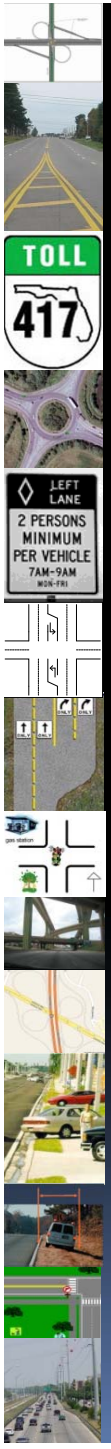
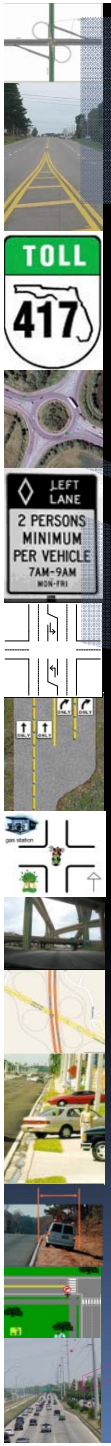


- Lesson 1
  - Sampling Framework
- Lesson 2
  - AADT Volume Groups, Precision Levels, and Sample Size Estimation Procedure

Module IV

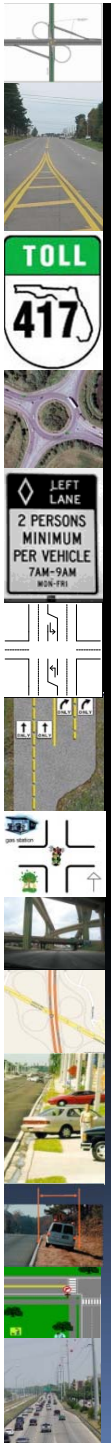
SAMPLING

Learning Outcomes for Module IV



You will be able to:

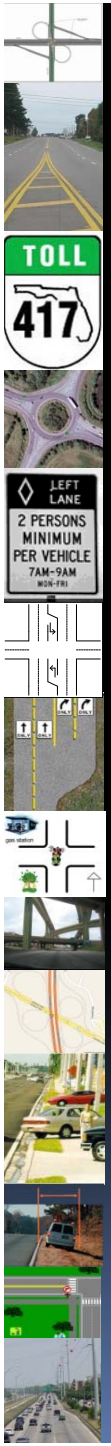
- Describe the Sampling Framework
- Describe the use of AADT Volume Groups and Precision Levels
- Explain the Sample Size Estimation Procedure



Lesson 1

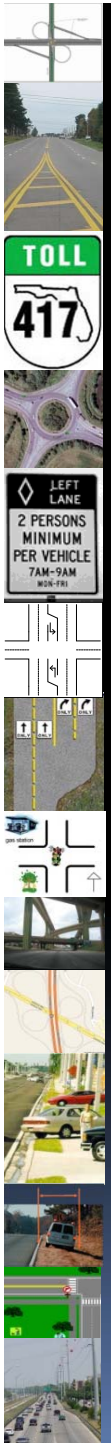
SAMPLING FRAMEWORK

Lesson 1 Introduction



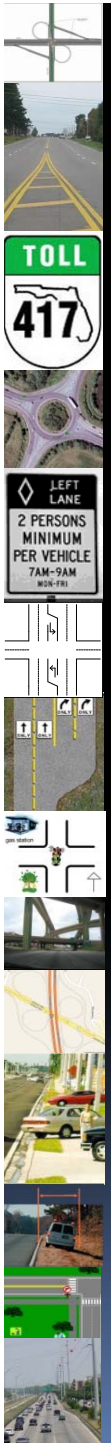
- Sample data is used to describe detailed roadway characteristics:
  - Performance
  - Condition
  - Use
- Sample sections: statistically derived subset of the Full Extent road network
- Sample data are expanded to represent the entire road network

Definitions



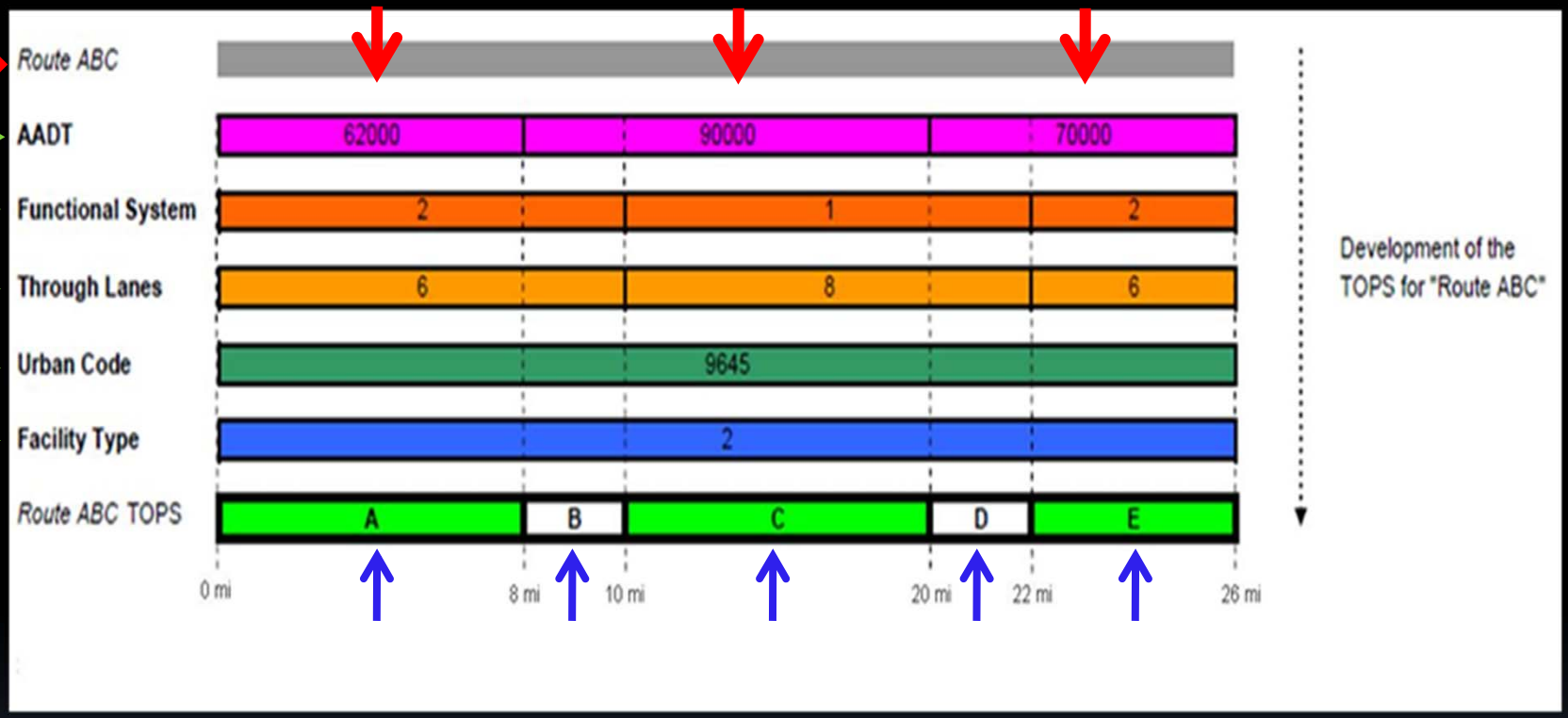
- *Universe*: "a population from which a sample is taken"
- *Sampling Units*: "elements within a population that can be counted or surveyed"
- *Sampling Frame*: "a list of all eligible sampling units in a universe"

HPMS Context

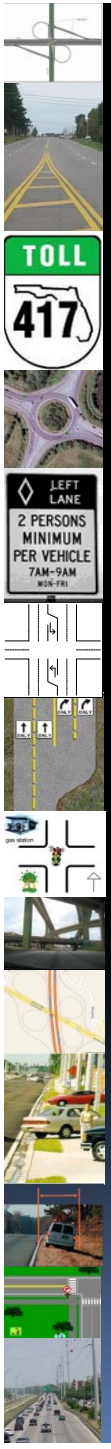


- *Universe*: Full Extent of public roads
- *Sampling Units*: HPMS sample sections
- *Sampling Frame*: Table of Potential Samples (TOPS)

TOPS Development Process

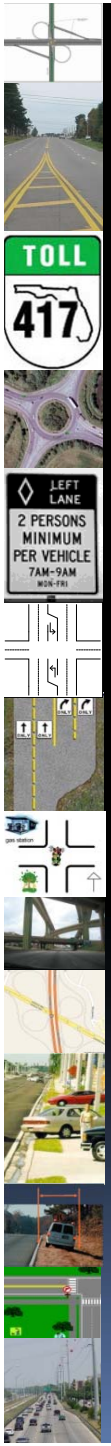


Extent-specific Data Items

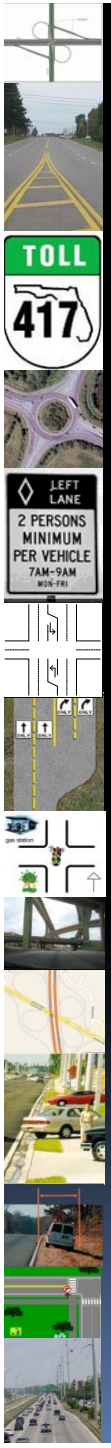


- Number of Signals (Data Item #31)
- Number of Stop Signs (Data Item #32)
- Number of At-Grade Intersections (Data Item #33)
- Curves (Data Item #43)
- Grades (Data Item #45)

Using the Table of Potential Samples (TOPS)



- The TOPS is used for
  - Sample selection purposes
  - Sample adequacy assurance
- The TOPS may require adjustments when the limits of a homogenous data item changes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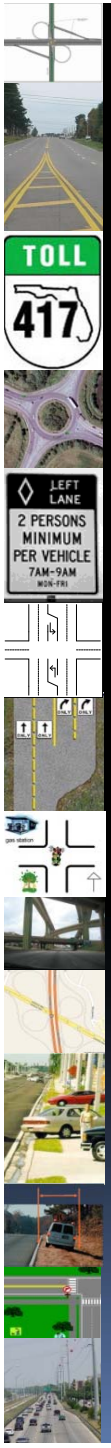
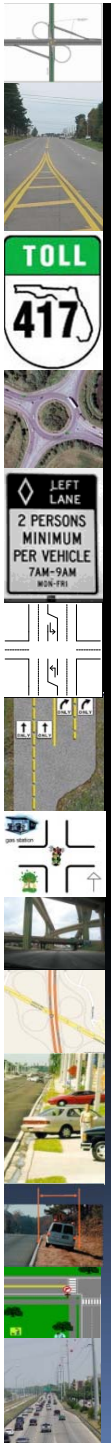
Questions???

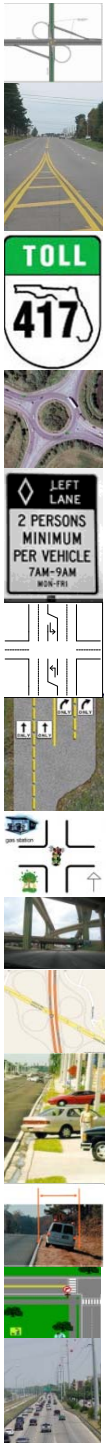


Lesson 2

AADT VOLUME GROUPS, PRECISION LEVELS, & SAMPLE SIZE ESTIMATION PROCEDURE



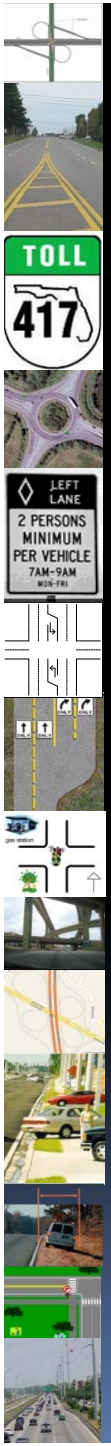
AADT VOLUME GROUPS AND PRECISION LEVELS



AADT Volume Groups

Volume Group	AADT Ranges
1	Under 500
2	500 to 1,999
3	2,000 to 4,999
4	5,000 to 9,999
5	10,000 to 19,999
6	20,000 to 34,999
7	35,000 to 54,999
8	55,000 to 84,999
9	85,000 to 124,999
10	125,000 to 174,999
11	175,000 to 249,999
12	250,000 and more

- AADT data is stratified into 12 volume groups
- Used for all sampled functional systems
- Stratification is used for expanding sample data items based on AADT ranges

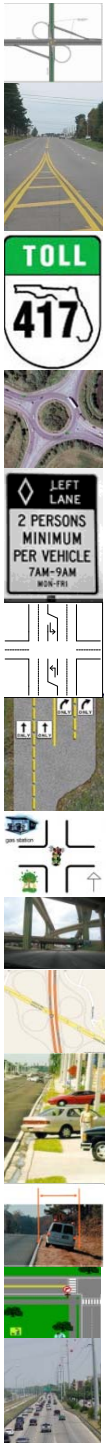


Definition of Precision Levels

"The degree of accuracy resulting from the use of a statistical sample"

Example:

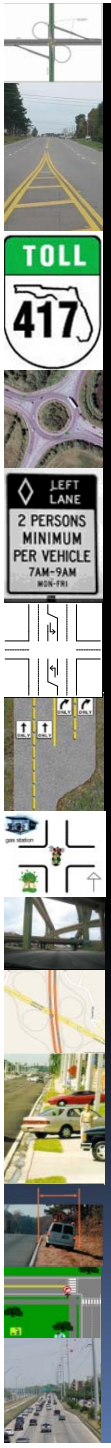
An 80-10 confidence interval and precision level indicates that the sample estimate will be within 10 ± percent of the true value, 80 percent of the time



Precision Levels by Functional System and Area Type

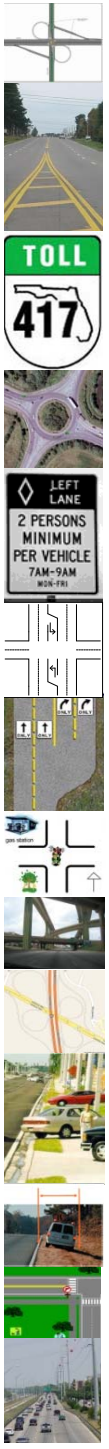
	Interstate	Other Freeways and Expressways	Other Principal Arterial	Minor Arterial	Major Collector	Minor Collector
RURAL	90-5	90-5	90-5	90-10	80-10	–
SMALL URBAN	90-5	90-5	90-5	90-10	80-10	80-10
URBANIZED < 200,000 population	80-10	80-10	80-10	80-10 or 70-15*	80-10 or 70-15*	80-10 or 70-15*
URBANIZED ≥ 200,000 population	90-10	90-10	90-10	90-10	80-10	80-10

*These precision levels will be applied if a State has three or more urbanized areas with a population < 200,000.



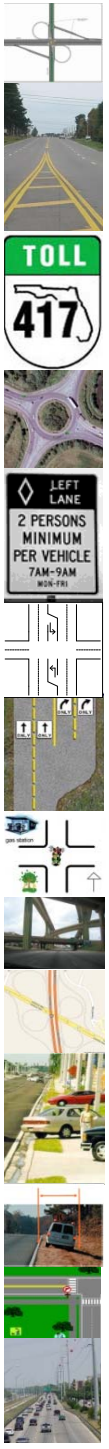
SAMPLE SIZE ESTIMATION PROCEDURE

Sample Size Estimation Formula



$$n = \frac{\left(\frac{Z^2C^2}{d^2}\right)}{1+\left(\frac{1}{N}\right)\left(\left(\frac{Z^2C^2}{d^2}\right)-1\right)}$$

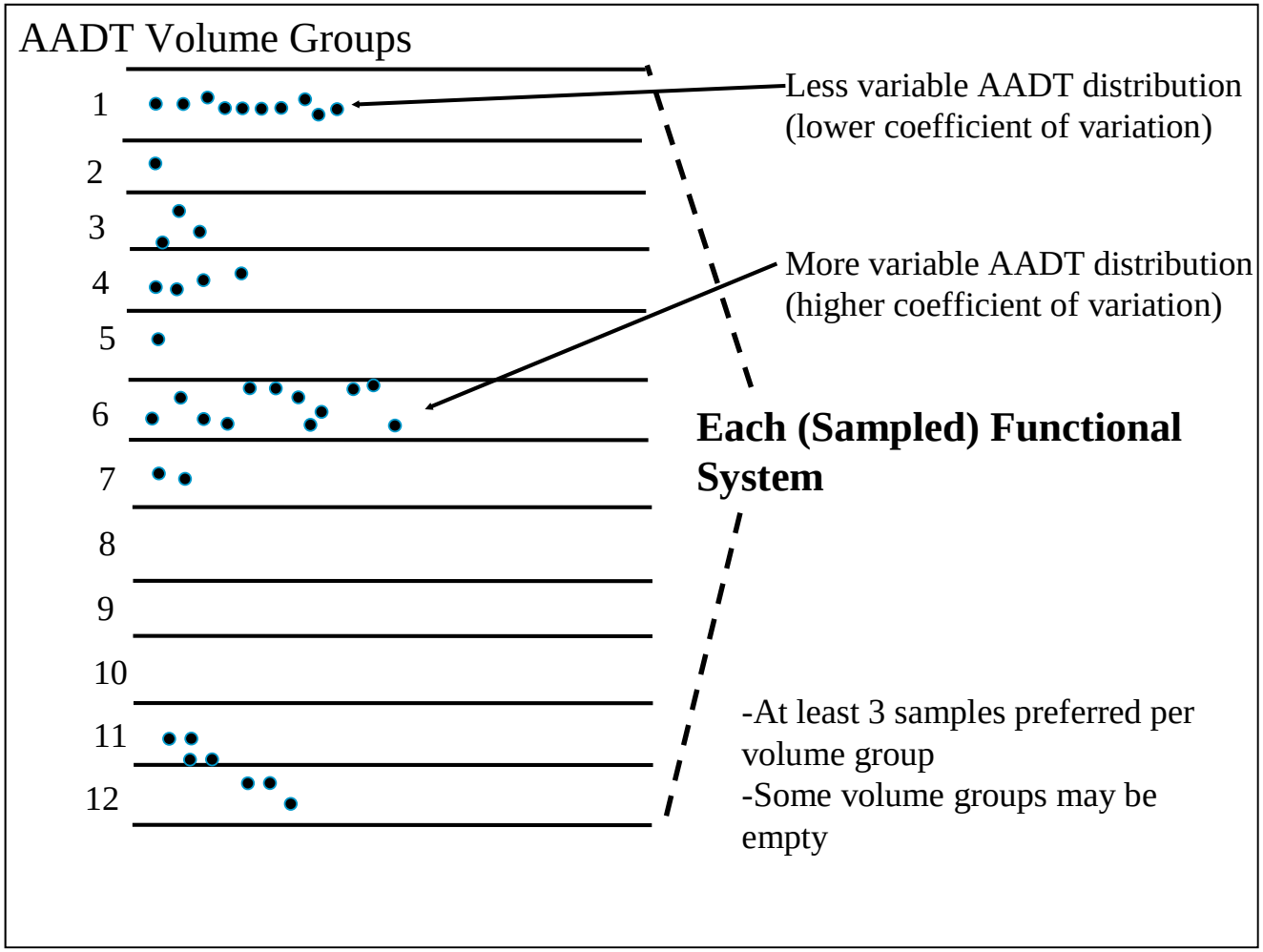
Where: ***n*** = number of required samples
Z = value of the standard normal statistic
C = AADT coefficient of variation
d = desired precision rate
N = number of available TOPS sections (within a particular volume group)



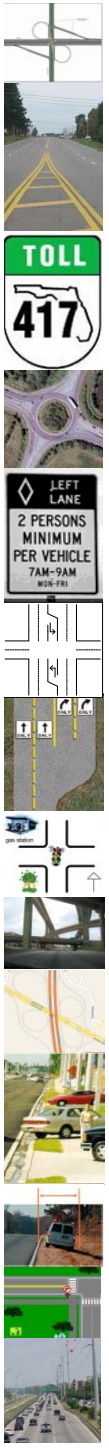
Z-values by Confidence Level

Confidence Level	Value of Z	Z Squared
90 Percent	1.645	2.706
80 Percent	1.282	1.644
70 Percent	1.040	1.082

AADT Coefficient of Variation (C)



Sample Size Estimation Example



$$n = \frac{\left(\frac{(1.645)^2(0.4)^2}{(0.05)^2}\right)}{1+\left(\frac{1}{300}\right)\left(\left(\frac{(1.645)^2(0.4)^2}{(0.05)^2}\right)-1\right)} = \frac{173.18}{1+\left(\frac{172.18}{300}\right)} = 110$$

Z = 1.645, standard normal statistic for 90 % confidence level

C = 0.40, coefficient of variation

d = 5%, desired precision rate

N = 300, no. of available TOPS Sections

Expansion Factor Calculation

Expansion Factor

Full Extent length in vol. group

Sample Panel lengths in vol. group

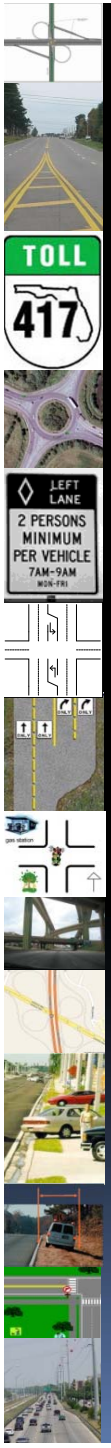
Exp. Factor $_{VG}$ = Total Full Extent length $_{VG}$ / Total Sample Panel length $_{VG}$

Short Sample Sections

Expansion factor approaches 100.000

Longer section lengths more representative (expansion factor approaches 1.000)

Expansion factors should be between 1.000-100.000
Rural length: 0.3-10.0 miles; Urban length: 0.1-3.0 miles
Urban Access Controlled Facility length: 0.1-5.0 miles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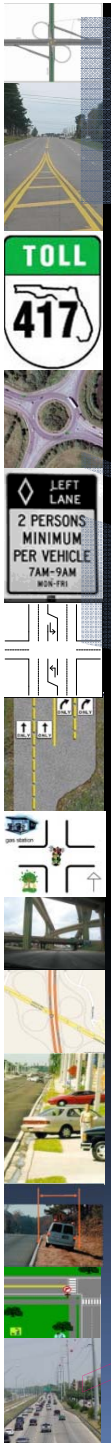
Review: Learning Outcomes



You should now be able to:

- Describe the Sampling Framework
- Discuss the use of AADT data, Volume Groups, Precision Levels
- Explain the Sample Size Estimation Procedure