NCTR
NATIONAL CENTER for TRANSIT RESEARCH

# With Circular 2710.1A being withdrawn what do you do now for NTD sampling?

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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)

# What does NTD require statistically?

- Only service consumed may be estimated
- Must report 100% counts if having the ability to collect 100% counts reliably
- When estimating
  - Random sampling
  - 10% precision at 95% confidence (annual totals)
  - Sampling plans
    - Pre-approved by FTA or
    - certified by a qualified statistician

# 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- FTA has withdrawn its NTD sampling circulars
  - Used for almost 40 years
  - Used widely
    - **2710.1A for bus and some other fixed-route**
    - 2710.2A for demand response
  - Institutionalized into agency data programs
- FTA has replaced them with the *NTD Sampling Manual*

# 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)

# 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

# Why was 2710.1A withdrawn?

- Leads to over-sampling for many agencies
- Leads 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 more agencies probably do not fall into the design range of variability

# 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 for agencies to customize sampling plans
- FTA pre-approves these customized plans
- Sampling for each calendar period: weekly, monthly, or quarterly

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

- All 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 the start of using APC data for NTD reporting

# As a user of 2710.1A, what do you need to do to keep interval-based sampling?

- Want to use your 2710.1A plan without change:
  - Need to determine if it meets the 10%/95% targets under your conditions
  - Cannot use it if the 10%/95 targets are not met
- Want to use other interval-based sampling plans:
  - Need to customize interval-based sampling plans to your conditions
  - For example: only need to sample 2 trips every other day rather than the 3 trips in 2710.1A
- Have your results certified

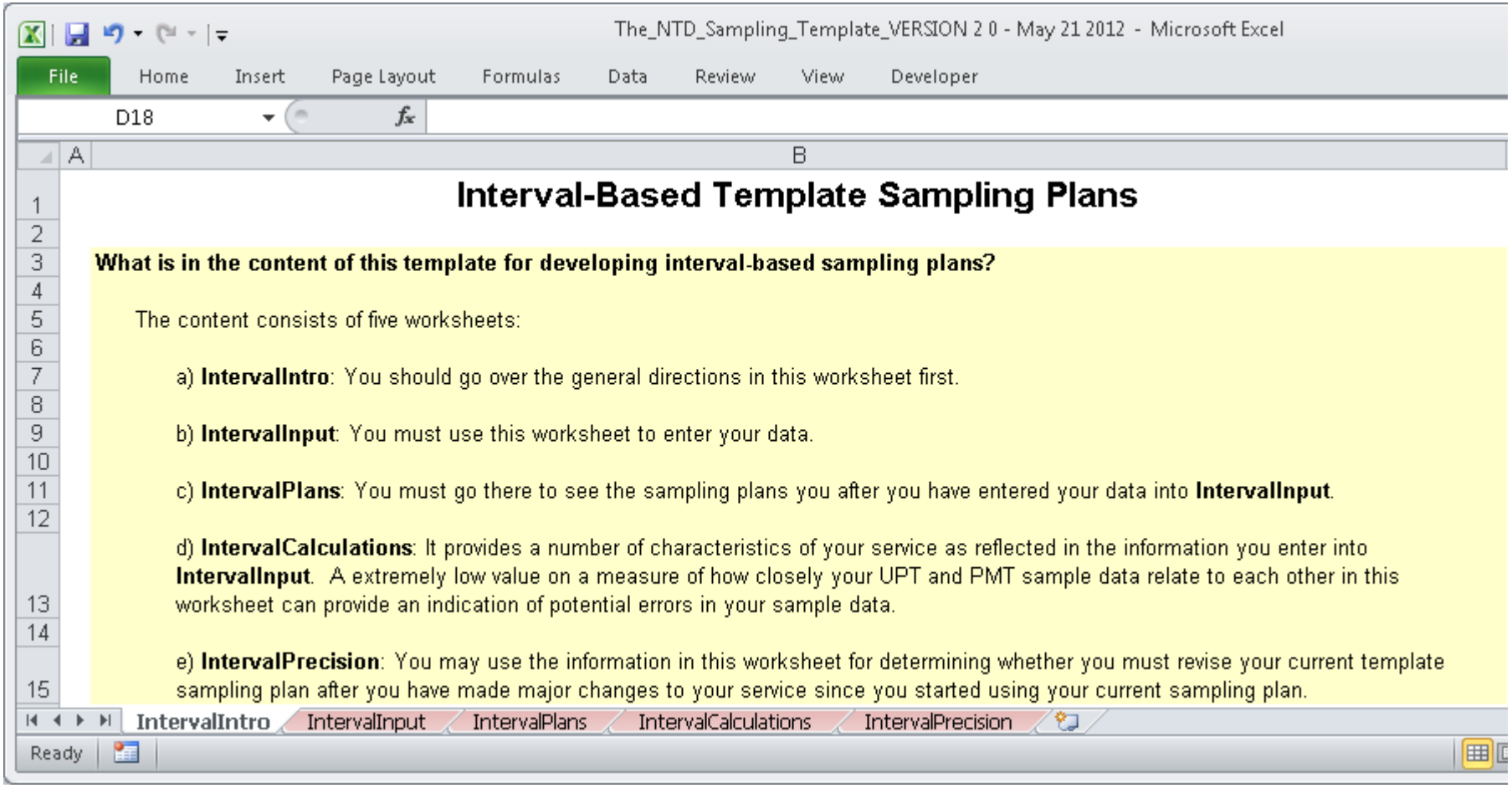
# Using period-based sampling, how do you find out if you may be better off with interval-based sampling?

- Develop interval-based sampling plans that reflect your local conditions.
- Compare the annual sample sizes required by these interval-based plans with the plan you currently use
- Consider using interval-based sampling if
  - Sample sizes are similar, and
  - You like the simplicity of interval-based sampling

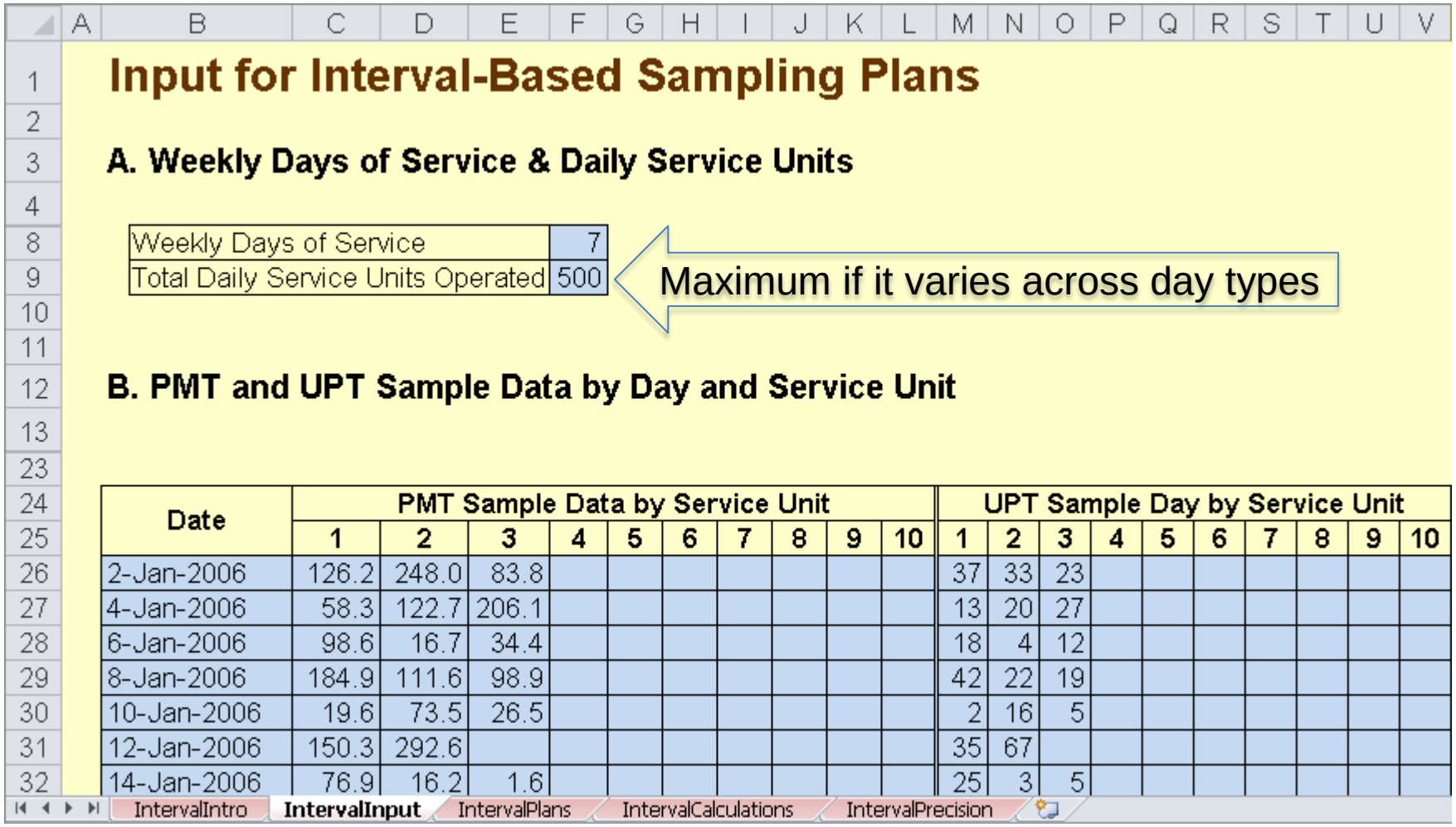
# How do you evaluate 2710.1A plans or customize interval-based plans?

- 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 Manual* template

# How does the tool work?



# 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 |

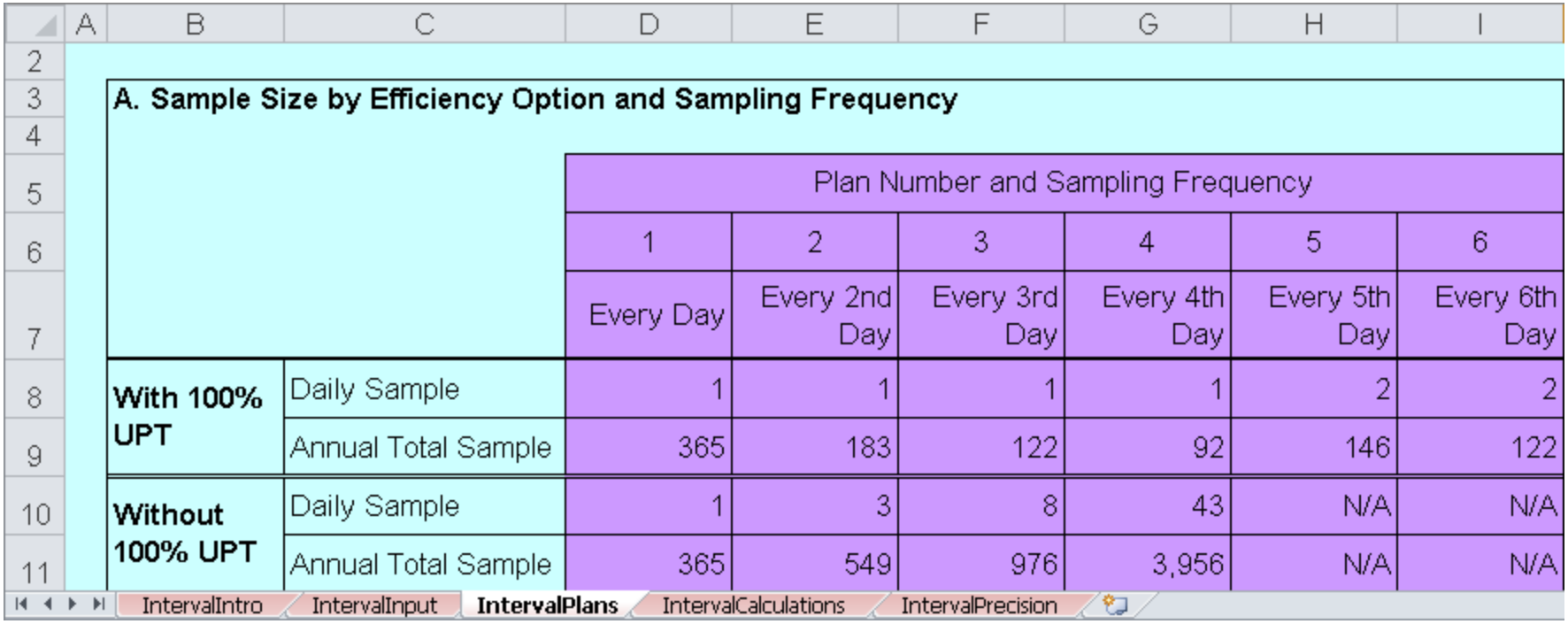
Maximum if it varies across day types

### 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 | | | | | | | |

IntervalIntro | **IntervalInput** | IntervalPlans | IntervalCalculations | IntervalPrecision

# 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 |

IntervalIntro | IntervalInput | **IntervalPlans** | IntervalCalculations | IntervalPrecision

# What do you do for NTD sampling?

## Interval-Based Sampling Plans

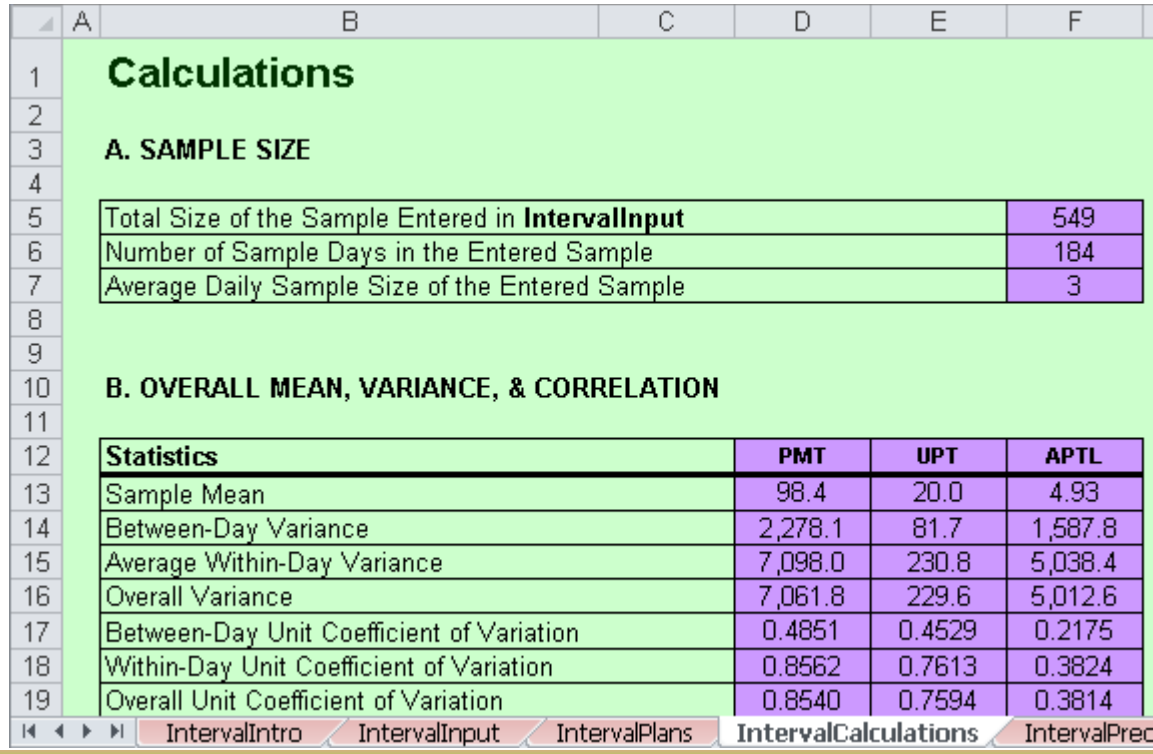
**A. Sample Size by Efficiency Option and Sampling Frequency**

| | | 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 |

Your annual sample is 72 trips with 100% UPT.

# 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**

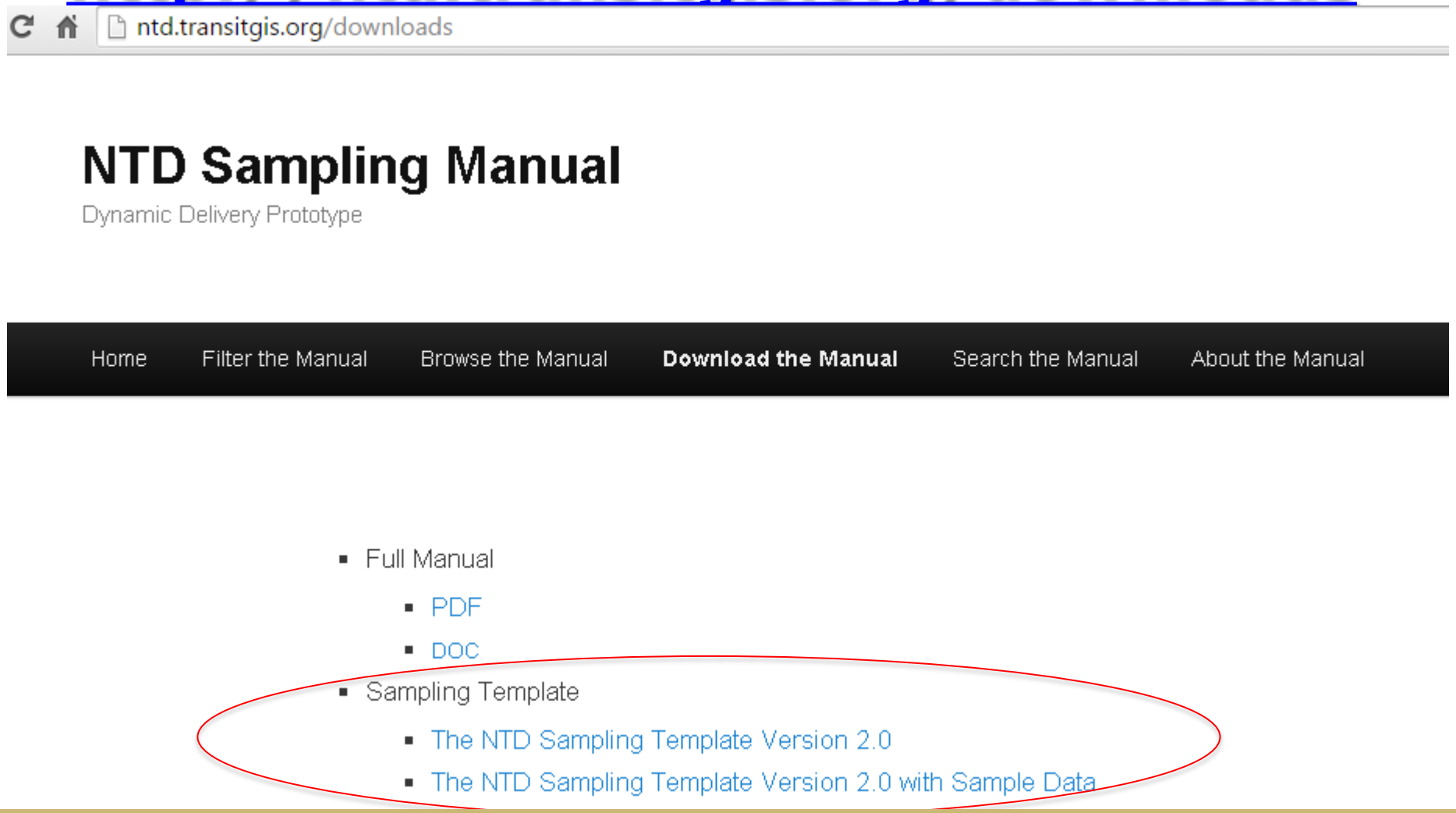
| | |
|---|---|
| Total Size of the Sample Entered in **IntervalInput** | 549 |
| Number of Sample Days in the Entered Sample | 184 |
| Average Daily Sample Size of the Entered Sample | 3 |

**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 |

IntervalIntro | IntervalInput | IntervalPlans | IntervalCalculations | IntervalPrec

# How do you get a copy?
# http://ntd.transitgis.org/downloads



# How do you learn more about the tool?

- The tool contains instructions
- Covered by a 2012 FTA webinar on the *NTD Sampling Manual*
  - Listed at the NTD webinar page: http://www.ntdprogram.gov/ntdprogram/seminars.htm
  - Title: NTD Sampling Requirements and Guidance Webinar
  - Recording: http://www.youtube.com/watch?v=tS-0WGS9IqQ
- Contact me at xchu@cutr.usf.edu

# How do you benefit from using the tool?

- Current users of 2710.1A
  - Continue interval-based sampling
    - Confirm your favorite 2710.1A plan meet 10%/95% targets
    - Provide smaller sample size for interval-based sampling
  - Stop using
    - Compare it to Sampling Manual plans
    - Savings from Sampling Manual plans too great to ignore
- Potential users of the tool
  - Compare to the sampling plan you currently use
  - Switch to interval-based sampling for simple structure if sample size does not increase much
- Provide necessary statistics for certification
- May avoid the need to hire a qualified statistician