th Day	Every 6th Day
With 100% UPT	Daily Sample	1	1	1	1	2	2
	Annual Total Sample	365	183	122	92	146	122
Without 100% UPT	Daily Sample	1	3	8	43	N/A	N/A
	Annual Total Sample	365	549	976	3,956	N/A	N/A






- Using the tool to evaluate sampling options

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### Can you keep using your 2710.1A plan?

	A	B	C	D	E	F	G	H	I
1	<b>Interval-Based Sampling Plans</b>								
2									
3	<b>A. Sample Size by Efficiency Option and Sampling Frequency</b>								
4									
5	Plan Number and Sampling Frequency								
6			1	2	3	4	5	6	
7			Every Day	Every 2nd Day	Every 3rd Day	Every 4th Day	Every 5th Day	Every 6th Day	
8	<b>With 100% UPT</b>	Daily Sample	1	1	1	1	2	2	
9		Annual Total Sample	365	183	122	92	146	122	
10	<b>Without 100% UPT</b>	Daily Sample	1	3	8	43	N/A	N/A	
11		Annual Total Sample	365	549	976	3,956	N/A	N/A	
	<b>2710.1A</b>	Daily Sample	2	3	5	7	10	15	
		Annual Total Sample	730	549	610	644	730	915	



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## Should you use customized interval-based sampling instead?

Interval-Based Sampling Plans							
A. Sample Size by Efficiency Option and Sampling Frequency							
		Plan Number and Sampling Frequency					
		1	2	3	4	5	6
		Every Day	Every 2nd Day	Every 3rd Day	Every 4th Day	Every 5th Day	Every 6th Day
With 100% UPT	Daily Sample	1	1	1	1	2	2
	Annual Total Sample	365	183	122	92	146	122
Without 100% UPT	Daily Sample	1	3	8	43	N/A	N/A
	Annual Total Sample	365	549	976	3,956	N/A	N/A
2710.1A	Daily Sample	2	3	5	7	10	15
	Annual Total Sample	730	549	610	644	730	915



## How do you have interval-based plans certified?

- Hope: FTA someday adopts the newer version
- Before that happens:
  - Staff with “a working knowledge of, and an education or background in, statistics”
  - Hire a qualified statistician with known outcomes
  - Show calculated statistics by the tool in certification

Calculations			
A. SAMPLE SIZE			
Total Size of the Sample Entered in IntervalInput			549
Number of Sample Days in the Entered Sample			184
Average Daily Sample Size of the Entered Sample			3
B. OVERALL MEAN, VARIANCE, & CORRELATION			
Statistics	PMT	UPT	APTL
Sample Mean	98.4	20.0	4.93
Between-Day Variance	2,278.1	81.7	1,587.8
Average Within-Day Variance	7,098.0	230.8	5,038.4
Overall Variance	7,061.8	229.6	5,012.6
Between-Day Unit Coefficient of Variation	0.4851	0.4529	0.2175
Within-Day Unit Coefficient of Variation	0.8562	0.7613	0.3824
Overall Unit Coefficient of Variation	0.8540	0.7594	0.3814



## Currently using 2710.1A, would you be better off with period-based sampling?

		A	B	C	D	E	F	G	H	I
<b>Interval-Based Sampling Plans</b>										
<b>A. Sample Size by Efficiency Option and Sampling Frequency</b>										
		Plan Number and Sampling Frequency								
		1	2	3	4	5	6			
		Every Day	Every 2nd Day	Every 3rd Day	Every 4th Day	Every 5th Day	Every 6th Day			
With 100% UPT	Daily Sample	1	1	1	1	2	2			
	Annual Total Sample	365	183	122	92	146	122			
Without 100% UPT	Daily Sample	1	3	8	43	N/A	N/A			
	Annual Total Sample	365	549	976	3,956	N/A	N/A			

**Period-Based Sampling Plan (from Using the [NTD Sampling Template](#)):**

**With 100% UPT** - Your annual sample is **72** trips with monthly sampling.

**Without 100% UPT** - Your annual sample is **348** trips with monthly sampling.

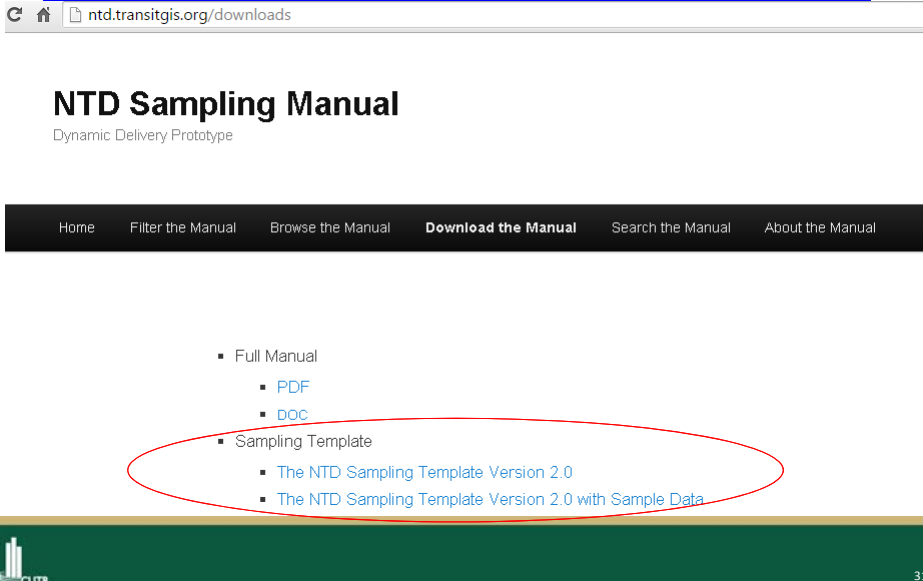


- Access and additional information



## How do you get a copy?

<http://ntd.transitgis.org/downloads>




The screenshot shows a web browser window with the address bar displaying "ntd.transitgis.org/downloads". The page title is "NTD Sampling Manual" with the subtitle "Dynamic Delivery Prototype". A navigation menu includes "Home", "Filter the Manual", "Browse the Manual", "Download the Manual", "Search the Manual", and "About the Manual". Under the "Download the Manual" section, there is a list of options: "Full Manual", "PDF", "DOC", "Sampling Template", "The NTD Sampling Template Version 2.0", and "The NTD Sampling Template Version 2.0 with Sample Data". A red oval highlights the "Sampling Template" and its sub-items. The CUTR logo is in the bottom left corner, and the number "31" is in the bottom right corner.

- Full Manual
  - PDF
  - DOC
- Sampling Template
  - The NTD Sampling Template Version 2.0
  - The NTD Sampling Template Version 2.0 with Sample Data

## How do you learn more about the tool?

- [The tool contains key instructions](#)
- Section 50 of the [newer Sampling Manual](#) has detailed instructions (<http://ntd.transitgis.org/downloads>)
- Covered by a 2012 FTA webinar on the *NTD Sampling Manual*
  - Title: NTD Sampling Requirements and Guidance Webinar
  - Listed at the NTD webinar page: <http://www.ntdprogram.gov/ntdprogram/seminars.htm>
  - Recording: <http://www.youtube.com/watch?v=tS-0WGS9lqQ>
- Contact me at [xchu@cutr.usf.edu](mailto:xchu@cutr.usf.edu)



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## What is the take-home message?

- Take advantage of the free, simple, and effective tool to evaluate your sampling options that can be implemented immediately for Report Year 2016
- Use original 2710.1A if you dislike changes
- Use customized 2710.1A if you like the simplicity of interval-based sampling
- Use period-based sampling if it significantly lowers your sampling burden



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## Do you have any questions?

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