



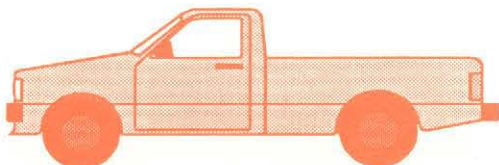
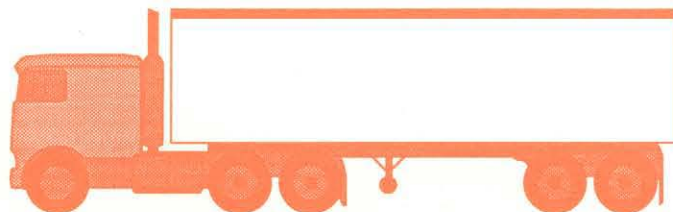
U.S. Department
of Transportation
**Federal Highway
Administration**

Highway Performance Monitoring System Field Manual

For the Continuing Analytical and
Statistical Data Base

Office of Highway
Information Management

August 1993 *As Amended*





U.S. Department
of Transportation

**Federal Highway
Administration**

Order

Subject

HIGHWAY PERFORMANCE MONITORING
SYSTEM (HPMS) FIELD MANUAL

Classification Code

Date

M 5600.1B

August 30, 1993

- Par. 1. Purpose
2. Cancellation
3. Authority
4. Responsibility
5. Comments

1. PURPOSE. To transmit the new HPMS Field Manual (OMB No. 2125-0028, approved through August 31, 1996) for use beginning with the collection of calendar year 1993 data to be reported on June 15, 1994.
2. CANCELLATION. FHWA Orders M 5600.1A, M 5600.1A, Chg. 1, M 5600.1A, Chg. 2, M 5600.1A, Chg. 3, dated December 1, 1987, July 15, 1988, April 14, 1989, and April 20, 1990, respectively, are canceled, effective September 15, 1993.
3. AUTHORITY. The reports and procedures outlined in the attached "HPMS Field Manual for the Continuing Analytical and Statistical Data Base" are authorized under 23 U.S.C. 307 which places the responsibility on the Secretary of Transportation for management decisions which affect transportation. In addition, 23 CFR 1.5 provides the Federal Highway Administrator with authority to request such information as he/she deems necessary to administer the Federal-aid highway program. Estimates of future highway needs of the Nation are mandated by the Congress on a biennial basis (23 U.S.C. 307 (e)). Additionally, HPMS data serve as the information source for the "Highway Safety Performance Report" prepared by the FHWA pursuant to Section 207 of the Surface Transportation Assistance Act of 1982 (P.L. 97-424).
4. RESPONSIBILITY. The State highway agencies are responsible for the overall coordination, collection, assembly, and reporting of complete, current high quality HPMS data on a timely basis. While cities, counties, municipalities, and metropolitan planning organizations (MPOs) have been participating in the HPMS in a number of instances, increased participation is strongly encouraged in the future, particularly by the MPOs. The FHWA regional and division offices will continue to be responsible for HPMS coordination and data and procedural reviews to assure delivery of quality data that meet all HPMS requirements.

DISTRIBUTION:

Special:

Headquarters
Regions
Divisions

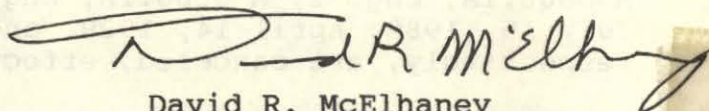
OPI: HPM-20

5. COMMENTS.

- a. This new HPMS Field Manual supersedes all previously issued HPMS Field Manuals.
- b. This new HPMS Field Manual reflects a major undertaking to redevelop the system to be responsive to the requirements of the Intermodal Surface Transportation Efficiency Act of 1991 and certain guidelines issued by the Environmental Protection Agency in response to the 1990 Clean Air Act Amendments.

The new Manual also contains certain data enhancements to permit monitoring of the National Highway System and to advance the overall state-of-the-art of this important program.

- c. Additional Chapters of this Manual addressing various HPMS software packages presently under development will be issued in the future.



David R. McElhaney
Director, Office of Highway
Information Management

Attachment



U.S. Department
of Transportation

**Federal Highway
Administration**

Order

Subject

HIGHWAY PERFORMANCE MONITORING
SYSTEM (HPMS) FIELD MANUAL

Classification Code

M 5600.1B, Chg. 1

Date

April 22, 1994

1. PURPOSE. To transmit new and revised portions of the HPMS Field Manual (OMB No. 2125-0028) dated August 30, 1993, for immediate use.
2. COMMENTS. The capacity calculation procedures published in the original Highway Capacity Manual (HCM), Special Report 209, Transportation Research Board, 1985 are still in use for HPMS. The procedures contained in the revision to the HCM dated May 1992 are not used by the HPMS software and are not to be used by the State Highway Agencies for HPMS purposes until further notice.
3. FILING INSTRUCTIONS. (See reverse side).

for Norman C. Mueller
David R. McElhaney
Director, Office of Highway
Information Management

DISTRIBUTION:
Special:

Headquarters
Regions
Divisions

OPI:
HPM-20

FILING INSTRUCTIONS

Page Changes

<u>Remove</u>	<u>Pages</u>	<u>Insert</u>	<u>Pages</u>
Preface	i-iii	Acronyms	i-ii
Acronyms	iv-v	Table of Contents	iii-x
Table of Contents	vi-x	Chapter I	5-6
Chapter I	5-6	Chapter II	9-10
Chapter II	9-10	Chapter III	3-4
Chapter III	3-4	Chapter III	13-16
Chapter III	13-16	Chapter III	19-20
Chapter III	19-20	Chapter IV	3-4
Chapter IV	3-4	Chapter IV	11-12
Chapter IV	11-12	Chapter IV	15-20
Chapter IV	15-20	Chapter IV	37-38
Chapter IV	37-38	Chapter IV	43-44
Chapter IV	43-44	Chapter IV	71-72
Chapter IV	71-72	Chapter IV	81-86
Chapter IV	81-86	Chapter VI	9-10
Chapter VI	9-10	Chapter VII	1-46
		Chapter VIII	1-24
		Chapter IX	1-28
Chapter X	1-11	Chapter X	1-13
Appendix F	5-6	Appendix F	5-6
Appendix J	5-6	Appendix J	5-6
		Appendix I	1-5
		Appendix L	1-17
		Appendix M	1
		Appendix N	1-14
		Appendix O	1-5
		Appendix Q	1-3
		Appendix T	1-3
		Appendix U	1-2
		Appendix V	1-9

HIGHWAY PERFORMANCE MONITORING SYSTEM

FIELD MANUAL

**FOR THE CONTINUING ANALYTICAL
AND STATISTICAL DATABASE**

**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
AUGUST 1993**

OMB No. 2125-0028 -- Expires August 31, 1996

A C R O N Y M S A N D A B B R E V I A T I O N S

AADT: Annual Average Daily Traffic
AASHTO: American Association of State Highway Transportation
 Officials
AMRL: AASHTO Materials Reference Lab
ANSI: American National Standards Institute
ARAN: Automatic Road Analyzer
ARS: Average Rectified Slope
ASTM: American Society for Testing and Materials
ATR: Automatic Traffic Recorder
BPI: Bits Per Inch
BPR: Bureau of Public Roads (In Reference to BPR Roughometer)
 (Now Federal Highway Administration)
CAAA: Clean Air Act Amendments
CBD: Central Business District
CFR: Code of Federal Regulations
D: Thickness (Depth) of Concrete Pavement
DRP: Data Review Package
DVKT: Daily Vehicle-Kilometers of Travel
DVMT: Daily Vehicle-Miles of Travel
EPA: Environmental Protection Agency
FAPG: Federal-Aid Policy Guide
FARS: Fatal Accident Reporting System
FHWA: Federal Highway Administration
FIPS: Federal Information Processing Standards
FMIS: Financial Management Information System
GIS: Geographic Information Systems
HCM: Highway Capacity Manual
HOV: High Occupancy Vehicle
HPMS: Highway Performance Monitoring System
INT: Interstate
IRI: International Roughness Index
IVHS: Intelligent Vehicle Highway System
KMPT: Kilometerpoint
LRS: Linear Referencing System
LTPP: Long Term Pavement Performance
MPO: Metropolitan Planning Organization
MPT: Milepoint
MSA: Metropolitan Statistical Area
NAAQS: National Ambient Air Quality Standards
NBS: National Bureau of Standards
NCHRP: National Cooperative Highway Research Program
NHPN: National Highway Planning Network
NHS: National Highway System
NHTSA: National Highway Traffic Safety Administration
NIST: National Institute of Standards and Technology
OFE: Other Freeways and Expressways
OPA: Other Principal Arterial

PAS: Principal Arterial System
PC: Personal Computer
PMCG: Pavement Management Coordinating Group
PMS: Pavement Management System
PSI: Present Serviceability Index
PSR: Present Serviceability Rating
R&R: Restoration and Rehabilitation
ROW: Right-of-Way
RQCS: Reference Quarter Car Simulation
RRI: Reference Roughness Index
RTRRM: Response Type Road Roughness Meter
SHA: State Highway Agency
SHRP: Strategic Highway Research Program
SI: International System
SN: Structural Number
SPR: State Planning Research
STAA: Surface Transportation Assistance Act
THS: Territorial Highway System
TMG: Traffic Monitoring Guide
TMS: Traffic Monitoring System
TRRL: Transport and Road Research Laboratory
U.S.C.: United States Code
USGS: United States Geological Survey
VKT: Vehicle Kilometers of Travel
VMT: Vehicle Miles of Travel
V/SF: Volume/Service Flow Ratio

T A B L E O F C O N T E N T S

HIGHWAY PERFORMANCE MONITORING SYSTEM FIELD MANUAL

	<u>Page</u>
ACRONYMS AND ABBREVIATIONS.....	i
<u>Chapter</u>	
I. INTRODUCTION.....	I-1
BACKGROUND.....	I-1
SCOPE OF HPMS.....	I-2
Overview of HPMS Reporting	
Requirements.....	I-3
ROLES OF HPMS PARTICIPANTS.....	I-6
USE OF HPMS DATA IN APPORTIONMENTS AND	
ALLOCATIONS OF FEDERAL FUNDS.....	I-8
II. DEFINITIONS, TYPE OF DATA, AND ANNUAL	
REPORTING REQUIREMENTS.....	II-1
DEFINITIONS.....	II-1
HPMS DATA TYPES, SUBMITTAL SPECIFICATIONS	
AND REPORTING REQUIREMENTS.....	II-11
Areawide Data.....	II-11
Universe Data.....	II-12
Sample Section Data Requirements.....	II-12
Universe and Sample Submittal	
Specifications.....	II-15
Submittal Software Package Printouts	
To Be Furnished to FHWA.....	II-17
LRS Data Submittals for HPMS/GIS.....	II-18
Travel Activity By Vehicle Type.....	II-20
Annual Data Submittal Transmittal Letter....	II-21
SUMMARY OF ANNUAL HPMS DATA REPORTING	
REQUIREMENTS.....	II-22
WHERE TO SEND THE ANNUAL HPMS DATA SUBMITTAL...	II-24
III. AREAWIDE DATA REQUIREMENTS.....	III-1
DEFINITIONS AND CODES.....	III-2
SYSTEM LENGTH AND DAILY TRAVEL DATA.....	III-8
MINOR COLLECTOR AND LOCAL FUNCTIONAL	
SYSTEMS LENGTH DATA.....	III-16
FATAL AND INJURY MOTOR VEHICLE ACCIDENT DATA...	III-19
Accidents to be Reported.....	III-19
Good Practice Data Checks Prior	
to Submittal.....	III-19
TRAVEL ACTIVITY BY VEHICLE TYPE DATA.....	III-22
U.S. TERRITORY INFORMATION.....	III-26

IV.	UNIVERSE AND SAMPLE DATA REQUIREMENTS.....	IV-1
	GENERAL CODING INSTRUCTIONS.....	IV-1
	DATA REPORTING.....	IV-2
	Universe.....	IV-2
	Standard Sample Panel.....	IV-2
	Donut Area Sample Panel.....	IV-2
	Coding Nonuniform Roadways.....	IV-3
	Structure Treatment.....	IV-4
	Data Usage and Reporting Requirements.....	IV-5
	Use of Acronyms.....	IV-6
	DATA ITEM SUMMARY TABLE.....	IV-7
	Data Item Requirements.....	IV-7
	All Records-Universe and Sample Data.....	IV-7
	Caution Regarding the Data Item	
	Coding Summary.....	IV-7
	Universe Data (Summary).....	IV-8
	Sample Data (Summary).....	IV-11
	UNIVERSE DATA CODING INSTRUCTIONS.....	IV-14
	Identification Data Items.....	IV-14
	System Data Items.....	IV-23
	Jurisdictional Data Items.....	IV-27
	Operation Data Items.....	IV-29
	Other Data Items.....	IV-31
	SAMPLE DATA CODING INSTRUCTIONS.....	IV-45
	Sample Identification.....	IV-45
	Sample Computational Elements.....	IV-46
	Sample Pavement Attributes.....	IV-47
	Sample Improvement Data.....	IV-53
	Sample Geometric/Configuration.....	IV-59
	Sample Traffic/Capacity Data.....	IV-70
	Sample Environment Data.....	IV-77
	Supplemental Data.....	IV-81
V.	LINEAR REFERENCING SYSTEM REQUIREMENTS.....	V-1
	DEFINING AN HPMS LINEAR REFERENCING SYSTEM.....	V-2
	General LRS Rules.....	V-2
	Incorporating a Linear Referencing System...	V-3
	Creating a New MPT/KMPT System.....	V-10
	SUMMARY OF LRS DATA REQUIREMENTS.....	V-11
	LRS SUBMITTAL OPTION 1-MAPS AND COMPUTER FILES.	V-11
	Procedural Steps.....	V-12
	Inventory Route and Node Map	
	Labeling Instructions.....	V-14
	Map Item Description.....	V-15
	NODE DATA FILE CODING INSTRUCTIONS.....	V-16
	INVENTORY ROUTE LINK DATA FILE	
	CODING INSTRUCTIONS.....	V-21
	LRS SUBMITTAL OPTION 2-MAPS ONLY.....	V-25
	Procedures for Developing the	
	Required HPMS LRS Information.....	V-25
	Map Labeling Instructions.....	V-27
	Map Item Description.....	V-32

VI.	HPMS UPDATING PROCEDURES.....	VI-1
	AREAWIDE DATA.....	VI-2
	UNIVERSE AND SAMPLE DATA.....	VI-3
	UPDATES ASSOCIATED WITH IMPROVEMENTS.....	VI-3
	GENERAL UPDATING INSTRUCTIONS.....	VI-4
	Universe Data.....	VI-4
	Sample (Standard and Donut Area)	
	Section Data.....	VI-7
	SAMPLE PANEL UPDATES.....	VI-11
	Standard Sample.....	VI-11
	Donut Area Sample.....	VI-11
	REASONS TO UPDATE THE SAMPLE PANEL	
	(STANDARD AND DONUT AREA).....	VI-12
	Census.....	VI-12
	Functional Reclassification.....	VI-13
	Volume Group Reassignments Within	
	A Functional System.....	VI-14
	SAMPLE (STANDARD AND DONUT AREA) ADEQUACY	
	REVIEW.....	VI-15
	Standard Sample.....	VI-15
	Donut Area Sample.....	VI-16
	SAMPLE (STANDARD AND DONUT AREA) SELECTION FOR	
	PANEL UPDATES.....	VI-17
	Example Interstate Sample Summary.....	VI-18
	Expansion Factors.....	VI-19
	SUMMARY OF CAUSES FOR UPDATES AND	
	CORRECTIVE PROCEDURES.....	VI-19
	Census Period.....	VI-19
	Intercensus Period.....	VI-20
	PERMANENCE OF SAMPLE (STANDARD AND	
	DONUT AREA) SELECTIONS.....	VI-21
	SAMPLE (STANDARD AND DONUT AREA) PANEL	
	CONFORMITY.....	VI-22
	SAMPLE (STANDARD AND DONUT AREA) PANEL	
	REDUCTION.....	VI-22
	LRS DATA UPDATES.....	VI-25
	Universe and Sample Records.....	VI-25
	Inventory Route and Node Maps.....	VI-25
	Node Date File and Inventory Route	
	Link Data File.....	VI-25
VII.	HPMS SUBMITTAL SOFTWARE PACKAGE.....	VII-1
	INTRODUCTION.....	VII-1
	OVERALL SYSTEM.....	VII-1
	REQUIRED INPUT DATASET.....	VII-5
	OPERATING INSTRUCTIONS.....	VII-5
	USER INTERFACE.....	VII-5
	Required Statements for All Executions.....	VII-5
	Program Option Statements.....	VII-6
	Program Specific Statements.....	VII-16
	Restrictions for Program Option	
	Combinations.....	VII-18

CONTROL STATEMENTS.....	VII-19
Transaction Statements/Sets.....	VII-19
Urbanized Area Name Statements.....	VII-35
County Name Statements.....	VII-36
INPUT/OUTPUT DATASETS.....	VII-36
Microcomputer Set Commands.....	VII-36
Mainframe Job Control Language.....	VII-37
ERROR MESSAGES.....	VII-43
OUTPUT.....	VII-44
Datasets on Tape or Disk.....	VII-44
Printed Output.....	VII-44
CORE REQUIREMENTS FOR MAINFRAME.....	VII-44
SAMPLE SETUPS FOR EXECUTION ON THE MAINFRAME...	VII-44
VIII. HPMS DATA REVIEW PACKAGE (DRP) SOFTWARE.....	VIII-1
BACKGROUND.....	VIII-1
INTRODUCTION.....	VIII-1
USER INTERFACE.....	VIII-4
ID Statement.....	VIII-5
PAR Statement.....	VIII-5
ITEM Statement.....	VIII-7
REPORT Statement.....	VIII-10
HISTORY Statement.....	VIII-11
INPUT/OUTPUT DATASETS.....	VIII-12
Microcomputer.....	VIII-12
Mainframe.....	VIII-12
Datasets Provided to Each State.....	VIII-18
OUTPUT.....	VIII-18
Datasets on Tape or Disk.....	VIII-18
Printed.....	VIII-18
ERROR MESSAGES/USER MESSAGES.....	VIII-19
MEMORY REQUIREMENTS.....	VIII-20
OTHER CONSIDERATIONS.....	VIII-20
SAMPLE JCL SETUPS.....	VIII-22
IX. HPMS MICROCOMPUTER SOFTWARE MENU SYSTEM.....	IX-1
INTRODUCTION.....	IX-1
GETTING STARTED.....	IX-1
Microcomputer Requirements (Minimum).....	IX-1
Copying the Software.....	IX-2
Preparing the HPMS Data Files.....	IX-3
IBM 3270 Protocol (or Compatible).....	IX-3
CrossTalk (or Other Communication Package) Via a Modem.....	IX-4
Other Data Files Required for Submittal Software.....	IX-4
Other Data Files Required for the Data Review Package.....	IX-5
Setting State Specific Options and Inventory Year of Data.....	IX-6

EXECUTING THE MENU SYSTEM.....	IX-9
HPMS Software System Screen.....	IX-10
Data Files Required for Execution.....	IX-11
Runtime Errors/System Errors.....	IX-11
Data Selection Package.....	IX-12
Building the Selection Statements.....	IX-13
Submittal Software Package.....	IX-16
Data Review Package (DRP).....	IX-18
SENDING DATA TO FHWA.....	IX-20
SENDING DATA TO THE MAINFRAME.....	IX-21
IBM 3270 Protocol (or Compatible).....	IX-21
Crosstalk (or Other Communication Package)	
Via a Modem.....	IX-22
ERASING DATA FILES IN HPMS DIRECTORY.....	IX-23
SIZE OF THE HARD DISK.....	IX-23
MAINFRAME PREPARATION FOR DOWNLOADING.....	IX-24
Disassemble the Data Record for Downloading..	IX-25
Reassemble the Data Record after Uploading..	IX-26
FILES ON DISTRIBUTION DISKETTE.....	IX-28
X. AREAWIDE TEMPLATE PROCEDURES.....	X-1
INTRODUCTION.....	X-1
GENERAL GUIDELINES.....	X-2
Data Review Package (DRP).....	X-4
SPECIFIC DIRECTIONS.....	X-5
Template 1.....	X-5
Template 2.....	X-6
Template 3.....	X-7
Template 4.....	X-7
Minor Collector and Local DVMT Estimates....	X-8
Template 5.....	X-10
Template 6.....	X-12
Template 7.....	X-12
Template 8.....	X-13
XI. LRS DATA FILE TEMPLATE PROCEDURES.....	XI-1
GENERAL GUIDELINES.....	XI-1
SPECIFIC OPTIONS.....	XI-1
Option 1, Manual Data Entry, Abbreviated	
Field Names.....	XI-1
Option 2, Manual Data Entry, Full Field	
Names.....	XI-2
Option 3, Automatic Computer Data Entry.....	XI-2
Option 4, ASCII File.....	XI-3
Option 5, EBCDIC File.....	XI-3

chapter 12 Sample Adequacy

Chapter 13 Matrix

Appendices

- A. Table of Standard Codes for States
- B. Urbanized Area Codes
- C. Determination of Available Sight Distance
- D. Procedures for Determining Weighted Design Speed
- E. Standard Sample Panel Considerations
- F. Prescribed Volume Groups and Precision Levels
- G. Sample Size Estimation Procedures
- H. Sample Size Requirements for Estimating Proportions
- I. Highway Capacity in HPMS Submittal Software
- J. Roughness Equipment, Calibration and Data Collection
- K. Traffic Monitoring Procedures for the HPMS
- L. Edit Specifications for HPMS Data
- M. Battery of Summary Tables from the HPMS Submittal Software
- N. Formats to Add New HPMS Sections
- O. Update Data Item Numbers for HPMS Submittal Software
- Q. HPMS Record Format
- R. Climate Zone Definitions
- S. Sampling Procedures for the Donut Areas
- T. Reports Available from the DRP Software
- U. DRP Data File Formats
- V. DRP Record Layouts

List of Tables

IV-1	Roughness Reporting Requirements.....	IV-41
IV-2	Pavement Condition Rating.....	IV-43
IV-3	Examples of Pavement Section Coding Using English Units.....	IV-51
IV-4	Coding Guide for Horizontal and Vertical Alignment.....	IV-65
X-1	Table of AADT Values Used for Creating the DVMT Estimate.....	X-9
D-1	Travel Times for Curves of Various Design Speeds.	D-4
F-1	Standard Sample Volume Groups and Precision Levels (Rural Areas).....	F-1
F-2	Standard Sample Volume Groups and Precision Levels (Small Urban Areas).....	F-2
F-3	Standard Sample Volume Groups and Precision Levels (Urbanized Areas < 200,000 Population)....	F-3
F-4	Standard Sample Volume Groups and Precision Levels (Urbanized Areas \geq 200,000 Population)....	F-5
F-5	Donut Area Sample Volume Groups and Precision Levels (for NAAQS Nonattainment Areas).....	F-6
J-1	List of Equipment Types and Maximum Error by Class.....	J-5
J-2	Roughness Calibration Ranges.....	J-8

List of Figures

II-1	Houston NAAQS Nonattainment Area.....	II-6
II-2	A typical divided highway section.....	II-8
Template 1	System Length and Daily Vehicle Travel Totals of Urbanized Areas, Small Urban Areas, Rural Areas, and Statewide.....	III-9
Template 2	System Length and Daily Vehicle Travel Individual Urbanized Areas.....	III-10
Template 3	System Length and Daily Vehicle Travel Donut Area Data for Individual NAAQS Nonattainment Areas.....	III-12
Template 4	Minor Collector and Local Functional System Length; By Surface Type and Volume Group....	III-18
Template 5	Fatal and Injury Motor Vehicle Accidents....	III-21
Template 6	Travel Activity by Vehicle Type; Basic Data.	III-24
Template 7	Travel Activity by Vehicle Type; Supplemental Data.....	III-25
Template 8	U.S. Territory Information.....	III-27
IV-1	Two-Way At Grade Intersections.....	IV-32
IV-2	Freeway Connections.....	IV-33
IV-3	Median Measurement.....	IV-40
IV-4	Milled, Overlaid Pavement.....	IV-53
IV-5	Reconstruction, Old Pavement Removed.....	IV-54
IV-6	Both Side Parking.....	IV-59
IV-7	Bike Lane in Roadway.....	IV-61
IV-8	Bike Lane <u>Not</u> in Roadway.....	IV-63
IV-9	Left Turn Bays.....	IV-74
IV-10	Exclusive Right Turn Lane.....	IV-75
IV-11	Count Items.....	IV-80
V-1	Duplicate Milepoint Equation.....	V-4
V-2	Re-Entering a County; Equation Created.....	V-5
V-3	Route Stops and Restarts at a Different Location; Milepoint Stays the Same.....	V-5
V-4	Nonduplicate Milepoint Equation.....	V-6
V-5	Re-Entering a County; No Duplicate Milepoints....	V-7
V-6	Route that Stops and Restarts at Different Locations; Milepoint Increases.....	V-7
V-7	HPMS Section Near a Duplicate Milepoint Equation.	V-8
V-8	HPMS Section Crossing a Duplicate Milepoint Equation.....	V-9
V-9	HPMS Section Crossing a Nonduplicate Milepoint Equation.....	V-9
V-10	An HPMS Section that Runs Through Overlapping Routes.....	V-10
V-11	Nodes and Political Boundaries.....	V-17
V-12	Map Annotation of MPTS/KMPTS.....	V-29
V-13	Inventory Route Intersection Treatment.....	V-30
V-14	Annotation of Equation Nodes.....	V-31
VII-1	Highway Performance Monitoring System Submittal Software Package.....	VII-4
VIII-1	HPMS Data Review Package.....	VIII-3

List of Figures (cont.)

X-1	Spreadsheet Layout for Templates 1-5.....	X-4
X-2	Spreadsheet Layout for Templates 6 & 7.....	X-11
D-1	Worksheet for Calculating Weighted Design Speed (WDS).....	D-3
H-1	Functional System Standard Sample Size to Detect a 10-Percent Change in Proportions.....	H-5
J-1	Example RTRRM Correlation Graph.....	J-10

C H A P T E R I**INTRODUCTION**BACKGROUND

The Federal Highway Administration (FHWA) has the responsibility to assure that adequate highway transportation information is available to support all aspects of its functions and responsibilities, including those of the Administration and the Congress. The primary purpose of the Highway Performance Monitoring System (HPMS) is to serve these data and information needs as they relate to the Nation's streets and highway systems. The HPMS data assesses the systems length, use, condition, performance, and operating characteristics of the highway infrastructure. The HPMS data also have considerable utility throughout the transportation community, including the various governmental levels, businesses, industry, institutions of higher learning, the media, and the general public.

The provision of data is a cooperative effort with the State highway agencies (SHAs), local governments and the metropolitan planning organizations (MPOs) working in partnership to assemble and report the necessary information. In consultation with the HPMS partnership, FHWA identifies the data to be collected, establishes efficient collection methods, develops improved analytical techniques, and analyzes the data. Collectively, these activities facilitate informed highway planning, policymaking, and decisionmaking at the national level.

During the past two decades, there has been a growing need to continually assess the system length, use, physical condition, operating characteristics, and safety of the Nation's street and highway plant. Safe, efficient, and effective highway transportation is fundamental to the movement of people and goods, particularly when competing economically in the world marketplace. Increases in highway congestion and heavy truck volumes, accompanied by the concerns about air quality, are among the key issues facing transportation planners, particularly in our large urban areas. Assuring that efficient highway transportation programs are effective requires enhanced monitoring and analyses at all levels of government. Legislative mandates related to transportation, transportation monitoring programs, and air quality also have a direct effect on national data needs, analytical mechanisms, and actions of the FHWA. Traditionally, HPMS has been an integral part of policy planning. As HPMS has matured, there has been an increasing use of HPMS by FHWA in program administration decisions.

Additionally, FHWA has the responsibility to assess the potential impacts of alternative and proposed legislative programs and policies. The HPMS, initially implemented in 1978, is the nationwide data base and analytical mechanism that FHWA relies upon to serve these essential functions. To be responsive to important highway transportation issues, the HPMS is periodically reassessed to assure its effectiveness in serving in this role. When the key highway focal point was on pavements, HPMS pavement data was enhanced to expand our knowledge of pavements. Currently, with clean air a priority issue, HPMS is used to monitor travel. New Federal-aid highway program and systems structure and new legislative mandates require additional HPMS data enhancements to permit the HPMS to focus on emerging issues such as the National Highway System (NHS). Similarly, as our focus changes, we must revisit HPMS data requirements in the interest of eliminating data that may no longer be needed--the discontinuation of the rural minor collector system sample and certain sample data items are examples of this effort. The data requirements contained in this Field Manual are designed to serve a new era in highway transportation.

The HPMS participants should be aware of the regulations for administration of FHWA State Planning and Research (SPR) funded work programs (23 Code of Federal Regulations (CFR), Part 420) which outline responsibilities for furnishing FHWA adequate information for administering the Federal-aid highway program. The importance of the maintenance of valid HPMS data is emphasized as an item of national significance. Items of national significance are to be adequately addressed in each State's annual work program. Adequately addressing the HPMS extends beyond simple submission of data each year and includes taking actions to assure that all data are complete, current, and accurate. It is emphasized that although there may be other participants in gathering information for HPMS, the ultimate responsibility for the accuracy and timely reporting of the data lies with the SHA.

SCOPE OF THE HPMS

The HPMS is a nationwide inventory system that includes all of the Nation's Public Road Mileage as certified by the States' Governors on an annual basis (the District of Columbia and the Commonwealth of Puerto Rico are considered to be equivalent to a State in the HPMS). In concert with recent highway legislative mandates and regulations, this includes all facilities both on and off the State highway systems. Each State shall furnish on an annual basis all data requirements specified in Chapter II of this Manual. United States Territories, consisting of Guam, the Commonwealth of the Northern Marianas, American Samoa, and the Virgin Islands must annually report certain HPMS areawide data (see Chapter III) as well as Certifications of Public Road Mileage.

Contents of the HPMS Field Manual -- The HPMS Field Manual includes an acronyms section that provides the user with frequently used abbreviations found throughout the Manual. This chapter provides the background, states the scope, describes the major uses, introduces the sampling concept, and lists the responsibilities of participants. The following chapters serve as the major building blocks to develop and prepare the HPMS submittal:

- Chapter II -- Data summary and reporting requirements,
- Chapter III -- Areawide data requirements,
- Chapter IV -- Universe and sample data items required for certain functional systems, National Highway System, and rural, small urban, and urbanized areas,
- Chapter V -- Geographic Information System reporting requirements,
- Chapter VI -- Data item and sample panel update cycles.

The remaining chapters deal with the software used to prepare, edit, and submit the HPMS products. The appendices provide details on specific data or coding procedures, sample selection procedures, and other information too lengthy to furnish within the chapters.

Overview of HPMS Reporting Requirements

The HPMS is an integrated data base that relies on the SHAs to annually furnish complete, high quality data on a timely basis. The HPMS requires the reporting of areawide data, universe data, standard sample data, "donut" area sample data, and HPMS linear referencing system (LRS) data for geographic information systems (GIS).

- The areawide data consist of five statewide summaries. The summaries include information for travel, system length, accidents and vehicle classification by functional system and area type, plus land area and population by area type. The area types include rural, small urban, individual urbanized and the donut area of National Ambient Air Quality Standards (NAAQS) nonattainment areas.
- The term "universe" refers to a limited set of data items reported for the entire public road system as individual section or grouped length records. The public road system includes those roads owned by SHAs, local governments and Federal agencies.

- In contrast, sample data (standard or donut area) consist of data items added to the universe data that are reported for a small portion (sample) of the total highway length (universe). The sampled sections form "fixed" panels of highway sections that are monitored from year to year and represent the universe of the systems that are sampled. The more detailed information collected for a sample section is assumed to represent similar conditions on the associated universe after expansion.
- A **standard sample** section record contains the universe data plus additional data items related to the physical characteristics, condition, performance, use, and operation of the sampled sections of highway. These sample data provide detailed information which is used as the basis for evaluating change over time, and provides the basic input to the HPMS Analytical Process (models).
- **Donut area samples** are unique in that their sole purpose is to enhance the precision of travel estimates outside of the adjusted urbanized area(s) boundary but within the NAAQS nonattainment areas designated by the Environmental Protection Agency (EPA). Consequently, donut sample data item additions are limited to identification, AADT and an expansion factor.
- The HPMS LRS/GIS data provide for a linear referencing system for the universe and sample data on selected highway systems. This allows for analyses in a GIS environment.

This Manual contains the specifications for the preparation of the various types of data reported and instructions for building and editing the data set, and includes a timetable for coordinating and updating the various data items/components of the HPMS. All HPMS data are to represent conditions as of December 31 of the data year. Travel data should represent the entire calendar year; to report fiscal year travel data that is either 3 or 6 months behind the calendar year is strongly discouraged. Since travel data are used to apportion funds and travel usually increases over time, States using a fiscal year reporting scheme would likely receive a reduced apportionment of Federal-aid funds.

It is important to note that each State is expected to make an annual submittal of the areawide templates and the data tape (or floppy diskette) in accordance with the procedures, formats, and codes specified in this Manual. Each State shall also ensure that there is agreement between the Certified Public Road Mileage and the total length (miles or kilometers) reported to FHWA via HPMS areawide and universe data. After the initial reporting of LRS/GIS data, only updated information is required on an annual basis.

Multiagency HPMS Data Requirements -- To minimize the burden and avoid duplication of efforts by the States, MPOs and local governments for travel data reporting, FHWA encouraged the EPA to use the HPMS to meet the EPA travel needs. These requirements, consisting of travel estimates for NAAQS nonattainment areas as designated by EPA, are in response to the Clean Air Act Amendments of 1990 (CAAA). Specifically, EPA's data requirements contained in HPMS are found in Section 187, Vehicle Travel Forecasting and Tracking Guidance (Federal Register, Thursday, March 19, 1992, Vol. 57, No. 54) for applicable, designated NAAQS nonattainment areas. This guidance calls for States/MPOs having affected **urbanized areas** to estimate total annual vehicular highway travel using the HPMS.

Although HPMS is the mechanism through which travel information is to be developed, it is the responsibility of the State (with direct involvement of the FHWA field offices) to communicate with the appropriate EPA Regional Administrator to obtain additional information. This communication should at least establish the following:

- Specific affected areas for which travel data will be required
- The type of nonattainment area pollutants (such as carbon monoxide) that require travel information
- The severity classifications (such as serious) for which travel data will be required
- The length of time that travel information will be required via HPMS

EPA's interest in HPMS travel data is unique in that these data are to represent total travel within the **NAAQS nonattainment area boundary** for affected urbanized areas. The NAAQS nonattainment area boundaries (as far as the design of HPMS procedures are concerned) relate only to those NAAQS nonattainment areas that contain one or more urbanized areas. In addition, within the nonattainment area boundary, there will most likely be surrounding land area that may contain rural land, one or more small urban places of between 5,000 to 49,999 population, and other urbanized areas. The land area between the FHWA-approved adjusted urbanized area(s) boundary and the NAAQS nonattainment area boundary is referred to as the "donut" area throughout this Manual.

Proper estimation of actual travel on the rural minor collector and local functional systems is most important for nonattainment areas subject to the highest ambient carbon monoxide (CO) concentrations. Based on current guidance, the States containing serious CO nonattainment areas by June 30, 1994, will need to propose to, and obtain approval from, EPA for a method to estimate travel on the "local" (minor collector and local) functional systems within the donut areas and FHWA-approved, adjusted urbanized areas of nonattainment areas by a count-based methodology to take effect no later than January 1, 1995.

The National Highway Traffic Safety Administration (NHTSA) has responsibility for the Fatal Accident Reporting System (FARS) and, by agreement with FHWA, the statewide totals of fatal accidents and fatalities must agree based on a June 1 cutoff date following the data calendar year.

ROLES OF HPMS PARTICIPANTS

The HPMS is a joint effort of the Federal, State, and local governmental agencies. Primary responsibilities of HPMS' partners are summarized as follows:

FHWA Headquarters responsibilities:

- Program development, management, and day-to-day operations;
- Coordination with States, field offices, and other Federal agencies;
- Software development, maintenance, and application;
- Data review for quality and consistency, analyses, trends, and model development and applications;
- Data dissemination and publications; and
- Fulfillment of certain congressional mandates.

FHWA field office responsibilities:

- Assurance of complete, quality implementation by the States;
- Interpretation of procedures and instructions, in conjunction with guidance from Headquarters;
- Data uniformity and consistency;
- Coordination;
- Oversight to assure high quality data; and
- Performance of data and procedural reviews.

State highway agency responsibilities:

- Implementation of HPMS Field Manual requirements;
- Collection/assembly and timely reporting of complete, high quality HPMS data in prescribed codes and formats;
- Internal coordination (including the various management systems);
- Coordination with MPOs, other Federal, State, and local governments; and
- In concert with MPOs and local governments, establish their active, cooperative roles in HPMS.

MPO responsibilities:

The role of the MPOs in the HPMS is expected to increase significantly beginning in 1993 because of the increased responsibilities placed on them by recent air quality and surface transportation legislation. This is particularly the case for those urbanized areas that have been designated as NAAQS nonattainment areas by the EPA. The role of the MPOs in the HPMS is not specified; rather, it is to be determined in a cooperative manner between the MPOs and the State. HPMS-related functions that the MPOs might perform include the following:

- Furnishing management systems-type data mandated by recent legislation (traffic monitoring, pavement management, congestion management data, etc.) to the State for HPMS reporting purposes;
- For urbanized areas that are NAAQS nonattainment areas, collection of donut area supplemental traffic data required to serve EPA's Sec. 187 travel and travel forecasting data needs;
- Furnishing vehicle occupancy data collected as part of the Section 134 planning process to the State for HPMS data reporting purposes;
- Furnishing high occupancy vehicle (HOV) operations data to the State for HPMS data reporting purposes; and
- Furnishing highway surveillance system inventory data to the State for HPMS data reporting purposes.

USE OF HPMS DATA IN APPORTIONMENTS
AND ALLOCATIONS OF FEDERAL FUNDS

Interstate System length, the number of through lanes average annual daily traffic (AADT), and other HPMS data items are used to identify eligible segments to derive the lane miles (or lane kilometers) and vehicle travel that are entered into the formula to annually apportion Interstate Maintenance Program funds. Because of this use, these data receive high visibility, and **both the FHWA and the States have special responsibilities to assure that these data are consistent, current, and accurate.**

Highway safety funds are annually apportioned based on the Certified Public Road Mileage (or kilometers) in each of the 50 States, District of Columbia, Commonwealth of Puerto Rico, and the U.S. Territories consisting of Guam, the Commonwealth of the Northern Marianas, American Samoa, and the Virgin Islands.

Statewide public road length and vehicle travel are also used as two of five factors to annually allocate motor carrier safety assistance program funds to the States.

Submission of false data is a violation of United States Code (U.S.C.), Title 18, Section 1020, which reads as follows:

Whoever, being an officer, agent, or employee of the United States or Territory, or whoever, whether a person, associate, firm or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of material used or to be used, or the quality or quantity of the work performed or to be performed, or the costs thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction of any highway or related project submitted for approval to the Secretary of Transportation: or

Whoever, knowingly makes any false statement, false representation, false report, or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to the material fact in any statement, certificate, or report submitted pursuant to the provisions of the Federal-Aid Act Approved July 1, 1916 (39 Stat. 355), as amended and supplemented;

Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both.

C H A P T E R I I**DEFINITIONS, TYPES OF DATA, AND ANNUAL REPORTING REQUIREMENTS**

This chapter contains definitions, descriptions of the various types of data that are required, annual data reporting requirements, reporting media, and reporting specifications to be used by the SHAs for submitting the data to FHWA Headquarters. Additional details addressing areawide, universe, standard and donut area samples and LRS locational data are contained in Chapters III, IV and V, respectively. Chapter VI contains data updating requirements necessary to keep the database current. Collectively, these chapters should provide State and local personnel the specific definitions, guidelines, coding instructions, reporting formats, and updating requirements necessary to facilitate the reporting of current, consistent, and uniform data on a nationwide basis.

DEFINITIONS

The definitions are to be used throughout this Manual.

Areawide Template

A computerized format (spreadsheet) for data entry of system length, vehicle travel, population, net land area, fatal and injury accidents, and percent of travel by vehicle type.

Certification of Public Road Mileage

An annual document (certification) that must be furnished by each State to FHWA certifying the total public road mileage (kilometers) in the State as of December 31 of the preceding year. This document is to be signed by the Governor of the State or by his/her designee. See the definition of public road in the latter part of this definition section and Subchapter E, Planning, "Federal-Aid Policy Guide."

Combination Commercial Vehicle

Any combination vehicle described by vehicle types 8-13 (see Chapter III).

Confidence Level/Precision Level

The degree of accuracy resulting from the use of a statistical sample. For example, if a sample is designed at the 90-10 confidence level (or precision level), the resultant sample estimate will be ± 10 percent of the true value, 90 percent of the time.

Divided highway

A multilane facility with a curbed or positive barrier median, or a median that is 4 feet (1.2 meters) or wider (see Figure II-2).

Donut Area

The area outside of the FHWA-approved adjusted boundary of one or more urbanized areas but within the boundary of a NAAQS nonattainment area is considered to be the "donut area." In the example, shown as **Figure II-1**, the donut area includes six small urban areas and the remaining rural area.

Donut Area Sample Sections

The combination of existing standard sample sections and randomly selected supplementary sample sections for the donut area of an urbanized area NAAQS nonattainment area. The supplementary samples are chosen from the universe of rural and small urban minor arterial systems and the rural major collector and small urban collector systems, and are combined with the existing standard sample sections in these systems for the sole purpose of estimating travel on these systems. A discussion of the donut area sample design for these systems is presented in Appendix S.

English Units

The term "English" refers to the United States legislative interpretation of the units as defined in a document prepared by the National Institute of Standards and Technology (NIST), U.S. Department of Commerce, Special Publication 330. Commonly used English units in HPMS are miles, feet, and inches.

Expressway

An expressway is defined as a divided highway for through traffic with full or partial access control and including grade separations at all or most major intersections.

FHWA-Approved Adjusted Census Urban Boundary

Designated boundaries of a Census urban place or urbanized area can be adjusted by responsible State and local officials in cooperation with each other, subject to the approval by the FHWA (23 U.S.C. 101). In some cases where the incorporated boundaries of a place extend far beyond the community, village, or town, the U.S. Bureau of the Census limited the area boundaries to the urban populated areas using extended city criteria.

Freeway

A freeway is defined as an expressway with full control of access.

Functional Systems

The functional systems required by Title 23, U.S.C., have been chosen as the most logical, stable base for the HPMS (23 CFR 470). The systems are defined in the reference manual entitled "Highway Functional Classification: Concepts, Criteria, and Procedures," FHWA, March 1989. The functional system names and codes are as follows:

Rural Functional SystemsCode Name

	Principal Arterial System
01	Interstate System
02	Other Principal Arterial
06	Minor Arterial System
	Collector System
07	Major Collector
08	Minor Collector
09	Local System

Urban Functional SystemsCode Name

	Principal Arterial System
11	Interstate System
12	Other Freeways and Expressways
14	Other Principal Arterial
16	Minor Arterial System
17	Collector System
19	Local System

Geographic Information System (GIS)

The GIS is a system of hardware, software, and data for collecting, storing, analyzing, and disseminating information about areas of the Earth. For HPMS purposes, GIS is defined as a highway network (spatial data which graphically represents the geometry of the highways--an electronic map) and its geographically referenced component attributes (HPMS section data, bridge data, and other data including socio-economic data) that are integrated through GIS technology to perform analyses. From this, GIS can display attributes and analyze results electronically in map form.

Highway

A highway is any road, street, parkway, or freeway/expressway that includes rights-of-way, bridges, railroad-highway crossings, tunnels, drainage structures, signs, guardrails, and protective structures in connection with highways. The highway further includes that portion of any interstate or international bridge or tunnel and the approaches thereto (23 U.S.C. 101(a)).

Linear Referencing System (LRS)

The total set of procedures for determining and retaining a record of specific points along a highway. Typical systems used are milepoint, milepost, reference point, and link-node.

Metric Units

The metric conversion policy of FHWA, published on June 9, 1992, in the Federal Register, specifies full metric conversion for data reported after 1995. Until 1995, the States have the option of reporting HPMS data in either English or Metric units. However, **all data reported for any given year must be in either metric or English units.**

The term "metric" refers to the modernized metric system known as the International System (SI). Further information is available under NIST's special publication 811, entitled "Guide for the Use of the International System of Units: The Modernized Metric System," and the American Society for Testing and Materials (ASTM) Standard E380-89a. Commonly used metric units in the HPMS are kilometers, meters, and millimeters.

Metropolitan Planning Organization (MPO)

The MPO, formed in cooperation with the State, develops transportation plans and programs for the metropolitan area. For each urbanized area, an MPO must be designated by agreement between the Governor and local units of government representing 75 percent of the affected population (in the metropolitan area), including the central cities or cities as defined by the Bureau of the Census, or in accordance with procedures established by applicable State or local law (23 U.S.C. 134(b)(1)/Federal Transit Act of 1991 Sec. 8(b)(1)).

National Ambient Air Quality Standards Nonattainment Area,
Boundary and Coding Requirements

An area not meeting the NAAQS is designated as a nonattainment area out to the boundaries established under the Clean Air Act Amendments of 1990. States are to report travel data via HPMS for NAAQS nonattainment areas that **contain one or more urbanized areas**, as identified by EPA. Portions of an NAAQS nonattainment area may be located in more than one State. Other comments concerning State responsibilities, travel requirements and communication with the EPA Regional Administrator are contained on page I-5 of this Manual. NAAQS nonattainment area codes must follow these general rules:

- If a named NAAQS nonattainment area includes only one urbanized area, the nonattainment area code is the same as the urbanized area code.
- If a named NAAQS nonattainment area includes more than one urbanized area, the nonattainment area code used for each urbanized area (or portion thereof) within a named NAAQS nonattainment area is that of the primary urbanized area, as declared by EPA.
- The nonattainment area code is that of the primary urbanized area for the rural and small urban areas outside the boundaries of the FHWA-approved adjusted urbanized area(s) but within a named NAAQS nonattainment area.

NOTE: The three-digit code assigned will be FHWA's urbanized area code (Appendix B) for the primary urbanized area within the named NAAQS nonattainment area. This coding must be consistent among the areawide template and the universe/sample data records. In some cases, the primary urbanized area could be in another State. Under these circumstances, the NAAQS nonattainment code is still for the primary urbanized area in the adjoining State.

As an example, an NAAQS nonattainment area is illustrated for "Houston" in **Figure II-1**. It consists of the urbanized areas of Houston (the primary urbanized area), Texas City, and Galveston, six small urban areas and the remaining rural area. All of the urbanized areas, small urban areas, and rural areas within the NAAQS nonattainment area will be coded with the FHWA urbanized area code of Houston (015) as the nonattainment area code. The table below contains the proper coding for a universe or sample data record and for the pertinent areawide template fields for urbanized area and nonattainment area.

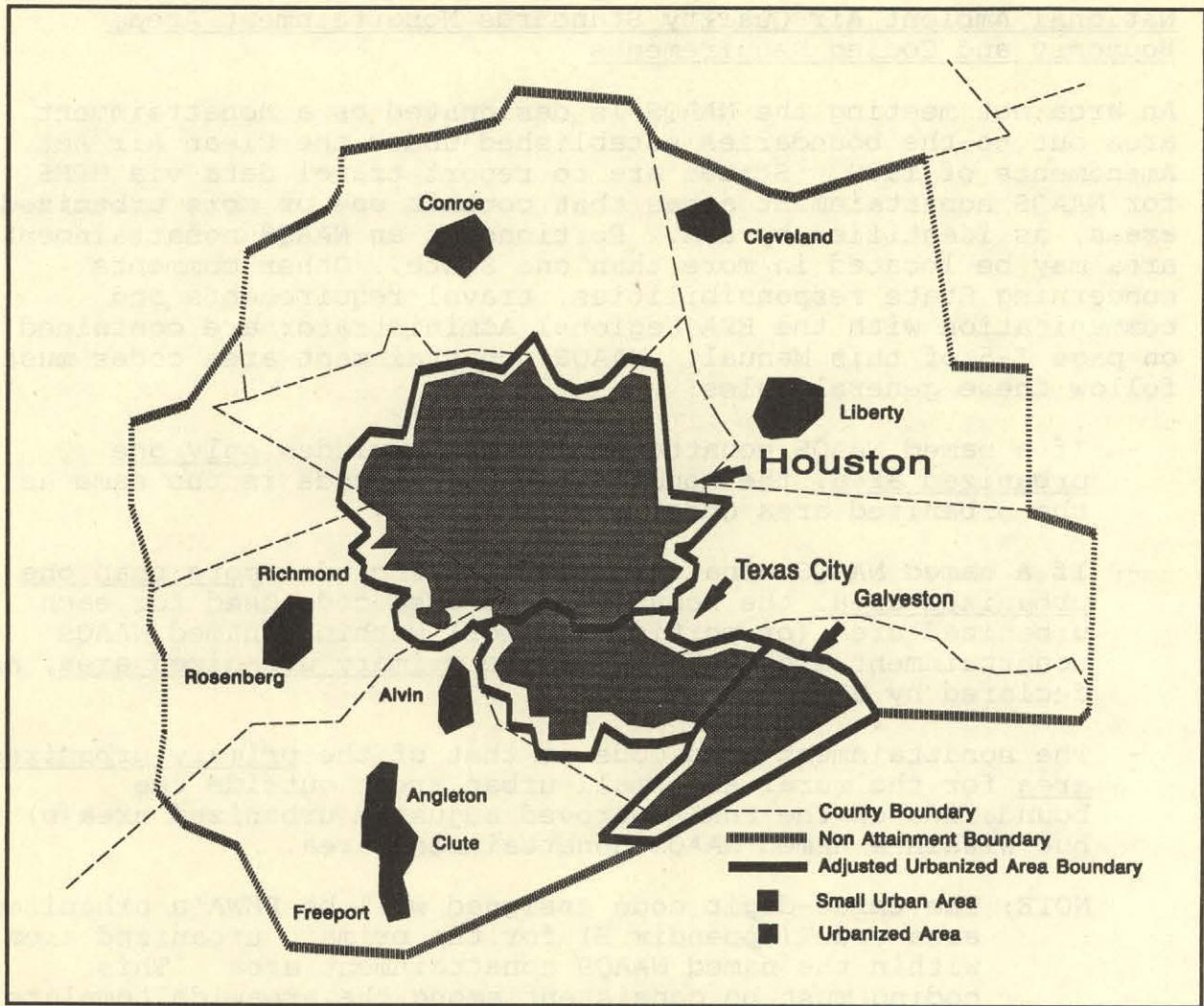


Figure II-1 - Houston NAAQS Nonattainment area

Houston NAAQS Nonattainment Area

<u>Urbanized Area Code</u>	<u>Nonattainment Area Code</u>	<u>Location</u>
015	015	Houston Urbanized Area
137	015	Galveston Urbanized Area
250	015	Texas City Urbanized Area
000	015	Small Urban Area
000	015	Rural Area

For all road segments outside of nonattainment areas, "000" is coded in the nonattainment area field.

National Highway System (NHS)

A new Federal-aid highway system initiated via recent legislation. The SHA NHS proposals, as amended through negotiations with appropriate FHWA division and region offices, are to be furnished to FHWA Headquarters by June 30, 1993. The FHWA Headquarters, after analyses and perhaps some coordinated (negotiated) changes, is to report to the Congress on the "proposed" NHS by December 18, 1993. The proposed NHS routes contained in this report to the Congress are to be identified by the States in the 1993 HPMS data submittal to be furnished to FHWA by June 15, 1994. This relates to all 1993 HPMS universe and sample data. **For 1993, only the areawide accident data will not be stratified by the NHS.**

Subsequent to the reporting of calendar year 1993 data, the States shall report NHS data based on the latest system agreed to by the FHWA or approved by the Congress for **all HPMS data requirements.**

Parkway

A highway that has full or partial access control, is usually located within a park or a ribbon of park-like developments, and prohibits commercial vehicles. Buses are not considered commercial vehicles in this case.

Public Road

"A public road is any road under the jurisdiction of and maintained by a public authority and open-to-public travel."
(23 U.S.C. 101(a)).

- The term "maintenance" means the preservation of the entire highway, including surface, shoulders, roadsides, structures, and such traffic-control devices as are necessary for its safe and efficient utilization."
(23 U.S.C. 101)
- To be open to public travel, a road must be available, except during scheduled periods, extreme weather or other emergency conditions, and open to the general public for use by four-wheel, standard passenger cars without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight, or class of registration. Toll plazas of public toll facilities are not considered restrictive gates. (23 CFR 460.2(c))

Public Road, Cont.

- A public authority is defined as a Federal, State, county, township, municipal, or other local government or instrumentality thereof, with authority to finance, build, operate, or maintain highway facilities, either as toll or toll free. (23 CFR 460.2(b))

Right-of-way

The land (usually a strip) acquired for or devoted to highway transportation purposes (see **Figure II-2**).

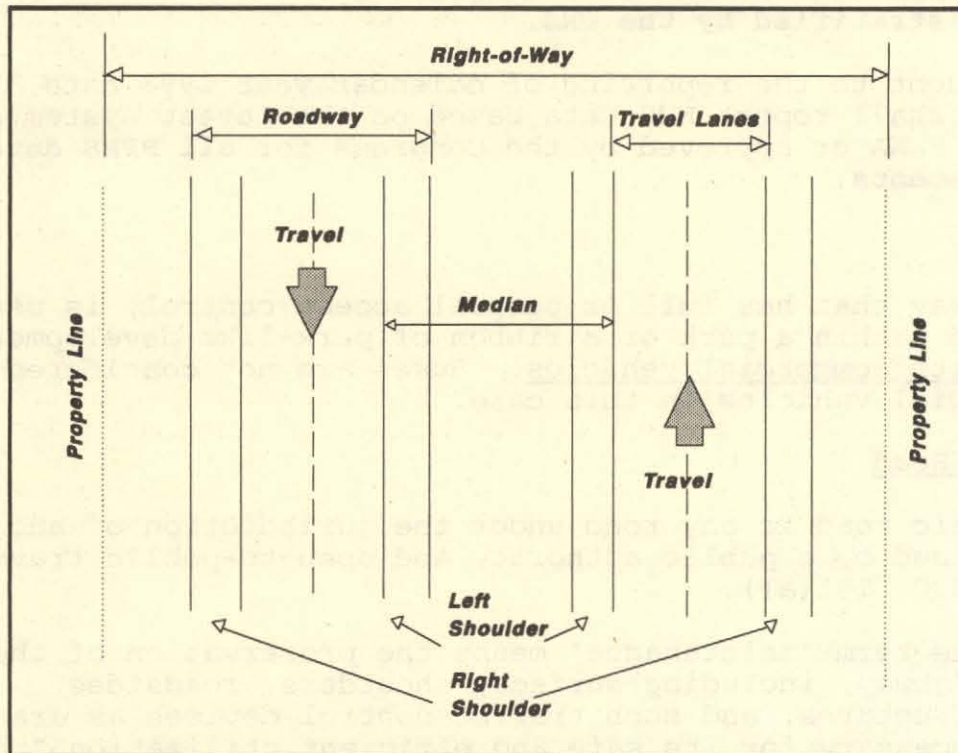


Figure II-2 - A typical divided highway section

Roadway

The portion of a highway, including shoulders, for vehicular use (see **Figure II-2**).

Rural Areas

Rural includes all areas of a State outside of the FHWA-approved adjusted Census boundaries of small urban and urbanized areas.

Single Unit Commercial Vehicle

Any single unit vehicle described by vehicle types 4-7 (see Chapter III).

Small Urban Areas

Small urban areas are defined as Census places of 5,000 to 49,999 urban population (except in the case of cities in Maine and New Hampshire) outside of urbanized areas. As a minimum, the small urban area includes any place containing an urban population of 5,000 or more as designated by the U.S. Bureau of the Census. A State is to report information only for the portion within the State. The SHA adjustment of small urban area Census boundaries are at the States' option. However, if adjustments were made to the Census boundaries and approved by FHWA, the adjusted boundaries must be used for HPMS purposes.

Standard Sample Sections

Randomly selected sections from the universe of arterial and collector systems (excluding rural minor collector) for which additional physical and operational data elements along with the universe data are reported. The sections are homogeneous as to geometrics, cross section, AADT and condition, and the termini are fixed as to location over time. The arterial and collector samples (in section form consisting of both universe and sample data) provide basic physical inventory and operational data for specific sections of highway from which the performance of the Nation's highways will be evaluated. A discussion of the HPMS sample selection design for the arterial and collector systems is presented in Appendix E.

State (Codes)

The term "State" as used in this Manual refers to any one of the 50 States, the District of Columbia, and the Commonwealth of Puerto Rico. The Federal Information Processing Standards Publication (FIPS PUB 5-2) Codes are furnished in Appendix A.

Supplemental Sample Sections (in donut areas)

The additional NAAQS donut area small urban area minor arterial and collector and rural minor arterial and major collector systems samples needed to obtain a donut area travel estimate for these systems at the 90-10 confidence level. These are the samples needed in addition to the standard sample sections that are already available for these systems in each donut area.

Supplemental Sample Sections (in donut areas), Cont.

These sample sections are randomly selected from the small urban and rural minor arterial, rural major collector, and small urban collector systems in the donut area of an NAAQS nonattainment area to enhance the precision for travel estimating purposes of these systems only. **Supplementary sample sections are combined with existing standard sample sections within the donut area and are then called the donut area sample panel.** A discussion of the donut area sample panel design is contained in Appendix S.

System Length

The total length of public roads as of December 31 of a data year that is to be reported via HPMS. All of this length must be under the jurisdiction of and maintained by public authorities and open-to-public vehicle travel (see below). This applies to all "public roads" owned by Federal, State, and local governments, or instrumentality thereof, within the boundaries of the reporting State. It also applies to an individual functional system or other classified system type of road or individual road or street segment.

Planned, unbuilt facilities on the PAS and NHS that are part of an approved plan to build the new facility in the near future (up to six years) are also to be reported in the HPMS data tape file.

Template

Fixed, standardized, spreadsheet or database formats used for HPMS areawide and LRS data entry and reporting by the States (see Chapters III and V.)

Universe Data

Data representing all public road mileage and all principal arterial system and other National Highway System mileage not yet built or open to traffic. The universe data defines the extent of roadway mileage by system and jurisdiction. These can be reported in either of the following ways:

- Section Data -- A continuous length of roadway that is homogeneous with respect to the physical, operational, administrative, and jurisdictional characteristics being reported, or

Universe Data, Cont.

- Grouped Data -- Universe data for a group of highway sections, not necessarily contiguous, with mileage aggregated with respect to the homogeneous administrative, physical, and jurisdictional characteristics being reported. Interstate System, other freeways and expressways, other principal arterial, rural minor arterial, NHS, and sample sections (standard and donut area) cannot be reported in grouped data form.

Urbanized Areas and Codes

Urbanized areas with a population of 50,000 or more, at a minimum, encompass an entire urbanized area in a State, as designated by the U.S. Bureau of the Census. The FHWA-approved, adjusted urbanized area boundaries include the Census-defined urbanized areas plus transportation centers, shopping centers, major places of employment, satellite communities, and other major trip generators near the edge of the urbanized area, including those expected to be in place shortly. FHWA's three-digit codes for urbanized areas designated by the U.S. Bureau of the Census are furnished in Appendix B. A State is to report information for the portion of an FHWA-approved adjusted urbanized area boundary within the State boundary.

U.S. Territories

The U.S. Territories include Samoa, Guam, the Northern Marianas, and the Virgin Islands. The Federal Information Processing Standards Publication (FIPS PUB 5-2) Codes are furnished in Appendix A.

HPMS DATA TYPES, SUBMITTAL SPECIFICATIONS AND REPORTING REQUIREMENTSAreawide Data

These data consist of annual summary reports for statewide rural, small urban, individual urbanized areas, and individual NAAQS nonattainment areas. Much of the data contained in these reports consist of length and travel summaries that can be obtained from the universe and standard and/or donut area sample data that are to be submitted via magnetic tape (or floppy diskettes). Specifically, areawide data consist of summary totals of system length, vehicle travel, fatal and injury accidents, minor collector and local functional system data by surface type and volume group, percentage of travel by vehicle type, net land area, and population.

Areawide data sources include the HPMS data submittal tape (or floppy diskettes), statewide highway data bases consisting of accident data files and records, management systems, traffic monitoring systems, Census, and data available from local governments and MPOs. These sources should serve all HPMS areawide data requirements.

Areawide Data Submittal Specifications --The areawide data are to be submitted to the FHWA as microcomputer template files on IBM-compatible high density diskettes (5 1/4" or 3 1/2") (or via electronic-type mail to be announced as an HPMS submittal option in the future). These data are discussed in detail in Chapter III and graphically illustrated as Templates 1-7. (Blank templates are routinely made available to the States by FHWA Headquarters.) Completed templates are to be submitted to the appropriate FHWA division office for their use and for forwarding, along with other submittal items, to FHWA Headquarters.

Corrections and revisions to areawide data that have been submitted at an earlier date shall also be submitted in template format on a floppy diskette.

Universe Data

These data consist of a complete inventory of length (miles or kilometers) by functional system, jurisdiction, geographic location (rural, small urban, urbanized, and NAAQS nonattainment areas) and other selected characteristics. Universe data must fully reflect all open-to-traffic public roads in the State as well as contain basic information for planned, unbuilt future PAS and NHS routes that are part of an approved/adopted plan. Only open-to-traffic routes that are on the PAS/NHS are to be reported in HPMS.

Sample Section Data Requirements

The HPMS contains requirements for two types of samples--standard and donut area (used for travel estimates only). For simplicity purposes, sample data can be described as additional data that are added to certain universe (sample sections) data records for urban arterial and collector systems and rural arterial and major collector functional systems. The added standard sample data consist of additional pavement, condition, usage, traffic/capacity, supplemental, environmental and operational data. The added donut area sample data consist only of identifiers and an expansion factor.

Standard Sample Data -- These data consist of additional inventory, condition, usage, pavement, operational and improvement data that complement the universe data for those sections of roadway that have been selected as standard samples. When expanded through use of the appropriate expansion factor, the resultant expanded data represent the universe of the highway length it represents (the entire sample from which the sample was drawn), permitting evaluation of the performance of the various highway systems. The sample sections form "fixed" panels of road segments that are monitored on an established cyclical basis. The panels of roadway sections were established using a statistically designed sampling plan based on the random selection of road segments at predetermined precision levels. The sample is stratified by area, by functional system, and by traffic volume group (see Appendix E for additional information concerning the standard sample design).

Sample selection is done randomly within each stratum (a predetermined AADT volume group) for each arterial and major collector functional highway system in rural and for each arterial and collector functional system in small urban and urbanized areas of the State. Unique sampling is required for each urbanized area having $\geq 200,000$ population and smaller urbanized areas that are NAAQS nonattainment areas. Urbanized areas of $< 200,000$ population that are not part of an NAAQS nonattainment area may be sampled collectively statewide, or in more than one collective group, or individually, at the State's option (see Item 10 in Chapter IV for additional details). Rural and small urban areas (5,000 to 49,999 population) are sampled collectively statewide.

Donut Area Sample Data for Donut Area Travel Estimates -- These data consist of identifiers, AADT, and an expansion factor in addition to universe data for the supplementary samples and an additional expansion factor for standard samples. The supplementary samples that must be taken in the nonurbanized portion (donut area) of NAAQS nonattainment areas are **to enhance the precision of the estimate of vehicle travel only**. This additional sampling is required to serve the EPA's Section 187 Travel Tracking and Forecasting Procedures for NAAQS nonattainment areas. The sample panels consist of a combination of small urban area and rural systems. Specifically, there are two unique donut area sample stratifications (within each donut area only): (1) rural major collector and small urban area collector, combined, and, (2) rural minor arterial plus small urban area minor arterial, combined. Each of these two stratifications are further stratified by traffic volume group (see Appendix S for additional details).

It is important to note that the donut area sample contains both existing standard samples and supplementary donut area samples. This is the case because standard samples exist in the donut portions of NAAQS nonattainment areas, which can serve two basic purposes: (1) normal standard sample data uses, and (2) as the beginning point for "filling travel estimate sample needs" in the donut areas. The donut area sample panels will consist of existing standard sample sections that already exist in the donut area, plus supplementary samples that are likely needed to bring the donut area sample panel up to the required precision level. That is, because insufficient standard samples are likely to exist in the donut areas, supplemental samples are needed to enhance donut area travel estimating precision. This is applicable only to rural and small urban area minor arterial and rural major collector and small urban area collector functional systems.

The travel estimates derived from the universe for the PAS (100 percent AADT reporting for the PAS), from the combined donut area sample for the systems noted above, and travel estimates for the small urban and rural local roads and rural minor collectors are added together to obtain the travel estimate for the entire donut (nonurbanized) portion of the NAAQS nonattainment area.

NOTES: An NAAQS nonattainment area can contain more than one urbanized area.

The HPMS does not provide for estimating travel on rural and urban local and rural minor collector systems.

To obtain the total travel estimate for the NAAQS nonattainment area, the urbanized area travel total for the urbanized area(s) contained within the NAAQS nonattainment area must be added to the donut area estimate to obtain the areawide NAAQS nonattainment area travel total for EPA's Section 187 Travel Tracking and Forecasting Procedures use.

Universe and Sample Data Submittal Specifications

The HPMS universe data, along with sample data on sample sections (donut area and standard), are to be submitted via magnetic tape or floppy diskette to FHWA. Universe data are required to be reported on a **section-by-section basis for rural arterials, urban principal arterials, the entire NHS, and standard and donut area supplemental samples.** The remaining universe length may be grouped at the State's option, providing the guidelines for grouped records contained in Chapter IV are followed. The same record format is used for both section and grouped data reporting. Grouped records, however, are identified by a countywide (or equivalent) unique group number as opposed to a specific location. Complete reporting of universe data on a section-by-section basis is acceptable (see Chapter IV for details).

It is emphasized that submittals of clean data files on magnetic tape or diskette that have been edited, corrected, and summarized using the latest HPMS Submittal Software, are of the utmost importance. Universe and sample data must be furnished in the format discussed in Chapter IV--all codes must be consistent with those contained in this Manual. Please note that the data tape (or floppy diskettes) must also contain the generated/calculated data items that are inserted into the records by the FHWA-developed software that is documented in Chapter VII. It is advisable for the State to retain a copy of the data (diskettes and tape) for several years, both for reference and for historical backup purposes.

Chapters VII, VIII, and IX contain user documentation for the Submittal Software Package, Data Review Package (DRP), and the Personal Computer (PC) versions of these packages, respectively. The Submittal Software Package provides for editing, updating, and summarization of the universe and sample data. The DRP prepares trends, and other summaries that enable reviewing the universe and sample data in relation to past data. The PC software allows these same software packages to be executed on an IBM-compatible microcomputer.

Submittal Tape of Universe and Sample Section Data--The annual data tape may be submitted on a nine-track, 6250 bits per inch (BPI) density, standard round tape or on an 18 track cartridge tape, that contains standard (internal) tape labels compatible with the IBM operating system (external labels on the tape are also a necessity). The data set name (DSNAME) should be HPxxxx, where xx is the last two digits of the data year and zz is the State FIPS code--see Appendix A. The tape should have a volume serial number (VOL=SER) of HPMSzz, where zz is also the State FIPS code. If the above specifications cannot be met, the transmittal correspondence and external physical label on the tape reel (must be present on all submitted tapes) should contain the following information at a minimum:

- Name and model of computer on which the tape was produced,
- Number of tracks (channels),
- Whether or not the tape has standard labels and what they consist of,
- Dataset name (if applicable),
- Density,
- Character representation code,
- Blocking factor, and
- Other pertinent information.

Diskette Submittal of Universe and Sample Section Data--The IBM compatible PC Submittal Software Package can be used at the option of the State to create, update and edit the universe and sample dataset. When this occurs, the submittals can be made on floppy diskettes. Users of this PC software package should be aware that the HPMS universe and sample section dataset called CURMAST.DAT is the file that is to be submitted (see Chapter IX). In many States this file will be too large to fit on one diskette, but there are alternative methods for making a submittal of large files. The first is to compress the file using a commonly available software package called PKZIP. This software will reduce the file size of an HPMS dataset by about 80 percent such that a file of about 6 megabytes, for example, would compress down to about 1.2 megabytes, which would then fit onto a 5 1/4-inch, high density diskette.

The PKZIP software is the only compression software that is currently available at FHWA Headquarters. If other compression software is used by a State, we will not be able to process the file unless it has been made into an executable file (i.e., NAME.EXE). An executable file will uncompress itself back into the original file without a need for the software package. ZIP2EXE, which is part of the PKZIP software family, does this, and is used by FHWA Headquarters to send software and data to the States and other agencies.

If the file size is too large for one diskette, after compression, then the data will have to be split into as many subfiles as needed to allow the data to fit on individual diskettes. This may be accomplished before compression by separating rural from urban, or by grouping functional systems in some fashion, or by any number of separation techniques. The Data Selection Package, the Data Review Package (both a part of the HPMS PC software system - see Chapter IX) or other utility software on the PC may be used to split the data into manageable subfiles.

The diskette data submittal of the CURMAST.DAT file may be made on any size diskette (high or low density, 3 1/2 or 5 1/4 inch). If compression or splitting of the CURMAST.DAT file has been done, an explanation of what needs to be done to get back to one whole file must accompany the submittal.

Submittal Software Package Printouts To Be Furnished To FHWA

The edit listing produced as output by the "FINAL" edit option using the FHWA-furnished Submittal Software Package (see Chapter VII) shall be furnished to FHWA annually. Edit messages that remain must be explained either on the edit listing/printout or in the transmittal letter.

Expansion factor tables developed as output by the Submittal Software Package (see Chapter VII) are also to be furnished to FHWA as part of the annual data submittal. If the State contains one or more NAAQS nonattainment areas, an expansion factor table for each donut area will be produced for each nonattainment area. These tables shall also accompany the annual HPMS data submittal to FHWA.

Volume group tables shall also be submitted by those States using volume groups other than those prescribed by FHWA. The format and content of this table should be similar to those shown in Appendix F. Separate tables are necessary for the standard and the donut area panels, etc.

LRS Data Submittals for HPMS/GIS

Initial LRS Data Submittal--The State effort required to initially provide the LRS data will range considerably. States with a well established GIS and LRS will be required to expend the least effort. States are requested to submit the required LRS data as part of the annual HPMS submittal due June 15, 1994. However, for those States unable to comply with this request, the reporting date for LRS data only is extended to October 15, 1994 to spread the overall work load of implementing the HPMS changes. LRS data consist of Inventory Route and Node Maps, Node data File and Inventory Route Link Data File, as appropriate for the submittal option chosen, and Items 5, 7 and 8 of the HPMS data records for rural arterials, urban principal arterials and other NHS.

States making LRS data submittals after the HPMS data submittal due June 15, 1994, may have to provide an updated universe and sample data file containing the required inventory route, inventory subroute, and beginning and ending MPTs/KMPTs in Items 5, 7 and 8. This would be necessary only if the original HPMS data submitted in 1994 contained data for these items that are incompatible with the submitted LRS data.

States that are unable to meet the extended October 15, 1994 LRS reporting date may request, in writing, a further extension. However, such requests must be accompanied by a plan (including milestones and dates) to accomplish the full implementation of the LRS requirement by June 15, 1995. Field offices will be expected to work with the States to ensure that necessary resources are devoted to meeting the LRS data requirement and that State efforts progress satisfactory. FHWA Headquarters personnel will be available for technical consultations to support the LRS implementation.

After the initial LRS data submittal, updated LRS data are to be submitted as a part of the complete HPMS submittal due June 15 of each year, or as necessary.

LRS Submittal Option 1; Maps Plus Computer Files--The HPMS LRS data to be submitted consist of a **node data file**, an **inventory route and link data file**, and **inventory route and node maps**. These data and maps describe the arrangement and the characteristics of nodes and links that are used to define the LRS. Annual HPMS/LRS data reporting encompasses the PAS/NHS and rural minor arterial systems. Optional submittal media for LRS data reporting requirements are noted below. (See Chapter VI for annual LRS update requirements.)

The inventory route and node maps should contain the locations of nodes, inventory routes and inventory subroutes, if necessary. Signed routes are also to be identified on the maps. The node data file (fully edited and updated/corrected) is to be submitted to FHWA on a data tape, cartridge tape or floppy diskette. The inventory route link file (fully edited and updated/corrected) is to be furnished to FHWA on a data tape, cartridge tape, or floppy diskette. In addition, each State is to submit a narrative that describes unique situations or characteristics of the State's LRS that may require special attention when constructing the LRS on the network. (See Chapter V for details on LRS requirements.)

Diskette Submittal of the Node and Inventory Route Link Data Files--If a State elects this data submittal option, unique dBASE templates will be provided to the States by the FHWA for the submittal of the Node Data File and the Inventory Route Link Data File. Also at the State's option is the submittal of these data files in ASCII format. If a State selects one of these two options, the data must be submitted to the FHWA on either a 3 1/2- or 5 1/4-inch high density, IBM PC compatible diskette. (See Diskette Submittal of Universe and Sample Section Data for procedures for handling large files.)

Tape Submittal of the Node and Inventory Route Link Data Files--If necessary, the initial or updated LRS data may be submitted on a nine-track, 6250 BPI density, standard round tape or on an 18 track cartridge tape. Tapes shall contain standard (internal) tape labels compatible with the IBM operating system (external labels on the tape are also a necessity). The data set name (DSNAME) should be GSxxzz, where xx is the last two digits of the data year and zz is the State FIPS code--see Appendix A. The tape should have a volume serial number (VOL=SER) of HGISzz, where zz is also the State FIPS code. If the above specifications cannot be met, the transmittal correspondence and external physical label on the tape reel (must be present on all submitted tapes) should contain the following information at a minimum.

- Name and model of computer on which the tape was produced,
- Number of tracks (channels),
- Whether or not the tape has standard labels and what they consist of,
- Dataset name (if applicable),
- Density and Character representation code,
- Blocking factor, and
- Other pertinent information.

LRS Submittal Option 2; Inventory Route, Node and MPT/KMPT Map--
The HPMS LRS data to be submitted will consist of maps only. The data on these maps shall describe the arrangement and characteristics of nodes and links that are used to define the State's LRS.

The inventory route and node maps should show the locations of nodes, inventory routes, MPTs/KMPTs and signed routes. The inventory route and node maps are to be furnished to FHWA as paper maps. The FHWA will assimilate the information from the maps and convert the data into a Node Data File and an Inventory Route Link Data File. This information will then be used to place the LRS data onto the network. Every effort should be made to ensure that the visual quality of the maps are such that information can be readily interpreted from them. In addition, each State is to submit a narrative that describes unique situations and other characteristics of the State's LRS that may require special attention when constructing the LRS on the network. The files and other information will be forwarded to the State upon completion of these efforts.

Travel Activity By Vehicle Type

Each State is requested to submit all site specific vehicle classification data records (Card 4) that are used to develop the percentages for Template 6 via any electronic media. Station Description records (Card 2) associated with the Card 4 data should also be submitted in order to allow identification of the location of the sites used for the classification information. See Section 5, Chapter 4 of FHWA's "Traffic Monitoring Guide," for submittal specifications, inventory site descriptions, and other information.

If these data are already being submitted via the Truck Weight Study, they need not be resubmitted via HPMS. The State should mention this in its submittal correspondence.

Annual Data Submittal Transmittal Letter

This letter is used to transmit the annual HPMS data submittal to FHWA and explain a variety of subjects regarding the data that is being forwarded. This could include, but is not limited to, what specifically is being furnished, significant changes from previous submittals, problems that will turn up in the data review process, problems the State may have had with the data, problems or deficiencies that still exist in the data, answers to questions raised by FHWA in the previous data submittal review(s) (unless already answered in other correspondence), etc. The purpose of documentation of this nature is to avert questions and/or problems that FHWA may have when reviewing and using the data and to rapidly gain a better understanding of the datasets before the review actually takes place. The letter should also contain the name and telephone number of a person at the State to contact regarding the data.

If a State has elected to provide IRI data for a complete functional system, and eliminate PSR reporting for that functional system, the submittal letter must also advise FHWA Headquarters of the procedures and equipment used to measure and report the IRI. More details are given with the instructions for reporting Pavement Condition (Item 36) in Chapter IV.

Truth-In-Data Narrative--Each State under the Truth-In-Data reporting concept (as part of the HPMS data submittal) is required to furnish an annual **narrative report** that describes the origin of travel-related data. These include K- and D-factors and percent single unit and combination commercial vehicles. This narrative should describe how and when the data are collected and how it is used to derive the reported values, including data stratifications made and the degree of uniqueness of reported values (i.e., route-specific, by urbanized area, by rural area, by functional system, etc.).

Recurring Unusual Conditions--These conditions are to be documented in the transmittal letter or as an attachment to it. The FHWA Headquarters reviews each State's annual data submittal in depth and returns comments about the review to the State via the FHWA field offices. It is not possible for Headquarters personnel to remember unusual conditions pertinent to specific States, nor is it reasonable or likely that all correspondence beyond the current and previous year will be examined when reviewing the data. To at least reduce or possibly eliminate the likelihood of repeat comments concerning unusual conditions that will exist in the data year after year, it is suggested that each State remind FHWA of these conditions by annually providing a copy of a concise summary each year.

Vehicle Occupancy Information--This narrative should describe location, duration, and frequency of the data collected and how it was used to derive the reported values. In addition, the narrative should note whether reported values represent only specific time periods (e.g., peak hours) and specific information on how, when, and where the data that are furnished were collected.

SUMMARY OF ANNUAL HPMS DATA REPORTING REQUIREMENTS

The annual HPMS data reporting requirements are summarized immediately below. These items are to be submitted to FHWA headquarters by June 15 of the year following the calendar data year. Although portions of these items may come from various agencies, the SHA is ultimately responsible for the timely reporting of accurate and complete HPMS submittals that consist of the following:

1. Up to seven (7) **completed** Areawide Data Templates contained on a floppy diskette:
 - Templates 1, 2 and 3 -- System Length and Daily Vehicle Travel Summary Data.
 - Template 4 -- Minor Collector and Local Functional System Length Data.
 - Template 5 -- Fatal and Injury Motor Vehicle Accident Data.
 - Templates 6 and 7 -- Travel Activity by Vehicle Type Data.
 - Template 8 -- U.S. Territory information (Reserved for the territories.)
2. A fully edited and updated/corrected data tape (or floppy diskette), containing universe, standard sample, and donut area sample section data.
3. Data Submittal Tape (or floppy diskette) Development Verification information:
 - Printout of the final edit including explanations for all remaining messages.
 - Printout of the expansion factor tables for the standard sample panel, and for each existing nonattainment area donut area sample panel.

- Number and Ranges of Volume Groups by Functional System and Required Precision Level (see Appendix F) for the standard sample panels and the donut area sample panel(s) if applicable. This is to be submitted only by States using volume grouping other than that prescribed by FHWA.
4. LRS for GIS products
 - LRS Submittal Option 1; Maps and Computer Files.
 - Inventory Route and Node Maps.
 - Node Data File.
 - Inventory Route Link Data File.
 - LRS narrative.
 - Name and telephone number of a State LRS contact person.
 - LRS Submittal Option 2; Maps Only.
 - Inventory Route and Node Maps (including MPTs/KMPTs).
 - LRS narrative.
 - Name and telephone number of a State LRS contact person.
 5. Site-specific travel activity/vehicle classification data.
 6. Data submittal transmittal letter containing the following information, at a minimum:
 - A summary of changes in the data from previous years.
 - A discussion of any large variation in mileage, number of sections, sample panel changes, etc.
 - Comments in response to previous year HPMS data reviews, if not already done in previous correspondence.
 - Explanations for remaining edit messages, if not supplied in the edit printout.
 - Information concerning IRI measurement and reporting procedures when provided for a complete functional system, and in lieu of PSR.
 - The State HPMS contact name and phone number.

- Any other information pertinent to the submittal, or that would be useful to the data reviewer.
 - A list of NAAQS nonattainment areas (or portions thereof) contained in the State and the urbanized areas contained within each NAAQS nonattainment area.
 - A list of any standard sample panel groupings of urbanized areas of less than 200,000 population, not part of an NAAQS nonattainment area, that are being collectively sampled.
7. A summary of recurring unusual conditions.
 8. A "Truth in Data" narrative that describes the bases of the derivation of K-factors, D-factors, percent single unit commercial vehicles, and percent combination commercial vehicles that are reported in the standard sample section records.
 9. A narrative description for the vehicle occupancy data furnished by the MPOs must accompany submittal of these data.

WHERE TO SEND THE ANNUAL HPMS DATA SUBMITTAL

The FHWA field offices and the State should mutually agree on how the submittal should be handled in terms of what is sent where, since the field offices can make practical use of data contained on floppy diskettes, but not necessarily data on computer tapes. In addition, many field offices have direct ties to the State's data system and can easily obtain a copy of HPMS datasets via electronic transmission. Certainly, the FHWA field offices should retain copies of correspondence. Conversely, copies of all HPMS-related correspondence should be forwarded to FHWA Headquarters. In any event, the preceding items must be submitted to FHWA Headquarters by June 15, following the end of each data year.

The HPMS data are to be furnished to:

Chief, Highway Systems Performance Division
Office of Highway Information Management, HPM-20
Federal Highway Administration
400 7th Street, S.W., Room 3306
Washington, D. C. 20590

C H A P T E R I I I

AREAWIDE DATA REQUIREMENTS

The purpose of this chapter is to explain the HPMS areawide data reporting requirements. The areawide data are to be submitted to FHWA via microcomputer-produced completed templates on a floppy diskette. (Chapter X contains more information.) It is recommended that to the maximum practical extent, areawide length and travel data by area and system be obtained directly from the HPMS universe and sample data submitted via magnetic tape (or floppy diskette).

As many as seven areawide templates will be required for complete data reporting by the individual States. The areawide templates are provided to the States by FHWA for use in furnishing these data. The seven areawide templates are as follows:

- System Length and Daily Vehicle Travel for:
 - Template 1 -- Statewide Subtotals for Urbanized, Small Urban, and Rural Portions of the State,
 - Template 2 -- Individual Urbanized Areas, and
 - Template 3 -- Donut Area Data for NAAQS Nonattainment Areas.
- Template 4 -- Rural Minor Collector and Rural, Small Urban and Urbanized Area Local Functional Systems,
- Template 5 -- Fatal and Injury Motor Vehicle Accidents, and
- Travel Activity by Vehicle Type:
 - Template 6 -- Basic Data, and
 - Template 7 -- Supplemental Data.
- Template 8 -- U.S. Territory Information.

This chapter contains general reporting instructions for completing the areawide templates and pertinent definitions and explanations of the necessary codes, in addition to those already described in Chapter II. Each areawide data template is explained in the latter part of this chapter.

Note that the U.S. Territories, consisting of Guam, Northern Marianas Islands, Samoa, and the Virgin Islands, are required to annually submit **Template 8** as noted above in addition to annually providing FHWA a Certification of Public Road Mileage.

DEFINITIONS AND CODES

The data reported by the States via the areawide templates must conform to the definitions, codes, and specifications described below and elsewhere in this Manual.

Fatal Accident Data

Fatal accident statistics reported to FHWA shall conform to the 30-day rule, i.e., a fatality resulting from a highway vehicular accident is to be **counted only if death occurs within 30 days of the accident**. This definition applies only to statistics furnished to and used by the U.S. Department of Transportation agencies. This should not be taken to imply that States should be required or urged to stop collecting and using information about fatalities that occur more than 30 days after an accident for their own purposes. The National Highway Traffic Safety Administration's Fatal Accident Reporting System (FARS) statistics are based on the 30-day definition and are available to the States for their use. If the State uses some other fatality counting definition, appropriate adjustments of the nonconforming data shall be made prior to reporting the data to FHWA.

Pedestrian -- A pedestrian is any person injured or killed in a highway motor vehicle accident who is not a vehicle occupant.

Fatal Accidents -- A fatal accident is any injury accident that results in one or more fatalities. The number of motor vehicle accidents involving one or more fatalities, includes pedestrian fatalities.

Nonfatal Injury Accidents -- A nonfatal injury accident is any injury accident other than a fatal accident. The number of motor vehicle accidents resulting in nonfatal injuries to one or more persons, includes pedestrian injuries.

Fatalities -- Fatalities are those (1) which result from motor vehicle accidents that occurred during the relevant calendar year and (2) in which the injured person(s) died within 30 days of the accident. The number of (person) fatalities also includes the number of pedestrian fatalities, which are also reported separately.

Nonfatally Injured Persons -- These are the number of persons who are nonfatally injured in motor vehicle accidents. Included are the most serious nonfatally injured persons and the nonfatally injured pedestrians; the latter two categories are also reported separately.

Most Serious Nonfatally Injured Persons -- Most serious injured persons are nonfatally injured persons whose injury is classified as incapacitating (as defined in the "Manual On Classification of Motor Vehicle Traffic Accidents," American National Standards Institute (ANSI) D16.1-1989, scheduled to be updated in the mid-1990's). States may receive information about these injuries on the accident report forms as incapacitating, incapacitating injury, incapacitated, disabled, carried from scene, severe injury, critical nonfatal, major injury, or other similar terms. The number of nonfatally injured pedestrians is included.

Pedestrian Fatalities -- These are the number of pedestrians fatally injured in motor vehicle accidents. The number of pedestrians fatally injured is also included in the number of fatalities.

Nonfatally Injured Pedestrians -- These are the number of pedestrians nonfatally injured in motor vehicle accidents. The number of nonfatally injured pedestrians is also included in the number of nonfatally injured persons.

Daily Vehicle Travel

Daily vehicle travel is the amount of vehicle travel (in thousands) accumulated over a 24-hour day, midnight to midnight, traversed along a "public road" by motorized vehicles, excluding construction equipment or farm tractors. The data must be representative of all days in a calendar year, ending December 31. All vehicle travel that occurs on "public roads" within the State is to be reported. Vehicle travel not occurring on public roads, such as that occurring on private land roads (private roads in parking lots, shopping centers, etc.) must be excluded.

Land Area (Net)

This is the amount of net land area for rural, small urban, and urbanized areas based on FHWA-approved, adjusted urban and urbanized area boundaries. The U.S. Bureau of the Census definition of land area will be used: Land area includes dry land and land temporarily or partially covered by water, such as marshlands, swamps and river flood plains; systems, sloughs, estuaries and canals less than 1/8 of a statute mile (0.2 kilometers) in width; and lakes, reservoirs and ponds less than 1/16 square mile (0.16 square kilometers) in area. [For Alaska, 1/2 mile (0.8 kilometers) and 1 square mile (2.60 square kilometers) are substituted for these values.] The net land area excludes areas of oceans, bays, sounds, etc., lying within the 3-mile (4.8 kilometers) U.S. jurisdiction as well as inland water areas larger than indicated above.

Population

The annual Census estimate of State resident population reflects the July 1 time frame (April 1 in decennial Census years) for the calendar year of the report. The population of an urban place or urbanized area is updated by the State based on growth factors applied to the latest official decennial figures or most recent census estimate, if applicable, from the U.S. Bureau of the Census. In some cases, population estimates are also available from a State agency or MPO for various bounded areas. These data, however, shall be corrected to match the FHWA-approved, adjusted boundaries of the reporting area.

Surface Types

The general road surface types to be used in reporting the rural minor collector and rural/urban local functional system length data are described/categorized below. The specific surface types/code(s) used for this template (they are consistent with the Surface/Pavement Type codes used for the standard sample), are defined as follows:

- Paved. Bituminous, concrete, brick, block, and other special surfaces (Surface/Pavement Type Codes 51 and above).
- Low type Bituminous surface-treated (Surface/Pavement Type Code 51).
- Intermediate type. . Mixed bituminous and bituminous penetration (Surface/Pavement Type Codes 52 and 53).
- High type. High flexible, composite, rigid, etc. (Surface/Pavement Type Codes 61, 62, 71-76 and 80).
- Unpaved. Gravel/soil and unimproved roads and streets (Surface/Pavement Type Codes 20, 30 and 40).

Territorial Highway System

A system of arterial and collector highways, plus interisland connectors that is established under 23 U.S.C. 215 by each territory (Guam, Northern Marianas Islands, Samoa, and the Virgin Islands). The full name is Federal-aid territorial highway system (THS). All public road mileage will be reported in HPMS. Interisland ~~(and other)~~ waterway connectors will not be a part of the HPMS reporting mechanism.

← (non public road)

Units of Measurement

The following English or Metric units are applicable to all entries in the templates and in the data submittal tape. **All entries for a given years' HPMS data submittal must be made in the same system of measurement--English or Metric.**

- System Length Miles or Kilometers
- Daily Vehicle Travel. Vehicle Miles or Vehicle
Kilometers (in thousands)
- Accidents Actual Numbers
- Persons Injured Actual Numbers
- Population. Actual Numbers (in thousands)
- Net Land Area Square Miles or Square
Kilometers
- Vehicle Occupancy Persons per Vehicle (nearest
tenth of a person)

Vehicle Occupancy Data

Vehicle occupancy data are to be reported as the "**best available data**" to the nearest tenth of a person. These data should be **obtained from the most recent studies conducted by the MPOs or State or local governments.** Such data should be available from the management systems, the traffic monitoring system, or the Section 134 planning process. Newly developed vehicle occupancy counts as part of HPMS are not expected. The submittal is to include a narrative that explains details concerning specifically what the data represents (i.e., AM peak hour--an average of counts taken on 2 days--Tuesday and Wednesday in April, etc.).

Vehicle Types and Codes¹

In reporting information on trucks, the following criteria should be followed:

- Truck tractor units traveling without a trailer will be considered single-unit trucks.
- A truck tractor unit pulling other such units in a "piggyback" (or "saddle-mount") configuration will be considered as one single-unit truck and will be defined only by the axles on the pulling unit.
- Vehicles shall be defined by the number of axles in contact with the roadway. Therefore, "floating" axles are counted only when in the down position.
- The term "trailer" includes both semi- and full-trailers.

Code Vehicle Type and Description

- 1 Motorcycles (Optional) -- All two- or three-wheeled motorized vehicles. Typical vehicles in this category have saddle type seats and are steered by handle bars rather than a wheel. This category includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles. This vehicle type may be reported at the option of the State, but should not be reported with any other vehicle type.
- 2 Passenger Cars -- All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers. Vehicles registered as passenger cars that are pickups, panels, vans, etc., (described as vehicle type "3") should be reported as vehicle type "3".
- 3 Other Two-Axle, Four-Tire, Single-Unit Vehicles -- All two-axle, four-tire vehicles, other than passenger cars. Included in this classification are pickups, panels, vans and other vehicles such as campers, motor homes, ambulances, hearses, and carryalls. Other two-axle, four-tire single-unit vehicles pulling recreational or other light trailers are included in this classification.

¹ Additional information about the means of identifying the vehicle types may be found in the "Traffic Monitoring Guide," FHWA, December 1992.

- 4 Buses -- All vehicles manufactured as traditional passenger-carrying buses with two-axles, six-tires and three or more axles. This category includes only traditional buses (including school buses) functioning as passenger-carrying vehicles. All two-axle, four-tire minibuses should be classified as other two-axle, four-tire, single-unit vehicles (type "3"). Modified buses should be considered as trucks and be appropriately classified.
- 5 Two-Axle, Six-Tire, Single-Unit Trucks -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., having two axles and dual rear wheels.
- 6 Three-Axle, Single-Unit Trucks -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., having three axles.
- 7 Four-or-More Axle, Single-Unit Trucks -- All vehicles on a single frame with four-or-more axles.
- 8 Four-or-Less Axle, Single-Trailer Trucks -- All vehicles with four-or-less axles consisting of two units, one of which is a tractor or straight truck power-unit.
- 9 Five-Axle, Single-Trailer Trucks -- All five-axle vehicles consisting of two units, one of which is a tractor or straight truck power-unit.
- 10 Six-or-More Axle, Single-Trailer Trucks -- All vehicles with six-or-more axles consisting of two units, one of which is a tractor or straight truck power-unit.
- 11 Five-or-Less Axle, Multi-Trailer Trucks -- All vehicles with five-or-less axles consisting of three-or-more units, one of which is a tractor or straight truck power-unit.
- 12 Six-Axle, Multi-Trailer Trucks -- All six-axle vehicles consisting of three-or-more units, one of which is a tractor or straight truck power-unit.
- 13 Seven-or-More Axle, Multi-Trailer Trucks -- All vehicles with seven-or-more axles consisting of three-or-more units, one of which is a tractor or straight truck power-unit.

SYSTEM LENGTH AND DAILY TRAVEL DATA

These three areawide templates, illustrated as **Templates 1, 2, and 3**, contain reporting cells for the population, net land area, system length and daily vehicle travel. Vehicle occupancy data are to be reported in **Template 2**.

Template 1 is to be completed by all States. This template shall contain the Statewide totals of population, net land area, system length, and daily vehicle travel and the subtotals for all urbanized areas, all small urban areas, and all rural portions of the State.

The length line consists of the length (miles or kilometers) by functional system. The travel line consists of the daily vehicle travel (in thousands) for the same system stratifications. Statewide length and travel data totals are also contained on this template. The State should ensure that the totals from **Template 2** agree with those values entered on **Template 1** for urbanized areas.

Template 2 is to be completed for each urbanized area (or portion thereof) within the State. In addition, this template requires the entry of a NAAQS nonattainment area code only when the urbanized area is part of an EPA-designated NAAQS nonattainment area.

Three consecutive lines are to be completed for each urbanized area (or portion thereof, as designated by the Bureau of the Census) within the State that reflects the FHWA-approved, adjusted urbanized area boundary. Enter the NAAQS nonattainment area code, urbanized area code (see Appendix B), population and net land area data in addition to the miles or kilometers on the length line. (Coding details for an "NAAQS nonattainment area" are provided in the definitions section of Chapter II.) If the urbanized area is not in an NAAQS nonattainment area, enter "000" as the nonattainment area code. The length line of this areawide template shall contain the length of each functional system and a total for each individual urbanized area. The travel line shall contain the daily vehicle travel (in thousands) for each functional system and the total for the same area. The (vehicle) occupancy line shall contain the best available data (to the nearest tenth of a person); its derivation shall be described in the data submittal narrative. Vehicle occupancy data shall be reported for urbanized areas of 200,000 or more population and is optional for smaller urbanized areas.

Template - 1
SYSTEM LENGTH AND DAILY VEHICLE TRAVEL
 TOTALS OF URBANIZED AREAS, SMALL URBAN AREAS, RURAL AREAS, AND STATEWIDE

STATE: _____ STATE FIPS CODE: _____ UNITS: [] English 1/ [] Metric 2/ DATA YEAR: _____ DATE: _____

URBANIZED AREAS TOTAL

POPULA- TION (1,000)	NET LAND AREA	DATA TYPE	FUNCTIONAL SYSTEM						
			PRINCIPAL ARTERIALS			MINOR ARTERIAL	COLLECTOR	LOCAL	TOTAL
			INTERSTATE	OTHER FREEWAYS & EXPRESSWAYS	OTHER				
		LENGTH							
		TRAVEL (1,000)							

SMALL URBAN AREAS TOTAL

POPULA- TION (1,000)	NET LAND AREA	DATA TYPE	FUNCTIONAL SYSTEM						
			PRINCIPAL ARTERIALS			MINOR ARTERIAL	COLLECTOR	LOCAL	TOTAL
			INTERSTATE	OTHER FREEWAYS & EXPRESSWAYS	OTHER				
		LENGTH							
		TRAVEL (1,000)							

RURAL AREAS TOTAL

POPULA- TION (1,000)	NET LAND AREA	DATA TYPE	FUNCTIONAL SYSTEM					LOCAL	TOTAL
			PRINCIPAL ARTERIALS		MINOR ARTERIAL	COLLECTOR			
			INTERSTATE	OTHER		MAJOR	MINOR		
		LENGTH							
		TRAVEL (1,000)							

STATEWIDE TOTALS

POPULA- TION (1,000)	NET LAND AREA	TOTAL LENGTH	TOTAL TRAVEL (1,000)

1/ English units for length and travel are miles and vehicle-miles (in thousands), respectively.
 2/ Metric units for length and travel are kilometers and vehicle-kilometers (in thousands), respectively.

6-III

Template - 2

SYSTEM LENGTH AND DAILY VEHICLE TRAVEL

INDIVIDUAL URBANIZED AREAS

STATE: _____ STATE FIPS CODE: _____ UN ITS: English 1/ Metric 2/ DATA YEAR: _____ DATE: _____

Shaded cells are reserved for titles and computer software generated values. Enter data in the unshaded cells only.

URBAN- IZED AREA CODE	NONAT- TAINMENT AREA CODE 3/	POPULA- TION (1,000)	NET LAND AREA	DATA TYPE	FUNCTIONAL SYSTEM						
					PRINCIPAL ARTERIAL			MINOR ARTERIAL	COLLECTOR	LOCAL	TOTAL
					INTERSTATE	OTHER FREEWAYS & EXPRESSWAYS	OTHER				
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							
				LENGTH							
				TRAVEL (1,000)							
				OCCUPANCY 4/							

1/ English units for length and travel are miles and daily vehicle-miles (in thousands), respectively.
 2/ Metric units for length and travel are kilometers and daily vehicle-kilometers (in thousands), respectively.
 3/ The National Ambient Air Quality Standards Nonattainment Area Code is the same as the Urbanized Area Code of the primary urbanized area contained in the nonattainment area. When the Urbanized Area is not in a nonattainment area, code zero.
 4/ Average vehicle occupancy is reported to the nearest tenth of a person.

III-10

FHWA ORDER M 5600.1B
August 30, 1993

Chapter III

Template 3 is to be completed only for the rural and small urban portions of the donut portion of NAAQS nonattainment areas, as designated by EPA. (Note: If an NAAQS nonattainment area does not contain at least one entire urbanized area, it is to be ignored for HPMS and not entered in this template). When applicable, this template shall contain the system length and daily vehicle travel data for the rural and small urban area portion (the donut area portion) of each NAAQS nonattainment area. Two consecutive lines are to be completed in this template for each NAAQS nonattainment area (or portion thereof within the State) -- the length line shall contain the donut area population and net land area, and system length for rural and small urban functional systems **within the donut area**. The travel line consists of the daily vehicle travel (in thousands) for the same system categories in the same donut area.

Population and Net Land Area data are to be reviewed and updated annually and must relate to changes in decennial Census estimates. States should submit annually revised estimates when they find changes have occurred in either population or net land area for any rural, small urban or urbanized area of the State. Data based on the U.S. Bureau of the Census estimates must be adjusted to match the FHWA-approved, adjusted Census boundaries for each urbanized and small urban area. In addition, annually revised estimates of population and net land area shall be made for the donut portion of each applicable NAAQS nonattainment area. Annual updates between decennial Censuses shall be based on local trends or Census or State or MPO estimates.

System Length data (miles or kilometers) reported in the templates must agree with existing "open-to-traffic" public road miles (or kilometers) furnished via the annual universe and sample data submittal tape and the total reported to FHWA as certified public road mileage (kilometers). System length by functional system shall be reported for individual urbanized areas, combined small urban areas, rural and the individual donut area portions (rural and small urban only) of NAAQS nonattainment areas. The Submittal Software Package (see Chapter VII) will generate the current system length for the above categories based on Item 23 (Section Length) from all open to traffic data records included in the State's HPMS data file -- States are encouraged to use these summaries for the areawide template entries. More information about the software may be found in Chapter VII.

Template - 3

SYSTEM LENGTH AND DAILY VEHICLE TRAVEL

DONUT AREA DATA FOR INDIVIDUAL NAAQS NONATTAINMENT AREAS

STATE: _____ STATE FIPS CODE: _____ UNITS: English 1/ Metric 2/ DATA YEAR: _____ DATE: _____

Shaded cells are reserved for titles and computer software generated values. Enter data in the unshaded cells only.

NONATTAIN- MENT AREA CODE 3/	POPULATION (1,000)	NET LAND AREA	DATA TYPE	RURAL AND SMALL URBAN FUNCTIONAL SYSTEMS COMBINED			
				PRINCIPAL ARTERIAL	MINOR ARTERIAL AND (MAJOR) COLLECTOR	MINOR COLLECTOR AND LOCAL	TOTAL
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				
			LENGTH				
			TRAVEL (1,000)				

1/ English units for length and travel are miles and daily vehicle-miles (in thousands), respectively.
 2/ Metric units for length and travel are kilometers and daily vehicle-kilometers (in thousands), respectively.
 3/ The National Ambient Air Quality Standards (NAAQS) Nonattainment Area Code is the same as the Urbanized Area Code of the primary urbanized area contained in the nonattainment area.

Daily Vehicle Travel estimates by functional system are to be annually reported via the templates for rural, combined small urban, and individual urbanized areas as well as for Statewide subtotals and for rural and small urban portions of the donut areas of NAAQS nonattainment areas.

Development of HPMS estimates of highway travel by functional system are to be derived using count-based traffic data that are in concert with Appendix K of this Manual and the "Traffic Monitoring Guide" (TMG), December 1992. The explicit goal of HPMS is to derive areawide daily vehicle travel estimates based on count-based traffic volume data. The count-based traffic data should be representative of the entire calendar year, ending December 31.

The following is a summary of HPMS travel requirements -- monitoring and data reporting:

1. PAS and NHS daily vehicle travel estimates, including those for the Interstate System, shall be determined/reported based on travel estimates derived using all applicable and open-to-traffic section records on the data submittal tape (floppy diskette) (i.e., the sum of the products of each segment length times its AADT). Count-based AADT data will be reported for all principal arterial system sections (including Interstate and the entire designated/approved NHS). These data will be used to derive the travel estimates for these systems. Although expanded standard sample daily travel estimates can be prepared for the principal arterial systems for comparison, the universe values (accumulation of all sample and nonsample segments' AADT times segment length) shall be reported in the "System Length and Daily Vehicle Travel" templates (**Templates 1, 2 and 3**). The Submittal Software Package (see Chapter VII) will generate these values for the principal arterials from the universe information. Count-based requirements for annually updating PAS/NHS universe AADTs are contained in Appendix K.

The universe system length and daily vehicle travel for the principal arterial system within each NAAQS nonattainment area can also be produced using the Submittal Software Package (see Chapter VII). Since the NAAQS nonattainment area code is a universe data item (see Item 11 in Chapter IV), estimates for the nonattainment areas can easily be prepared for the principal arterial systems and reported in the template (**Template 3**).

2. Daily vehicle travel estimates for the rural and urban minor arterial and rural major collector and small urban collector systems shall be based on the expanded **standard sample** information (sum of the products of the standard sample section AADT times the section length times the standard sample expansion factor). The HPMS **standard sample** panels of sections have been statistically designed for a high level of measurable accuracy, particularly for the determination of travel. If a State highway agency is confident that all volume groups are properly represented by the sample, the expansion factors have been properly and accurately calculated, and the AADTs are sound and current, then the expanded travel for these systems may be entered in the appropriate templates (**Templates 1 and 2**). The State should assure that corrections for missing volume groups have been made before making the final template entries.

The sum of the areawide data for individual urbanized area travel estimates entered in **Template 2** for a State choosing to collectively sample urbanized areas under 200,000 population, must be consistent with the overall travel estimate produced from the expanded sample (minor arterial and collector) for the areas grouped into a collective urbanized area (see Chapter VII).

3. The donut area sample for NAAQS nonattainment areas is used only to derive travel estimates for rural and small urban minor arterial, small urban collector, and rural major collector functional systems within the donut area boundary. The donut area sample will consist of two system stratifications within each NAAQS nonattainment area: (1) small urban area and rural minor arterial, and (2) small urban area collector and rural major collector. The sample is further stratified by traffic volume group within each of these two system stratifications. For donut area travel estimating purposes, however, it must be recognized that the donut area sample panel is a combination of existing standard sample sections and supplementary sample sections that are needed to attain the required precision level.

Donut area expansion factors will differ from the **standard sample expansion factors** because a different mix of samples are used in their derivation, the unique grouping of rural and small urban sections for the donut sample, use of different volume groups, and the universe of the systems extent differ for the donut areas. The **donut area sample panels (consisting of standard and supplemental samples)** are to be used to prepare the travel estimates (sum of the products of the donut area sample section AADT times the segment length times the donut area expansion factor) for small urban area and rural minor arterial and small urban area collector and rural major collector systems. The results are to be entered in the "System Length and Daily Vehicle Travel" (**Template 3**). The Submittal Software Package will generate these travel estimates from the data submittal tape (or diskette) based on the **donut area sample panel information**.

4. Travel estimates on the statewide rural minor collector and the rural, small urban, and urbanized area local functional systems should be traffic count-based and include breakouts of travel data for these systems in the NAAQS nonattainment areas. Emphasis must be placed on the development of rural and urban local and rural minor collector functional system travel to assure that it is reasonable and consistent.

Sound and repeatable traffic monitoring procedures will be established and documented to estimate travel on these systems as follows:

<u>Area Type</u>	<u>Functional Systems</u>	
	<u>Local</u>	<u>Minor Collector</u>
Each urbanized area	X	
Small urban statewide	X	
Rural statewide	X	X
Each NAAQS nonattainment donut area:		
Small urban	X	
Rural	X	X

These estimates shall be coordinated with the preparation of the "Minor Collector and Local Functional System Length" template discussed later in this Chapter (**Template 4**).

Recommended procedures for the annual updating of the AADTs for the PAS, NHS, and the standard and donut area sample panels are described in Appendix K, with further references to the TMG.

NOTE: Traffic monitoring requirements entail annual traffic counting on one-third of the sample sections (**standard and donut area**) and on one-third of all PAS and NHS sections each year (see Appendix K). All AADTs reported for the PAS, NHS, standard and donut area samples must be updated annually (by direct count or by application of appropriate growth factors). This includes the appropriate derivation and application of: (1) axle correction factors (when applicable), (2) weekday/weekend factors, and, (3) seasonal factors to raw traffic count data.

MINOR COLLECTOR AND LOCAL FUNCTIONAL SYSTEMS LENGTH DATA

The Minor Collector and Local Functional System Length template (**Template 4**) requires the reporting of public road length (miles or kilometers) by surface type and AADT volume group. The system length is to be summarized for the minor collector and local functional systems in rural areas and urban areas (small urban and urbanized areas combined) for the State. The Submittal Software Package will generate the minor collector and local system length totals directly from the universe portion of all open-to-traffic data records on the data submittal tape (or floppy diskettes). Template 1 will also contain these length totals. System length estimates for this template are to be reported by two groupings:

- Certain surface types (see the Definitions Section above) for the rural minor collector system, and
- Traffic volume group for paved and unpaved categories for the rural minor collector and the rural and urban local systems.

Based on the data available in the current State inventory data base, a sound estimating process should yield satisfactory stratifications/breakdowns of the mileage (kilometers) that can be entered into the individual cells. The estimates should be made in such a fashion that the process can be repeated in the future on a consistent basis. The estimating procedures selected for stratifying system length should depend on the degree of detail available (for surface type and AADT) in a State's data base or from local governments for minor collector and local road systems. State county series general highway maps, United States Geological Survey quadrangle maps, air photos, etc., may also be useful in estimating these data. The total system length (miles or kilometers) reported in the "Minor Collector and Local Functional System Length" template (**Template 4**) must be consistent with the information reported in the "System Length and Daily Vehicle Travel" template (**Template 1**) and that contained in the universe of the annual data submittal tape.

The States are encouraged to improve traffic estimating practices on the local and rural minor collector functional systems. Rural areas in or near fast growing communities will require the most attention to determine changes in system length assigned by surface type and traffic volume group. On the other hand, it is assumed that a portion of the rural minor collector and local functional systems, away from the major growth areas of the State, will experience little traffic growth, thereby reducing the effort required to update this information. If the State has made reasonable estimates of system length by traffic volume group, an estimate of the level of daily travel can be computed for these systems (see Chapter X for a means of determining whether the values are reasonable). The computed daily travel should compare favorably with the rural minor collector and local functional system estimates reported in the "System Length and Daily Vehicle Travel" Template (**Template 1**).

Template - 4

MINOR COLLECTOR AND LOCAL FUNCTIONAL SYSTEM LENGTH BY SURFACE TYPE AND VOLUME GROUP

STATE: _____ STATE FIPS CODE: _____ UNITS: [] English 1/ [] Metric 2/ DATA YEAR: _____ DATE: _____

Shaded cells are reserved for titles and computer software generated values. Enter data in the unshaded cells only.

FUNCTIONAL SYSTEM	SURFACE TYPE				TOTAL LENGTH
	PAVED			UNPAVED	
	HIGH	INTERMEDIATE	LOW		
RURAL MINOR COLLECTOR					

FUNCTIONAL SYSTEM / SURFACE TYPE	TRAFFIC VOLUME GROUP					TOTAL LENGTH
RURAL MINOR COLLECTOR	UNDER	100-	200-	500-	2,000 &	
	100	199	499	1,999	OVER	
	PAVED					
	UNPAVED					
TOTAL						
RURAL LOCAL	UNDER	50-	200-	500-	2,000 &	
	50	199	499	1,999	OVER	
	PAVED					
	UNPAVED					
TOTAL						
URBAN LOCAL	UNDER	200-	500-	2,000-	4,000 &	
	200	499	1,999	3,999	OVER	
	PAVED					
	UNPAVED					
TOTAL						

- 1/ English units consist of miles.
2/ Metric units consist of kilometers.

FATAL AND INJURY MOTOR VEHICLE ACCIDENT DATA

Motor vehicle accident data shall be reported for rural and urban areas stratified by functional system and NHS via the "Fatal and Injury Motor Vehicle Accidents" template (**Template 5**). Complete reporting of these data is essential. Note that when a particular cell entry is zero, a zero must be entered -- do not leave any cell blank.

Accidents to be Reported

All highway motor vehicle accidents in a State involving injuries, both fatal and nonfatal, that occur within the right-of-way of "public roads" shall be reported. Responsibility for roadway maintenance or traffic law enforcement are not criteria for inclusion in this report; only injury motor vehicle accidents that occurred within the right-of-way of a public road within the geographic boundaries of the State are to be reported. Vehicle accidents that occur on private driveways and roads outside the public right-of-way are to be excluded.

Accidents that occur at intersections should be assigned to the functional system of the road or street that the vehicles involved were using or, if more than one system was being used by vehicles involved in the accident, to the higher functional system. This rule applies to all intersections, including those within interchanges. Accident assignments are based on the "Manual on Classification of Motor Vehicle Traffic Accidents," ANSI D16.1 - 1989 (~~scheduled to be updated in the mid-1990's~~), using the hierarchy of the functional systems listed under Definitions in Chapter II. Where the segments in question are of the same functional system, the designated National Highway System segment will be considered first, if applicable. An accident on an interchange ramp should be assigned to the higher functional system served by the ramp. Accidents on a frontage road of an expressway, freeway, parkway, or through street should be assigned to the functional designation of the frontage road.

Good Practice Data Checks Prior to Submittal

- Individual functional system length and travel entries must agree with respective values reported in the areawide template titled "System Length and Daily Vehicle Travel," **Template 1**.

- NHS system length and travel estimates shall be determined and reported based on estimates derived from the data tape (or floppy diskette) using the open-to-traffic NHS universe section records. The accumulation of all NHS section lengths will provide the total system length as well as the lengths by functional system breakdowns. The accumulation of all NHS section lengths times the AADTs will provide travel data for the same system and total breakdowns. These breakdowns will be reported in this template (**Template 5**). The Submittal Software Package (see Chapter VII) will derive these NHS length and travel estimates.
- SHAs should develop appropriate cooperative arrangements with responsible State and local agencies to obtain the necessary accident data. Accident data on public roads under Federal jurisdiction within the State should be obtained from the appropriate Federal agencies.
- Statewide totals of fatal accidents and fatalities must agree with FARS data (as of June 1 -- 5 months following the end of the data year). Statewide urban and rural subtotals should also agree with FARS values. Coding discrepancies should be resolved with the State FARS representatives prior to submitting the data to FHWA. **HPMS requires the data to represent accident location identification based on FHWA-approved, adjusted Census small urban and urbanized area boundaries.**

Template - 5

FATAL AND INJURY MOTOR VEHICLE ACCIDENTS

STATE: _____ STATE FIPS CODE: _____ UNITS: English 1/ Metric 2/ DATA YEAR: _____ DATE: _____

Shaded cells are reserved for titles and computer software generated values. Enter data in the unshaded cells only.

HIGHWAY SYSTEM	SYSTEM LENGTH	DAILY TRAVEL (1,000)	ACCIDENTS		FATALITIES	PERSONS 3/		PEDESTRIANS	
			FATAL	NONFATAL INJURY		TOTAL NONFATAL INJURY 4/	MOST SERIOUS NONFATAL INJURY	FATALITIES	NONFATAL INJURY
RURAL									
INTERSTATE									
OTHER PRINCIPAL ARTERIAL									
NATIONAL HIGHWAY SYSTEM (NHS)									
OTHER (NON-NHS)									
SUBTOTAL									
MINOR ARTERIAL									
NATIONAL HIGHWAY SYSTEM (NHS)									
OTHER (NON-NHS)									
SUBTOTAL									
MAJOR COLLECTOR									
MINOR COLLECTOR									
LOCAL									
TOTAL - RURAL									
URBAN									
INTERSTATE									
OTHER FREEWAYS & EXPRESSWAYS									
NATIONAL HIGHWAY SYSTEM (NHS)									
OTHER (NON-NHS)									
SUBTOTAL									
OTHER PRINCIPAL ARTERIAL									
NATIONAL HIGHWAY SYSTEM (NHS)									
OTHER (NON-NHS)									
SUBTOTAL									
MINOR ARTERIAL									
NATIONAL HIGHWAY SYSTEM (NHS)									
OTHER (NON-NHS)									
SUBTOTAL									
COLLECTOR									
LOCAL									
TOTAL - URBAN									
TOTAL - STATEWIDE									

- 1/ English units for length and travel are miles and daily vehicle-miles (in thousands), respectively.
- 2/ Metric units for length and travel are kilometers and daily vehicle-kilometers (in thousands), respectively.
- 3/ Includes pedestrians.
- 4/ Includes most serious nonfatally injured persons.

III-21

Chapter III

FHWA ORDER M 5600.1B
August 30, 1993

TRAVEL ACTIVITY BY VEHICLE TYPE DATA

The percentage of travel made by various vehicle types over the various functional systems of highway are to be reported as areawide data on the "Travel Activity by Vehicle Type" template graphically illustrated as **Template 6**. The vehicle types to be reported are listed and defined in the Definitions Section near the beginning of this Chapter. The percentage of travel is reported for each vehicle type (relative to the total vehicle travel) for each functional system (by rural and urban areas) such that the values for each functional system sum to 100 percent. The individual vehicle type data cell should carry values to at least the nearest hundredth.

States using equipment that they believe cannot differentiate autos from other two-axle, four-tire single-unit vehicles may report these two vehicle types as an aggregate figure. Of course, if a State that uses automated equipment normally augments its data with automobile-specific information, that data should be used to complete this template. The States are encouraged to provide automobile information distinct from other two-axle, four-tire single-unit vehicles even if estimates based on limited manual counts serve as the base. In entering aggregate data of two-axle, four-tire vehicles for a functional system, the values should be entered in the passenger car column and the "other two-axle, four-tire" column should remain blank. **An entry of a zero in any column is interpreted to mean that such vehicle types were monitored but not found in the traffic stream.**

The vehicle activity information is to be reported for each functional system, rural and urban. The TMG should be consulted for recommended practices regarding the development of the vehicle classification sample -- a subset of the HPMS panel of standard sample sections. The procedures are flexible, allow incorporation of existing automated sites, and are deemed sufficient to meet the areawide and standard sample section reporting needs of the HPMS.

August 30, 1993

If the **standard sample** is statistically valid (assuming the HPMS and the TMG sampling procedures have been fully implemented), estimates of percent travel for all vehicle type/functional system cells in the template are computed as the average of all the classification sample locations within that cell. For example, the percentage of buses on the rural Interstate System is simply the average of the percents of buses of all vehicle classification measurements in the sample taken on the rural Interstate System. If the sample consisted of 10 sections and the percent buses measured at each section were 0.9, 0.5, 1.1, 0.8, 0.3, 0.4, 0.2, 1.3, 0.5, and 0.3 (total = 6.3), then the average of 0.63 would be the estimated percentage of buses in the rural Interstate cell of the areawide templet. If the TMG procedures have not been fully implemented, the source and derivation of the cell values should be thoroughly documented (as discussed in Appendix K).

In addition to annually furnishing FHWA the completed template, each State is requested to submit the detailed, site-specific vehicle classification data (the source data for template 6 entries) to FHWA. Section 5, Chapter 4 of the TMG must be referenced for data submittal specifications, inventory site descriptions, format and other information regarding electronic data reporting media. Basically, Card 4 (Vehicle Classification) and associated Card 2 (Station Description) data are to be reported (see Chapter II for more details).

Because of different data collection techniques and in order to normalize the data reporting from the various States, an additional template (**Template 7**) must be completed and submitted to FHWA. Each State is to indicate how various truck-trailer counts are collected, provide the time of day and day of week and on what systems the State normally collects the information. If classification is accomplished differently on different systems or in different areas (such as rural versus urban), a copy of **Template 7** should be provided for each system/area, appropriately annotated in parts 1 and 2.

The comments section (part 4) of **Template 7** should contain any additional information regarding the vehicle classification data, as deemed necessary by the State. This portion of the template may be submitted as a Wordperfect or plain ASCII file if it is more convenient to do so.

Template - 6
TRAVEL ACTIVITY BY VEHICLE TYPE
 BASIC DATA

STATE: _____ STATE FIPS CODE: _____ DATA YEAR: _____ DATE: _____

Shaded cells are reserved for titles and computer software generated values. Enter data in the unshaded cells only.

FUNCTIONAL SYSTEM	MOTORCYCLES [OPTIONAL]	PASSENGER CARS [2 AXLE, 4 TIRE]	LIGHT TRUCKS [OTHER 2 AXLE, 4 TIRE]	BUSES	PERCENT OF TRAVEL									TOTAL
					SINGLE-UNIT TRUCKS			SINGLE-TRAILER TRUCKS			MULTI-TRAILER TRUCKS			
					2 AXLE, 6 TIRE	3 AXLE	4 AXLE OR MORE	4 AXLE OR LESS	5 AXLE	6 AXLE OR MORE	5 AXLE OR LESS	6 AXLE	7 AXLE OR MORE	
RURAL														
INTERSTATE														
OTHER PRINCIPAL ARTERIAL														
MINOR ARTERIAL														
MAJOR COLLECTOR														
MINOR COLLECTOR														
LOCAL														
URBAN														
INTERSTATE														
OTHER FREEWAYS & EXPRESSWAYS														
OTHER PRINCIPAL ARTERIAL														
MINOR ARTERIAL														
COLLECTOR														
LOCAL														

III-24

FHWA ORDER M 5600.1B
August 30, 1993

Chapter III

Template - 7

TRAVEL ACTIVITY BY VEHICLE TYPE

SUPPLEMENTAL DATA

STATE: _____ STATE FIPS CODE: _____ DATA YEAR: _____ DATE: _____

1. VEHICLE CLASSIFICATION DATA ON TEMPLATE 6 ARE REPRESENTATIVE OF DATA NORMALLY COLLECTED DURING THE INDICATED HOURS, DAYS OF THE WEEK, AND MONTHS:

___ AM/PM TO ___ AM/PM, ALL HOURS OF DAY

- | | | |
|------------------------------------|-------------------------------------|------------------------------------|
| <input type="checkbox"/> ALL DAYS | <input type="checkbox"/> ALL MONTHS | |
| <input type="checkbox"/> SUNDAY | <input type="checkbox"/> JANUARY | <input type="checkbox"/> JULY |
| <input type="checkbox"/> MONDAY | <input type="checkbox"/> FEBRUARY | <input type="checkbox"/> AUGUST |
| <input type="checkbox"/> TUESDAY | <input type="checkbox"/> MARCH | <input type="checkbox"/> SEPTEMBER |
| <input type="checkbox"/> WEDNESDAY | <input type="checkbox"/> APRIL | <input type="checkbox"/> OCTOBER |
| <input type="checkbox"/> THURSDAY | <input type="checkbox"/> MAY | <input type="checkbox"/> NOVEMBER |
| <input type="checkbox"/> FRIDAY | <input type="checkbox"/> JUNE | <input type="checkbox"/> DECEMBER |
| <input type="checkbox"/> SATURDAY | | |

2. VEHICLE CLASSIFICATION DATA ON TEMPLATE 6 ARE REPRESENTATIVE OF DATA NORMALLY COLLECTED ON THE FOLLOWING HIGHWAY SYSTEMS:

- | | |
|--------------------------------------|---|
| <input type="checkbox"/> ALL SYSTEMS | <input type="checkbox"/> INTERSTATE |
| <input type="checkbox"/> RURAL | <input type="checkbox"/> OTHER PRINCIPAL ARTERIAL |
| <input type="checkbox"/> URBAN | <input type="checkbox"/> MINOR ARTERIAL |
| <input type="checkbox"/> STATE OWNED | <input type="checkbox"/> (MAJOR) COLLECTOR |

3. INDICATE BELOW WHERE EACH OF THE SPECIFIC VEHICLE TYPES, LISTED IN THE LEFT COLUMN, ARE INCLUDED ON TEMPLATE 6:

SPECIFIC VEHICLE TYPE	PREFERABLE VEHICLE TYPE	REPORTED VEHICLE TYPE IS CONTAINED IN THE FOLLOWING CATEGORY ON TEMPLATE 6
2-AXLE, 4-TIRE TRUCKS WITHOUT A TRAILER	3	
2-AXLE, 4-TIRE TRUCKS WITH A TRAILER	3	
2-AXLE, 6-TIRE PICKUP TRUCKS WITHOUT A TRAILER	5	
2-AXLE, 6-TIRE PICKUP TRUCKS WITH A TRAILER	8 - 10 AS APPROPRIATE	
OTHER SINGLE-UNIT TRUCKS WITH SEMI-TRAILERS	8 - 13 AS APPROPRIATE	
OTHER SINGLE-UNIT TRUCKS WITH FULL-TRAILERS	8 - 13 AS APPROPRIATE	

4. COMMENTS.

U.S. TERRITORY INFORMATION

Template 8 is to be annually completed only by the U.S. Territories of American Samoa, Guam, Northern Marianas Islands, and Virgin Islands. This template contains the totals for population, net land area, system length and travel, and motor vehicle accidents.

Population and Net Land Area data are to be reviewed and updated annually and must relate to changes in decennial Census estimates. The U.S. Territories should annually submit revised estimates when changes have occurred in either population or net land area for rural or small urban areas. Data based on the U.S. Bureau of the Census estimates must be adjusted to match the FHWA-approved adjusted Census boundaries for the small urban and rural areas. Annual updates between decennial Censuses shall be based on local trends or Census or territorial estimates.

System Length shall include all arterial and collector system public roads on the Territorial Highway System and other public roads that are maintained by a public authority. Under 23 U.S.C. 215, each territory shall establish, with FHWA approval, a system of arterial and collector highways designated as the Federal-aid Territorial Highway System (THS). Breakdowns by paved and unpaved surface types shall be based on definitions contained in the Definition Section above. The total length shall be consistent with the public roads mileage certified annually to FHWA.

Daily Travel shall accurately indicate the usage of the public roads by motorized highway vehicles. The U.S. Territories are encouraged to use traffic count-based practices to develop travel estimates by arterial, collector, and local functional systems in small urban and rural areas. Since vehicle usage in the U.S. Territories is limited to motorized vehicles maintained on the islands, other procedures, such as annual odometer surveys, could also be used to verify total travel. Procedures used to develop estimates of travel should be thoroughly documented and meet the requirements of Appendix K.

Motor Vehicle Accidents within the U.S. Territories involving injuries, both fatal and nonfatal, that occur within the right-of-way of public roads shall be reported. Additional explanations about reporting fatal and injury motor vehicle accidents data have already been explained above.

Template - 8

U. S. TERRITORY INFORMATION

TERRITORY: _____ TERRITORY FIPS CODE: _____ UNITS: English 1/ Metric 2/ DATA YEAR: _____ DATE: _____

Shaded cells are reserved for titles and computer software generated values. Enter data in the unshaded cells only.

CATEGORY	RURAL	URBAN	TOTAL
POPULATION (1,000)			
NET LAND AREA			
FEDERAL-AID TERRITORIAL HIGHWAY SYSTEM -- ARTERIAL:			
PAVED LENGTH			
UNPAVED LENGTH			
SUBTOTAL			
DAILY TRAVEL (1,000)			
FEDERAL-AID TERRITORIAL HIGHWAY SYSTEM -- COLLECTOR:			
PAVED LENGTH			
UNPAVED LENGTH			
SUBTOTAL			
DAILY TRAVEL (1,000)			
OTHER PUBLIC ROADS:			
PAVED LENGTH			
UNPAVED LENGTH			
SUBTOTAL			
DAILY TRAVEL (1,000)			
ALL PUBLIC ROADS:			
TOTAL LENGTH			
TOTAL DAILY TRAVEL (1,000)			
MOTOR VEHICLE ACCIDENTS ON PUBLIC ROADS:			
NUMBER OF FATAL ACCIDENTS			
NUMBER OF NONFATAL INJURY ACCIDENTS			
NUMBER OF FATALITIES			
NUMBER OF NONFATALLY INJURED PERSONS			
1/ English units for length and travel are miles and daily vehicle-miles (in thousands), respectively.			
2/ Metric units for length and travel are kilometers and daily vehicle-kilometers (in thousands), respectively.			

C H A P T E R I V

UNIVERSE AND SAMPLE DATA REQUIREMENTS

GENERAL CODING INSTRUCTIONS

This chapter contains the record format and detailed coding instructions for each data item contained in the HPMS dataset. There are three types of data records (Universe, Standard Sample and Donut Area Supplementary Sample). Basic coding rules for these three types of data records with references to the functional systems involved, follow.

Universe Records (Items 1-38 and 81-82, if applicable;
Length = 229, 236, 287 or 294):

- Principal arterial sections which include the Interstate, other freeways and expressways, and other principal arterial systems.
- Minor arterial, collector, and local section records where non-applicable items are to be zero-filled.
- Grouped length records where nonapplicable items are to be zero-filled. Principal arterial, rural minor arterial, and sample (standard or donut area) section records cannot be part of a grouped length record.

Standard Sample Records (Items 1-80 and 81-82, if applicable;
Length = 476, 483, 534 or 541):

- Includes principal arterial, minor arterial, urban collector and rural major collector section records where nonapplicable items are to be zero-filled.

Donut Area Supplementary Sample Records (Items 1-41; Length = 248)

(for NAAQS nonattainment area travel estimates):

- Includes rural and small urban minor arterial, small urban collector, and rural major collector section records where non-applicable items are to be zero-filled.

All Records

All numeric data item codes or values must be right-justified and include leading zeroes, or be zero-filled where codes/values are not applicable or are not required. Alphanumeric fields may include blanks and are not required to be right-justified or zero-filled.

DATA REPORTING

Universe

All open to traffic, public road systems are to be represented by universe records such that the total length agrees with the Certified Public Road Mileage. In addition, facilities on the Principal Arterial or other National Highway Systems that are not yet built or open to traffic are to be reported, provided the proposed roadway is part of an approved or adopted plan.

Standard Sample Panel

A statistically chosen portion of all functional systems, except for the rural minor collector and local, and urban local systems are part of the standard sample panel. The standard sample panel must represent all applicable systems both on and off the State highway system. The standard sample panel is used for a variety of purposes including publication, modeling and other analyses. The standard sample panel selection and maintenance process is contained in Appendix E with references to other companion appendices.

Donut Area Sample Panel (**for urbanized areas that are NAAQS nonattainment areas only**)

There is a special, additional, sample panel requirement for the "donut" portion of urbanized areas that are NAAQS nonattainment areas. The purpose of the donut area sample panel is limited to the development of travel estimates for the rural and small urban minor arterial, rural major collector, and small urban collector functional systems located in the donut portion of the nonattainment area. This travel estimation process will also make full use of the universe and standard sample panel AADT estimates that already exist in the donut portion of the nonattainment area boundaries. The donut area supplementary sample panel will merely enhance the existing data to enable achievement of higher confidence levels for the arterial and collector (except rural minor collector) travel estimates, respectively. The combination of standard samples that already exist in the donut area for these systems, plus the donut area supplementary samples make up the donut area sample panel.

The donut area sample panel consists of sections in the rural and small urban minor arterial, rural major collector, and small urban collector functional systems that are located outside of any urbanized areas, but within the nonattainment area boundary. Standard sample panel sections for these systems that are in the donut area will be incorporated into the donut area sample panel, along with additional supplementary samples, as needed, to meet the confidence levels for the donut area travel estimate. The Nonattainment Area Code (Item 11), Donut Area AADT Volume Group (Item 28), AADT (Item 30), and Donut Area Expansion Factor (Item 42) are required to be reported for the special donut area sample sections in addition to other data item requirements for the sections.

Chapter II contains an explanation of NAAQS nonattainment and donut areas, and includes more details about the required travel estimate. See Appendix S for complete details concerning the donut area sample panel selection and maintenance process.

Coding Nonuniform Roadways

Since HPMS is an inventory system that requires reported data to be representative of both directions of roadway operation, conflicts in data item coding may arise for various reasons, particularly among the standard sample data items. The following provides some aid in addressing these conflicts.

Independent or Common Alignment, Divided Highway Sections - Data items that involve curvature, grade, widths, types, condition, etc., may differ in shape or dimension on each side of the roadway. This is to be resolved by choosing one side of the divided facility for inventory purposes, and by coding all applicable data items only for the chosen side of the highway. This "inventory direction" must be chosen on a statewide basis (i.e., always South to North, East to West, or vice versa) and must never change.

Some data items must still reflect the complete two way facility (such as AADT, Number of Through Lanes, Median Width, ROW Width, etc.). Careful consideration must be given to reporting data items that involve the whole facility; for example, Interstate length and through lane counts must be precise because of the apportionments involving these data.

Appendix J specifies that IRI is to be reported for the same direction and lane (and wheelpath if applicable) all of the time. The inventory direction of a divided facility must be chosen on the side where IRI is measured and reported if it is not measured on both sides of the applicable systems.

Undivided Highway Sections - Code the lesser or worse measurement or condition applicable to these roadways if the two sides of a roadway are different in some respect (i.e., shoulder type). If one end of a section is very different from the other end, lengthwise, (i.e., a change in the number of lanes or the surface type, etc., somewhere between the end points of the section), the section should be subdivided. In a situation where a construction improvement stops between the end points of a sample section, the section should also be subdivided at that point until, and if, the sample section again becomes homogeneous (via more construction). More discussion about subdivisions may be found under Item 40.

All Sections, Divided or Undivided - Averages can be used for some dimensioned items that change back and forth for short distances (i.e., ROW width, shoulder width). In some situations where a condition changes back and forth between two or more possible types, along the roadway (or inventory direction), lengthwise, for short distances, the predominant condition should be reported (i.e., shoulder type, surface type). Where the changes are not for short distances, or do not change back and forth between the same set of conditions, subdivision of the sample may be necessary. Otherwise, report the lesser or worse measurement or condition for the roadway (or inventory direction) being inventoried.

Structure Treatment

The total length of all public roads, including structures, must be represented in the universe of the HPMS. Since the HPMS standard sample panel is intended to be representative of the nonstructure road system, and since structures do not always represent the nonstructure roadway conditions, standard sample sections that exist totally on structures must be avoided except under the following conditions:

- 1) Where a total inventory (100% sample data) is being provided at the State's option for the system (such as for the Interstate System), or
- 2) Where a volume group sample size cannot be satisfied without inclusion of a structure section (i.e., no more roadway sections exist in the volume group), or the volume group would be completely unsampled because the traffic on the structure does not occur anywhere else (on a roadway).

Type of Facility (Item 22) is used to identify any section (universe or sample) that lies entirely on a structure. The data item description provides a list of data items that are required to be reported for sections that lie entirely on a structure. All other data items are optional or may be coded with zeroes.

Structures may be a part of a universe or standard sample section, but the reported data items should reflect the nonstructure roadway conditions. Standard sample sections that already exist totally on structures should be eliminated in favor of standard sample sections on a nonstructure roadway in the same volume group provided other sections exist to meet volume group sample size requirements. When choosing new standard samples, delete any sections from the list of candidates that exist totally on structures.

The supplementary sample sections in the donut area sample panel can exist totally on structures and are not affected by this rule because the donut area sample panel is used for AADT/travel enhancement purposes only.

Structures are fully represented in the National Bridge Inventory reporting system.

Data Usage and Reporting Requirements

The HPMS data are used for a variety of purposes that span the gamut from apportionment of highway monies to public information. In most situations, the use of a data item governs how it is required to be coded in HPMS. This is especially true for the standard sample data, where most of the standard sample data items are for the benefit of the HPMS Analytical Process (models). The coding scheme is created or updated to reflect the way the models (or other use) require the data.

It is recognized that the reporting agencies may have a need for highway inventory data in a coding scheme different from HPMS, and it is the prerogative of the State to obtain and retain data in that fashion. However, the State's highway inventory data coding scheme must be capable of providing the HPMS data according to the coding scheme contained in this Manual for the annual submittals. If there is not a one for one relationship, the State must obtain the additional data, as needed, or revise its coding scheme to facilitate aggregation if there are more breakdowns than required by the HPMS. The reformatting and code changes are normally accomplished by software.

In other circumstances, the State may have a need for a data item or some physical attribute that is not needed for HPMS. For example, HPMS has data items for both shoulder type and parking, but requires the coding to reflect that if parking is allowed on both sides of the roadway, then no shoulders may exist (single side parking with shoulder data on the other side of the roadway is all right). The models use these data in such a way that would prove duplicative, if a standard sample section were coded as having both side parking and shoulders. As a result, the instructions in this chapter indicate the parking versus shoulder type coding restrictions. If the State has a need for information on both shoulders and parking, or simply wants to treat them separately, then the data should be obtained and retained in the State's inventory system, and converted via software to meet the needs of HPMS at submittal time. Other HPMS data item coding schemes or restrictions that do not meet the State's needs could be treated in a similar fashion.

If the HPMS data format is the only highway inventory system used by the State, there may be a need to make use of the 100 characters provided for State use at the front of each record (Item 1) to encode any special data attributes that the State requires.

Use of Acronyms

Many acronyms are used in this chapter, as well as throughout the Manual. The user/reader is referred to the acronym list at the front of the Manual for those used in this chapter. It is necessary to note, however, that the combined acronym "PAS/NHS" means that the principal arterial system (PAS) consisting of Interstate, other freeways and expressways and other principal arterial, and other National Highway System (NHS) sections that are not on the PAS are being discussed or require a certain treatment.

DATA ITEM SUMMARY TABLEData Item Requirements

Under the columns headed "Required Universe Items" and "Required Sample Items," in the data item summary table, an "A" indicates that the item is required for "All" of that system's section records, both universe and sample (standard and donut area). An "S" indicates that the item is only required if the section record is part of the "Standard" sample panel. A "D" indicates that the item is only required if the section record is part of the "Donut" area sample panel. The following abbreviations are used in the column headings:

All Records - Universe and Sample Data

Prin Art/Oth NHS Report these items for all principal arterial and other National Highway System sections. The principal arterial system includes the rural and urban Interstate, urban other freeways and expressways and rural and urban other principal arterial functional systems. The National Highway System is made up primarily of these same systems, but may include a minor amount of roadways on other functional systems.

Int	Interstate	Rural and Urban
OFE	Other Freeways and Expressways	Urban
OPA	Other Principal Arterial	Rural and Urban
MA	Minor Arterial	Rural and Urban
MaC	Major Collector	Rural
MiC	Minor Collector	Rural
Col	Collector	Urban
Loc	Local	Rural and Urban

Pos This column indicates the position of the item in the section record as reported to FHWA.

Len This column indicates the length of the field used for the data item.

Caution Regarding the Data Item Coding Summary

Several data items in both the universe and sample data portions of these records require additional discussion regarding the type of section for which the data item is applicable. For example, Percent Passing Sight Distance (Item 62) is required only for rural paved, two-lane facilities. The summary table only indicates that this item is required for the rural standard sample sections. Do not rely solely on the data item summary table for system coding requirements; each data item description must be consulted for complete details.

Universe Data

Item No.	Pos	Len	Required Universe Items								Data Item		
			<---- Rural ---->				<---- Urban ---->						
			Prin Art/Oth NHS	MA	MaC	MiC & Loc	Prin Art/Oth NHS	MA	Col	Loc			
1	1-100	100											<u>Identification</u> State Control Field
2	101	1	A	A	A	A	A	A	A	A	A	A	Reporting Units
3	102-103	2	A	A	A	A	A	A	A	A	A	A	Year
4	104-105	2	A	A	A	A	A	A	A	A	A	A	State code
5	106	1	A	A	A	A	A	A	A	A	A	A	Type of Section
6	107-109	3	A	A	A	A	A	A	A	A	A	A	County code
7	110-133	24	A	A	A	A	A	A	A	A	A	A	Section/LRS Identification
8	134-147	14	A	A				A					LRS Milepoint/ Kilometerpoint
9	148	1	A	A	A	A	A	A	A	A	A	A	Rural/Urban Designation
10	149-152	4	A	A	A	A	A	A	A	A	A	A	Urbanized Area Sampling Technique and Code
11	153-155	3	A	A	A	A	A	A	A	A	A	A	Nonattainment Area Code
12	156-157	2	A	A	A	A	A	A	A	A	A	A	<u>System</u> Functional System
13	158	1	A	A	A	A	A	A	A	A	A	A	Generated Functional System Code
14	159	1	A	A	A	A	A	A	A	A	A	A	National Highway System
15	160	1	A					A					Unbuilt Facility
16	161-165	5	A					A					Official Interstate Route Number
17	166	1	A	A				A					Route Signing
18	167	1	A	A				A					Route Qualifier
19	168-175	8	A	A				A					Signed Route Number

Key: A - Code for "All" universe, standard and donut area sample sections.
 S - Code for all "Standard" sample sections.
 D - Code for all "Donut" area sample sections.

Universe Data (Cont.)

Item No.	Pos	Len	Required Universe Items								Data Item	
			<---- Rural ---->				<---- Urban ---->					
			Prin Art/ Oth NHS	MA	MaC	MiC & Loc	Prin Art/ Oth NHS	MA	Col	Loc		
20	176-177	2	A	A	A	A	A	A	A	A	A	Jurisdiction Governmental Ownership Special Systems
21	178-179	2	A	A	A	A	A	A	A	A	A	Operation Type of Facility Designated Truck Route/ Parkway Toll
22	180	1	A	A	A	A	A	A	A	A	A	Other Section Length Donut Area Sample Panel AADT Volume Group ¹
23	181	1	A	A	A	A	A	A	A	A	A	Standard Sample Panel AADT Volume Group
24	182	1	A	A	A	A	A	A	A	A	A	AADT AADT Derivation Number of Through Lanes
25	183-188	6	A	A	A	A	A	A	A	A	A	
26	189	1	A	A	A	A	A	A	A	A	A	
27	190-191	2	A	A	A			A	A	A		
28	192-197	6	A	S&D	S&D			A	S&D	S&D		
29	198	1	A	S&D				A	S&D			
30	199-200	2	A	S	S			A	S	S		

Key: A - Code for "All" universe, standard and donut area sample sections.
S - Code for all "Standard" sample sections.
D - Code for all "Donut" area sample sections.

¹ The "A" in the summary table cells for the Donut Area Volume Group (Item 26) is meant to indicate that all data records (universe and sample) for the noted functional systems in a donut area are to include these data.

Universe Data (Cont.)

Item No.	Pos	Len	Required Universe Items						Data Item
			<---- Rural ---->			<--- Urban ---->			
			Prin Art/ Oth NHS	MA	MaC	MiC & Loc	Prin Art/ Oth NHS	MA	

Other (Cont.)

31	201	1						A	S			Urban Location
32	202	1	A	S	S			A	S	S		Access Control
33	203	1	A	S	S			A	S	S		Median Type
34	204-206	3	A	S	S			A	S	S		Median Width
35	207-209	3	A	S				A				Roughness (IRI)
36	210-211	2	A	S	S			A	S	S		Pavement Condition (PSR)
37	212-225	14										Reserved for Federal Use
38	226-229	4	A	A	A	A		A	A	A	A	Record Type

(A Universe section record ends here unless the section contains HOV Operations and/or Surveillance Systems. If one or both of these exist on the applicable PAS section, data Items 81 and/or 82 must be added to the universe record.)

Key: A - Code for "All" universe, standard and donut area sample sections.
 S - Code for all "Standard" sample sections.
 D - Code for all "Donut" area sample sections.

Sample Data

Item No.	Pos	Len	Required Sample Items											Data Item
			<--- Rural --->				<----- Urban ----->							
			Int	OPA	MA	MaC	Int	OFE	OPA	MA	Col			
														<u>Identification</u>
39	230-241	12	S	S	S&D	S&D	S	S	S	S&D	S&D	Sample Number		
40	242	1	S	S	S&D	S&D	S	S	S	S&D	S&D	Sample Subdivision		
														<u>Computational</u>
41	243-248	6			D	D				D	D	Donut Area Expansion Factor		
														(A Donut area sample section record ends here, unless it is also a standard sample section record.)
42	249-254	6	S	S	S	S	S	S	S	S	S	Standard Expansion Factor		
														<u>Pavement</u>
43	255-256	2	S	S	S	S	S	S	S	S	S	Surface/ Pavement Type		
44	257	1	S	S	S	S	S	S	S	S	S	Pavement Section		
45	258-260	3	S	S			S	S	S			SN or D		
46	261	1	S	S			S	S	S			Type of Base		
47	262	1	S	S			S	S	S			Type of Subgrade		
														<u>Improvements</u>
48	263-265	3	S	S	S	S	S	S	S	S	S	Overlay <u>or</u> Pavement Structure Thickness		
49	266-269	4	S	S	S	S	S	S	S	S	S	Year of Surface Improvement		
50	270-271	2	S	S	S	S	S	S	S	S	S	Type of Improvement		

Key: A - Code for "All" universe, standard and donut area sample sections.
 S - Code for all "Standard" sample sections.
 D - Code for all "Donut" area sample sections.

Sample Data (Cont.)

Item No.	Pos	Len	Required Sample Items										Data Item
			<--- Rural --->				<----- Urban ----->						
			Int	OPA	MA	MaC	Int	OFE	OPA	MA	Col		
<u>Geometrics</u>													
51	272-273	2	S	S	S	S	S	S	S	S	S	S	Lane Width
52	274	1	S	S	S	S	S	S	S	S	S	S	Shoulder Type
53	275-278	4	S	S	S	S	S	S	S	S	S	S	Shoulder Width
54	279	1					S	S	S	S	S	S	Peak Parking
55	280-282	3	S	S	S	S	S	S	S	S	S	S	ROW Width
56	283	1	S	S	S	S	S	S	S	S	S	S	Widening
57	284	1				S							Feasibility
Horizontal													
Alignment													
Adequacy													
58	285-375	91	S	S	S	S	S	S	S				Curves by Class
59	376	1	S	S	S	S							Type of
Terrain													
60	377	1				S							Vertical
Alignment													
Adequacy													
61	378-419	42	S	S	S	S	S	S	S				Grades by Class
62	420-422	3	S	S	S	S							Percent Passing
Sight Distance													
<u>Traffic/Capacity</u>													
63	423-425	3	S	S	S	S	S	S	S	S	S	S	Speed Limit
64	426-428	3				S							Weighted Design
Speed													
(calculated)													
65A	429-432	4	S	S	S	S	S	S	S	S	S	S	Percent Single
Unit Trucks													
65B	433-436	4	S	S	S	S	S	S	S	S	S	S	Percent
Combination													
Trucks													
66	437-438	2	S	S	S	S	S	S	S	S	S	S	K-Factor
67	439-441	3	S	S	S	S	S	S	S	S	S	S	Directional
Factor													
68	442-446	5					S	S	S	S	S	S	Peak Capacity
69	447-449	3	S	S	S	S	S	S	S	S	S	S	V/SF Ratio
(calculated)													
70	450-451	2					S	S	S	S	S	S	Turning Lanes
71	452	1					S	S	S	S	S	S	Signalization
72	453-454	2					S	S	S	S	S	S	% Green Time

Key: A - Code for "All" universe, standard and donut area sample sections.
 S - Code for all "Standard" sample sections.
 D - Code for all "Donut" area sample sections.

Sample Data (Cont.)

Item No.	Pos	Len	Required Sample Items											Data Item
			<--- Rural --->				<----- Urban ----->							
			Int	OPA	MA	MaC	Int	OFE	OPA	MA	Col			
73	455-460	6	S	S	S	S	S	S	S	S	S	S	<u>Traffic/Capacity</u> Future AADT	
74	461-462	2	S	S	S	S	S	S	S	S	S	S	Future AADT Year	
75	463-464	2	S	S	S	S	S	S	S	S	S	S	<u>Environment</u> Climate Zone ²	
76	465	1	S	S	S	S	S	S	S	S	S	S	Drainage Adequacy	
77	466	1	S	S	S	S							Type of Development	
78	467-468	2	S	S	S	S	S	S	S	S	S	S	Number Grade Separated Interchanges	
79	469-474	6	S	S	S	S	S	S	S	S	S	S	Number At-Grade Intersections	
80	475-476	2	S	S	S	S	S	S	S	S	S	S	Number At-Grade Railroad Crossings	

The following supplemental data are reported only if HOV Operations and/or Highway Surveillance Systems exist on the applicable PAS (universe or standard sample). Do not report these data items if the features do not exist.

3

			<u>Supplemental</u>										
81	Varies ³	58	A	A			A	A	A				HOV Operations
82	Varies ³	7	A	A			A	A	A				Surv. Systems

Key: A - Code for "All" universe, standard and donut area sample sections.
S - Code for all "Standard" sample sections.
D - Code for all "Donut" area sample sections.

² The Climate Zone entry (Item 75) is made by the Submittal Software Package. It may be changed by the State.

³ The positions for these data items depend on whether they are attached to a universe record or to a standard sample record, and whether one or both exist on the section. For universe records, the positions are 230-287 for Item 81 and 288-294 for Item 82, if they both exist. For a standard sample record the positions are 477-534 for Item 81 and 535-541 for Item 82, if they both exist. If only one of the data items exist, it will begin at position 230 for a universe record and at position 477 for a standard sample record. The ending position depends on the data item length.

UNIVERSE DATA CODING INSTRUCTIONS

Identification Data Items

Item 1 -- State Control Field (Length = 100)

This portion of the record is for the use of the State. It may contain anything the State wishes for identification or for any other purpose. FHWA Headquarters does not use these data.

Item 2 -- English or Metric Reporting Units (Length = 1)

This item is to be coded for all section records. Enter the code to indicate the units of measurement used to report applicable measurement type data items. **All applicable data items must use the same reporting units for the entire data file.** There can be no mixing of units within the file.

Code Description

- 1 This file of section data is coded using the English system of unit measurement (miles, feet, inches, etc.).
- 2 This file of section data is coded using the modernized metric system of unit measurement known as the SI (kilometers, meters, millimeters, etc.).

Universe data items 7, 8, 25, 34, 35, and standard sample data items 45, 48, 51, 53, 55, 58, 61, 63 and 64 are to be coded with the units specified by this item.

English and metric units are defined in Chapter II.

Soft conversions may be made using the following conversion factors taken from AASHTO "Guide To Metric Conversion", 1993:

1 mile = 1.609344 kilometers
1 foot = 0.3048 meters = 304.8 millimeters
1 inch = 0.0254 meters = 25.4 millimeters

Typical hard conversions normally used for design purposes also found in the AASHTO guide include:

11 foot lane = 3.3 meters
12 foot lane = 3.6 meters
8 foot shoulder = 2.4 meters
10 foot lane or shoulder = 3.0 meters

More information may be found in the AASHTO publication referenced above.

Item 3 -- Year (Length = 2)

Enter the last two digits of the calendar year for which the data apply. For example, the 1993 data reported in 1994 would be coded "93".

Item 4 -- State Code (Length = 2)

The FIPS codes, listed in Appendix A, are used.

Item 5 -- Type of Section Identification (Length = 1)Code Description

- | | |
|---|--|
| 1 | Section Identifier -- A countywide unique identifier for section records |
| 2 | Grouped Length -- a countywide unique identifier for grouped length (miles or kilometers) records only |

Enter the code that indicates the type of unique identification used in Item 7A.

Use the grouped length code "2" only for those records that truly include grouped length and do not reflect contiguous roadways. Only nonsample rural major collector, minor collector and local, and nonsample urban minor arterial, collector, and local system records may contain grouped length. Grouping may only be done for roadways where the data for Items 1-7, 9-14, 20-24 and 26-27, as applicable, are homogeneous across all sections being grouped.

Use code "1" for all section records, including standard and donut area sample section records and universe section records that cannot or are not being grouped. Code "1" must be used for Linear Referencing System (LRS) section records (Interstate, Other Principal Arterial, rural Minor Arterial, and other NHS) (see Items 7B and 8).

See examples in Item 7A.

Item 6 -- County Code (Length = 3)

Use the three-digit FIPS county code (see FIPS Publication 6-4, "Counties and Equivalent Entities of the United States, its Possessions, and Associated Areas"). County equivalents are to be used in HPMS for the following:

Alaska	The highway districts
Louisiana	The parishes
Puerto Rico	The "Municipio" districts

Item 7A -- Section Identification (ID) (Length = 12)

This field must be coded in accordance with the type of section coded in Item 5, and must contain a countywide unique record identification. It provides for the flexibility needed to identify sections in accordance with a State's needs independent of the unique identification that must be maintained for sample sections (see Item 39, Sample Number). This item may be redefined to suit the needs of the State.

The appropriate type of ID is as follows:

- o For all section records including rural arterials (Interstate, other principal arterial, minor arterial), urban principal arterials (Interstate, other freeways and expressways, other principal arterial), other NHS sections, and all sample (standard and donut area) sections, supply a countywide unique section identifier (code "1" in Item 5). This may be a location specific identifier such as route milepoint (or kilometerpoint), anode-bnode, or just a unique number.
- o For grouped length records, use a countywide, unique identifier (code "2" in Item 5). Only nonsample, urban minor arterial, collector and local, and nonsample, rural major and minor collector and local data records may be grouped.

Examples for each method follow:

1. Section Identifier (Item 5 = 1)

Any countywide unique identifier with no more than 12 digits is coded, right justified.

Example: Interstate inventory route 56, milepoint 4.321

Pos.:	110	111	112	113	114	115	116	117	118	119	120	121
Code:	0	0	0	I	5	6	0	0	4	3	2	1

2. Grouped Length (Item 5 = 2)

Any countywide unique identifier with no more than 12 digits is coded, right justified.

Grouped data is an aggregation of roadway miles/kilometers, where at least the following data items are homogeneous across all roadways being combined: Items 1-7, 9-14, 20-24 and 26-27, as applicable.

Item 7A -- Section Identification (ID), Cont.

Use this choice ONLY when the length is truly grouped.
Otherwise, use the "Section Identifier" identification.

Example: 98365

Pos.:	110	111	112	113	114	115	116	117	118	119	120	121
Code:	0	0	0	0	0	0	0	9	8	3	6	5

Item 7B -- LRS Identification (Length = 12)

This item is required for all PAS, other NHS and rural minor arterial system section records, and must be coded in conjunction with LRS Milepoints/Kilometerpoints (Item 8) as part of the LRS location identifier. The Type of Section (Item 5) must be coded "1" for these systems. Items 7B and 8 are for the purpose of establishing an LRS for GIS applications. More information concerning the LRS may be found in Chapter V, Linear Referencing System for Geographic Information Systems.

Inventory Route, Subroute Number, for LRS use

The inventory route and subroute numbers to be reported in this field must be consistent with the inventory route and subroute numbers identified on the Inventory Route and Node Maps and in the Inventory Route Link Data File that are fully discussed in Chapter V, Linear Referencing System Requirements.

The **inventory route number** is coded in positions 122-131 (ten positions), right justified, followed by the subroute number in the last two positions (132-133) of this field. The LRS inventory route number can be alphanumeric, but must not contain blanks. The inventory route number is not necessarily the same as that posted along the roadway, but is a number used to uniquely identify a route within at least a county and perhaps throughout the State.

The **subroute number** is a number that uniquely identifies the AHEAD and BACK portions of an inventory route section where duplicate MPTs/KMPTs occur.

Example: Inventory Route 63951, Subroute Number 2:

Pos.:	122	123	124	125	126	127	128	129	130	131	132	133
Code:	0	0	0	0	0	6	3	9	5	1	0	2

Item 8 -- LRS Beginning and Ending Milepoints/Kilometerpoints
(Length = 14)

This item is required for all PAS, other NHS, and rural minor arterial system section records for the purpose of establishing an LRS. The Type of Section (Item 5) must be coded "1" for these systems. This field must be coded with the beginning and ending MPTs/KMPTs for the inventory route and subroute number coded in the LRS Identification (Item 7B), as specified under the example. It must also reflect units as defined by English or Metric Reporting Units (Item 2).

The MPTs/KMPTs for the section must be consistent with the LRS information found on the Inventory Route and Node Maps and in the Inventory Route Link Data File for a particular route and subroute. In order to be consistent, section breaks must adhere to the conditions listed in Chapter V, particularly under the section titled "The Effect of Duplicate/Non-Duplicate Milepoints/Kilometerpoints and Subroutes on HPMS Sections." See Chapter V for a full discussion on coding of the Linear Referencing System.

Zero-fill this field for all records where LRS information is not provided. The beginning MPT/KMPT is coded in positions 134-140 (seven positions), right justified (xxxx.xxx -- implied decimal point). The MPT/KMPT represents the distance in miles/kilometers from a set reference point to the beginning of this highway segment and is the lowest MPT/KMPT of the section.

Similarly, the ending MPT/KMPT is coded in positions 141-147 (seven positions), right justified (xxxx.xxx -- implied decimal point) and is the highest MPT/KMPT of the section.

The MPT/KMPT numbering format should be such that the combination of county, inventory route number, subroute number, and MPT/KMPT information will define a unique location.

Example: Beginning kilometerpoint 98.25 and ending kilometerpoint 101.20 for the inventory route and subroute number coded in Item 7B:

Pos.:	134	135	136	137	138	139	140	141	142	143	144	145	146	147
Code:	0	0	9	8	2	5	0	0	1	0	1	2	0	0

(Page intentionally left blank.)

Item 9 -- Rural/Urban Designation (Length = 1)

Adjusted urban area boundaries apply. See Chapter II for the definition of adjusted urban area boundaries.

<u>Code</u>	<u>Description</u>
1	Rural area
2	Small Urban area (population 5,000 to 49,999)
3	Urbanized area (population 50,000 - 199,999)
4	Urbanized area (population 200,000 or more)

Item 10 -- Urbanized Area Sampling Technique and Urbanized Area Code
(Length = 4)

This item must be coded when the Rural/Urban Designation (Item 9) is coded "3" or "4" for section records within an urbanized area boundary. Otherwise, zero-fill this field.

10A -- Urbanized Area Sampling Technique (Length = 1)

All urbanized areas that contain a population of 200,000 persons or more, or smaller urbanized areas that are within an NAAQS nonattainment area boundary, or smaller urbanized areas that are NAAQS nonattainment areas on their own, MUST be individually sampled. This includes any portion of a nonattainment urbanized area that crosses a State boundary, and individual State portions of an urbanized area that, in the aggregate (all States), contains more than 200,000 persons, even if a State's portion does not reach that population by itself. Otherwise, the State may sample urbanized areas individually or it may group two or more urbanized areas into one or more collective groups.

In order to identify how the State is sampling urbanized areas, this data item must be coded for all urbanized area universe and standard sample records as follows:

- 0 -- If the urbanized area is being individually sampled or if the section record is not in an urbanized area.

**Item 10 -- Urbanized Area Sampling Technique and Urbanized Area Code,
Cont.**

10A -- Urbanized Area Sampling Technique, Cont.

Sequential (1-9) -- If two or more areas are being grouped, one number from 1 to 9 should be used for each group, starting with "1". For example, if a State has consolidated all qualifying urbanized areas (< 200,000 population and not an NAAQS nonattainment area) into one group, only "1" should be coded. If qualifying areas have been consolidated into two groups plus some individual areas, the first group of qualifying areas must be coded "1", the second group must be coded "2", and the individual areas must be coded "0".

10B -- Urbanized Area Code (Length = 3)

Code the actual three-digit urbanized area code for the urbanized area in which the section falls (see Appendix B). The urbanized area code for the specific urbanized area is always coded for all section records in the urbanized area, universe and standard sample, regardless of the sampling option selected. If the section is not in an urbanized area, zero-fill this field.

Item 11 -- NAAQS Nonattainment Area Code (Length = 3)

Enter the three-digit urbanized area code for the **name** of the NAAQS nonattainment area, as declared by the EPA. **This code is required for all rural, small urban, and urbanized area records, both universe and sample (standard and donut area), that are within an NAAQS nonattainment area boundary.**

Code "000" for section records that are not within a nonattainment area boundary.

The urbanized area codes may be found in Appendix B of this Manual. A discussion of NAAQS nonattainment areas is contained in Chapter II under definitions. The Houston nonattainment area coding example under the definition provides more explanation for coding this data item.

This data item is not to be confused with the Urbanized Area Code (Item 10B). Item 10B is reported only for section records that are within the urbanized area boundary.

System Data Items**Item 12 -- Functional System Code** (Length = 2)Code Description

Rural:

01	Principal Arterial -- Interstate
02	Principal Arterial -- Other
06	Minor Arterial
07	Major Collector
08	Minor Collector
09	Local

Urban:

11	Principal Arterial -- Interstate
12	Principal Arterial -- Other Freeways and Expressways
14	Principal Arterial -- Other
16	Minor Arterial
17	Collector
19	Local

Codes 12, 13, 14 and 15 have been used in the past to identify nonconnecting/connecting link portions of the urban Other Freeways and Expressways and Other Principal Arterial functional systems. Although codes 13 and 15 may still be used, codes 12 and 13 will be treated as code 12, and codes 14 and 15 as code 14.

Definitions of the highway functional systems can be found in "Highway Functional Classification, Concepts, Criteria and Procedures," FHWA, March 1989.

Item 13 -- Generated Functional System Code (Length = 1)

This field consists of a code that is generated by software based on the Functional System (Item 12), and is used as a software aid. It is encoded by the HPMS Submittal Software, as described in Chapter VII. If Item 12 is changed by non-HPMS software, the HPMS Submittal Software must be run to obtain the proper code in this field. This code is automatically updated when using the update option of the HPMS Submittal Software to update Item 12. The codes are as follows:

Item 13 -- Generated Functional System Code, Cont.

<u>Code</u>	<u>Description</u>	
	<u>Rural</u>	<u>Urban</u>
1	Interstate	Interstate
2	Other Principal Arterial	Other Freeways & Expressways
3	Minor Arterial	Other Principal Arterial
4	Major Collector	Minor Arterial
5	Minor Collector	Collector
6	Local	Local

Item 14 -- NHS (Length = 1)

This item is to be coded for all records to indicate whether this section is on the NHS. Initially, this code should reflect the State designated NHS roadways as proposed to FHWA. Upon approval by the Congress, the coding must henceforth reflect the congressionally approved NHS. Also see the definition of NHS in Chapter II. Enter one of the following codes:

<u>Code</u>	<u>Description</u>
0	This section <u>is not</u> on the NHS system
1	This section <u>is</u> on the NHS system

Item 15 -- Planned Unbuilt Facility (Length = 1)

This item is to be coded for all PAS and other NHS data records. Only unbuilt or not open to traffic roadways that are on the PAS/NHS are to be reported in HPMS. Enter the status of the roadway section being reported.

<u>Code</u>	<u>Description</u>
0	Section is not on the applicable (PAS/NHS) systems, and <u>is open to public travel</u> .
1	PAS/NHS section is built and open to public travel.
2	PAS/NHS section is not yet built, but is <u>part of an approved or adopted plan</u> of a short range improvement program which has a good probability of being under construction in the reasonably near future (up to 6 years). This code shall include those sections that are built but were not yet open to traffic for the reporting year.

Item 15 -- Planned Unbuilt Facility, Cont.

If the section record is coded "2", report at least items 1-22, 24-25, 28 and 30 as applicable; for codes "0" and "1", code all applicable data items for the section record.

Item 16 -- Official Interstate Route Number (Length = 5)

This data item is required for all Interstate System data records, and must contain the official Interstate route number, right justified. If two-or-more Interstate routes occupy the same roadway, code the lowest official route number. If the route is not an official Interstate route, zero-fill this item, regardless of signing.

Only the officially approved AASHTO Interstate numeric route number is to be coded, right-justified. Extra alphanumeric characters must not be entered -- provide leading zeroes for the remaining digits. Short Interstate route spurs are to be identified with their own approved route number and not that of the main route.

Alaska, Hawaii, and Puerto Rico may use alpha characters in the Interstate route number field as part of the official AASHTO route number. Other exceptions to the Interstate numeric rule include a major route that has a parallel or diverging branch with fully paired directional roadways and has an official route number containing a letter for relative direction (i.e., E for east). For example, Interstate route 35 in Minnesota splits with 35E going through St. Paul and 35W through Minneapolis.

Item 17 -- Route Signing (Length = 1)

This data item is required for all PAS, other NHS and rural minor arterial system data records. The reporting of routes for other systems is optional. These codes specify the manner in which the highway segment actually is or will be signed with route markers. If the roadway is unsigned, code this field "0".

<u>Code</u>	<u>Description</u>
0	Not signed or not applicable
1	Interstate
2	U.S.
3	State
4	Off-Interstate Business Marker
5	County
6	Township
7	Municipal
8	Parkway Marker or Forest Route Marker
9	None of the above

Item 17 -- Route Signing, Cont.

When a route is signed with two or more identifiers (i.e., Interstate Route 83 and U.S. Route 32), the code for the highest class of route shall be used (Interstate in this example). The hierarchy is in the order listed above.

Item 18 -- Route Signing Qualifier (Length = 1)

This data item is required for all PAS, other NHS and rural minor arterial system data records. The reporting of routes for other systems is optional. These codes specify the manner in which the highway segment actually is or will be signed on the route marker described in Item 17. Where more than one code is applicable, use the lower code. If the roadway is unsigned, code this field "0".

<u>Code</u>	<u>Description</u>
0	No Qualifier or not signed or not applicable
1	Alternate
2	Business Route
3	Bypass
4	Spur
5	Loop
6	Proposed
7	Temporary
8	Truck Route
9	None of the above

Item 19 -- Signed Route Number (Length = 8)

This data item is required for all PAS, other NHS and rural minor arterial system data records, and must reflect the route signing hierarchy as coded in Item 17. Enter the signed route number, right justified, for the marker described in Items 17 and 18. This item is optional for non-PAS/NHS routes. Any alphabetic character prefixes or suffixes that do not conform to the Route Signing or Route Signing Qualifier lists should be reported in this item, and abbreviated to fit the field length, as necessary. If two or more routes of the same class in the hierarchy (see Item 17) are signed along a roadway section, the lowest route number is to be entered in this field. If Item 17 is coded "0", zero-fill this field.

Jurisdictional Data Items**Item 20 -- Governmental Ownership** (Length = 2)

This data element is used to identify the level of government that owns the facility. It does not matter if agency agreements exist for maintenance or other purposes, or if the roadway passes through a political or other boundary. The purpose of this item is to identify the owner of the facility. In the case of toll authorities, this code is not dependent upon a toll being charged. Where more than one code could be used for a section, the lowest numerical code shall be reported (i.e., if county and town boundaries are the same, but only one ownership body exists, use code "02").

<u>Code</u>	<u>Description</u>
01	State Highway Agency
02	County Highway Agency
03	Town or Township Highway Agency
04	Municipal Highway Agency
11	State Park, Forest, or Reservation Agency
12	Local Park, Forest, or Reservation Agency
21	Other State Agencies
25	Other Local Agencies
26	Private ⁴
31	State Toll Authority
32	Local Toll Authority
60	Other Federal Agencies (not listed below)
62	Bureau of Indian Affairs
64	U.S. Forest Service
66	National Park Service
68	Bureau of Land Management
70	Military Reservation/Corps of Engineers

Item 21 -- Special Systems (Length = 2)

This field is used to identify the special funding categories for applicable highway segments, both open-to-traffic and unbuilt, not-open-to-traffic PAS/NHS roadways (identified via Item 15). These special systems are separate and distinct from those outlined in previously defined fields, and may overlap previously defined systems. For example, the National Forest Highway System may include roadways owned by a State or local government.

⁴ A "private" roadway is one that is privately owned, but is commonly used by, and open to, public traffic. In many of these cases, the roadway may be closed for a short time period (such as 1 day) each year by the owner to maintain its private status.

Item 21 -- Special Systems, Cont.

However, if the roadway is part of the National Forest Highway System, it should be coded as such in this field. Where conflicts exist, use the lower numbered code (i.e., use "02" where "02" and "08" are both applicable).

<u>Code</u>	<u>Description</u>
00	Not on a Special System
01	Addition to the Interstate System (23 U.S.C. 139(c)) ⁵
02	Addition to the Interstate System (23 U.S.C. 139(a)) <u>approved before March 9, 1984</u> ⁶
03	Addition to the Interstate System (23 U.S.C. 139(a)) <u>approved on or after March 9, 1984</u> ⁶
04	Future addition to the Interstate System (23 U.S.C. 139(b)) ⁷
08	Strategic Highway Network (STRAHNET) ⁸
11	Appalachian Development Highway ⁹
13	Indian Reservation Roads and Bridges ¹⁰
15	National Forest Highway System ¹⁰
16	National Forest Development Roads and Trails
18	National Park Service Parkway ¹⁰
19	National Park Roads and Trails

⁵ Highways designated as part of the Interstate System that are only applicable to Alaska and Puerto Rico.

⁶ Highways designated as part of the Interstate System under the provisions of 23 U.S.C. 139(a) should be coded "02" or "03" for this data item, depending on the date of approval. They must be functionally classified as Interstate (Item 12 = "01" or "11").

⁷ Highways designated as a future part of the Interstate System under the provisions of 23 U.S.C. 139(b) should be coded "04" for this data item. These highways should not be functionally classified as Interstate until the highway has been officially designated as part of the Interstate System.

⁸ This definition is intended to be consistent with 23 U.S.C. 103(b)(2)(C). Includes Connectors.

⁹ This definition is intended to be consistent with 23 U.S.C. 143(f)(2) and 23 U.S.C. 101(a).

¹⁰ These definitions are intended to be consistent with 23 U.S.C. 101(a), Definitions and Declaration of Policy.

Operation Data Items**Item 22 -- Type of Facility (Length = 1)**

<u>Code</u>	<u>Description</u>
1	One-Way Roadway
2	Two-Way Roadway
3	One-Way Structure (bridge, tunnel, causeway, etc.)
4	Two-Way Structure (bridge, tunnel, causeway, etc.)

Use the "roadway" codes when a structure is on part of the section being reported. Use the "structure" codes when the section being reported is **entirely** on a structure. As noted at the front of this chapter under the heading, "Treatment of Structures", sections **entirely** on a structure are to be avoided as standard samples except under the two special conditions noted.

When a section is entirely on a structure, only the following data items need to be reported: 1-30, 33, 34, 38, and if a standard sample under the special circumstances noted above, 39-42, 51, 63, 65, 73, 74, 81 & 82 as applicable. All other data items may contain zeroes.

Definitions:

One-Way -- A roadway or structure section with traffic moving in only one direction during nonpeak period hours. When part of a one-way couplet, each roadway/structure must be reported independently.

Two-Way -- A roadway or structure with traffic moving in both directions during nonpeak period hours.

Item 23 -- Designated Truck Route/Parkway (Length = 1)

This item is required for all systems. Due to the demise of the Federal-aid Systems, and because of the tie of the designated truck route system to the Federal-aid Primary System which is still in effect, careful consideration must be given to codes "1" and "2".

Item 23 -- Designated Truck Route/Parkway, Cont.

Code Description

- 1 Designated truck route under Federal authority in 23 CFR 658. This code would include all Interstate and those sections/routes designated only under Federal authority or under both Federal and State authority. It would not include the routes in those States that have designated all, or almost all, of the non-Interstate, and now defunct, Federal-aid Primary System. If these roadways are on the current principal arterial system, use code "2" if there are no limitations/restrictions.¹¹
- 2 Designated truck route only under State authority and fully available to both types of trucks described below.¹¹
- 3 Parkway -- not on a designated truck route.
- 4 Not a Parkway -- not on a designated truck route.

Designated truck routes (codes "1", "2") are those sections/routes that are available to truck tractor and 48-foot (or longer if "grandfathered") semitrailer combinations, truck tractor and 28-foot twin trailer combinations, both subject to no overall length limits, and specialized combination vehicles such as automobile and boat transporters, maxicube vehicles, and saddlemount combinations, subject to Federal minimum overall length limits (generally 65 to 75 feet), all of which may be up to 102 inches wide.

The designated truck routes as shown in Appendix A to 23 CFR 658, are open to vehicles subject to Federal minimum length limits specified in Section 411 of the Surface Transportation Assistance Act of 1982 (STAA) and the Federal width limit of 102 inches specified in Section 416 of STAA. Additional routes for such vehicles have been designated under State authority.

The following are not to be included as designated truck routes for the purposes of this data item (use code "4"):

- a. Routes (or portions thereof) that simply provide "access" for these large vehicles to terminals and for food, fuel, repair or rest services.

¹¹ Those States designating all, or almost all, of the non-Interstate Federal-aid Primary (now defunct) were: AR, CO, IN, KS, LA, MS, MT, NE, NV, OH, OK, SD, TN, TX, UT, WA AND WY. Code "2" shall be used for these States if the roadways are currently on the principal arterial system and are fully available to the trucks described for this data item.

Item 23 -- Designated Truck Route/Parkway, Cont.

- b. Those routes designated only under State authority that restrict some of the trucks described above because of length or width limitations or because of time of day restrictions.

For purposes of this data element, a parkway (code "3") is a highway that has full or partial access control, is usually located within a park or a ribbon of park-like developments, and prohibits commercial vehicles. In this instance, buses are not considered commercial vehicles.

Item 24 -- Toll (Length = 1)

<u>Code</u>	<u>Description</u>
1	Non-Toll
2	Toll
3	Interstate toll segment under Secretarial Agreement (Section 105 of 1978 Federal-aid Highway Act, as amended).
4	Interstate toll segment under Secretarial Agreement, now free of tolls.

If portions of a roadway can be traversed without the payment of a toll, but a toll is charged on other portions, the segment is considered to be toll. This applies even if a vehicle can enter and exit from the main through route without payment of a toll. If a toll is charged in only one direction, the "free" direction is also considered to be toll. The coding for this item should agree with any other data furnished to FHWA.

If a roadway is maintained by toll funds, the roadway is considered toll.

Other Data Items**Item 25 -- Section Length (xxx.xxx -- implied decimal) (Length = 6)**

This field must reflect units as defined by English or Metric Reporting Units (Item 2). **It is required for all records including those PAS/NHS routes that are being reported as unbuilt, or not open to traffic (identified via Item 15).**

Item 25 -- Section Length, Cont.

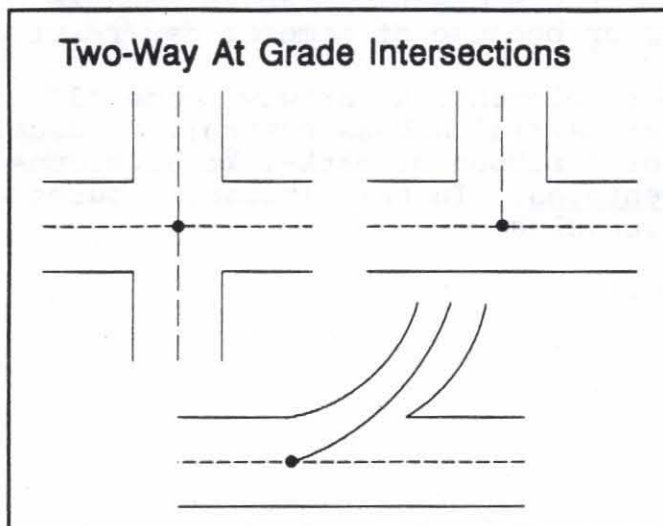


Figure IV-1 - Length is measured to the midpoint intersection of the roadways

Length, in miles or kilometers, is to be reported as measured or as driven by a precise mechanical measuring device along the centerline of the roadway. On independently aligned, divided highways, the reported length should be the average of the lengths of the directional roadways, measured along their centerlines. The two roadways of a one-way couplet (see Item 22) are to be reported independently (not averaged).

Where a route length is reported from or to the intersection with another route, the point of measurement should be taken as the actual center of the intersection (see Figure IV-1). If two routes cross by a structure, the length measurement should be treated as if the two routes were unseparated highways meeting at grade (i.e., to the theoretical center of the intersection). When a route terminates at an interchange (a tee intersection), the length is measured as the average of the two directional, connecting roadway (ramp) lengths to the first points of intersection (see Figure IV-2) or cross over/under with the other mainline route. Except in the case of the terminating route discussed above (see Figure IV-2), ramps are considered part of the mainline routes and are not considered for HPMS length purposes.

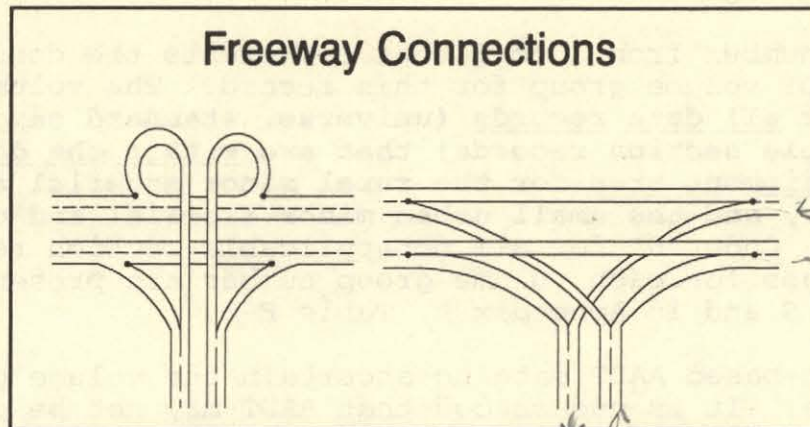
Item 25 -- Section Length, Cont.

Figure IV-2 - Freeway Tee Intersection - length is an average of the four connectors (ramps) measured to the gore points

The length of certain non-PAS/NHS, nonrural minor arterial, nonsample roadways may be grouped if the roadways are homogeneous across several universe data items (see Items 5 and 7 for details). Under the grouping situation, the total combined length of these roadways is coded. Should it be necessary to code a number larger than 999.999 Kilometers (or 621.387 miles), two or more records should be included so as to produce the required sum. Care should be taken to avoid splitting the length equally between records so that the possibility of mistaking these for duplicate records can be avoided--each record identification for grouped length must be unique.

While provision has been made for coding to a maximum precision of 0.001, records should reflect the precision normally utilized by the State, but at least to the nearest tenth (mile or kilometer). This not only provides maximum precision, but alleviates rounding and checking problems. The field should be coded with trailing and leading zeroes, depending on the precision obtained, e.g., 56.2 would be coded "056200".

Item 26 -- Donut Area Sample Panel AADT Volume Group Identifier
(Length = 1)

Enter a number from 1 to 5 that represents the donut area sample panel AADT volume group for this record. **The volume group must be coded for all data records (universe, standard sample, and donut area sample section records) that are within the donut portion of a nonattainment area for the rural minor arterial and major collector, and the small urban minor arterial and collector systems.** Code "0" for all nonapplicable section records. The AADT ranges for each volume group number are presented in Appendix S and in Appendix F, Table F-5.

Use count-based AADT data to ascertain the volume group where available. It is understood that AADT may not be precisely known for all applicable universe sections. Use traffic flow maps, count data obtained from local governments, and other available data to make reasonable volume group assignments. The volume group can be determined by the HPMS Submittal Software provided the AADT is reported and the FHWA volume group ranges are being used.

A discussion of NAAQS nonattainment and donut areas may be found in Chapter II. A description of the donut area sampling scheme is contained in Appendix S.

Item 27 -- Standard Sample Panel AADT Volume Group Identifier
(Length = 2)

Enter a number from 01 to 13 that represents the standard sample panel AADT volume group for the record. **The volume group must be coded for all data records (universe, standard sample, and donut area sample section records) for all systems except for rural minor collector and rural and urban local functional systems.** Code "00" for all nonapplicable section records. The AADT ranges for each volume group number are presented in Appendix F, Tables F-1 to F-4.

Use count-based AADT data to ascertain the volume group where available. It is understood that AADT may not be precisely known for all applicable universe sections. Use traffic flow maps, count data obtained from local governments, and other available data to make reasonable volume group assignments. The volume group can be determined by the HPMS Submittal Software provided the AADT is reported and the FHWA volume group ranges are being used.

A description of the standard sampling scheme is contained in Appendix E.

Item 28 -- AADT (Length = 6)

This item is required for all PAS and other NHS data records (including not-yet-open-to-traffic facilities coded via Item 15), and for all standard and donut area sample sections; it is optional for the remaining data records. The field is zero-filled when not used.

Enter the section's AADT for the given year. For two-way facilities, provide the AADT for both directions; provide the directional AADT if part of a one-way couplet or for one-way streets. Since many applications, including travel estimates, will be based on these section AADT's, the States are to concentrate efforts on the PAS/NHS and sample (standard and donut area) sections of the highway system, and to provide AADT's that are count-based (actual counts adjusted to represent AADT) rather than estimates. Code the expected (estimated) AADT for the PAS/NHS facilities that are not yet open to traffic.

The reported AADT values are to be annually updated. The AADT values that are derived from pneumatic tube counts must include the application of an axle correction factor. All counts should reflect application of current day of week and seasonal factors; growth factors must be applied if the AADT was not derived from current year counts. Specific guidance for the frequency and size of traffic data collection programs, and factor development, age of data, and other applications is contained in Appendix K with further references to the "Traffic Monitoring Guide."

Traditionally, metropolitan planning organizations and other local governmental agencies develop an average weekday traffic volume for local purposes. The HPMS requires the AADT reported here to be an average that represents all days of the year.

Leading zeroes must be coded. For example, an AADT of 25,300 vehicles per day is coded "025300".

Item 29 -- AADT Derivation (Length = 1)

This item is to be coded for all urban and rural arterial section records where AADT (Item 28) is a required data item. This includes the complete PAS and other NHS data records and all standard and donut area minor arterial sample section records. Enter one of the following codes that best describes the method used to develop the AADT on the applicable sections.

Code Description

- 0 Not applicable. AADT is not required to be coded for this section, or it is not on the PAS/NHS and is not a standard sample or donut area minor arterial sample.
- 1 The AADT for this section is developed from traffic counts collected on or adjacent to the section during the current year and appropriately factored as required by the procedures in Appendix K .
- 2 The AADT for this section is factored from a previous year count-based AADT (using Appendix K procedures) that is less than or equal to 2 years old.
- 3 The AADT for this section is based on count data that exceeds the 3-year cycle, as addressed by the procedures in Appendix K and in the code "2" description.
- 4 The AADT for this section is estimated using a means not corroborated in Appendix K or the TMG, such as from traffic flow maps, based on "engineering judgement", regionwide trends, etc., or does not fit into the above coding scheme.

Item 30 -- Number of Through Lanes (Length = 2)

This item is required for all PAS and other NHS data records, and all standard sample section records. It is optional for all other data records. Enter "00" when not supplied.

Enter the prevailing number of through lanes in both directions (excluding collector-distributor lanes, weaving lanes, frontage road lanes, parking and turning lanes, etc.) carrying through traffic in the off-peak period. Exclude truck climbing lanes unless the length and importance is sufficient to warrant inclusion. Other additional short-length lanes needed for toll collection, police and emergency vehicle turnaround, acceleration/deceleration lanes, etc. are to be excluded.

Item 31 -- Urban Location (Urban Data Item) (Length = 1)

This item is required to be reported for urbanized areas that contain 200,000 or more persons for the following systems:

- all urban PAS data records
- all urban minor arterial standard sample section records.

The complete adjusted urbanized area, including portions that cross State boundaries, is used to establish the population criteria for coding this data item.

The purpose of this data item is to identify the general character of the land surrounding each section of roadway. The process of doing so, however, must fully recognize that "pure" delineations may be the exception rather than the rule because of the variety and mixes of land uses that exist. A reasonable approach to accomplishing this task may be by delineating sizeable portions of the urbanized areas according to the individual code descriptions noted below. Sport complexes, zoos, air and rail terminals, etc., are to be included in the delineations based on both trip end and density characteristics. Please note that this data item is in effect a surrogate for vehicular trip end density or the vehicular trip generation characteristics of the land area.

Enter the code that represents the predominant characteristics of the land area based on the delineation procedures noted above for the roadway section. If a road section is contained in two different delineated areas or if the areas differ on either side of the road section, code the higher of the delineated densities (lower code) for the section.

Code Description

- 0 Not applicable for this section record; not on the PAS, not a minor arterial standard sample and not an urban section in an urbanized area with 200,000 or more population.
- 1 Central Business District (CBD) -- The traditional commercial and retail trade center in the central city of an urbanized area. An area having very high land value because of intense concentration of retail trade, office space, cultural, and service activities.

Item 31 -- Urban Location, Cont.

- 2 High Density Business/Commercial Center (excluding the CBD) -- One or more centers of business and/or commercial activities within the urbanized area (or a cluster of two or more adjacent smaller centers.). (Note: these smaller centers may have different names and may have been built at different times.) The inclusion of adjacent high density housing should also be considered in the delineation of these areas.

Typical density and size characteristics are as follows:

- | | | |
|-----|---------------------|--|
| (1) | Number of employees | > 10,000 |
| | | OR |
| | All development | > 5,000,000 ft ²
(450,000 m ²) |
| | | WITH A |
| | Retail portion | > 600,000 ft ²
(55,000 m ²) |

- - - - - AND - - - - -

- (2) Land Area > 7,500 acres
(30 km²)
- 3 Low Density Commercial -- That portion of an urbanized area that is not the CBD or a High Density Business/Commercial Center and contains a lower density of business, industrial, warehousing, service and strip development or a wide mixture/variety of such uses.
- 4 High Density Residential -- That portion of an urbanized area in which the major land use is residential and has a density of 5,000 or more persons per square mile (2,000 persons/km²).
- 5 Low Density Residential -- That portion of an urbanized area in which the major land use is residential and has a density less than 5,000 persons per square mile (2,000 persons/km²). The development density is greater than or equal to one dwelling unit per acre (250 dwellings/km²).
- 6 Other, including undeveloped land and residential areas having a density of less than one dwelling unit per acre.

Item 32 -- Access Control (Length = 1)

Enter the code for the type of access control for all PAS and other NHS data records and all standard sample section records.

<u>Code</u>	<u>Description</u>
0	Not applicable; not on the PAS/NHS and not a standard sample section.
1	Full Access Control -- Preference has been given to through traffic movements by providing interchanges with selected public roads and by prohibiting crossing at grade and by prohibiting direct driveway connections.
2	Partial Access Control -- Preference has been given to through traffic movement. In addition to interchanges, there may be some crossings at-grade with public roads, but direct private driveway connections have been minimized through the use of frontage roads or other local access restrictions. Merely controlling curb cuts does not constitute partial control of access.
3	No Access Control. For HPMS purposes, this code includes all section records that do not meet the criteria for the above codes.

Item 33 -- Median Type (Length = 1)

Enter one of the following codes for all PAS and other NHS data records, and for all standard sample section records:

<u>Code</u>	<u>Description</u>
0	Not applicable; not on the PAS/NHS and not a standard sample section
1	Curbed
2	Positive Barrier
3	Unprotected
4	None

Item 33 -- Median Type, Cont.

A positive barrier would normally consist of guard-rail or concrete (Jersey type barrier), but could consist of a line of closely-spaced (large) trees or of thick, impenetrable shrubbery on most of the section. Turning lanes or bays are not considered medians unless a median exists on the major portion of the roadway, and the turning lanes/bays are cut into the median at intersections, entrances to commercial enterprises, etc.

A continuous turning lane is not to be considered a median. Continuous crosshatching that is at least 4 feet (1.2 meters) wide may be considered a median; however, if a crosshatched portion of a roadway is used as a turning lane by law, it is to be considered a turning lane, not a median.

Item 34 -- Median Width (Length = 3)

This item is required for all PAS and other NHS data records, and for all standard sample section records. The units of measurement must be reported in accordance with the option chosen in English or Metric Reporting Units (Item 2).

Enter the predominant median width (including shoulders, if any; see Figure IV-3), measured between the inside edges of the through roadways, to the nearest foot or tenth of a meter (xx.x -- implied decimal). Enter "000" for undivided or nonapplicable roadways. Enter "999" where the median width is 1000 feet or 100.0 meters or greater. Provide a leading zero if applicable. Ignore turning bays cut into the median.

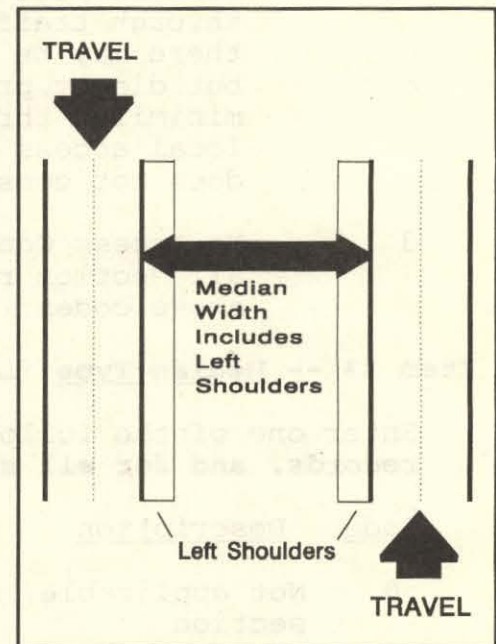


Figure IV-3 - Median Measurement

Item 35 -- Measured Pavement Roughness (International Roughness Index (IRI)) (Length = 3)

This item is required for all paved PAS and other NHS universe and sample (standard and donut area) data records, and all paved standard sample section records on the rural minor arterial system. It is also recommended to be reported for all other paved standard sample sections (see Table IV-1). Code "999" for unpaved facilities on the required systems. Zero-fill for all other sections when not supplied.

Item 35 -- Measured Pavement Roughness (International Roughness Index (IRI)), Cont.

Enter the actual calibrated IRI value to the nearest unit per length measurement (whole inches/mile for the English system or hundredths of meters/kilometer (x.xx -- implied decimal) for the Metric system). The entry must be in accordance with the reporting units chosen in English or Metric Reporting Units (Item 2). Provide leading zeroes where necessary.

State Pavement Management Systems (PMS) are expected to provide roughness data that meet HPMS standards. These data should be incorporated into HPMS for applicable sections.

Appendix J contains requirements, good practice guidelines and references pertaining to equipment, calibration/correlation and data collection procedures. Note that calibration and data collection activities are to be conducted during stable pavement and weather conditions (no frost heave, freeze/thaw, wet conditions, etc.).

Table IV-1

Roughness Reporting Requirements

Functional System	Record Type	Roughness
Rural:		
Interstate	All Records	Required
Other Prin. Art.	All Records	Required
Minor Arterial	Std. Sample	Required
Major Collector	Std. Sample	Recommended
Urban:		
Interstate	All Records	Required
Other Fwys & Exps	All Records	Required
Other Prin. Art.	All Records	Required
Minor Arterial	Std. Sample	Recommended
Collector	Std. Sample	Recommended

Reporting of IRI for all NHS data records, regardless of functional system, is required.

Item 36 -- Pavement Condition (Length = 2 -- x.x -- implied decimal)

Enter the pavement condition, actual Present Serviceability Rating (PSR) or equivalent, to the nearest tenth, **for all paved PAS and other NHS data records, and all paved standard sample section records.** Code "99" for unpaved facilities on the required systems. Zero-fill for all other sections when not supplied. Use PSR or the Present Serviceability Index (PSI) where available. If current sufficiency ratings of pavement condition (but excluding geometrics) are available, a correlation between the sufficiency rating scale and the PSR scale or rating factors may be developed so that such existing ratings may be used.

If there are no current PSR, PSI, or sufficiency ratings that can be adapted, the section must be rated from the following table (Table IV-2). In view of the growing national concern regarding pavement deterioration, careful attention to realistic pavement condition ratings is strongly suggested. Estimates to the nearest tenth within the applicable range should be made, e.g. -- 2.3. This is most important for comparisons to prior years. Where different lanes have different pavement condition ratings, code the worst condition.

If IRI is reported for a complete functional system where IRI is required (see Table IV-1), and has been collected and reported in full conformity with the data item instructions and the Appendix J procedures and good practice guidelines, then PSR for that system is not required to be reported. Conformity to the calibration procedures in Appendix J and to those of the equipment manufacturer must also have been followed. A narrative indicating that the proper methods and devices were employed to measure and report IRI must accompany each HPMS submittal (where PSR has been eliminated), and include the concurrence of the FHWA field offices.

Where IRI is required only for a standard sampled system (i.e., rural minor arterial), the complete functional system means all of the standard samples in that system (not the universe). PSR is required for those systems where IRI is not required (urban minor arterial and collector, and rural major collector).

Table IV-2Pavement Condition Rating

(Use full range of values)

PSR & Verbal RatingDescription

5.0 -----

Only new, superior (or nearly new) pavements are likely to be smooth enough and distress free (sufficiently free of cracks and patches) to qualify for this category. Most pavements constructed or resurfaced during the data year would normally be rated very good.

4.0 -----

Pavements in this category, although not quite as smooth as those described above, give a first class ride and exhibit few, if any, visible signs of surface deterioration. Flexible pavements may be beginning to show evidence of rutting and fine random cracks. Rigid pavements may be beginning to show evidence of slight surface deterioration, such as minor cracks and spalling.

3.0 -----

The riding qualities of pavements in this category are noticeably inferior to those of new pavements, and may be barely tolerable for high speed traffic. Surface defects of flexible pavements may include rutting, map cracking, and extensive patching. Rigid pavements in this group may have a few joint failures, faulting and cracking, and some pumping.

2.0 -----

Pavements in this category have deteriorated to such an extent that they affect the speed of free-flow traffic. Flexible pavement may have large potholes and deep cracks. Distress includes ravelling, cracking, rutting, and occurs over 50 percent, or more, of the surface. Rigid pavement distress includes joint spalling, faulting, patching, cracking, scaling, and may include pumping and faulting.

1.0 -----

Pavements in this category are in an extremely deteriorated condition. The facility is passable only at reduced speeds, and with considerable ride discomfort. Large potholes and deep cracks exist. Distress occurs over 75 percent or more of the surface.

0.0 -----

Item 37 -- Reserved for Federal Use (Length = 14)

This field is reserved for future use, and is to be zero-filled. The HPMS Submittal Software will zero-fill this field when this package is used to build the dataset.

Item 38 -- Record Type Code (Length = 4)

This field must be present in all records. It indicates the type of section record that is being reported, consists of four elements, and is normally encoded by software. The coding possibilities are:

A universe section or a grouped length record	"0000"
A universe section with only HOV Operations	"0010"
A universe section with only Surveillance Systems	"0001"
A universe section with <u>both</u> HOV Operations and Surveillance Systems	"0011"
A sample section record for the standard sample panel	"1000"
A standard sample section with only HOV Operations	"1010"
A standard sample section with only Surveillance Systems	"1001"
A standard sample section with <u>both</u> HOV Operations and Surveillance Systems	"1011"
A supplementary sample section record for a donut area ¹ sample panel	"0100"

A sample section record that is both a standard sample and a donut area sample will carry the record type code of a standard sample ("1000"). The NAAQS Nonattainment Area Code (Item 11), the Functional System Code (Item 12) and the Donut Area Sample Panel AADT Volume Group (Item 26) will be used by software to determine if the section is also a donut area sample.

NOTE: This is the end of the record for all nonsample sections that do not contain HOV Operations (Item 81) and/or Surveillance Systems (Item 82). If this roadway section is a universe section on the PAS, check data items 81 and 82 to see if they should be reported (added to the universe section record). If applicable, Items 81 and/or 82 will immediately follow Item 38 on a universe data record.

¹ HOV Operations or Surveillance Systems are not to be reported for donut area sample sections since the donut area samples cannot exist on the PAS and the data items will not be recognized by the software.

SAMPLE DATA CODING INSTRUCTIONS

Samples (donut area and standard) are obtained only from open-to-traffic, public roads under the jurisdiction of and maintained by a public authority. All system and ownership categories must be fully represented among the required functional systems in order to ensure that the sample is representative of all of the street and highway length within the State.

Sections that are fully contained on a structure are not to be chosen as standard samples. Choose sections that contain nonstructure roadway and code the standard sample data items for the roadway portion(s) of the section. Donut area sample sections (that are not also standard sample sections) are not affected by this rule.

Sample Identification**Item 39 -- Sample Number (Length = 12)**

Code the sample section identifier used for this section in the original HPMS submission or a unique number for a new sample section. This number may have been route-milepoint or A-node, B-node, Segment when first entered, but, once coded, is to be considered a countywide unique number that cannot change in the future, even if locational information changes. It will be assigned to all subdivided portions of a sample section, as necessary.

This data item is used to track sample sections (standard and donut area) over time. In order to do this, the Sample Number must never change for any reason. The State may change the Section Identification (Item 7A) for any good cause, or the State Control Field (Item 1) may be used for additional identifiers, or for any other use.

Item 40 -- Sample Subdivision (Length = 1)

This field will be used if it becomes necessary to subdivide a section due to operational or capital improvements on part of the section's length. Initially, this field is coded "0". If the section is subdivided over time, the code is changed to 1, 2, 3, etc, depending upon the number of subdivisions (records) created from the original section. The order or value of the subdivision numbers are not significant except as an aid to determine the relative positions of the segments for field reviews and data updates. Item 39, Sample Number, always remains the same for all subdivided sections.

Item 40 -- Sample Subdivision, Cont.

Sample sections should be subdivided only when significant changes have occurred. Routine maintenance, short lengths of surfacing or sealing, or repair of several joints would not normally constitute a significant change. A change in almost any one of the data items in the universe would be cause for subdividing (such as county or other political boundary changes, functional system, ownership, volume group, number of lanes, median type, etc.). A change in many of the data items in the standard sample would also be cause for subdividing (such as surface type, improvement to a midpoint, shoulder type, any width if the change is substantial, etc.). If the changes are back and forth between the same values (or codes) along the length of the section for short distances, the predominant type should be reported, rather than subdividing numerous times. Some additional information is contained on page IV-3 under the subtitle, "Coding Nonuniform Roadways".

If more than nine subdivisions are proposed, it is suggested that the section be reviewed for recombination of contiguous subdivisions with similar characteristics. Recombining contiguous subdivisions that have become homogeneous should be done annually. Reset this data item to "0" if subdivisions no longer exist at any point in time.

Sample Computational Elements

Item 41 -- Donut Area Sample Expansion Factor

(Length = 6 -- xxx.xxx -- implied decimal)

This data item is calculated and placed in the donut area sample section record by the HPMS Submittal Software using the volume group information placed in Item 26. A table of the results is also produced, a copy of which must be forwarded to FHWA Headquarters as part of the annual HPMS data submittal.

By definition, the expansion factor is the ratio of the total length in a volume group to the total sampled volume group length:

$$\text{Expansion Factor} = \frac{\text{Total length in the Volume Group}}{\text{Sampled length in the Volume Group}}$$

If the expansion factor for a given group exceeds 100.000, additional sections in the volume group must be selected for sampling until the expansion factor is reduced to a maximum of 100.000. Additional sample sections must also be selected if there are fewer than three samples in a volume group and additional sections are available for sampling.

Item 41 -- Donut Area Sample Expansion Factor, Cont.

Chapter II contains a discussion of NAAQS nonattainment area travel estimate requirements for the donut area portion of urbanized areas that are NAAQS nonattainment areas. Appendix S describes the donut area sample panel selection and maintenance scheme.

NOTE: This is the end of the record for all donut area sample sections that are not also standard sample sections.

Item 42 -- Standard Sample Expansion Factor

(Length = 6 -- xxx.xxx -- implied decimal)

This data item is calculated and placed in the standard sample section record by the HPMS Submittal Software using the volume group information placed in Item 27. A table of the results is also produced, a copy of which must be forwarded to FHWA Headquarters as part of the annual HPMS data submittal.

By definition, the expansion factor is the ratio of the total length in a volume group to the total sampled volume group length:

$$\text{Expansion Factor} = \frac{\text{Total length in the Volume Group}}{\text{Sampled length in the Volume Group}}$$

If the expansion factor for a given group exceeds 100.000, additional sections in the volume group must be selected for sampling until the expansion factor is reduced to a maximum of 100.000. Additional sample sections must also be selected if there are fewer than three samples in a volume group and additional sections are available for sampling.

Appendix E contains a description of the standard sample panel selection and maintenance scheme.

Sample Pavement Attributes**Item 43 -- Surface/Pavement Type (Length = 2)**

Enter the code that represents the type of surface on the section.

Code Description

20 Unimproved Road -- A road using the natural surface and maintained to permit bare passability for motor vehicles, but not conforming to the requirements for a graded and drained road. The road may have been bladed and minor improvements may have been made locally. (Unpaved)

Item 43 -- Surface/Pavement Type, Cont.

Code Description

- 30 Graded and Drained -- A road of natural earth aligned and graded to permit reasonably convenient use by motor vehicles and with drainage systems (natural and artificial) sufficient to prevent serious impairment of the road by normal surface water. It is with or without dust palliative treatment or a continuous course of special borrow material to protect the new roadbed temporarily and to facilitate immediate traffic service. (Unpaved)
- 40 Soil, Gravel or Stone -- A road, the surface of which consists of mixed soil, stabilized soil, gravel or stone. Gravel or stone surfaces may also be stabilized. (Unpaved)
- 51 Bituminous Surface-Treated -- An earth road, a soil-surfaced road, or a gravel or stone road to which has been added by any process a bituminous surface course with or without a seal coat, the total compacted thickness of which is less than 1 inch (25 millimeters). Seal coats include those known as chip seals, drag seals, plant-mix seals, and rock asphalt seals. (Low Type)
- 52 Mixed Bituminous -- A road, the surface course of which is 1 inch (25 millimeters) or greater and less than 7 inches (178 millimeters) in compacted thickness composed of gravel, stone, sand or similar material, and mixed with bituminous material under partial control as to grading and proportions. (Intermediate Type)
- 53 Bituminous Penetration -- A road, the surface course of which is 1 inch (25 millimeters) or greater and less than 7 inches (178 millimeters) in compacted thickness composed of gravel, stone, sand or similar material, bound with bituminous penetration material. (Intermediate Type)
- 61 High Flexible -- Mixed bituminous or bituminous penetration road on a flexible base with a combined (surface and base) thickness of 7 inches (178 millimeters) or more. Includes any bituminous concrete, sheet asphalt or rock asphalt having a high load-bearing capacity. (High Type Flexible)
- 62 Composite; Flexible over Rigid -- Mixed bituminous or bituminous penetration road on a rigid pavement with a combined (surface and base) thickness of 7 inches (178 millimeters) or more. Includes any bituminous concrete, sheet asphalt or rock asphalt overlay that is greater than 1 inch (25 millimeters) of compacted bituminous material. Otherwise, use rigid pavement codes. (High Type Flexible)

Item 43 -- Surface/Pavement Type, Cont.

NOTE: If applicable, codes 74, 75 and 76 have priority over other rigid surface type codes.

Code Description

- 71 High Rigid; Plain Jointed -- Portland cement concrete pavement that is jointed but is without reinforcing. (High Type Rigid)
- 72 High Rigid; Reinforced Jointed -- Reinforced (with mesh or equivalent) Portland cement concrete pavement that has been jointed. (High Type Rigid)
- 73 High Rigid; Continuously Reinforced -- Continuously reinforced Portland cement concrete pavement. (High Type Rigid)
- 74 Rigid over Rigid; Bonded or Partially Bonded -- Portland Cement concrete pavement over a Portland cement concrete pavement where the two separate layers have been bonded. (High Type Rigid)
- 75 Rigid over Rigid; Unbonded (i.e., bond breaker used) -- Portland cement concrete pavement over a Portland cement concrete pavement where the two separate layers are unbonded. (High Type Rigid)
- 76 Rigid over Flexible -- Portland cement concrete pavements that have been placed over a bituminous (mixed or penetration) pavement. (High Type Rigid)
- 80 Brick, Block or Other Combination -- A road consisting of paving brick; stone, asphalt, wood and other block; steel or wood with or without a bituminous wearing surface less than 1 inch (25 millimeters) in compacted thickness. Includes roads with a combination of wearing surfaces. (High Type Flexible)

Item 44 -- Pavement Section (Length = 1)

Enter the appropriate code to indicate that the structural number (SN) for flexible pavements or the slab thickness (D) for rigid pavements is known, or enter the code for the type of pavement section (heavy, medium, light) where SN or D are not reported. **The SN or D, as appropriate, is required for Interstate, Other Freeways and Expressways and Other Principal Arterial systems.** Where available, code SN or D for all functional systems. A roadway with at least 1 inch (25 millimeters) of compacted flexible overlay (disregarding short patches) is considered a flexible pavement for purposes of this code.

To assist in determining the type of pavement section (heavy, medium or light) for those sections where SN or D, as appropriate, are not required or are not available, Table IV-3 has been prepared showing typical pavement sections. This guide includes typical thicknesses of surface, base and subbase. Unpaved facilities are those designated as unimproved, graded and drained earth, gravel or stone (codes 20/30/40 in Item 43).

Code Description

- 0 Unpaved
- 1 "SN" known
- 2 "D" known
- 3 Heavy
- 4 Medium
- 5 Light

Table IV-3

Examples of Pavement Section Coding Using English Units

Code	Type of Pavement Section	Flexible Pavement			Rigid Pavement	
		"SN" Range	Surface Type & Min. Thick.	Base Type & Min. Thick.	Subbase Type & Min. Thick.	Range in Pavement Thickness "D"
3	Heavy	4.6- 6.0	6"	12"	13"	> 9.0" (8" if continuously reinforced)
			Asphaltic Concrete	Aggregate	Aggregate	
			----- or -----			
			4"	8"	8"	
			Asphaltic Concrete	Asphaltic Concrete	Aggregate	
4	Medium	3.1- 4.5	4"	8"	8"	7.1 - 9.0" (6" if continuously reinforced)
			Asphaltic Concrete	Aggregate	Aggregate	
			----- or -----			
			3"	6"		
			Asphaltic Concrete	Asphaltic Concrete		
5	Light	1.0- 3.0	Surface Treatment	4" Aggregate	4" Aggregate	6.0 - 7.0"
			----- or -----			
			2"	6"		
			Asphaltic Concrete	Aggregate		

Item 45 -- SN or D (Length = 3)

This item is required for Interstate, Other Freeways and Expressways and Other Principal Arterials. Where available, code SN or D for all functional systems. Enter the SN value to the nearest tenth (xx.x --implied decimal) for those sections coded "1" in Item 44. Enter D to the nearest whole inch or whole millimeter for those sections coded "2" in Item 44. Provide leading zeroes where necessary. Otherwise code "000".

Item 45 -- SN or D, Cont.

Both of these data items are to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2). When calculating and reporting SN (a unitless number), ensure that the layer coefficients (value per inch or millimeter) and the layer thicknesses (inches or millimeters) are both in the same unit system before reporting the resulting SN value.

Item 46 -- Type of Base (Length = 1)

This item is required for Interstate, Other Freeways and Expressways, and Other Principal Arterials. Enter the code that describes the type of base. Use the highest numerical code where a mixture of materials has been used.

<u>Code</u>	<u>Description</u>
0	Not applicable due to functional system requirements.
1	Roadbed Soil.
2	Granular Material.
3	Stabilized earth or granular material with admixture (cement, lime, fly ash, asphalt, etc.)
8	Hot mix asphalt.
9	Lean concrete.

Item 47 -- Type of Subgrade (Length = 1)

Enter the code that describes the type of material used for the subgrade on the section. **This item is required for Interstate, Other Freeways and Expressways, and Other Principal Arterials.**

<u>Code</u>	<u>Description</u>
0	Not applicable due to functional system requirements.
1	Coarse graded material (gravel, sand, etc.)
2	Fine graded material (original earth, clay, etc.)

Sample Improvement Data**Item 48 -- Overlay or Pavement Structure Thickness** (Length = 3)

Enter the total overlay pavement thickness (for overlaid pavements) or the total pavement structure thickness (**for new pavements**) to the nearest tenth of an inch (xx.x -- implied decimal) or nearest whole millimeter when an improvement has been completed on the section. The reporting units must reflect those chosen in English or Metric Reporting Units (Item 2).

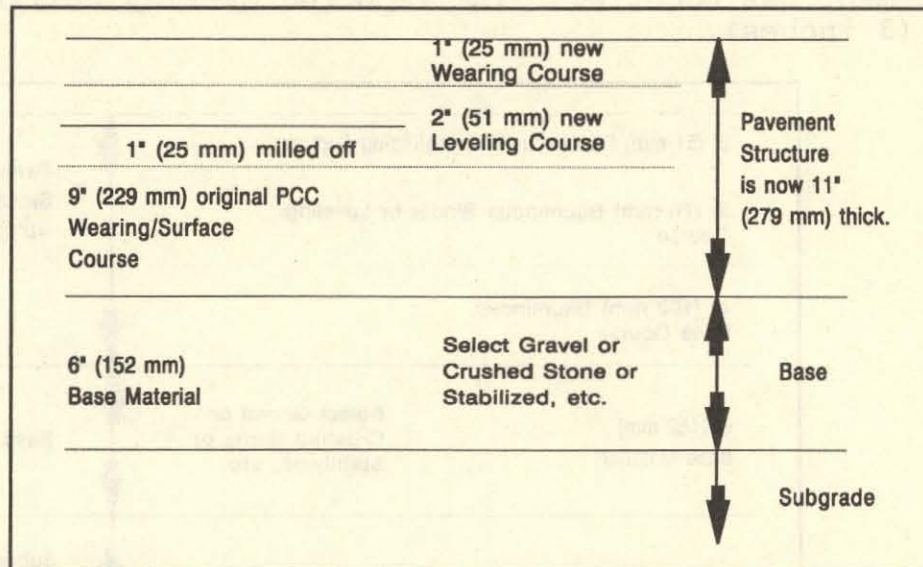


Figure IV-4 - Milled, Overlaid Pavement

This item is intended to be coded when 1 inch (25 millimeters) or more of compacted resurfacing is accomplished as part of any improvement or when the pavement is completely reconstructed. It shall remain fixed (retained in the HPMS data record) until another resurfacing/reconstruction improvement is completed on the section. Code "000" initially.

All Types of Improvement codes (Item 50), with the possible exception of "40", "50" and "60" (Major or Minor Widening and Restoration and Rehabilitation), would cause a change to this item (or the initial coding of this item). **The surface on the roadway must be improved in order for this data item to be coded.** If original paving material is left in place (in major widening, for example, where the pavement on the original lane is left intact), this field is not to be changed (or initially coded). If this field is changed (or initially coded), ensure that Year of Surface Improvement (Item 49) is also changed.

Item 48 -- Overlay or Pavement Structure Thickness, Cont.

The thickness reported here shall include all newly laid pavement, including replacement pavement material where milling or grinding has occurred.

See "NOTES" under Item 49 for additional information about coding this data item.

The example in Figure IV-4 contains a roadway where milling and replacement has occurred. The reported overlay thickness would be "030" (3 inches).

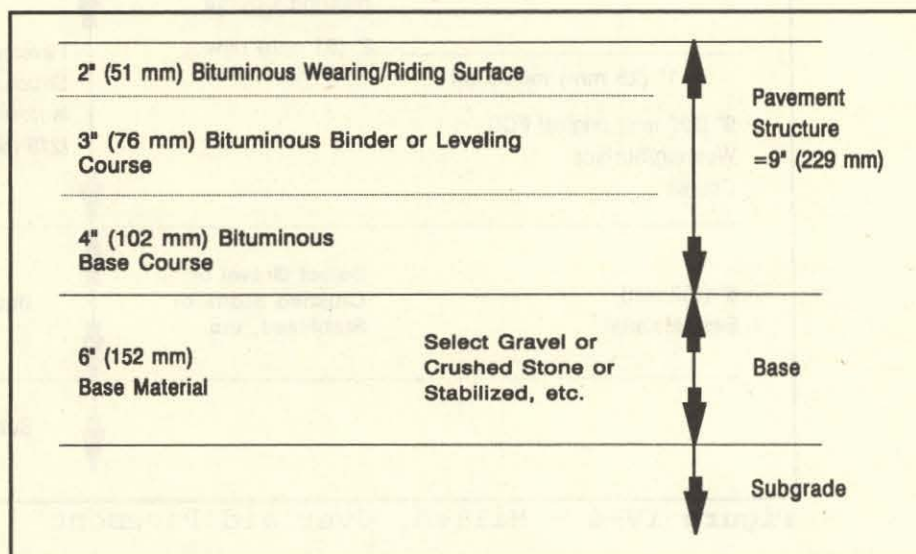


Figure IV-5 - Reconstruction, old pavement removed

If the improvement was reconstruction, the whole pavement structure (all pavement material) shall be entered. For example, since the improvement is reconstruction for the roadway portrayed in Figure IV-5, the reported pavement structure thickness value would be "090" (9 inches).

Item 49 -- Year of Surface Improvement (Length = 4)

Enter the year when a surface improvement (e.g., resurfacing or reconstruction, including new samples selected on newly constructed or improved roadway facilities) has been completed on the section; e.g., 1993 would be coded "1993". Do not remove this entry in subsequent data years; it shall be retained in the HPMS data record until another improvement affecting the surface is completed on the section. Initially (for existing, unimproved sections), this field should be coded "0000".

Item 49 -- Year of Surface Improvement, Cont.

All Types of Improvement codes (Item 50), with the possible exception of "40", "50" and "60" (Major or Minor Widening and Restoration and Rehabilitation), would cause a change to this item (or the initial coding of this item). **The surface must be improved on the roadway in order for this data item to be coded.** If original paving material is left in place (in minor widening, for example, where the original lane pavement has been left intact), then this field is not to be changed (or initially coded). If this field is changed (or initially coded), ensure that Overlay or Pavement Structure Thickness (Item 48), is also changed.

NOTES:

When the improvement items (Items 48, 49, 50) indicate that a surface improvement has been completed, all affected data items, including IRI and PSR (Items 35 and 36), must be updated for the same data submittal to reflect the improved roadway.

If the PSR/IRI update cycle is not in sync with the improvement completion year, report a "reasonable" value for PSR/IRI, inform FHWA of this action via the submittal letter, and indicate when the actual PSR/IRI will be reported for any sections that are affected.

One inch (25 millimeters) or more of compacted pavement material must be put in place to be considered an improvement for HPMS purposes.

The reporting of improvements is limited to those completed after 1987. Should a completed improvement be overlooked for any given year after 1987, however, code the proper improvement data (Items 48, 49 and 50, as applicable) when the improvement is identified. Include post 1987 improvements on newly selected sample sections.

Item 50 -- Type of Improvement (Length = 2)

This item is coded as defined below for all improvements completed during the reporting year. If completed improvements overlap, use the improvement type code with the highest priority (lowest numerical code). If no improvements were completed during the reporting year, the section shall retain the last improvement type coded. Do not include routine maintenance.

See "NOTES" under Item 49 for additional information about coding this data item.

Item 50 -- Type of Improvement, Cont.

If only a portion of the section, lengthwise, was improved and completed during the reporting year, the section should be split into two or more subdivisions at the point(s) of change. If only one side of a divided highway is improved, report the improvement only if it occurs on the inventory side of the highway (see section titled "Coding Nonuniform Roadways" on page IV-3). Use one of the following codes:

Code Improvement Type Definitions

00 NONE -- No improvement has been completed on the section.

10 NEW ROUTE -- The only time this code could possibly be used is when a new sample has been randomly chosen on a newly constructed roadway that was completed and opened to traffic in the data year being reported.

20 RELOCATION -- Construction of a facility on new location that replaces an existing route to the extent that the old route is abandoned. If the existing facility remains in use as a rural major collector, urban collector, or higher functional system, do not code the improvement and retain the old facility as the sample with no improvement (unless the old facility was also improved). If the existing facility is abandoned, the sample should be moved to the new facility and coded with this improvement type; if the existing facility remains open and becomes a local functional system facility, delete the sample.

RECONSTRUCTION -- Construction on approximate alignment of an existing route where the pavement structure is substantially removed and replaced. Such reconstruction may include widening to provide additional through lanes, adding grade separations, and replacing other highway elements. Adjustment to existing horizontal and vertical alignment can be made. Code one of the following types of reconstruction (Codes 31 to 35).

31 RECONSTRUCTION TO FREEWAY -- Complete reconstruction to freeway design standards on substantially existing alignment. This improvement type always includes the addition of full control of access. It may include the addition of through lanes, dualizing, addition of interchanges or grade separations, or widening of through lanes, depending on what was required to bring the facility to freeway standards.

32 RECONSTRUCTION WITH MORE LANES -- Complete reconstruction on substantially the same alignment with the addition of through lanes to the existing section. Alignment, shoulder, and drainage deficiencies are corrected.

Item 50 -- Type of Improvement, Cont.

<u>Code</u>	<u>Improvement Type Definitions</u>
33	RECONSTRUCTION TO WIDER LANES -- Complete reconstruction on substantially the same alignment with through lanes at least 1 foot (.3 meters) wider than the existing section. Alignment, shoulder, and drainage deficiencies are corrected.
34	PAVEMENT RECONSTRUCTION WITH ALIGNMENT IMPROVEMENTS -- Reconstruction of the highway section to correct a pavement deficiency. Specific horizontal or vertical alignment deficiencies are also corrected.
35	PAVEMENT RECONSTRUCTION -- Complete reconstruction on substantially the same alignment without widening the pavement structure. Drainage deficiencies and minor alignment deficiencies are corrected.
40	MAJOR WIDENING -- The addition of through lanes or dualization of an existing facility where the existing pavement is salvaged. Also included, where necessary, is the resurfacing of existing pavement and other incidental improvements such as drainage and shoulder improvements.
50	MINOR WIDENING -- The addition of more width per through lane to the roadway of an existing facility without adding through lanes. The existing pavement is salvaged. In many cases, the improvement will include resurfacing the existing pavement and other incidental improvements, such as shoulder and drainage improvements.
60	RESTORATION AND REHABILITATION -- Work required to return an existing pavement (including shoulders) to a condition of adequate structural support or to a condition adequate for placement of an additional stage of construction. There may be some upgrading of unsafe features or other incidental work in conjunction with restoration and rehabilitation. Typical improvements would include replacing spalled or malfunctioning joints; substantial pavement stabilization prior to resurfacing; grinding/grooving of rigid pavements; replacing deteriorated materials; reworking or strengthening bases or subbases, adding underdrains, subsealing, diamond grinding, milling, inlays, etc. If this type of improvement is done in preparation for resurfacing, it should be reported separately only if the resurfacing is not completed in the year for which the data are reported.

Item 50 -- Type of Improvement, Cont.

<u>Code</u>	<u>Improvement Type Definitions</u>
71	RESURFACING WITH SHOULDER IMPROVEMENTS AND PORTLAND CEMENT CONCRETE PAVEMENT RESTORATION -- Placement of additional Portland cement concrete material over the existing roadway to improve serviceability or to provide additional strength. Shoulders are widened or reconstructed to provide additional strength. There may be some upgrading of unsafe features and other incidental work. This code should also be used when concrete restoration includes techniques such as subsealing, joint repair, diamond grinding, etc. Where surfacing is constructed by separate project as a final stage of construction, the type of improvement should be the same as that of the preceding stage--relocation, reconstruction, minor widening, etc.
72	RESURFACING WITH SHOULDER IMPROVEMENTS AND BITUMINOUS PAVEMENT RESTORATION -- Placement of at least 1 inch (25 millimeters) of compacted bituminous material over the existing roadway to improve serviceability or to provide additional strength. Shoulders are widened or reconstructed to provide additional strength. There may be some upgrading of unsafe features and other incidental work. Where surfacing is constructed by separate project as a final stage of construction, the type of improvement should be the same as that of the preceding stage--relocation, reconstruction, minor widening, etc.
77	RESURFACING WITH PORTLAND CEMENT CONCRETE PAVEMENT RESTORATION --Placement of additional Portland cement concrete material over the existing roadway to improve serviceability or to provide additional strength. There may be some upgrading of unsafe features and other incidental work in conjunction with resurfacing. This code should also be used when concrete restoration includes techniques such as subsealing, joint repair, diamond grinding, etc. Where surfacing is constructed by separate project as a final stage of construction, the type of improvement should be the same as that of the preceding stage -- relocation, reconstruction, minor widening, etc.
78	RESURFACING WITH BITUMINOUS PAVEMENT RESTORATION--Placement of at least 1 inch (25 millimeters) of compacted bituminous material over the existing roadway to improve serviceability or to provide additional strength. There may be some upgrading of unsafe features and other incidental work in conjunction with resurfacing. Where surfacing is constructed by separate project as a final stage of construction, the type of improvement should be the same as that of the preceding stage--relocation, reconstruction, minor widening, etc.

Sample Geometrics/Configuration

GENERAL GUIDELINES for coding Number of Through Lanes (Item 30), Lane Width (Item 51), Shoulder Type (Item 52), Shoulder Width (Item 53) and Peak Parking (Item 54)

All of the above data items need to be considered together in order to properly code them for HPMS. The standard descriptions and coding requirements are given under the respective data item. This section simply provides some additional guidelines where the coding of one item depends on one or more of the other items.

The number of through lanes and the lane width should be coded according to the striping, if present, on multilane facilities, or according to the traffic use if no striping or only centerline striping is present. For example, the number of through lanes in Figure IV-6 would probably be 2 and the lane width might be 13 feet (3.6 meters), even though 17.5 feet (5.33 meters) are available, since traffic would normally only use the middle portion of the roadway.

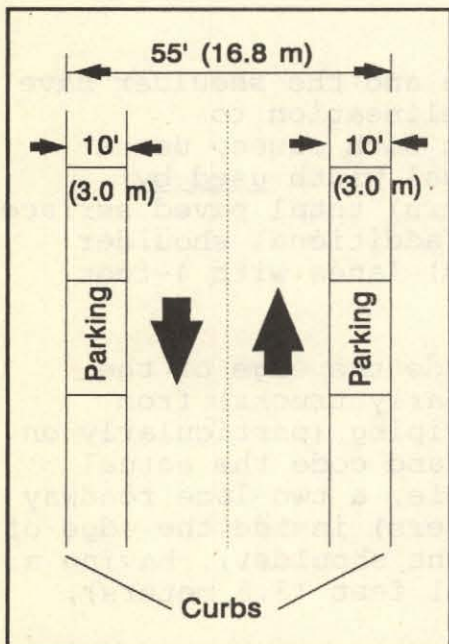


Figure V-6 - Both side parking

The roadway beyond the ends of the sample section being inventoried should be considered when the number of lanes and the lane width, in particular, are being coded. For example, if the sample section is short and atypically wider than the rest of the contiguous roadway, code the typical roadway conditions according to the conditions before and after the ends of the short section.

Shoulder width (or lane width) cannot include parking lanes, bicycle lanes, or bikeways. There is no shoulder (or shoulder width) coded under these circumstances (i.e., parking takes precedence over shoulders for HPMS purposes). If a curb exists, code the curbing under shoulder type. If there is parking on one side of a roadway and a shoulder or a curb on the other side, code both parking and shoulder type (and shoulder width), accordingly.

A shoulder cannot exist between a traffic lane and a parking lane that is completely within the roadway boundaries. Code no shoulder and zero (00) shoulder width under this circumstance.

GENERAL GUIDELINES for coding Number of Through Lanes (Item 30), Lane Width (Item 51), Shoulder Type (Item 52), Shoulder Width (Item 53) and Peak Parking (Item 54), Cont.

As with all HPMS data items, code the lesser or worse condition where the two sides of the roadway differ; code the predominant condition where frequent changes take place along the roadway, lengthwise.

It is recognized that the total roadway width may not be fully represented under a few of the coding schemes that would develop under these guidelines. Under these situations, the "lost" roadway area is considered to be for uses other than capacity, parking and emergency storage for disabled vehicles (i.e., other uses for which there are no data items in the HPMS).

Item 51 -- Lane Width (Length = 2)

Enter the prevailing traffic lane width (through lanes) to the nearest whole foot or tenth of a meter (x.x -- implied decimal). Provide the leading zero where applicable. This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2).

There are situations where the traffic lane and the shoulder have the same surface type/appearance with no delineation to distinguish the lane from the shoulder. In such cases, use a reasonable width for each based on the actual width used by traffic. For example, a 32-foot (9.75 meters) total paved surface width with centerline striping only and no additional shoulder width could be coded as 12-foot (3.6 meters) lanes with 4-foot (1.3 meters) shoulders.

In some situations, striping is placed inside the edge of the pavement in order to keep traffic (particularly trucks) from breaking the pavement edge. Ignore the striping (particularly on the outside lanes of multilane facilities) and code the actual lane width under this situation. For example, a two-lane roadway that contains a solid stripe 1 foot (.3 meters) inside the edge of the roadway surface (to the left of the right shoulder), having a width from centerline to edge-striping of 11 feet (3.3 meters), should be coded as 12 feet (3.6 meters).

Additional information concerning coding of this and other related data items is contained on page IV-59.

Item 52 -- Shoulder Type (Length = 1)

Enter the code for the type of shoulder on the section. If the shoulder type changes back and forth between types along the length of the section for short distances, code the predominant type. (However, there may be cause for subdividing instead. See "Coding Nonuniform Roadways" on page IV-3.) If left and right shoulder types differ on a divided facility, the right shoulder type should be considered the predominant type. If the section has both shoulders and curbs (i.e., a shoulder bounded by a curb or a mountable curb and then a shoulder), code the shoulder.

If the section has parking or bike lanes (or one of each) on both sides of the roadway, there cannot be a shoulder and only codes "1" (none) and "8" (curbed) are legitimate. There is no shoulder or shoulder width on the roadway section contained in Figure IV-7; the shoulder type code would be "8" (curbed).

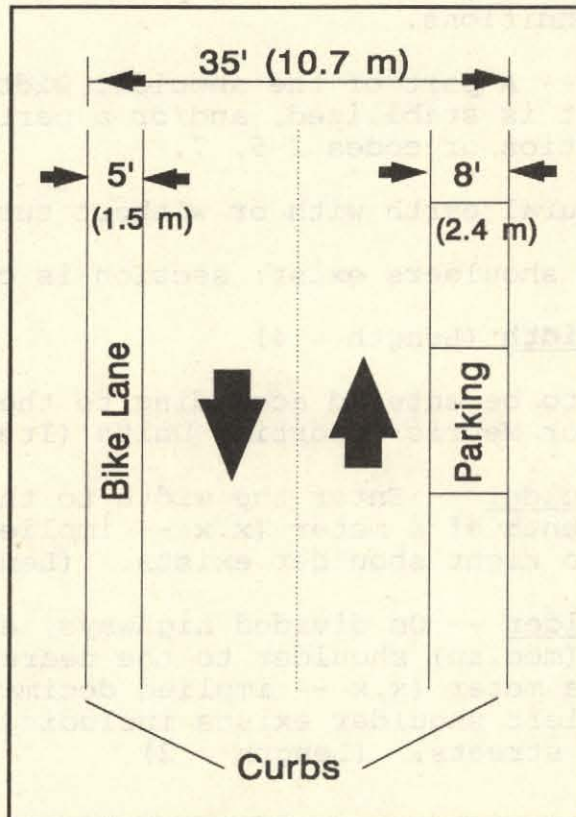


Figure IV-7 - Bike lane in roadway

Additional information concerning coding of this, and other related data items, is contained on page IV-59.

Item 52 -- Shoulder Type, Cont.

Code Description

- 1 None -- No shoulders or curbs exist.
- 2 Surfaced with bituminous material -- A bituminous course over a granular or stabilized base.
- 3 Surfaced with Portland cement concrete (not tied) -- A Portland cement concrete course over a granular or stabilized base.
- 4 Surfaced with tied Portland cement concrete -- A Portland cement concrete course over a granular or stabilized base that is part of the mainline pavement.
- 5 Stabilized -- A gravel or other granular material, with or without admixture, capable of supporting most loads even under wet conditions.
- 6 Combination -- A part of the shoulder width is surfaced and/or a part is stabilized, and/or a part is turf, etc. -- some combination of codes 2-5, 7.
- 7 Earth -- Natural earth with or without turf.
- 8 Curbed -- No shoulders exist; section is curbed.

Item 53 -- Shoulder Width (Length = 4)

This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2).

- 53a -- Right Shoulder -- Enter the width to the nearest whole foot or tenth of a meter (x.x -- implied decimal). Enter "00" if no right shoulder exists. (Length =2)
- 53b -- Left Shoulder -- On divided highways, enter the width of the left (median) shoulder to the nearest whole foot or tenth of a meter (x.x -- implied decimal). Enter "00" where no left shoulder exists including two-way, undivided streets. (Length = 2)

Item 53 -- Shoulder Width, Cont.

Do not include parking or bicycle lanes as (part of) the shoulder width measurement when parking and/or bicycle lanes exist on both sides of the roadway. There is no shoulder width under these circumstances. Figure IV-8 contains an example where the bike lane is outside of the roadway; the shoulder width of 8 feet is reported under this circumstance. Use the predominant width where it is not constant (changes back and forth along a roadway, lengthwise, in short lengths). Particular attention should be paid to "combination" shoulders to ensure that the total width is being reported.

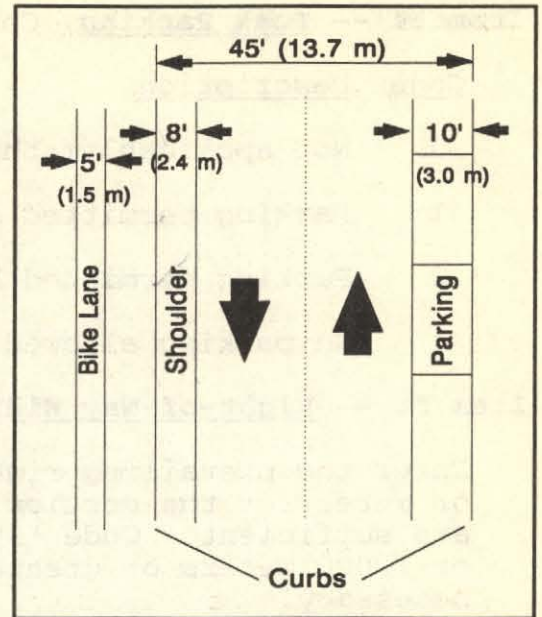


Figure IV-8 - Bike lane not in roadway

Additional information concerning coding of this, and other related data items, is contained on page IV-59.

Item 54 -- Peak Parking (Urban Data Item) (Length = 1)

Enter the appropriate code reflecting the type of peak-hour parking, if any, that exists on the section. If parking prohibitions are routinely ignored, use the "permitted" code(s) to reflect the actual situation rather than the regulations. The facility does not have to be formally signed or striped for parking to use the "permitted" code(s) (i.e., parking is simply available). If parking is actually beyond the shoulder (or beyond the pavement edge where no shoulder exists), use code "3" for no parking.

Additional information concerning coding of this, and other related data items is contained on page IV-59.

Item 54 -- Peak Parking, Cont.

Code Description

- 0 Not applicable; this is a rural section
- 1 Parking permitted one side
- 2 Parking permitted both sides
- 3 No parking allowed or none available

Item 55 -- Right-of-Way Width (Length = 3)

Enter the prevailing right-of-way width to the nearest whole foot or meter for the section. Where data are unavailable, estimates are sufficient. Code "999" where the right-of-way is 1,000 feet or 1,000 meters or greater. Provide leading zeroes where necessary.

This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2).

Item 56 -- Is Widening Feasible? (Length = 1)

Enter the appropriate code to indicate the extent to which it is feasible to widen the existing road. Consider mainly the physical features along the roadway section, such as large buildings, severe terrain, cemeteries and park land, as well as where widening would be cost or environmentally prohibitive. Do not consider restrictions because of current right-of-way width, State practices concerning widening, politics or projected traffic. Single-family residences, barns, private garages, etc. are considered expendable for purposes of this item. Large office buildings, shopping centers and other large enterprises may not be considered expendable.

The code is to represent the lanes that could be added in both directions, e.g. if a lane could be added for each direction of the roadway, then use code "4"; if only some widening could occur (a few feet perhaps), use code "2".

Restriping to narrower lanes, such that an additional lane results on a multilane facility, does not constitute widening feasibility. When coding this item, medians and other areas already within (as well as outside) the right-of-way are considered to be available for widening.

Item 56 -- Is Widening Feasible?, Cont.

<u>Code</u>	<u>Description</u>
1	No widening is feasible
2	Yes, partial lane
3	Yes, one lane
4	Yes, two lanes
5	Yes, three lanes or more

Items 57-58, 60-61 -- Coding Guide for Horizontal and Vertical Alignment**Table IV-4**

Highway Category	Item 57- Horizontal Alignment Adequacy	Item 58- Curves by Class	Item 60- Vertical Alignment Adequacy	Item 61- Grades by Class
Paved -- Rural				
Principal Art.	Code "0"	Required	Code "0"	Required
Minor Arterial	Code "0"	Required	Code "0"	Required
Major Collector	Required	Not Req'd	Required	Not Req'd
Paved -- Urban				
Principal Art.	Code "0"	Required	Code "0"	Required
Minor Arterial	Not Req'd	Not Req'd	Not Req'd	Not Req'd
Collector	Not Req'd	Not Req'd	Not Req'd	Not Req'd

**Item 57 -- Horizontal Alignment Adequacy (Rural Data Item)
(Length = 1)**

This item is required for paved rural major collectors unless Curves by Class (Item 58) is reported for the section. (See Table IV-4.) If Item 58 is not reported for the required systems (paved rural arterials and paved urban principal arterials), this item should be appropriately coded. The following codes will be used:

Item 57 -- Horizontal Alignment Adequacy, Cont.

Code Description

- 0 Item 58 (Curves) is reported (the HPMS calculation software will insert the appropriate code based on the curve data), or this item is not required for the section.
- 1 All curves meet appropriate design standards for the type of roadway. Reduction of curvature would be unnecessary even if reconstruction were required to meet other deficiencies (i.e., capacity, vertical alignment, etc.).
- 2 Although some curves are below appropriate design standards for new construction, all curves can be safely and comfortably negotiated at the prevailing speed limit on the section. The speed limit was not established by the design speed of curves.
- 3 Infrequent curves with design speeds less than the prevailing speed limit on the section. Infrequent curves may have reduced speed limits for safety purposes.
- 4 Several curves uncomfortable and/or unsafe when traveled at the prevailing speed limit on the section, or the speed limit on the section is severely restricted due to the design speed of curves.

Item 58 -- Curves by Class (Length = 91)

This item is required for paved rural arterials (Interstate, other principal arterial and minor arterial) and urban principal arterials (Interstate, other freeways and expressways and other principal arterial), but may be reported for other functional systems if the data are available (see Table IV-4). Zerofill this item when the data are not reported. When this item is not reported for the required rural systems, Horizontal Alignment Adequacy (Item 57) should be coded. Each individual curve segment, including each individual tangent, is to be counted as a separate curve. The segments are summed to obtain the total length.

This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2).

Item 58 -- Curves by Class, Cont.

The following data will be reported (for English units):

Curve Classes by Degree of Curvature	No. of Curves (right-justified)	Record Positions	Length of Curves in Class (implied decimal) (xx.xxx)	Record Positions
a. 0.0-0.4	--	285-286	-----	287-291
b. 0.5-1.4	--	292-293	-----	294-298
c. 1.5-2.4	--	299-300	-----	301-305
d. 2.5-3.4	--	306-307	-----	308-312
e. 3.5-4.4	--	313-314	-----	315-319
f. 4.5-5.4	--	320-321	-----	322-326
g. 5.5-6.9	--	327-328	-----	329-333
h. 7.0-8.4	--	334-335	-----	336-340
i. 8.5-10.9	--	341-342	-----	343-347
j. 11.0-13.9	--	348-349	-----	350-354
k. 14.0-19.4	--	355-356	-----	357-361
l. 19.5-27.9	--	362-363	-----	364-368
m. 28+	--	369-370	-----	371-375

When reporting in Metric units, curve classes are identified by the radius length in meters. They are about equivalent to the English unit degree of curvature classes and are provided below:

a. 3906+	e. 391-505	i. 161-205	m. < 61
b. 1206-3905	f. 321-390	j. 126-160	
c. 716-1205	g. 251-320	k. 91-125	
d. 506- 715	h. 206-250	l. 61- 90	

The format is a 91-position field with 13 classes of curves reported (13 x 7). For each of the 13 curve classes, the numbers of curves (2 positions) and the sum of the class lengths (5 positions, with implied decimal (xx.xxx miles or kilometers)) are reported. The sum of the curve lengths must equal the section length.

Item 59 -- Type of Terrain (Rural Data Item) (Length = 1)

Enter the code for the predominant terrain type through which the section passes.

Code Terrain Type

- 0 Not applicable; this is an urban section
- 1 Flat Terrain -- That condition where highway sight distances, as governed by both horizontal and vertical restrictions, are generally long or could be made to be so without construction difficulty or major expenses.
- 2 Rolling Terrain -- That condition where the natural slopes consistently rise above and fall below the highway grade line and where occasional steep slopes offer some restriction to normal highway horizontal and vertical alignment.
- 3 Mountainous Terrain -- That condition where the longitudinal and transverse changes in the elevation of the ground with respect to the highway are abrupt and where the roadbed requires frequent benching or side hill excavation.

Item 60 -- Vertical Alignment Adequacy (Rural Data Item) (Length = 1)

This item is required for paved rural major collectors unless Grades by Class (Item 61), is reported for the section. (See Table IV-4.) If Item 61 is not reported for the required systems (paved rural arterials and paved urban principal arterials) this item should be appropriately coded. The following codes will be used:

Code Description

- 0 Item 61 (Grades) is reported (the HPMS calculation software will insert an appropriate code based on the grade data), or this item is not required for the section.
- 1 All grades (rate and length) and vertical curves meet minimum design standards appropriate for the terrain. Reduction in rate or length of grade would be unnecessary even if reconstruction were required to meet other deficiencies (i.e., capacity, horizontal alignment, etc.).
- 2 Although some grades (rate and/or length) and vertical curves are below appropriate design standards for new construction, all grades and vertical curves provide sufficient sight distance for safe travel and do not substantially affect the speed of trucks.

Item 60 -- Vertical Alignment Adequacy, Cont.Code Description

- 3 Infrequent grades and vertical curves that impair sight distance and/or affect the speed of trucks (when truck climbing lanes are not provided).
- 4 Frequent grades and vertical curves that impair sight distance and/or severely affect the speed of trucks; truck climbing lanes are not provided.

Item 61 -- Grades by Class (Length = 42)

This item is required for paved rural arterials (Interstate, other principal arterial and minor arterial) and urban principal arterials (Interstate, other freeways and expressways and other principal arterial), but may be reported for other functional systems if the data are available. (See Table IV-4.) Zero-fill this item when it is not reported. When this item is not reported for the required rural systems, Vertical Alignment Adequacy (Item 60) should be coded. Each individual grade segment, including each individual zero (flat) gradient, is to be counted as a separate grade. The segments are summed to obtain the total length.

This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2).

The following data will be reported:

	Grade Classes by Gradient (percent)	No. of Grades (Right- Justified)	Record Positions	Length of Grades in Class (implied decimal) (xx.xxx miles)	Record Positions
a.	0.0-0.4	--	378-379	-----	380-384
b.	0.5-2.4	--	385-386	-----	387-391
c.	2.5-4.4	--	392-393	-----	394-398
d.	4.5-6.4	--	399-400	-----	401-405
e.	6.5-8.4	--	406-407	-----	408-412
f.	8.5 +	--	413-414	-----	415-419

The format is a 42-position field with six classes of grades reported (6 x 7). For each of the six grade classes, the numbers of grades (two positions) and the sum of the grade lengths (five positions, with implied decimal (xx.xxx miles or kilometers)) are reported. The sum of the lengths of grades must equal the section length.

Item 62 -- Percent of Length with Sight Distance of at least 1,500 Feet (460 Meters) (Length = 3)

For all rural, paved two-lane facilities, excluding dense rural sections, enter the percent of the section length (estimated to the nearest 10 percent) which has an available passing sight distance (as measured from the driver's eye to the road surface) of at least 1,500 feet (460 meters). Striping should be used for this measurement where it delineates unsafe passing zones. Contiguous roadway on both ends of the section are to be considered in estimating this item, particularly where the section is very short (i.e., 1500 feet = 0.28 mile). Where there is a discernable directional difference, enter the more restrictive sight distance percentage. See Appendix C for optional estimating procedures. Code "000" for nonapplicable sections including dense rural (Item 77 = 2).

Note that "000" is also a legitimate entry for roadways that are very curved and/or very hilly (i.e., the sight distance is not 1,500 feet (460 meters) for any portion of the section, including the sight distance at the end points of the section, for both directions of a two-way facility).

Sample Traffic/Capacity Data

Item 63 -- Speed Limit (Length = 3)

Enter the daytime speed limit (for automobiles) posted or legally mandated on the greater part of the section. This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2) (in miles per hour or kilometers per hour). Provide leading zeroes as necessary.

Item 64 -- Weighted Design Speed (Rural Data Item) (Length = 3)

This item is required for all paved rural major collectors with rural type of development (Item 77 = 1). Code "000" for all sections for which the weighted design speed is not supplied. Enter the weighted design speed, to the nearest 5 miles per hour (or 5 kilometers per hour), as determined by weighting the design speed of the individual horizontal curves and tangents in the section by the length of each. This item is calculated by the HPMS Submittal Software when Curves by Class (Item 58) are present. When Curves by Class are not provided for the required systems (rural arterials and urban principal arterials), this item must be appropriately coded. A recommended procedure for calculating weighted design speed is contained in Appendix D.

This data item is to be entered according to the reporting units chosen in English or Metric Reporting Units (Item 2) (in miles per hour or kilometers per hour). Supply leading zeroes as necessary.

Item 65A -- Percent Single Unit Trucks (Peak and Average Daily)
(Length = 4)

Enter the percentage of single unit trucks to the nearest whole percent. Single unit trucks include classes 4 through 7 (buses through four- or more axle, single-unit trucks) as identified in Chapter III of this Manual and in Chapter 3 of the TMG.

Certain routes may exhibit significant differences in truck percentages between peak period and average daily operation (i.e., recreational routes), and such differences can have a significant bearing on the calculation of capacity. In those cases where the State determines that such peak period operations have a significant bearing on capacity calculations, separate peak usage values are to be reported even if they must be estimated. In those situations where such differences are known not to exist, the same percentage should be reported for both peak and average daily.

The vehicle classification data reported for each sample section should be representative of the truck activity over all days of the week and seasons of the year. "Peak" and "Average Daily" refer to the total traffic peak and AADT, not just for truck traffic.

65A1 -- Percent Peak Single Unit Trucks (Length = 2)**65A2 -- Percent Average Daily Single Unit Trucks** (Length = 2)**Item 65B -- Percent Combination Trucks** (Peak and Average Daily)
(Length = 4)

Enter the percentage of combination trucks to the nearest whole percent. Combination trucks include classes 8 through 13 (four- or less axle, single-trailer trucks through seven- or more axle, multi-trailer trucks) as identified in Chapter III of this Manual and in Chapter 3 of the TMG.

Certain routes may exhibit significant differences in truck percentages between peak period and average daily operation (i.e., recreational routes), and such differences can have a significant bearing on the calculation of capacity. In those cases where the State determines that such peak operations have a significant bearing on capacity calculations, separate peak usage values are to be reported even if they must be estimated. In those situations where such differences are known not to exist, the same percentage should be reported for both peak and average daily.

Item 65B -- Percent Combination Trucks, Cont.

The vehicle classification data reported for each sample section should be representative of the truck activity over all days of the week and seasons of the year. "Peak" and "Average Daily" refer to the total traffic peak and AADT, not just for truck traffic.

65B1 -- Percent Peak Combination Trucks (Length = 2)

65B2 -- Percent Average Daily Combination Trucks (Length = 2)

Item 66 -- K-Factor (Length = 2)

Enter the K-factor -- the design hour volume (30th highest hour) as a percentage of the annual average daily traffic, to the nearest percent. Provide a leading zero, where necessary. These factors shall be locally derived and not simply assigned by area type or functional system. Except under extreme conditions, this factor ranges from 06 to 18.

Item 67 -- Directional Factor (Length = 3)

Enter the percentage of the design hour volume (30th highest hour) flowing in the peak direction, to the nearest 5 percent. Code "100" for one-way facilities. Provide a leading zero, where necessary. These factors shall be locally derived and not simply assigned by area type or functional system. Except under extreme conditions (and for one-way facilities), this factor normally ranges from 050 to 075.

Item 68 -- Peak Capacity (Length = 5)

Urban Areas, Required

Enter the present hourly capacity (in one direction) reflecting the peak-period situation, taking into consideration the peak-period parking regulations, signalization, local bus movements, etc. The procedures described in the 1985 "Highway Capacity Manual" (HCM), as updated, must be used for these calculations. For purposes of this data element, a service flow consistent with Level of Service "E" as defined in the 1985 HCM, as updated, should be calculated.

Item 68 -- Peak Capacity, Cont.

Often, urban street capacity is governed by a critical intersection in the section under study. When this is the case, code the capacity for the critical intersection on the section, since the intersection will control the capacity on the section. Otherwise, code the capacity of a typical intersection on the section. Where detailed information is not known, reasonable assumptions will necessarily have to be made regarding percent right and left turns and other information in order to calculate the section capacity.

Rural, Optional

Enter the present hourly capacity (total of both directions for two-lane facilities and for one direction on multilane facilities). Capacity is the maximum service flow at Level of Service "E", as described in the 1985 HCM, as updated. The procedures described in the HCM should be used for this calculation; however, the rural capacity is normally calculated by the HPMS Submittal Software (see Chapter VII)

In built-up areas of small towns (population less than 5,000), it may be more reasonable to calculate capacity using the procedures described in the HCM for urban areas, but the capacity should still be reported as a total of both directions for two-lane facilities and for one direction on multi-lane facilities. It is requested that a capacity for dense rural sections be coded as it is very difficult to calculate a reasonable value based on the data reported. When providing rural capacity values, the values should not be entered until all other calculations (via the HPMS Submittal Software) are completed. Otherwise, the software will replace the capacity values when the calculation software executes.

The procedures used by the HPMS Submittal Software to calculate rural capacity are given in Appendix I.

Item 69 -- Volume/Service Flow Ratio (V/SF)
(Length = 3 -- x.xx -- implied decimal)

This field is generated by the HPMS Submittal Software from data within the HPMS record. Appendix L contains the formulas.

Item 70 -- Turning Lanes (Urban Data Item) (Length = 2)

Enter the code (one each for left and right) that best describes the peak-period turning lane situation for a typical intersection on the section. Where Peak Capacity (Item 68) has been entered for a particular (critical) intersection on the section, code the turning lanes at that intersection; otherwise code for a typical intersection on the section.

Item 70 -- Turning Lanes, Cont.

Include turning lanes/bays that are located at commercial entrances (shopping centers, industrial centers, etc.). A continuous turning lane that contains painted bays for directing traffic turns is still considered to be a continuous turning lane. A through lane that contains painted arrows to indicate an exclusive turning lane at intersections is to be coded as a turning lane (see Figure IV-10). If through movements (crossing an intersection) may be made from a lane (where, for example, arrows painted on the pavement indicate both left and through movements), it is not to be considered a turning lane for the purposes of this data item.

Ignore short turning bays that cannot handle the turning traffic to the extent that the turning traffic continually blocks the adjacent through lane.

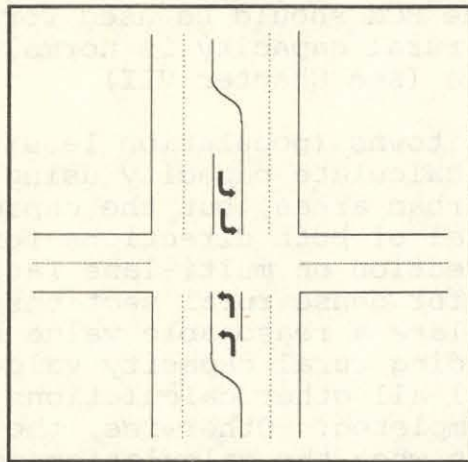


Figure IV-9 - Left Turn Bays

70A -- LEFT Turning Lanes/Bays (Length = 1)

<u>Code</u>	<u>Description</u>
0	Not applicable; this is a rural section or <u>no</u> intersections exist on the section
1	Multiple left turning lanes/bays exist (includes a continuous left turning lane that becomes multiple left turn bays just prior to the intersection). Through movements are prohibited in these lanes. Multiple turning lanes/bays allow for simultaneous turns from all turning lanes to take place.
2	A continuous left turning lane exists from intersection to intersection. Through movements are prohibited in this lane.

70A -- LEFT Turning Lanes/Bays, Cont.Code Description

- 3 A single left turning lane/bay exists.
- 4 No left turning lanes/bays exist (intersections do exist).
- 5 No left turns are permitted during the peak period.

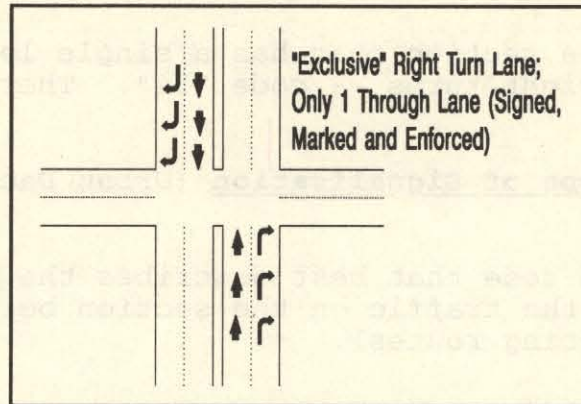


Figure IV-10 - Exclusive Right Turn Lane

70B -- RIGHT Turning Lanes/Bays (Length = 1)Code Description

- 0 Not applicable; this is a rural section or no intersections exist on the section
- 1 Multiple right turning lanes/bays exist (includes a continuous right turning lane that becomes multiple right turn bays just prior to the intersection). Through movements are prohibited in these lanes. Multiple turning lanes/bays allow for simultaneous turns from all turning lanes to take place.
- 2 A continuous right turning lane exists from intersection to intersection. Through movements are prohibited in this lane.
- 3 A single right turning lane/bay exists.
- 4 No right turning lanes/bays exist (intersections do exist).
- 5 No right turns are permitted during the peak period.

Item 70 -- Turning Lanes, Cont.

Examples:

Figure IV-10 contains what appears to be four through lanes, but one in each direction becomes an exclusive right turn lane as the intersection is approached. The correct code would be "43". Note that the number of through lanes is two for the section, since the exclusive turn lanes eliminate the other two lanes for through movement.

Figure IV-9 contains a section that has a single left turn bay, and nothing for the right turns -- code "34". There are four through lanes.

**Item 71 -- Prevailing Type of Signalization (Urban Data Item)
(Length = 1)**

Enter the appropriate code that best describes the predominant signal system facing the traffic on the section being inventoried (not for the intersecting routes).

Code Description

- 0 Not applicable; this is a rural section
- 1 Uncoordinated Fixed Time (includes pre-programmed changes for peak or other time periods)
- 2 Traffic Actuated
- 3 Progressive (coordinated signals through several intersections)
- 4 No signal systems exist

**Item 72 -- Typical Peak Percent Green Time (Urban Data Item)
(Length = 2)**

Enter the typical percent green time in effect during peak hours at the signalized intersections facing the traffic for the section being inventoried (not for the intersecting routes). Enter "00" if no signalized intersections exist or if this is a rural section. Where signals are traffic actuated, code an estimated average green time during peak hours. Ignore green-arrow time for turning movements -- this item is intended to obtain through movement green time.

Item 73 -- Future AADT (Length = 6)

Enter the forecasted AADT for both directions, for the appropriate year entered in Year of Future AADT (Item 74). This cannot be for less than 17 years nor for more than 22 years. The intent is to obtain a 20-year forecast, but it may be for some other period of time that is within the noted timespan. For example, the future AADT may be for any of the years 2010 to 2015 for the 1993 data year to be reported in 1994. This item may be updated anytime, but must be updated when the forecast falls below the 17-year limit.

The use of a repeatable procedure (computer models, etc.), and/or data from MPOs and other such sources are highly recommended for obtaining the future AADT. The intent is to obtain reliable estimates on a locally derived basis, rather than statewide estimates for whole functional systems. The value entered here should reflect any planned, unbuilt facilities in the traffic corridor (i.e., that will affect the sample section future AADT) to be built in the reasonably near future (up to 6 years).

Item 74 -- Year of Future AADT (Length = 2)

Enter the last two digits of the year for which Future AADT (Item 73) has been forecasted. This cannot be for less than 17 years nor more than 22 years from the data year. For example, a 21-year forecast reported for the 1993 data year would be coded "14" (for the year 2014).

Sample Environment Data**Item 75 -- General Climate Zone** (Length = 2)

This code is entered by the HPMS Submittal Software (see Chapter VII) from county/climate zone equivalency tables. It should be checked by the State and may be changed if found not to be representative of the area in question. Once corrected, there should be no further need for change except under extraordinary situations. Note that if the county code is changed using the update software, the climate zone will be updated, if necessary, by the HPMS Submittal Software. If county codes are updated via a State procedure, the climate zone should be updated via the HPMS Submittal Software. The definitions for the 9 possible climate zones are contained in Appendix R.

Item 76 -- Drainage Adequacy (Length = 1)

Enter the code for the drainage adequacy of the section. Adequacy is based on the height of the grade line, the design of the cross section, and the capability of the cross drains, both in condition and capacity, to maintain a well-drained surface on a stable subgrade.

Code Rating

- 1 Good -- A fully adequate drainage and cross section design exists. There is no evidence of flooding, erosion, ponding, or other water damage.
- 2 Fair -- The height of grade line, cross section, or culvert capacity are somewhat below the standard for the type of roadway that would comply with standards if rebuilt. Drainage structures are structurally sound. Some added maintenance effort is required due to drainage and sedimentation problems.
- 3 Poor -- Evidence of severe flooding, ponding, erosion, or other drainage problems exists. Drainage structures may be in poor condition. Considerable excess maintenance effort is required due to drainage and sedimentation problems.

Item 77 -- Type of Development (Rural Data Item) (Length = 1)

Enter the code for the predominant type of development.

Code Description

- 0 Not applicable; this is an urban section.
- 1 Rural -- Includes all areas outside of the adjusted urban boundaries (places of 5,000 or more population), excluding those described as "dense".
- 2 Dense -- Includes those areas that have urban characteristics but are outside of the adjusted urban boundaries (i.e., small towns), or those areas in which major recreational facilities, such as parks, ski resorts, scenic overlooks, rest areas, etc., have significant impact on traffic operation of the adjacent facility.

GENERAL GUIDELINES for reporting the data items that contain counts:

Number of Grade Separated Interchanges (Item 78)
Number of At-Grade Intersections with Public Roads (Item 79)
Number of At-Grade Railroad Crossings (Item 80)

All of the above data items must be treated such that they are not overcounted. Special treatment is required when a sample section begins and/or ends with a counted data item. This is accomplished by doing the following:

- Choose a statewide direction for inventory (South to North, West to East, etc.)
- Choose a statewide rule to always count the beginning only or the ending only, but **never both**
- Count and report, accordingly

In the upper portion of Figure IV-11, the intersection count would always be two regardless of the inventory direction or the beginning/ending only rule. There may be differences in other data items, however, since items such as green time, turning lanes, etc. would depend on what rule the State is using. For example, if the State always counts the beginning only, the ending intersection would be ignored for all data items affected by intersections.

The lower portion of Figure IV-11 bases the count of two on the assumptions that the inventory direction is bottom to top and that the beginning only rule is being followed. If the inventory direction remains as bottom to top, but the State rule is to count ending only, the count for this example would only be one.

If neither end of a sample section contains a counted data item, there is no special treatment. Simply count and report all that exist within the section endpoints.

Item 78 -- Number of Grade-Separated Interchanges (Length = 2)

For all freeway and expressway facilities by design, enter the number of grade-separated interchanges. See the GENERAL GUIDELINES on page IV-79 for the inventory direction and begin/end rules required to properly report this data item. Enter "00" if none exist or if the facility being inventoried is not a freeway or an expressway.

An expressway is defined as a divided highway for through traffic with full or partial access control and including grade separations at all or most major intersections. A freeway is defined as an expressway with full control of access.

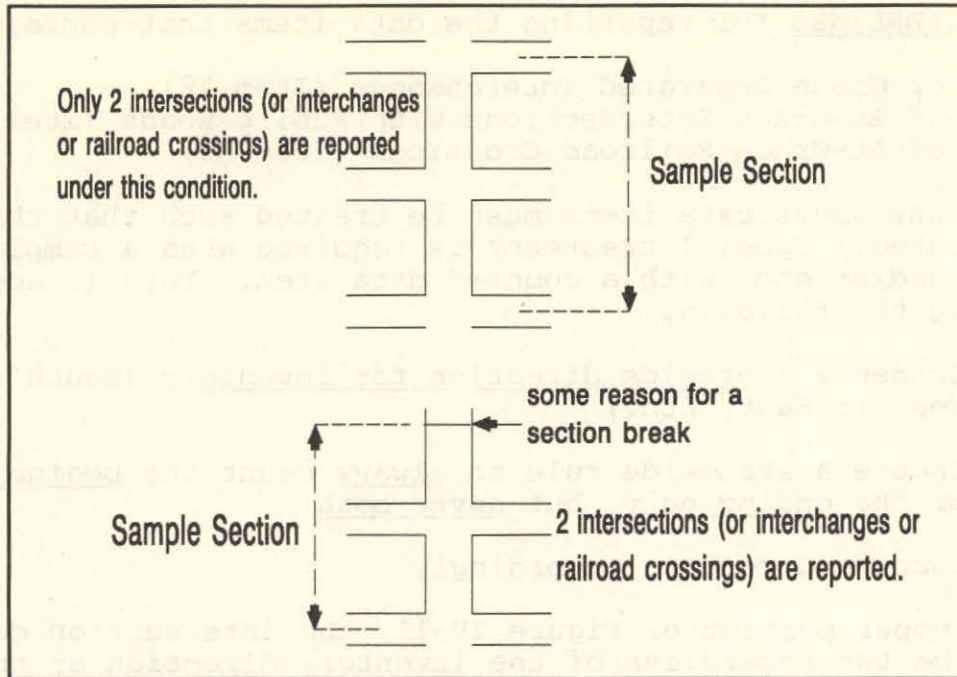


Figure IV-11 - Count Items

Item 79 -- Number of At-Grade Intersections with Public Roads
(Length = 6)

This data item pertains to the type of traffic controls on the route being inventoried and not those of the intersecting route. It consists of three elements. Only those controls facing (controlling) the route being inventoried are counted. See the GENERAL GUIDELINES on page IV-79 for the inventory direction and begin/end rules required to properly report this data item. Controls at shopping centers, industrial parks and other large traffic generating enterprises, should be included.

79a -- Signals -- Enter the number of intersections with a signal controlling the route being inventoried. A signal that cycles through red, yellow, and green for all or a portion of the day shall be counted as a signalized intersection. If none, enter "00". (Length = 2)

79b -- Stop Signs -- Enter the number of intersections with a stop sign controlling the route being inventoried. A continuously-operating, flashing red signal shall be counted as a stop sign control. If none, enter "00". (Length = 2)

Item 79 -- Number of At-Grade Intersections with Public Roads, Cont.

79c -- Other or No Controls -- Enter the number of intersections where the route being inventoried is not controlled by either a signal or a stop sign -- or is controlled by other types of signing or has no controls. A continuously-operating, flashing yellow signal shall be considered as "other or no control". If none, enter "00". (Length = 2)

Item 80 -- Number of At-Grade Railroad Crossings (Length = 2)

Enter the number of at-grade railroad crossings on the section. Supply a leading zero where necessary. Multiple tracks should be reported as a single crossing. Exclude crossings on abandoned railroads.

See the GENERAL GUIDELINES on page IV-79 for the inventory direction and begin/end rules required to properly report this data item. Code "00" if no at-grade railroad crossings exist.

- - - - -

Supplemental Data

NOTE: The following data items are to be reported for all applicable PAS data records, both universe and standard sample. The data are to be reported only if HOV facilities and/or Surveillance Systems exist on the applicable system sections.

If this is an applicable standard sample section, these data will immediately follow the Number of At-Grade Railroad Crossings (Item 80); if this is an applicable universe section, these data will immediately follow the Record Type Code (Item 38).

Item 81 -- HOV Operations (Length = 58; 26 separate fields of varying lengths)

This data item consists of 26 separate subitems that are **required to be coded if one or more of the described HOV facilities exist on a PAS universe or PAS standard sample section.** Report this data item only if HOV operations exist on the roadway.

Provide the appropriate code or value as denoted for each subitem to describe the HOV facility. Facilities that allow use of the highway right-of-way (ROW) for at or above ground rail transit shall be reported whether or not the facility contains roadway HOV facilities. Subitems 81E, 81S and 81W pertain to rail transit operation within the highway ROW. These data shall include all rapid, light and commuter rail facilities; exclude major intercity rail, such as AMTRAK, unless it obviously serves commuters.

The peak periods generally span a three hour period during both the AM and the PM. Please provide information in the correspondence regarding the peak period used for coding this data item if it does not reflect a three hour period.

Sub-
Item

Description

Allowable use by Type of Vehicle (Length = 5; five fields, each with a length of 1)

	<u>NO</u>	<u>YES</u>	
81A	0	1	Cars, pickup trucks and vans
81B	0	1	Large trucks (over 2 axle)
81C	0	1	Buses
81D	0	1	Motorcycles
81E	0	1	Rail Transit within (on or above) the Highway ROW

81F Minimum vehicle occupancy requirements (total persons) (except motorcycles) (Length = 1)

<u>Code</u>	<u>Description</u>
0	Nonapplicable
1	2 persons or more
2	3 persons or more
3	4 persons or more
4	Buses, only

Item 81 -- HOV Operations, Cont.81G Highway facilities used by HOV vehicles (Length = 1)

<u>Code</u>	<u>Description</u>
0	Nonapplicable
1	Exclusive HOV lane(s) or roadway (not reversible)
2	Exclusive HOV lane(s) or roadway (reversible)
3	Normal through lane that is signed for exclusive HOV use in specified time periods (concurrent flow, same direction as other traffic)
4	Normal through lane that is signed for exclusive HOV use in specified time periods (contra flow, opposite direction to other traffic)
5	Shoulder used during specified period by HOV
6	Shoulder used during specified period by general traffic
7	All through lanes used by HOV vehicles during specified periods
8	Other; describe in submittal correspondence

81H Delineation/Separation of HOV Lane(s) (Length = 1)

<u>Code</u>	<u>Description</u>
0	Nonapplicable
1	Permanent, fixed, positive barrier, or separate roadway
2	Movable positive barrier
3	Marked diamond lane(s), with or without drop traffic cones, pylons, painted buffer, or other "soft," temporary separation

Number of lanes used in HOV operations (Length = 4; four fields, each with a length of 1)

81I Code the number of lanes (including shoulders if applicable) used by HOV vehicles in the AM peak period. Code zero for nonapplicable section records.

81J Code the number of lanes (including shoulders if applicable) used by the general traffic in the AM peak period. Code zero for nonapplicable section records. Code "9" if the number of lanes is greater than 9, but provide a caution in the correspondence.

Item 81 -- HOV Operations, Cont.

- 81K Code the number of lanes (including shoulders if applicable) used by HOV vehicles in the PM peak period. Code zero for nonapplicable section records.
- 81L Code the number of lanes (including shoulders if applicable) used by the general traffic in the PM peak period. Code zero for nonapplicable section records. Code "9" if the number of lanes is greater than 9, but provide a caution in the correspondence.

Hours of HOV operation (Length = 6; three fields, each with a length of 2)

- 81M Code the number of hours that the HOV facilities are in operation during the AM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable section records.
- 81N Code the number of hours that the HOV facilities are in operation during the PM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable section records.
- 81O Code the total number of hours that the HOV facilities are in operation during the day for both directions. Supply leading zeroes, as necessary. Code zero for nonapplicable section records.

Traffic Volumes for the AM Peak Period Operations (Length = 16; two fields of 5 followed by two fields of 3)

- 81P Code the volume of cars, pickup trucks, vans and motorcycles using the HOV lanes/shoulders during the AM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 5)
- 81Q Code the volume of traffic using the general purpose lanes/shoulders during the AM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 5)
- 81R Code the volume of buses using the HOV lanes/shoulders during the AM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 3)
- 81S Code the number of commuter rail transit cars that use the highway facility right of way during the AM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 3)

Item 81 -- HOV Operations, Cont.

Traffic Volumes for the PM Peak Period Operations (Length = 16; two fields of 5 followed by two fields of 3)

- 81T Code the volume of cars, pickup trucks, vans and motorcycles using the HOV lanes/shoulders during the PM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 5)
- 81U Code the volume of traffic using the general purpose lanes/shoulders during the PM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 5)
- 81V Code the volume of buses using the HOV lanes/shoulders during the PM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 3)
- 81W Code the number of commuter rail transit cars that use the highway facility right of way during the PM peak period. Supply leading zeroes, as necessary. Code zero for nonapplicable facilities. (Length = 3)
- 81X **Total Traffic Volume for a typical, non holiday weekday**
(Length = 6)

Enter the total traffic volume for all traffic and all lanes for a typical, non holiday, 24 hour period of a weekday. This value is to include HOV volumes in addition to the traffic using the general purpose lanes/shoulders. Provide leading zeroes as necessary. Code zero for nonapplicable facilities.

HOV Enforcement Areas (Length = 2; two fields, each with a length of 1)

- | | <u>NO</u> | <u>YES</u> | |
|-----|-----------|------------|--|
| 81Y | 0 | 1 | Continuous shoulders are available for enforcement pull off. |
| 81Z | 0 | 1 | Special pull off areas are available for enforcement in addition to or instead of shoulders. |

Item 82 -- Highway Surveillance Systems (Length = 7; seven separate fields, each with a length of 1)

This data item consists of seven separate subitems that are **required to be coded only if one or more of the described surveillance systems exist on a PAS universe or PAS standard sample section.** Report this data item only if Surveillance Systems exist on the roadway. If the surveillance system affects the operation of the roadway, code this data item, even if the surveillance system does not actually exist on the section (i.e., variable message signs may be mounted every few miles, but the whole roadway is affected from the first such sign to the last -- all sections in between should contain the "yes" code).

Provide the appropriate code for "yes" or "no" to describe the surveillance system(s) being used on the applicable facility.

Sub-
Item

Description

	<u>NO</u>	<u>YES</u>	
82A	0	1	Manned Central Control Center that collects/receives data and information via cameras, detectors (lane counts and speed), etc. in real-time and relays the information to motorists using the facilities and/or police, emergency and other such vehicles.
82B	0	1	Ramp metering.
82C	0	1	Ramp metering with bypass lane(s) for certain (permissible) vehicles.
82D	0	1	Variable message signs to advise motorists of hazards, incidents and/or congestion ahead, route diversion, etc.
82E	0	1	Restricted visibility (fog, dust, etc.) and/or ice/snow detection system.
82F	0	1	Exclusive fixed frequency radio traffic condition reports (AM or FM) to alert motorists of roadway conditions, incidents, possible route diversions, etc.
82G	0	1	Other systems (Intelligent Vehicle Highway Systems (IVHS) operations, etc.). Describe in submittal correspondence.

C H A P T E R V**LINEAR REFERENCING SYSTEM REQUIREMENTS**

This chapter contains the requirements for reporting the HPMS linear referencing system (LRS) components needed to mount the LRS on the National Highway Planning Network (NHPN) for GIS processing. The GIS will advance the HPMS state-of-the-art and will enable FHWA, the States, and others to analyze HPMS data for rural arterials, urban principal arterials, and other NHS roadways within a spatial context. The ability to integrate data through GIS will result in enhanced analysis and presentation of the HPMS data nationwide, by State and by other subdivisions. Introducing this spatial component facilitates greater versatility of the HPMS in its application and integration with other databases, and enables the HPMS to meet the increasing demands placed on it as a transportation analytical and management tool. The HPMS GIS is therefore, an important step to increasing the effectiveness of the HPMS as an information system.

The GIS can be defined simply as a way by which State highway networks (spatial data) and their attributes can be presented and analyzed. In this context, the network represents highway geometry, and the HPMS data are among its attributes. The NHPN is the database that contains the geographic or spatial locations of the Nation's highways. The NHPN, developed in a separate 1993 effort sponsored by FHWA, is a digital database representing rural arterials and urban principal arterials. The NHPN was developed based on 1:100,000 digital line graphs from the U.S. Geological Survey augmented by State-supplied functional classification information. Some attribute data are available with the NHPN; however, this information is sparse and insufficient for many desired applications. In order to take full advantage of the potential uses that GIS offers, the NHPN must be enhanced through the addition of attributes from various national transportation databases, primarily the HPMS. To display HPMS attributes accurately on the network requires a tie or relationship between the HPMS and the network. Through this tie, any point along the network will represent its corresponding location on the ground. The tie is the LRS used by the States to record and reference their own inventory data.

After the LRS has been added to the NHPN, this enhanced network (either in its entirety or by State or portion thereof) will be available to the States and others for use in their GIS activities. The NHPN will serve as a national framework for information exchange and will be provided to the U.S. Geological Survey, the Bureau of the Census, the IVHS community, and the Bureau of Transportation Statistics to represent the higher order highways.

When trying to link any two data files, common information must exist between them. This is the same when linking the HPMS to the NHPN. The common fields used to link HPMS to this network are: county, inventory route number, inventory subroute number, and milepoint/kilometerpoint (MPT/KMPT). These data are necessary in order to get a one-to-one correspondence between the two data sets.

The combination of these data for each HPMS record (HPMS section) produces a unique location on the network. Anything less than this could result in the record appearing in the wrong location or more than once on the network. County, inventory route, and inventory subroute numbers are used to identify a particular portion of a route. The MPTs/KMPTs are used to find a specific location along a route. The general concept for an LRS is that it starts at the beginning of the route and accumulates measured distance, in MPTs/KMPTs, until it reaches the end of the route. Typically however, States modify this general concept to meet their particular needs. Whether a State uses an A-Node, B-Node reference point, or some other system, all roadway features can usually be related back to distance values along a route. Within the HPMS data set, each section record (see discussion below for specific requirements) will have a beginning and ending MPT/KMPT that represents the location of the section along the route. Therefore, placement of HPMS data on the network is in essence a two-step process: (1) select an HPMS data record and identify the corresponding county, inventory route/subroute on the network, and (2) locate the position of the HPMS data record along the inventory route/subroute by its beginning and ending MPT/KMPT.

The process of establishing an LRS for HPMS is a major undertaking. The majority of the work, however, is in the initial effort to provide the information necessary to mount the LRS on the NHPN and to incorporate these data into the HPMS records. The maintenance of the LRS information, in the absence of major State LRS revisions, will require much less effort. The instructions in this chapter were written to accommodate, to the maximum extent possible, existing State LRSs in order to ensure long range State support of the LRS and a continuing tie between HPMS and State data bases.

All of the figures in this chapter contain English units. Metric units may be substituted. Both unit systems are not shown because of the detail involved.

DEFINING AN HPMS LINEAR REFERENCING SYSTEM

General LRS Rules

The following general rules must be followed when establishing the LRS:

- All rural and urban principal arterial, rural minor arterial, and other NHS routes need to have an inventory route number. Existing SHA inventory routes should be used to maximize the relationship between the State and HPMS databases. These routes will consist of both existing and planned, unbuilt facilities (see Item 15 in Chapter IV).

- An LRS will be defined for each of the inventory routes identified above.
- Since only one LRS is to be reported for each inventory route, independently aligned roadways (divided highways) are treated as one highway with one MPT/KMPT system.
- Two or more inventory routes may not be assigned to a given highway link (a stretch of roadway between any two corresponding nodes). For HPMS reporting purposes, one inventory route must be chosen to represent the link and the remaining inventory routes must be ended and restarted where they diverge from the chosen inventory route.
- Ramps and collector/distributors are considered to be part of the mainline system and do not have separate LRSSs. Frontage roads belong to functional systems of their own and are to be treated as separate roadways.
- The LRS is to be reported in link-node format. Two options are provided for reporting the required data. Details are discussed later in this chapter.

Incorporating a Linear Referencing System

The LRS to be used for HPMS is a conventional MPT/KMPT. The MPT/KMPT represents the distance in miles/kilometers along the route from a set reference point to the beginning of a link. The reference point can be a State boundary, county boundary, or the beginning point of a route. This distance may be modified by physical route breaks and MPT/KMPT equations that compensate for gaps and duplications in the MPT/KMPT scheme.

Nearly all existing MPT/KMPT systems should be adaptable to the format used in HPMS. Flexibility has been designed into the HPMS LRS concept to accommodate existing LRSSs.

Inventory Routes with Duplicate MPTs/KMPTs -- Under certain conditions, duplicate MPTs/KMPTs can occur along a route. These conditions can occur when the route encounters certain types of equations, route breaks, or county lines. Inventory subroutes must be used to properly identify highway links with duplicate MPTs/KMPTs. This will ensure the proper location of the HPMS sections (or other attribute data) along these lengths of roadway with duplicate MPTs/KMPTs. An inventory route's subroute numbers and MPTs/KMPTs must not be duplicated within any one county. Finally, inventory subroutes along a route do not have to be in order.

Equations--Points along a route where discontinuities in MPTs/KMPTs occur (usually caused by construction) are remedied through the establishment of an equation. Some equations will create two lengths of roadway with duplicate ranges of MPTs/KMPTs, i.e., the BACK MPT/KMPT is larger than the AHEAD MPT/KMPT. In such instances, a subroute number must be used to distinguish between duplicate milepoints.

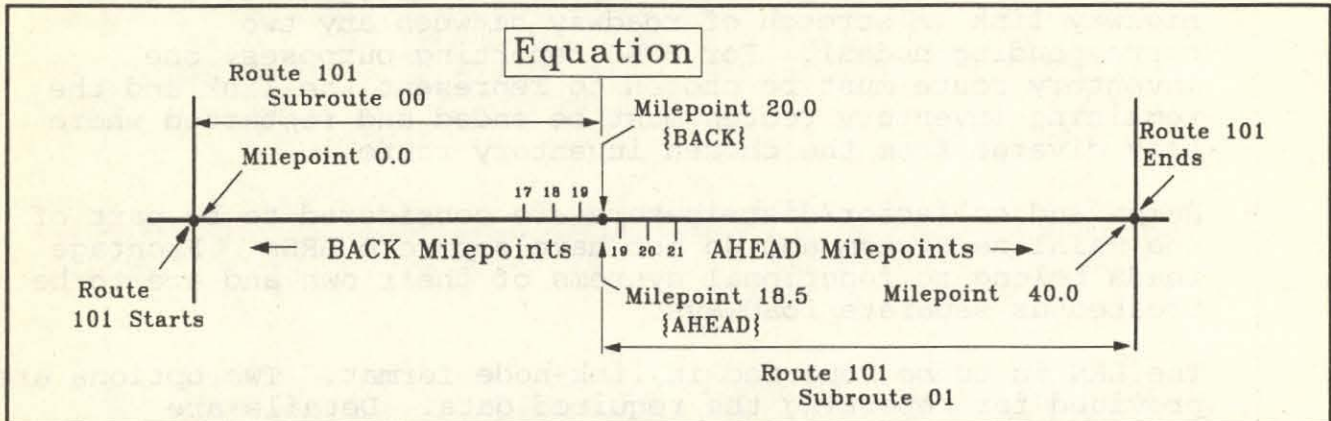


Figure V-1 - Duplicate Milepoint Equation

For example, on inventory route 101, an equation of BACK 20.00 = AHEAD 18.50 creates two 1.50 mile lengths of road with the range of milepoints from 18.50 to 20.00. The route starts at 0.00 milepoint and goes to BACK 20.00 where the mileage is adjusted to AHEAD 18.50, and goes to the end at milepoint 40.00. This route needs to be divided into two subroutes to distinguish between the duplicate milepoints. Subroute number 00 starts at 0.00 milepoint and goes to BACK 20.00. Subroute number 01 starts at AHEAD 18.50 milepoint and goes forward to milepoint 40.00 as illustrated in Figure V-1. The subroute number is continued until either another occurrence of duplicate MPTs/KMPTs (another equation, a route break, or a county boundary) is encountered or the end of the route is reached. For example, if another equation, (like the one mentioned above) is encountered, then the subroute number is incremented to 02, etc.

County Reentries and Route Breaks: When a route reenters a county or a route break occurs, and duplicate MPTs/KMPTs occur, inventory subroutes must be used to properly identify highway links. For example, in Figure V-2, inventory route 101 reenters counties 001 and 002 with the entry MPT/KMPTs equal to the exit milepoints, requiring the subroute numbers to be incremented to maintain uniqueness within the counties.

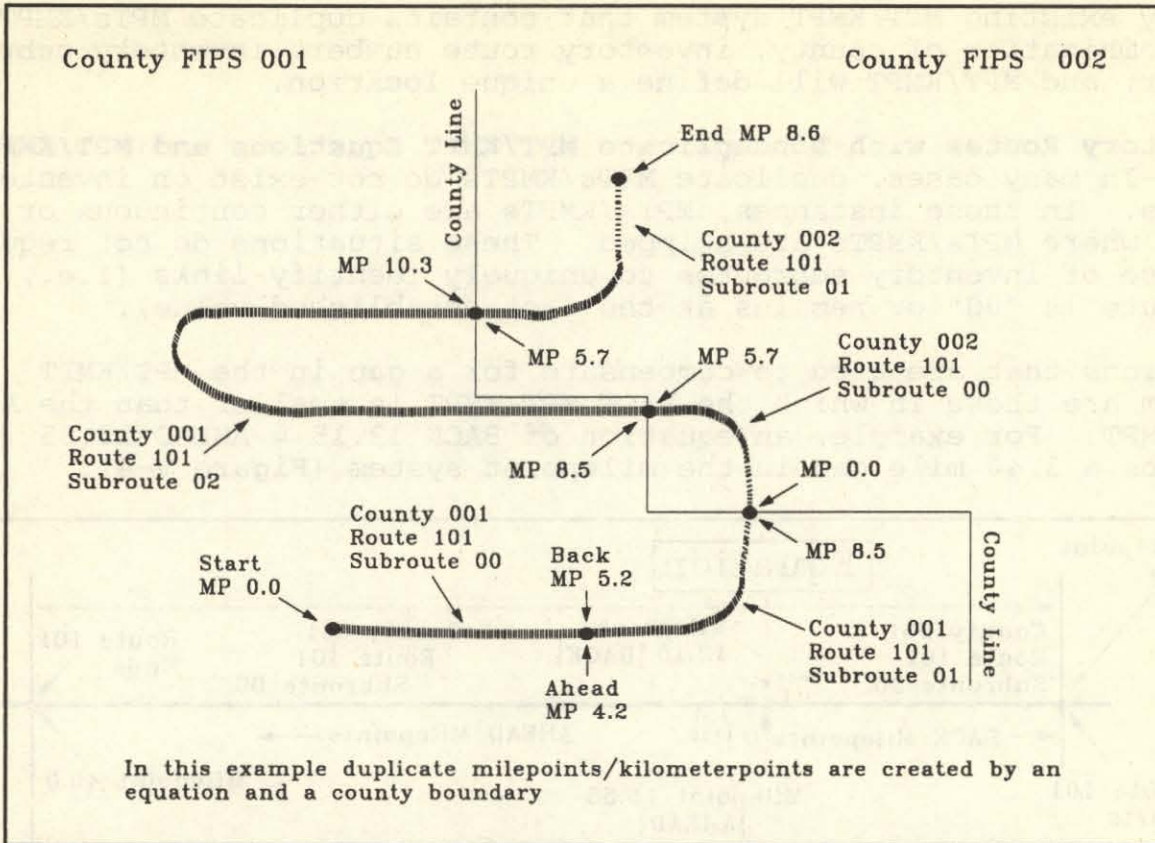


Figure V-2 - Re-entering a county; equation created

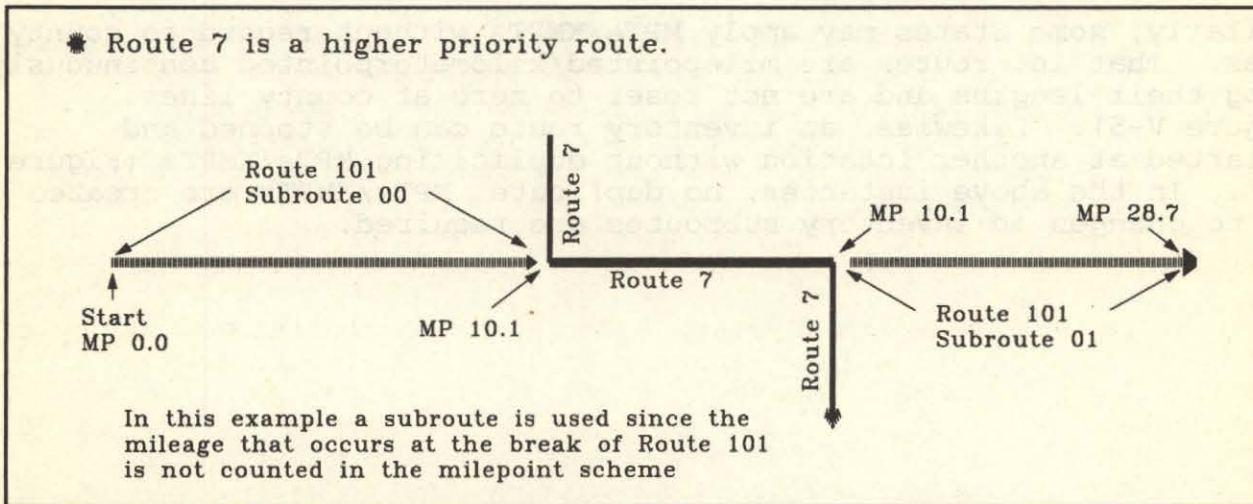


Figure V-3 - Route stops and restarts at a different location; milepoint stays the same

In Figure V-3, the length of a discontinuity in inventory route 101 is ignored in establishing the beginning MPT/KMPT, and the inventory subroute must be incremented to recognize the duplicate MPTs/KMPTs.

In any existing MPT/KMPT system that contains duplicate MPTs/KMPTs, the combination of county, inventory route number, inventory subroute number, and MPT/KMPT will define a unique location.

Inventory Routes with Nonduplicate MPT/KMPT Equations and MPT/KMPT Gaps--In many cases, duplicate MPTs/KMPTs do not exist on inventory routes. In these instances, MPTs/KMPTs are either continuous or gaps occur where MPTs/KMPTs are skipped. These situations do not require the use of inventory subroutes to uniquely identify links (i.e., the subroute is "00" or remains at the last established value).

Equations that are used to compensate for a gap in the MPT/KMPT system are those in which the BACK MPT/KMPT is smaller than the AHEAD MPT/KMPT. For example, an equation of BACK 12.15 = AHEAD 15.55 creates a 3.40 mile gap in the milepoint system (Figure V-4).

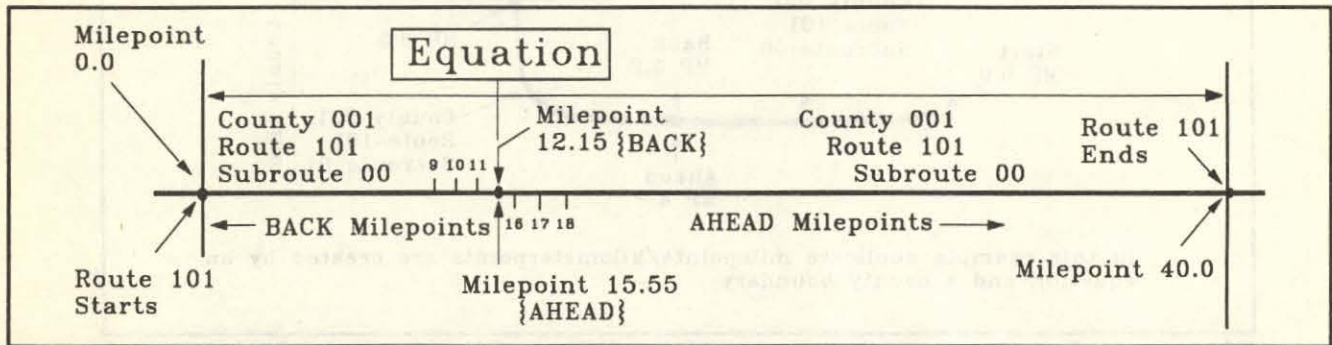


Figure V-4 - Nonduplicate milepoint equation

Similarly, some States may apply MPTs/KMPTs without regard to county lines. That is, routes are milepointed/kilometerpointed continuously along their lengths and are not reset to zero at county lines (Figure V-5). Likewise, an inventory route can be stopped and restarted at another location without duplicating MPTs/KMPTs (Figure V-6). In the above instances, no duplicate MPTs/KMPTs are created and no changes in inventory subroutes are required.

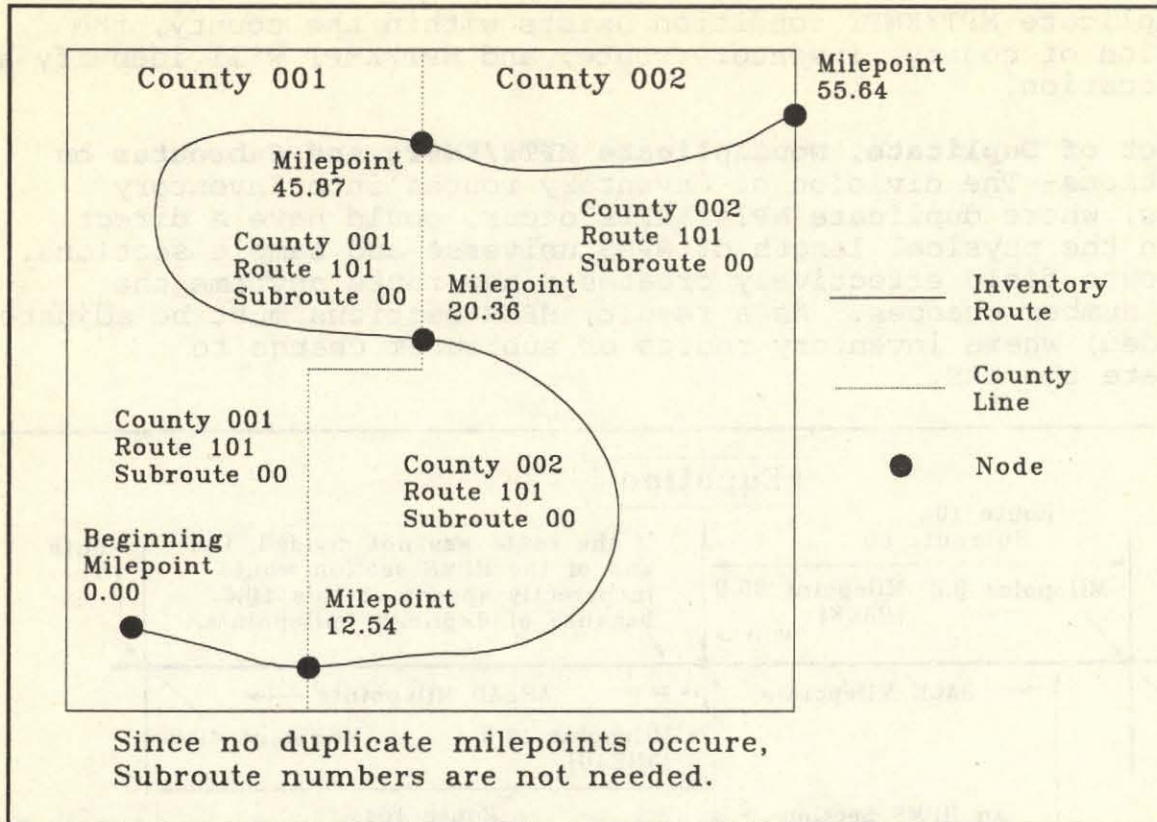


Figure V-5 - Re-entering a county; no duplicate milepoints

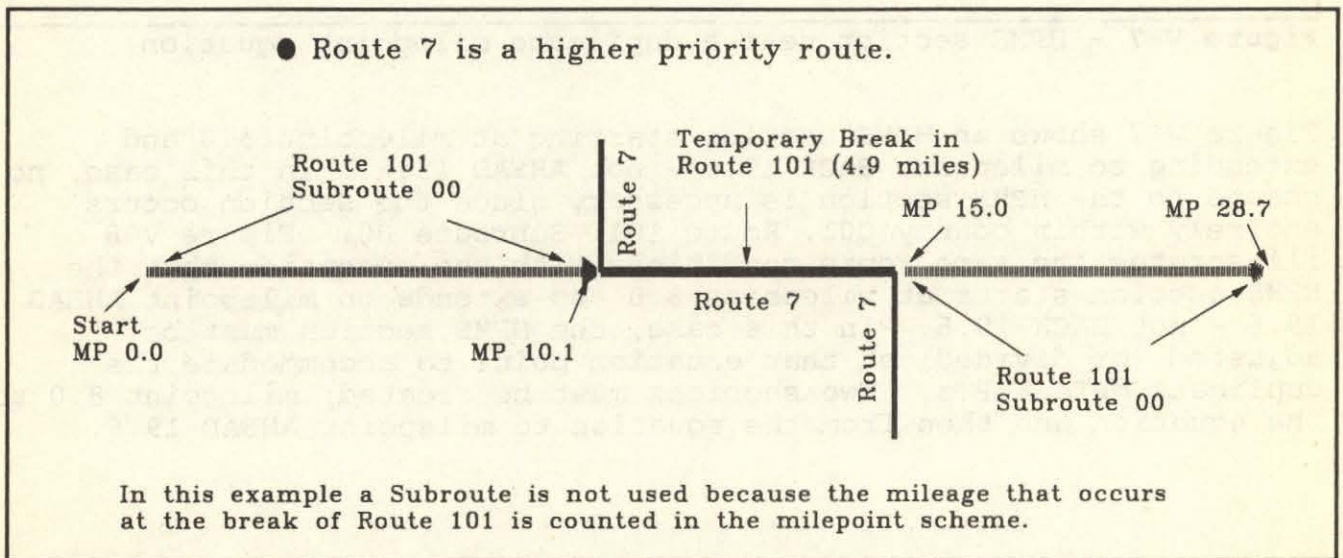


Figure V-6 - Route that stops and restarts at different locations; milepoint increases

If no duplicate MPT/KMPT condition exists within the county, the combination of county, inventory route, and MPT/KMPT will identify a unique location.

The Effect of Duplicate, Nonduplicate MPTs/KMPTs and Subroutes on HPMS Sections--The division of inventory routes into inventory subroutes, where duplicate MPTs/KMPTs occur, could have a direct impact on the physical length of HPMS universe and sample sections. The subroute field effectively creates a new route anytime the subroute number changes. As a result, HPMS sections must be adjusted (or divided) where inventory routes or subroutes change to accommodate the LRS.

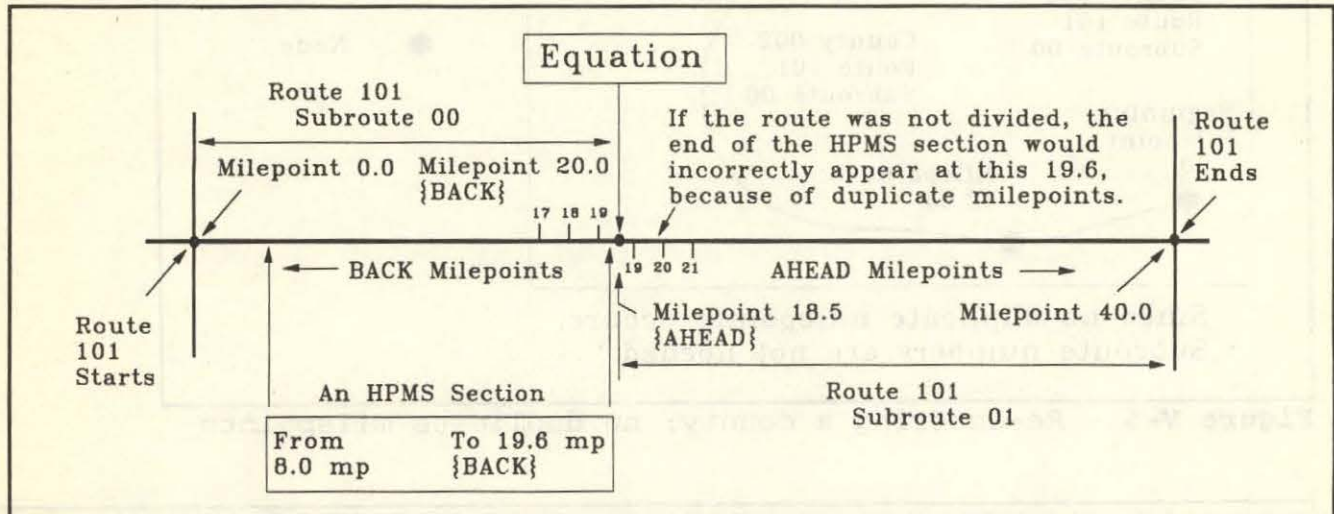


Figure V-7 - HPMS section near a duplicate milepoint equation

Figure V-7 shows an HPMS section starting at milepoint 8.0 and extending to milepoint BACK 19.6 - not AHEAD 19.6. In this case, no change to the HPMS section is necessary since the section occurs entirely within county 001, Route 101, Subroute 00. Figure V-8 illustrates the same route conditions with the exception that the HPMS section starts at milepoint 8.0 and extends to milepoint AHEAD 19.6 - not BACK 19.6. In this case, the HPMS section must be adjusted (or divided) at that equation point to accommodate the duplicate MPTs/KMPTs. Two sections must be created; milepoint 8.0 to the equation and then from the equation to milepoint AHEAD 19.6.

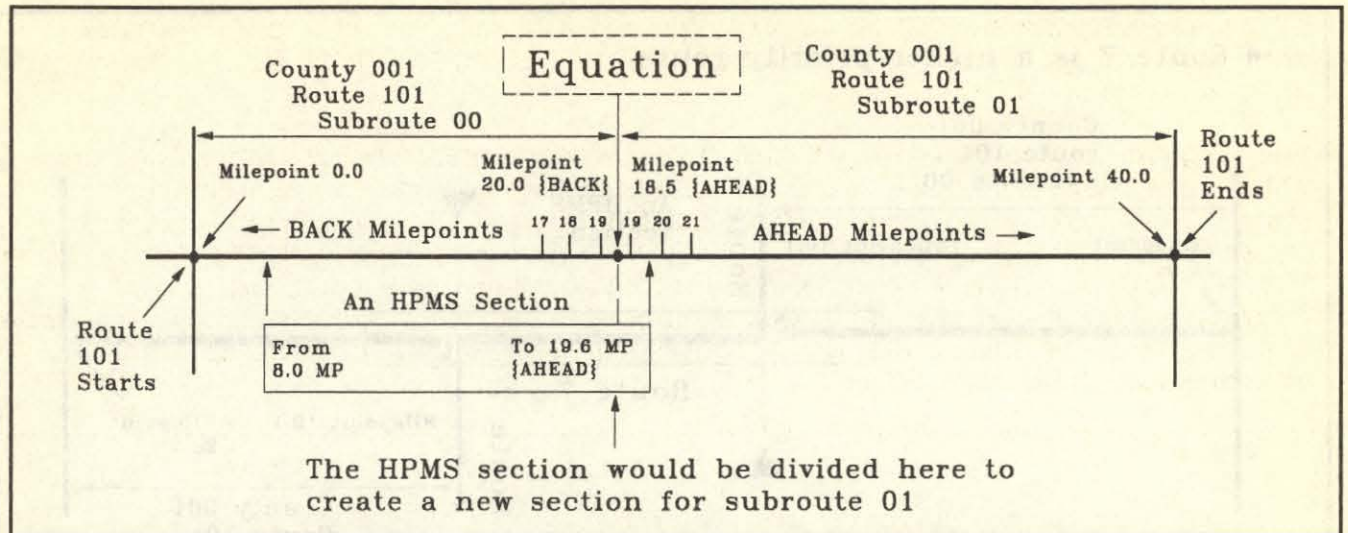


Figure V-8 - HPMS section crossing a duplicate milepost equation

In contrast, where an HPMS section crosses a nonduplicating equation point, the section need not be adjusted. (See Figure V-9.)

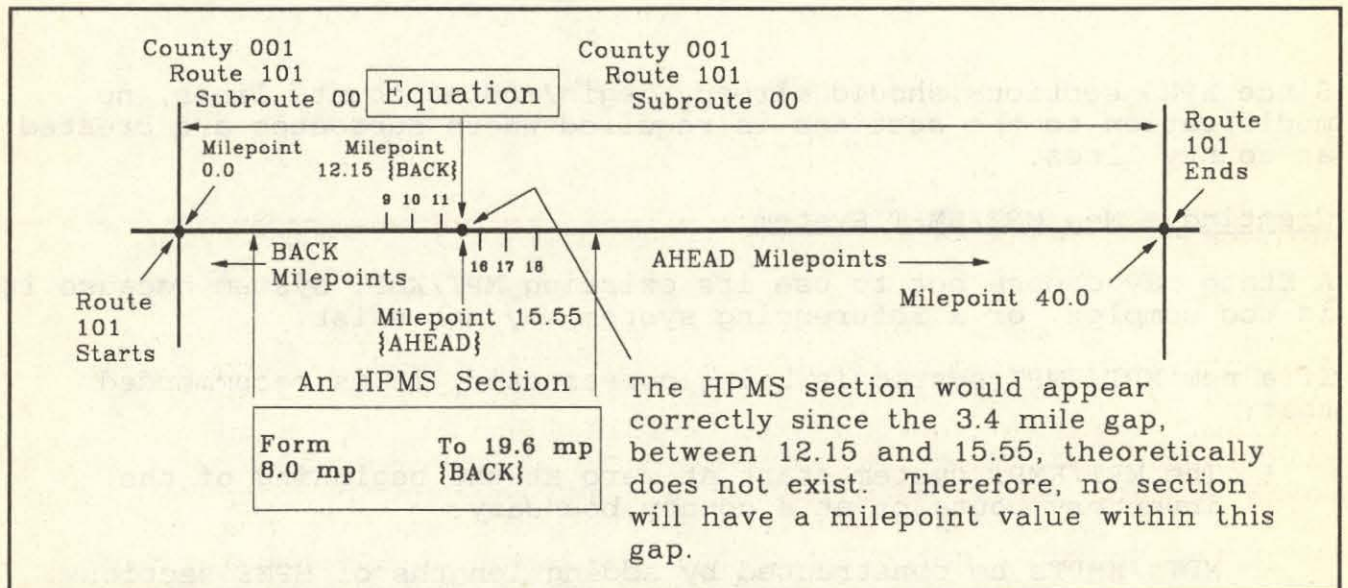


Figure V-9 - HPMS section crossing a nonduplicate milepost equation

Because of inventory route design, an HPMS section may have more than one inventory route traversing it. Where this occurs, the HPMS section must be divided to reflect the beginning and ending of the inventory routes. Figure V-10 shows an HPMS section extending across two inventory routes: 101 and 7. In this case, the HPMS section must be divided into three sections at the points where the inventory route changes.

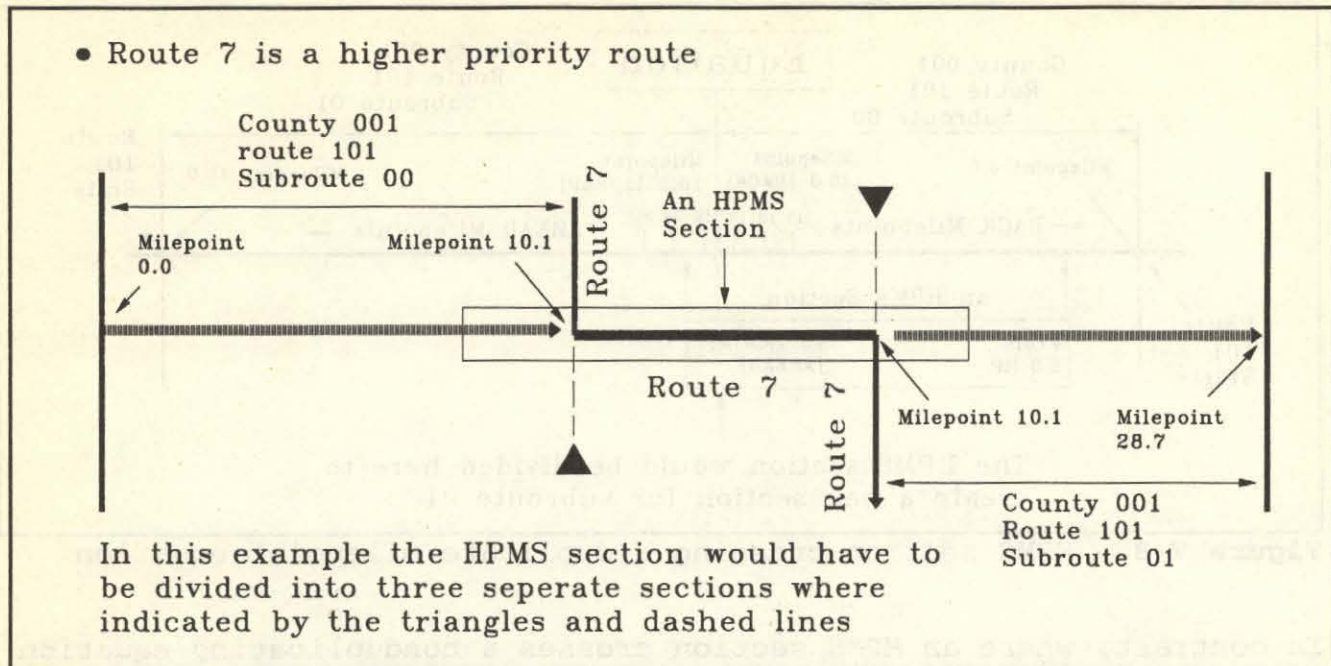


Figure V-10 - An HPMS section that runs through overlapping routes

Since HPMS sections should already begin/end at county lines, no modification to the sections is required where subroutes are created at county lines.

Creating a New MPT/KMPT System

A State may choose not to use its existing MPT/KMPT system because it is too complex, or a referencing system may not exist.

If a new MPT/KMPT system is being constructed, it is recommended that:

- The MPT/KMPT system start at zero at the beginning of the inventory route or at a county boundary.
- MPTs/KMPTs be constructed by adding lengths of HPMS sections.
- If the inventory route leaves and returns to a county, the beginning MPT/KMPT of the latest entry point into the county should equal the ending MPT/KMPT where the route last left the county (See Figure V-2). This approach, however, produces duplicate MPTs/KMPTs and mandates the use of subroute numbers.
- Inventory subroutes be renumbered (start at "00") within each county.

SUMMARY OF LRS DATA REQUIREMENTS

In addition to the data provided in each HPMS record as outlined in Chapter IV (see Items 5, 7 and 8), each State is to provide:

LRS Submittal Option 1 - Maps and Computer Files

- Inventory Route and Node Maps showing the location of inventory routes, inventory subroutes and nodes on the base network of rural arterials, urban principal arterials and other designated NHS routes.
- A Node Data File that describes all nodes in the network.
- An Inventory Route Link Data File that describes all inventory routes within the network.

Each product is described in more detail below. A dBASE template will be provided to the States for entering and reporting the Node Data and Inventory Route Link Data files discussed above. Data can be submitted on IBM-compatible PC diskettes (high or low density, 3 1/2" or 5 1/4") in dBase or ASCII format, or on a mainframe computer tape in EBCDIC. Specific data submittal requirements for format and media types are discussed in Chapter II.

LRS Submittal Option 2 - Maps Only

Inventory Route and Node Maps showing the location of inventory routes, inventory subroutes, nodes, and MPTs/KMPTs on the base network of rural arterials, urban principal arterials, and other designated NHS routes.

LRS SUBMITTAL OPTION 1 - MAPS AND COMPUTER FILES

The following section discusses how LRS information might be assembled. Following this procedure is not mandatory and is used only as an example of how to derive the necessary LRS information for the network and HPMS. Data generated in the 1992-1993 functional classification and NHS activities (maps and principal arterial route lists, etc.) should be reviewed for possible input to this effort. It is emphasized that the State should design its own procedures that will work best within its organizational and information system structures.

Procedural Steps

1. Prepare Base Maps

Prepare State and urbanized area maps (containing principal signed routes and street names) that display roads and streets that are functionally classified as rural arterials and urban principal arterials and other NHS roadways. These routes should be color coded to reflect functional class. (See "Inventory Route and Node Map Labeling Instructions" for specific requirements.)

2. Define Inventory Routes

Overlay the base network created in Step 1 with State inventory route numbers. If the complete base network is not covered by inventory routes, additional inventory routes must be established and numbered. Each inventory route number can be alphanumeric, but contain no blanks, and must be unique within each county; however, it is recommended that inventory route numbers be kept unique statewide.

3. Assemble Inventory Route MPT/KMPT Data

Assemble MPT/KMPT data for network nodes (to be identified in step 4).

Inventory routes with existing milepoints/kilometerpoints--At a minimum, extract MPTs/KMPTs from the State database/maps for each inventory route for:

- Beginning of an inventory route,
- Intersections with other inventory routes,
- Intersections with county lines,
- Equations (record BACK and AHEAD MPT/KMPT of equation),
- Physical breaks in an inventory route,
- End of an inventory route.

Any descriptive comment the State feels is pertinent to locating MPTs/KMPTs on the map should be recorded and retained for future reference.

Inventory routes without milepoints/kilometerpoints--Follow the procedures under the heading "Creating a New Milepoint System," discussed earlier, to build a MPT/KMPT system, and then proceed as indicated above for an existing MPT/KMPT system.

4. Define Nodes/Assign Node Numbers

Using the assembled inventory route MPT/KMPT information from Step 3, nodes are annotated on the inventory route map from Step 2 wherever one or more of the conditions listed in step 3 are met.

Nodes for equations will be placed on the maps in the approximate position between adjacent nodes, based on relative distance obtained from the milepoint log information. All nodes must have a unique number within the State, and may be comprised of both alphanumeric characters and numbers. See "Inventory Route and Node Map Labeling Instructions" for more details.

5. Develop Node Data File

The information for the file should be taken principally from the Inventory Route and Node Map from Step 4. See "Node Data File Coding Instructions" for details.

6. Develop Inventory Route Link Data File and Assign Subroutes

File information should be taken principally from the Inventory Route and Node Map from Step 4 and the assembled inventory route MPT/KMPT data from Step 3. The Inventory Route and Node Maps plus other available maps should be used to ensure that at least one and up to three signed routes are identified for each link. The priority of the signed routes will be based on Item 11, Route Signing, of the Inventory Route Link Data File.

In addition, inventory subroute numbers shall be assigned to all inventory route links with duplicate MPTs/KMPTs within a county. Inventory subroute numbers are incremented each time a situation is encountered that produces duplicate MPTs/KMPTs. These subroute numbers will be added to the Inventory Route Link Data File and the Inventory Route and Node Maps from Step 4. See "Inventory Route Link Data File Coding Instructions" for details.

7. Revise HPMS Data Records As Necessary and Add Necessary Data

An HPMS section must be adjusted (or divided as necessary) if it falls on more than one inventory route. If an existing HPMS section occurs on a single inventory route, but crosses a node that connects two different subroute numbers, the section must also be adjusted (or divided).

For each HPMS section the following information shall be provided: inventory route number, inventory subroute number, beginning MPT/KMPT, and ending MPT/KMPT.

Inventory Route and Node Map Labeling Instructions

As part of the HPMS submission requirements, States will be required to prepare and submit maps showing inventory routes and nodes. These maps will be used to ensure the correct location of inventory routes and nodes on the network in preparation for attaching a linear referencing system and linking HPMS data to the network. The amount of data on these maps should be kept to a minimum and only data necessary to check and transfer the information to the network is requested. Therefore, five basic categories of data shall be displayed on the maps:

1. Base State highway network -- rural arterials, urban principal arterials, and other NHS routes;
2. State/county boundaries;
3. Principal signed routes (US, State, etc.);
4. Inventory route and subroute numbers;
5. Nodes with node numbers.

These data should be placed on maps that are at a scale that keeps the number of map sections to a minimum, while maintaining good visual quality for data location and readability. A minimum map submittal would be:

1. One map depicting all rural and small urban areas of the State. However, the location of inventory routes and nodes in small urban areas must be clear.
2. One map for each urbanized area within the State.

In order to reduce confusion regarding which number goes with what feature, qualifiers shall be added as follows:

<u>Map Feature</u>	<u>Map Qualifiers</u>
Inventory Route	X
Inventory Subroute	()
Node	N
Signed Routes	No special map qualifiers (use existing prefixes)

For example, inventory route "234" with a subroute number of 05 would appear on the map as "X234(05)". The "X" and "N" prefixes and "()" are meant to be used only on the map, so the numbers can be more easily distinguished. These qualifiers shall not be used on the HPMS records, route/link file or node file. Unless shields exist on the maps that contain the route numbers, States should label the routes with existing prefixes (such as "US", "SR", etc.).

Map Item Description

The Base Network contains Interstate, other freeways and expressways, other principal arterials, and rural minor arterials. In addition, those routes not so classified, but that are part of the NHS, shall also be identified. Finally, officially approved proposed routes are to be included in this base network in keeping with HPMS data Item 15, Planned, Unbuilt Facility. Since these LRS data will be used with the HPMS, centerlines of dual alignments shall be indicated. However, in the case of one-way pairs (couplets), each directional roadway is to be separately defined, as is done in the HPMS records.

Boundaries & County Name Labels--This will typically be the complete boundary. However, if a State chooses, it may show only that portion of the county boundary that crosses an arterial. Also, the State shall place the name of the county within the boundaries.

Principal Signed Route Number Labels--The principal signed route or street name shall be provided for each link (i.e., between any two nodes). While the Inventory Route Link Data File allows for up to three signed routes, because of the need for good map readability, only one (the principal route) is required for each link on the map.

Inventory Route and Subroute Number Labels--Only one inventory route and subroute number is to be assigned for each link between any two nodes. In the case of one-way pairs (couplets), each directional roadway is considered a different inventory route. For identification purposes on the map only, route numbers are to begin with an "X" and subroutes are to be enclosed in parentheses.

All links in the link file must be shown on the map and vice-versa.

Nodes and Node Number Labels--Nodes will be established for:

1. Intersections of other inventory routes,
2. Intersections of inventory routes and State boundaries,
3. Intersections of inventory routes and county boundaries,
4. Equation locations,
5. Route termini (including route discontinuity termini).

All nodes in the node file must be shown on the map and vice-versa.

Each node should have a unique node number clearly displayed beside the node. Node numbers must be unique within the State. These node numbers are to begin with "N" for identification purposes on the map only.

NODE DATA FILE CODING INSTRUCTIONS

The Node Data File, together with the Inventory Route Link Data File, are used to define the geographic location of the inventory routes and the milepoints. These records complement the data supplied in the Inventory Route Link Data File and the Inventory Route and Node Map. In the following table, Items 6-11 identify each of the conditions that will create a node. (Items 1-5 and 12-14 provide other descriptor information about the nodes.) This information is necessary for accurate placement of the node on the network.

<u>Item No.</u>	<u>Position</u>	<u>Length</u>	<u>Data Type</u>	<u>Data Item Description</u>
<u>IDENTIFICATION</u>				
1	1 - 2	2	N	Year
2	3 - 4	2	N	State Code
3a	5 - 7	3	N	County Code No. 1
3b	8 - 10	3	N	County Code No. 2
4	11	1	N	Record Status
5	12 - 21	10	A	Node Number
<u>NODE TYPES</u>				
6	22	1	N	Inventory Route Intersection
7	23	1	N	County Boundary
8	24	1	N	State Boundary
9	25	1	N	Equation
10	26	1	N	Spur Route Termini
11	27	1	N	Inventory Route Termini
<u>COORDINATES (Optional)</u>				
12	28 - 37	10	N	X Coordinate
13	38 - 47	10	N	Y Coordinate
<u>OTHER DESCRIPTORS (Optional)</u>				
14	48 - 147	100	AN	Description of Node

N = Numeric
 AN = Alphanumeric

All numeric data items must be right justified and zero-filled. The alphanumeric field of Item 5 will be right justified and can use numbers and capitalized English letters. No embedded blanks are allowed. Item 14 may contain any characters, placed anywhere within the 100 positions.

Data Item Details

Identification

Item 1 -- Year (Length = 2)

See Item 3 of the HPMS Universe data coding instructions in Chapter IV.

Item 2 -- State Code (Length = 2)

See Item 4 of the HPMS Universe data coding instructions in Chapter IV.

Item 3a -- County Code No. 1 (Length = 3)

A node is created when an inventory route and a county boundary intersect.

When nodes occur at boundaries between adjoining counties, Item 3a will identify one of the two counties sharing the boundary at the node and Item 3b will identify the other county (Figure V-11 -- examples A and B). The counties can be identified in any sequence. If the node occurs at a boundary of three or more counties, any two of the possible three will be reported.

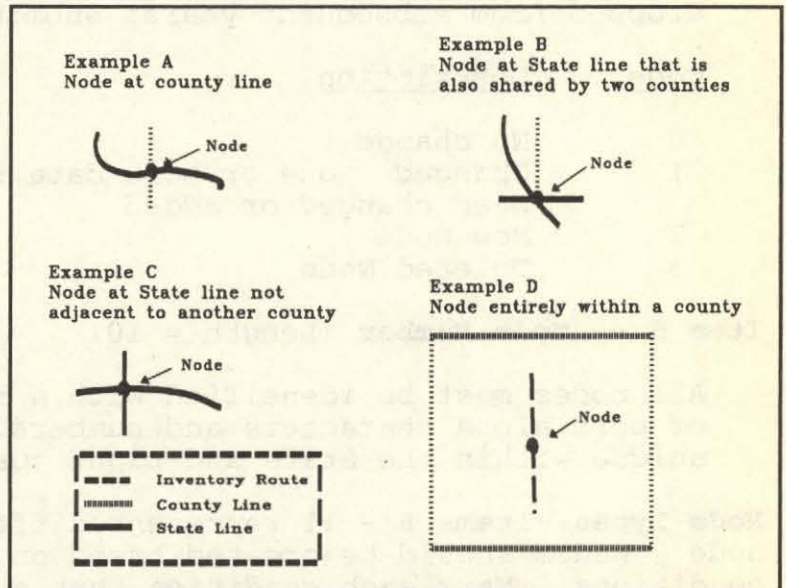


Figure V-11 - Nodes and political boundaries

When nodes occur within counties or at a State boundary where the county is not joining another county within that State, only one county is identified and will appear in both Items 3a and 3b (See Figure V-11 -- examples C and D).

Use the three-digit FIPS county code. (See Item 6 of the HPMS Universe data coding instructions in Chapter IV.)

Adjoining counties of neighboring States, under any of the above described conditions, are not to be coded.

Item 3b -- County Code No. 2 (Length = 3)

This item identifies the second of the two counties sharing the boundary at the node, as discussed above.

Item 4 -- Record Status (Length = 1)

This item depicts the condition of the node, relative to the data submittal of the past year--that is, a newly created node or an existing node which has incurred a change or addition to one or more of the data items represented in the Node File. In the first year's submittal, all nodes should be coded "0". In subsequent years, if a node is added or one or more of the characteristics have changed, it will be coded as either "2" or "1" respectively. If no change occurs to an existing node, then it will be coded "0". When a node is reported as being deleted, it shall be dropped from subsequent years' submittals.

<u>Code</u>	<u>Description</u>
0	No change
1	Changed - one or more data items on the node list have been changed or added
2	New Node
3	Deleted Node

Item 5 -- Node Number (Length = 10)

All nodes must be identified with a number which can be comprised of both alpha characters and numbers. Each node number must be unique within the State and right justified in the field.

Node Types--Items 6 - 11 represent different characteristics of a node. Nodes should be created based on one or more of these conditions. Mark each condition that applies to each node (all conditions that describe a particular node should be marked affirmative).

Item 6 -- Inventory Route Intersection (Length = 1)

Node that occurs where two inventory routes intersect:

<u>Code</u>	<u>Description</u>
0	NO
1	YES

Item 7 -- County Boundary (Length = 1)

Node that occurs where an inventory route is intersected by a county boundary:

<u>Code</u>	<u>Description</u>
0	NO
1	YES

Item 8 -- State Boundary (Length = 1)

Node that occurs where an inventory route is intersected by a State boundary:

<u>Code</u>	<u>Description</u>
0	NO
1	YES

Note: Since a State line will also be a county boundary, Items 7 and 8 will both be coded as "1" at all State lines.

Item 9 -- Equation (Length = 1)

Node that occurs where an equation occurs on an inventory route:

<u>Code</u>	<u>Description</u>
0	NO
1	YES

Item 10 -- Spur Route Termini (Length = 1)

Node that occurs where an inventory route terminates without intersecting another inventory route:

<u>Code</u>	<u>Description</u>
0	NO
1	YES

Note: If this item is marked "yes", Item 11 is also to be marked "yes."

Item 11 -- Inventory Route Termini (Length = 1)

Node that occurs where an inventory route begins, ends, stops at a discontinuity, or starts after a discontinuity.

<u>Code</u>	<u>Description</u>
0	NO
1	YES

Coordinates (Optional)--Specify whether these data exist, and the coordinate system and decimal positions (if any) used for the LRS submittal in the letter of transmittal.

Item 12 -- X Coordinate (Length = 10) (optional)

Enter the "X" coordinate for the node.

Item 13 -- Y Coordinate (Length = 10) (optional)

Enter the "Y" coordinate for the node.

Other Descriptors (Optional)

Item 14 -- Description of Node (Length = 100) (optional)

This item is provided if the State desires to provide additional descriptive information regarding node location. Any alphanumeric characters may be entered, including blanks.

INVENTORY ROUTE LINK DATA FILE CODING INSTRUCTIONS

The Inventory Route Link Data File, together with the Node Data File, are used to define the geographic location of the inventory route and the MPTs/KMPTs. This record complements the data supplied in the Node Data File and the Inventory Route and Node Map. A link is the roadway between two nodes. The Inventory Route and Node Map illustrates the locations of the links and nodes.

<u>Item No.</u>	<u>Position</u>	<u>Length</u>	<u>Data Type</u>	<u>Data Item Description</u>
<u>IDENTIFICATION</u>				
1	1 - 2	2	N	Year
2	3 - 4	2	N	State code
3	5 - 7	3	N	County code
4	8	1	N	Record Status
5	9 -18	10	AN	Inventory Route Number
6	19-20	2	N	Inventory Subroute Number
7	21-30	10	AN	Beginning Node Number
8	31-38	8	N	Beginning Milepoint/ Kilometerpoint
9	39-48	10	AN	Ending Node Number
10	49-56	8	N	Ending Milepoint/ Kilometerpoint
<u>Signed Route 1</u>				
11	57	1	N	Route Signing 1
12	58	1	N	Route Qualifiers 1
13	59-66	8	AN	Route Number 1
<u>Signed Route 2</u>				
14	67	1	N	Route Signing 2
15	68	1	N	Route Qualifiers 2
16	69-76	8	AN	Route Number 2
<u>Signed Route 3</u>				
17	77	1	N	Route Signing 3
18	78	1	N	Route Qualifiers 3
19	79-86	8	AN	Route Number 3
<u>Other</u>				
20	87-116	30	AN	Street Name

N = Numeric

AN = Alphanumeric

All numeric data shall be right justified and zero-filled. Beginning and ending node numbers shall be right justified.

Data Item Details

Identification

Item 1 -- Year (Length = 2)

See Item 3 of the HPMS Universe data coding instructions in Chapter IV.

Item 2 -- State Code (Length = 2)

See Item 4 of the HPMS Universe data coding instructions in Chapter IV.

Item 3 -- County Code (Length = 3)

See Item 6 of the HPMS Universe data coding instructions in Chapter IV.

Item 4 -- Record Status (Length = 1)

This item depicts the status of the route link, relative to the previous year's--that is, a newly created link or an existing link which has incurred a change or addition to one or more of the data items represented in the link file. In the first year's submittal, all links shall be coded "0". In subsequent years, if a link is added or one or more of its characteristics have changed, it will be coded as either "2" or "1" respectively. However, if no change occurs to an existing link, then it will be coded "0". When a link is reported as being deleted, it shall be dropped from subsequent years' submittals.

<u>Code</u>	<u>Description</u>
0	No Change
1	Changed - one or more data items on Route Link record has changed
2	New Route Link
3	Deleted Route Link

Item 5 -- Inventory Route Number (Length = 10)

The inventory route number, which is not necessarily the same as that posted along the roadway, is a number used to uniquely identify a route for inventory purposes. The inventory route number must be unique within a county, but it is recommended that it be unique within the State. This number can be alphanumeric, but must not contain blanks; it must be right justified in the field. Provide leading zeroes.

Item 6 -- Inventory Subroute Number (Length = 2)

This number is used to uniquely identify portions of an inventory route within a county where certain conditions (MPT/KMPT equations, inventory route breaks, or MPTs/KMPTs that are adjusted at county boundaries) create a length of roadway with a duplicate MPT/KMPT or range of MPTs/KMPTs. A new subroute number shall be assigned each time a duplicate MPT/KMPT or range of MPTs/KMPTs is encountered. These subroute numbers must only be unique within each county. In the absence of duplicate MPTs/KMPTs, and previous to the first duplicate MPT/KMPT condition encountered, code zero.

Item 7 -- Beginning Node Number (Length = 10)

This is the number of the first of two nodes of the link. This node is at the end of the link with the lowest MPT/KMPT.

Item 8 -- Beginning Milepoint/Kilometerpoint (xxxx.xxx--code the decimal) (Length = 8)

This is the lowest MPT/KMPT of the link.

Item 9 -- Ending Node Number (Length = 10)

This is the number of the last of two nodes of the link. This node is at the end of the link with the highest MPT/KMPT of the link.

Item 10 -- Ending Milepoint/Kilometerpoint (xxxx.xxx--code the decimal) (Length = 8)

This is the highest MPT/KMPT of the link.

Signed Route 1, 2 and 3--These three groups of three items define up to three signed route numbers assigned to a link. The priority of the signed routes shall be based on Item 11, below, where those with a non-zero lower code have the higher priority.

Items 11, 14, and 17 -- Route Signing 1,2 and 3 (Length = 1)

These codes specify the manner in which the highway segment is signed.

<u>Code</u>	<u>Description</u>
0	Not Signed or No More Signed Routes
1	Interstate
2	U. S.
3	State
4	Off-Interstate Business Markers
5	County
6	Township
7	Municipal
8	Parkway
9	None of the above

Items 12, 15, and 18 -- Route Qualifiers 1, 2 and 3 (Length = 1)

These codes specify the manner in which the highway segment is signed. Where more than one code is applicable, use the lower code excluding zero.

<u>Code</u>	<u>Description</u>
0	No Qualifier
1	Alternate
2	Business route
3	Bypass
4	Spur
5	Loop
6	Proposed
7	Temporary
8	Truck route
9	None of the above

Items 13, 16 and 19 -- Route Number 1, 2 & 3 (Length = 8)

Enter the signed route number (on the marker), right justified. Any alphabetic character prefixes or suffixes that cannot be identified with the Route Signing or Qualifier list of codes should be reported, and abbreviated to fit into the field length, if necessary. Zero-fill if the route is unsigned or there are no more signed routes.

Item 20 -- Street Name (Length = 30)

Enter a street, road, or highway name. This field need only be used when a signed route number is not available for use in describing the route. Otherwise, leave the field blank. If used, ensure that the name includes the proper suffix (street, place, court, etc.) to eliminate duplicate name possibilities.

For example: U.S. 5 Business Route and State 2 Truck Route are on the same link:

Item 11 = "2"	(U.S.)
Item 12 = "2"	(Business Route)
Item 13 = "00000005"	(Route Number)
Item 14 = "3"	(State)
Item 15 = "8"	(Truck Route)
Item 16 = "00000002"	(Route Number)

LRS SUBMITTAL OPTION 2 - MAPS ONLY

Option 2 is an alternative to providing digital data for the Node Data File and Inventory Route Link Data File. This option will allow States to provide all of the LRS data on one set of maps. Once submitted, these data will be processed by the FHWA into the Node Data File and Inventory Route Link Data File. These data will then be sent back to the respective States for review.

Procedures for Developing the Required HPMS LRS Information

The following section discusses how LRS information might be assembled. Following this procedure is not mandatory and is used only as an example of how to derive the necessary LRS information for the network and HPMS. Data generated in the 1992-1993 functional classification and NHS activities (maps and principal arterial route lists, etc.) should be reviewed for possible input to this effort. It is emphasized that the State should design its own procedures that will work best within its organizational and information system structures.

Procedural Steps**1. Prepare Base Maps**

Prepare State and urbanized area maps (containing principal signed routes and street names) that highlight roads and streets that are functionally classified as rural arterials and urban principal arterials plus other roads and streets designated as NHS roadways. These routes should be color coded to reflect functional class. (See "Inventory Route and Node Map Labeling Instructions" for specific requirements.)

2. Define Inventory Routes

Overlay the base network created in Step 1 with State inventory route numbers. If the complete base network is not covered by inventory routes, additional inventory routes must be established and numbered. Each inventory route number can be alphanumeric, but must contain no blanks, and it must be unique within each county; however, it is recommended that the inventory route number be kept unique statewide.

3. Assemble Inventory Route MPT/KMPT Data

Assemble MPT/KMPT data for network nodes (to be identified in step 4).

Inventory routes with existing MPTs/KMPTs -- At a minimum, extract MPTs/KMPTs from the State database/maps for each inventory route for:

- Beginning of an inventory route
- Intersection with other inventory routes
- Intersections with county lines
- Equations (record BACK and AHEAD MPT/KMPT of equation)
- Physical breaks in an inventory route
- End of an inventory route

Any descriptive comment the State feels is pertinent to locating MPTs/KMPTs on the map should be recorded and retained for future reference.

Inventory routes without MPTs/KMPTs -- Follow the procedures under the heading "Creating a New MPT/KMPT System," discussed earlier, to build a MPT/KMPT system, then proceed as indicated above for an existing MPT/KMPT system.

4. Define Nodes/Assign Node Numbers

Using the assembled inventory route, subroute, and MPT/KMPT information from Step 3, nodes are annotated on the Inventory Route and Node Map wherever one or more of the conditions listed in Step 3 are met.

Nodes at equations will be placed on the maps in the approximate position between adjacent nodes, based on a relative distance obtained from MPT/KMPT information. All nodes must have a unique number within the State, and may be comprised of both alphanumeric characters and numbers. See "Inventory Route and Node Map Labeling Instructions" for more details.

5. Label Links with MPTs/KMPTs

Place beginning and ending MPTs/KMPTs on the map for all links that occur along the inventory routes created in step 2. For more information, see Inventory Route and Node Map Labeling Instructions.

6. Assign Subroutes Numbers

Inventory subroute numbers shall be assigned to all inventory route links with duplicate MPTs/KMPTs within a county. Inventory subroute numbers must be incremented each time a situation is encountered that produces duplicate MPTs/KMPTs along a route within a county. These subroute numbers will be added to the Inventory Route and Node Maps. See Inventory Route and Node Map Labeling Instructions for more information on required format.

7. Revise HPMS Data Records As Necessary and Add Necessary Data

An HPMS section must be adjusted (or divided as necessary) if it falls on more than one inventory route. If an existing HPMS section occurs on a single inventory route, but crosses a node that connects two different subroute numbers, the section must also be adjusted (or divided).

For each HPMS section associated with a given link the following information shall be provided: inventory route number, inventory subroute number, beginning MPT/KMPT, and ending MPT/KMPT.

Map Labeling Instructions

As part of the HPMS submission requirements, States will be required to prepare and submit maps showing inventory routes, subroutes, nodes, and MPTs/KMPTs. These maps will be used to ensure the correct location of inventory routes and nodes for attaching an LRS to the NHPN and linking HPMS data to the NHPN. The amount of data on these maps should be kept to a minimum and only data necessary to check and transfer the information to the network is requested. The following are the basic categories of data that shall be displayed on the maps:

1. Base State highway network -- rural arterials, urban principal arterials, and other NHS routes;
2. State/county boundaries;
3. Principal signed routes (US, State, etc.);
4. Inventory route and subroute numbers;
5. Nodes with node numbers;
6. MPT/KMPT values for inventory routes.

These data should be placed on maps that are at a scale that keeps the number of map sections to a minimum, while maintaining good visual quality for data location and readability. A minimum Map submittal would be:

1. One map for each urbanized area within the State.
2. The number of rural and small urban maps will vary. States should provide the necessary number of maps that will ensure accurate placement of data on the map with good visual quality.

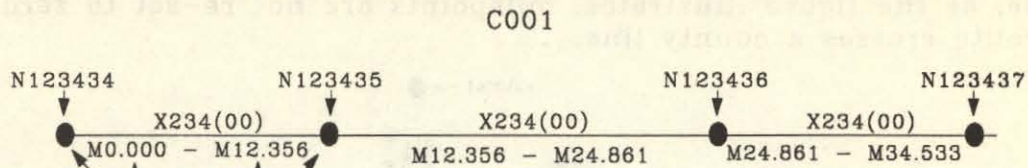
In order to reduce confusion regarding which number goes with what feature, qualifiers shall be added as shown below:

<u>Map Feature</u>	<u>Map Qualifiers</u>
County FIPS Code	C
Inventory Route	X
Inventory Subroute	()
Node	N
Signed Routes	No special map qualifiers (use existing prefixes)
Standard	
MPT/KMPT Values	M
AHEAD Equation Points	MA
BACK Equation Points	MB

The county FIPS code should appear at least once within each county and should not be attached to any particular route. For example, county 241 would appear away from the inventory route labeling as "C241."

Route number and subroute identification must appear directly above the MPTs/KMPTs. The inventory route with the beginning and ending MPTs/KMPTs should appear along each link of the inventory route. The beginning and ending MPTs/KMPTs must reference the appropriate closest node (see Figure V-12). Where needed for clarity, arrows should be used to indicate which link is being referenced by the LRS information. Nodes that occur at the intersection of two or more inventory routes will have at least one MPT/KMPT value referencing it for each route (see Figure V-13).

This example shows Inventory Route 234 starting at milepoint 0, subroute 00, within county 001, and ending at milepoint 34.533.



Milepoint 0.000 is at node 123434 Milepoint 12.356 is at node 123435

* Milepoint values should appear closest to the node they reference.

LEGEND

—	Inventory Route	N123434 =	Node Identification
●	Node	X234(00) =	Inventory Route and Subroute Identification
C001	= County Identification	M0.000 - M12.356 =	Beginning and Ending Milepoints

Figure V-12 - Map annotation of MPTs/KMPTs

This example shows the convention of annotating intersections and non-intersection nodes, and north-south, east-west routes. In this case, as the figure illustrates, milepoints are not re-set to zero when a route crosses a county line.

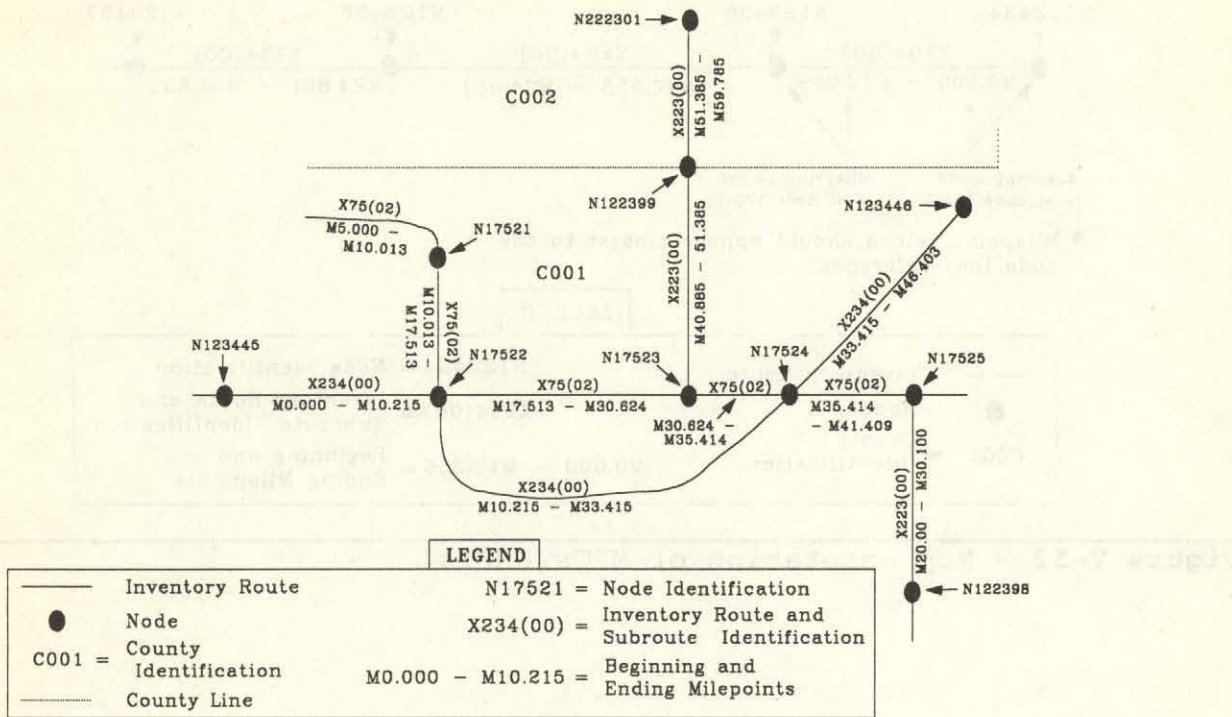


Figure V-13 - Inventory route intersection treatment

Figure V-14 illustrates how equation nodes should be represented on the maps. If the State believes it is necessary for an accurate understanding of the LRS, a copy of the route log may be provided along with any written comments that cover the routes in question.

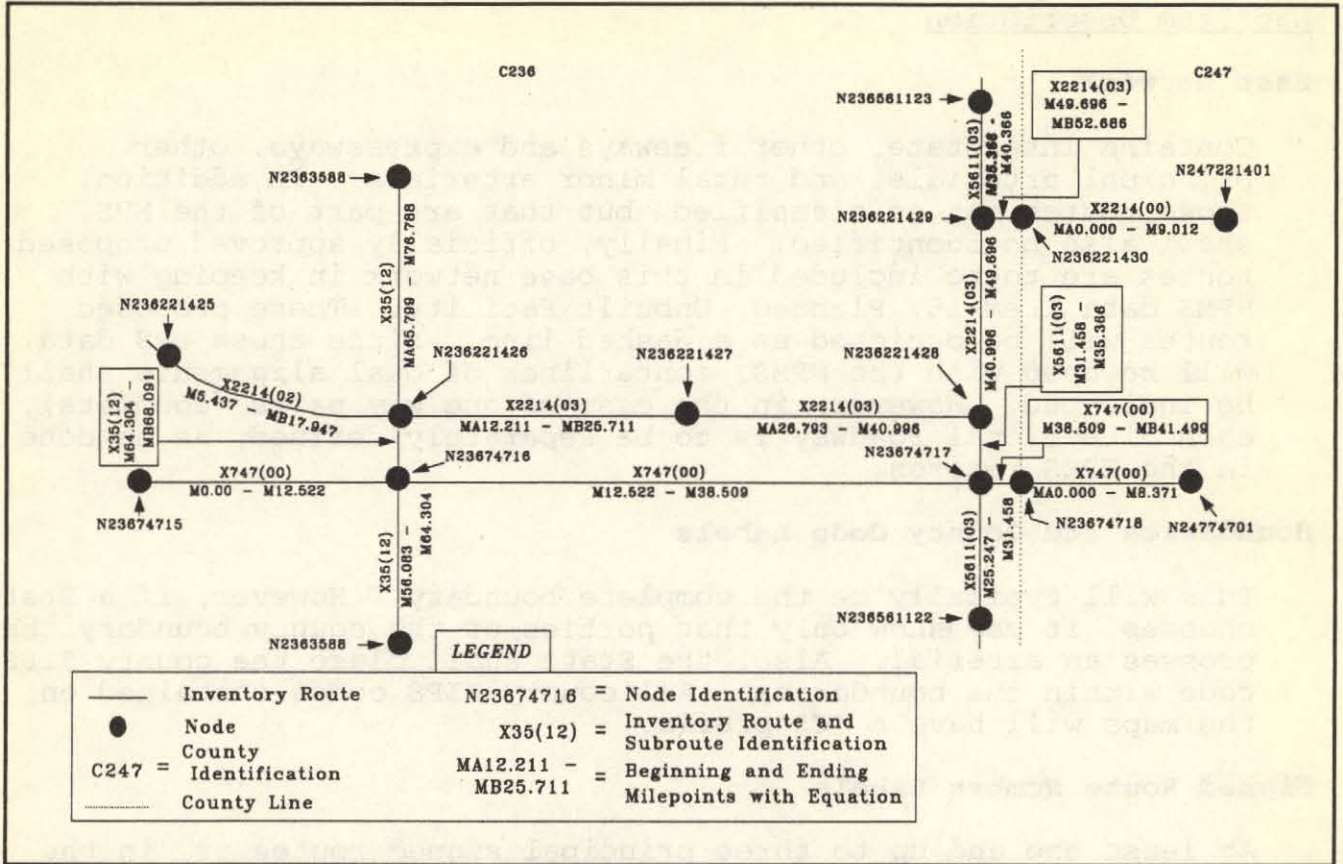


Figure V-14 - Annotation of equation nodes

The "C", "X", "N", "M", "MA", "MB" prefixes and "()" are meant to be used only on the map, so the numbers can be more easily distinguished. These qualifiers shall not be used on the HPMS records. Unless shields exist on the maps that contain the route numbers, States should label the routes with existing prefixes (such as "US", "SR", etc.).

Map Item Description

Base Network

Contains Interstate, other freeways and expressways, other principal arterials, and rural minor arterials. In addition, those routes not so classified, but that are part of the NHS, shall also be identified. Finally, officially approved proposed routes are to be included in this base network in keeping with HPMS data Item 15, Planned, Unbuilt Facility. These proposed routes will be depicted as a dashed line. Since these LRS data will be used with the HPMS, centerlines of dual alignments shall be indicated. However, in the case of one way pairs (couplets), each directional roadway is to be separately defined, as is done in the HPMS records.

Boundaries and County Code Labels

This will typically be the complete boundary. However, if a State chooses, it may show only that portion of the county boundary that crosses an arterial. Also, the State shall place the county FIPS code within the boundaries. All county FIPS codes contained on the maps will have a "C" prefix.

Signed Route Number Labels

At least one and up to three principal signed routes or, in the absence of signed routes, a street name shall be provided for each link (i.e. between any two nodes).

Inventory Route and Subroute Number Labels

Only one inventory route and subroute number is to be assigned for each link between any two nodes. In the case of one-way pairs (couplets), each directional roadway is considered a different inventory route. For identification purposes on the map only, route numbers are to begin with an "X" and subroutes are to be enclosed in parentheses.

Nodes & Node Number Labels

Nodes will be established for:

1. Intersections of other inventory routes,
2. Intersections of inventory routes and State boundaries,
3. Intersections of inventory routes and county boundaries,
4. Equation locations,
5. Route termini (including route discontinuity termini).

Each node should have a unique node number clearly displayed beside the node. Node numbers must be unique within the State. These node numbers are to begin with "N" for identification purposes on the map only.

Inventory Route MPT/KMPT

MPTs/KMPTs must be placed on the map for all links within a given inventory route. Route and subroute numbers must appear directly above all MPTs/KMPTs. All MPTs/KMPTs will have either a prefix of M (for standard milepoint), MA (for an equation AHEAD milepoint) or MB (for an equation BACK milepoint).

A complete set of maps is to be submitted to FHWA. A narrative should accompany the submittal that describes the map features, provides a contact person at the State, and gives other information pertinent to the maps submitted.

C H A P T E R V I**HPMS UPDATING PROCEDURES**

This chapter covers the areawide, universe and sample (standard and donut area) sections, and the GIS/LRS data file and map updates. The previous chapters discussed the basic requirements for the HPMS data and contained guidelines, formats, and procedures for reporting data. These data are to be updated on a regularly scheduled basis. The continuous monitoring (updating) aspects of HPMS are the key to its success. It not only provides current system length information but also provides a basis for evaluating highway performance, and enables analysis of information about specific highway sections with other geographic based information. While absolute measures of performance, i.e., condition, congestion, etc., are significant and useful in some very important analyses, the changes and trends in the performance of highway systems over time provide extremely valuable information to highway planners, pavement specialists and administrators. Using this information to develop performance-investment relationships, planners can assess the effectiveness of various highway programs, improvement strategies and prioritize future investments.

The HPMS has been designed to permit updating with a minimum of effort. For the sample sections (standard and donut area), special care is recommended to establish both external (MPO, local authorities, etc.) and internal State highway agency mechanisms to report changes that have taken place as they occur (normally to a State database from which HPMS is extracted). States are encouraged to set up these ongoing mechanisms so as to minimize periodic disruptions to other ongoing activities. By setting up a system for reporting and documenting changes as they occur, the data will not only be accurate and current, but States will also avoid periodic or sporadic workload requirements which are inefficient and disruptive.

It is essential that internal State coordination be established and maintained between the HPMS staff and that of the State and MPO Pavement Management Systems (PMS), traffic monitoring system, and other management systems and data collection activities. Such coordination should improve the efficient widespread use of the pavement, travel and other data. This is also true for other data collection efforts that may be performed by other State agencies or local governments or instrumentality thereof (i.e., accident data, vehicle classification information, improvement information, traffic counts, safety and congestion data, etc.).

With a current annually reported nationwide database containing length and performance information, the need for periodic national studies like those of the past is greatly reduced. The HPMS has been designed to obtain national standardized data that will serve a variety of purposes. With little additional effort, it can be used to assess the effectiveness of pavement rehabilitation strategies and as input to other future studies.

AREAWIDE DATA

All areawide data are submitted annually via the computerized templates discussed in Chapters III and X. Data are to be reported for the calendar year ending December 31. Updates may be made at any time for any data year, and shall be made via fully completed templates. Since some template entries depend on other completed template entries (such as functional system or area type totals that are transferred), all templates should be submitted even if only one has been updated. Correspondence should provide an explanation of what has been changed.

Templates 1-3, System Length and Daily Vehicle Travel--The population, net land area, length and daily travel by system, and the average vehicle occupancy are updated annually. Population and net land area data should reflect the current urbanized and small urban area boundaries as adjusted and approved by FHWA. Current population estimates are expected to be submitted between decennial censuses based on either a more recent census or on the decennial Census figures adjusted for recent growth using other Federal, State, or local information. Sources of information should always be identified. Length and daily travel data (based on AADT and length data from the universe and sample data sections) should be updated at least as often as the universe and sample section data, as appropriate, when totals change. Updates for past year submittals involving urbanized areas or small urban areas or NAAQS nonattainment areas should use the boundaries approved for the data year of reporting. Vehicle occupancy data should be updated as new information becomes available.

Template 4, Minor Collector and Local Functional System Length--Current highway inventory information regarding length of system by surface type and volume group should be reported. Inventories should be scheduled to derive the total public road length each year and these should agree with the total reported length based on the universe and sample data sections, and with the data in Template 1. The length of roadways by surface type and AADT volume group breakdowns are to be estimated based on whatever inventory data is available, and updated each year to reflect known changes. As much information as possible should be obtained from local governmental agencies. An estimate of AADT and surface type for each section is needed to properly complete the inventory. Estimates by surface type or traffic volume group may be needed for uninventoried portions of each system. However, all parts of the system should be inventoried periodically.

Template 5. Accident statistics are to be based on information gathered from all reported motor accidents that occurred on public roads during the calendar year. Complete statistics must be submitted in a timely fashion. Estimates based on past year's trends or sampling rates are unacceptable procedures to use in submitting the annual accident data. Complete motor vehicle accident data must be reported for all public roads owned by Federal, State and local governments or instrumentalities thereof classified by functional system and National Highway System. Should the original template data need to be updated, another completed template shall be submitted.

Templates 6 and 7. A summary of the State's vehicle classification data should be submitted annually. Information from the sites should be updated based on at least one-third of the panel each year. All functional systems must be monitored on a 3-year cycle. Updates will be submitted via completed templates.

The site specific data that is used for completing Templates 6 and 7 and for other purposes are also to be updated and submitted to FHWA via electronic media.

UNIVERSE AND SAMPLE DATA

All universe and sample (standard and donut area) data are submitted annually in the record format outlined in Chapter IV. Data items are updated annually as changes occur or on a 2- to 4-year cycle as indicated below. Note that the Interstate (for IM), other PAS/NHS and sample section AADT is to be updated annually (see Appendix K). Where a 2- or 3- or 4-year update cycle period is indicated, updated data will be reported in the odd years for the even years, where possible, e.g., pavement condition data representative of 1994 should be reported in 1995. It is important to note that when an improvement is completed on a section, many other items are likely to change as a result. The following presents the types of updates that will be necessary. As can be expected, errors or needed improvement in quality of the data may become apparent as the data are used. Data should be examined and corrective action taken whenever necessary.

UPDATES ASSOCIATED WITH IMPROVEMENTS

It is imperative that the Pavement Condition (PSR), the International Roughness Index (IRI) and all other data items marked as "I.C." (at a minimum) in the following section be updated in the same data year in which an improvement is completed and reported. The State should set up a mechanism that will provide these data to the SHA road inventory as soon as a construction project is completed, and ensure that the data items are all updated at the same time.

GENERAL UPDATING INSTRUCTIONS

The "Update Cycle" column in the listing below contains initials in some cases to indicate the following:

- N.C.P. "No Change Permitted" refers to an item that by its very nature cannot change except in extraordinary circumstances or due to an error (e.g., county code).
- C.A.N. "Change As Necessary" refers to items that may change as a result of administrative actions, changes in usage or operation, capital improvements, or simply because of age (e.g., functional system, number of lanes, shoulder type, pavement condition, etc.).
- I.C. "Improvement Change" refers to those items that can only change as a result of a capital improvement (e.g., shoulder width, surface type, etc.).

Universe Data

The updating of most universe data is a straightforward process, with any change in system, jurisdiction, or operation reported for the year in which it occurs. A few items will change only as a result of improvement or due to the collection cycle. A few other items must be updated annually.

<u>Data Item</u>	<u>Update Cycle</u>
1. State Control Field	C.A.N.
2. English or Metric Reporting Units	C.A.N.
3. Year	Annual - Code the calendar year for which data applies i.e., 1993 data submitted in 1994 is coded "93".
4. State Code	N.C.P.
5. Type of Section ID	C.A.N.
6. County Code	N.C.P.
7. Section ID	C.A.N.
8. LRS Milepoint/Kilometerpoint	C.A.N. or I.C.

- | | |
|--|--|
| 9. Rural/Urban (R/U) Designation | C.A.N. - Changes in small urban and urbanized area designations are expected as a result of the decennial Censuses or special Censuses. New or revised urban area boundaries may necessitate rural/urban (R/U) code revisions for some sections. Several other items will require updating as a result of a change to this item. |
| 10. Urbanized Area Sampling Technique and Code | C.A.N. - When a rural or small urban section is redesignated as an urbanized section the appropriate urbanized area code from Appendix B is used. (Appendix B will be revised as necessary to reflect Census changes.) Care must be taken to indicate whether an urbanized area is part of a collective urbanized area (see the write up for this item in Chapter IV). |
| 11. NAAQS Nonattainment Area Code | C.A.N. |
| 12. Functional System | C.A.N. |
| 13. Generated Functional System Code | Generated - C.A.N. |
| 14. National Highway System | C.A.N. |
| 15. Planned Unbuilt Facility | C.A.N. |
| 16. Official Interstate Route Number | C.A.N. |
| 17. Route Signing | C.A.N. |
| 18. Route Qualifier | C.A.N. |
| 19. Signed Route Number | C.A.N. |
| 20. Governmental Ownership | C.A.N. |
| 21. Special Systems | C.A.N. |

- | | |
|--|---|
| 22. Type of Facility | C.A.N. |
| 23. Designated Truck Route/Parkway | C.A.N. |
| 24. Toll | C.A.N. |
| 25. Section Length | C.A.N. - Changes in length may occur because of construction, section subdivision or due to events such as jurisdictional changes. |
| 26. Donut Area Sample Panel AADT Volume Group Identifier | C.A.N. - As AADT for a section changes, it may fall outside of the limits of its presently assigned volume group. |
| 27. Standard Sample Panel AADT Volume Group Identifier | C.A.N. - As AADT for a section changes, it may fall outside of the limits of its presently assigned volume group. |
| 28. AADT | Annual - <u>AADT's on all PAS/NHS sections and on all sample (standard and donut area) sections must be updated annually.</u> Appendix K contains a discussion concerning traffic counting recommendations and the annual updating of AADT estimates. |
| 29. AADT Derivation | C.A.N. - Change as often as the derivation of AADT changes for each reporting year. |
| 30. No. of Through Lanes | I.C. |
| 31. Urban Location (Urban Only) | C.A.N. |
| 32. Access Control | I.C. |
| 33. Median Type | I.C. |
| 34. Median Width | I.C. |
| 35. Roughness (IRI) | I.C. or 2 Year |
| 36. Pavement Condition (PSR) | I.C. or 2 Year |
| 37. Reserved for Federal Use | N.C.P. |

38. Record Type Code C.A.N.

Note: Supplemental data attached to universe **OR** sample section data, if applicable:

81. HOV Operations I.C. or C.A.N.

82. Surveillance Systems I.C. or C.A.N.

Sample (Standard and Donut Area) Section Data

The standard sample section data must be maintained. As part of the updating process, data elements reported for the standard sample sections must be accurate and current. Data elements that are traffic related or that indicate changes in physical condition must be verified on a periodic basis. Some data items such as AADT, pavement roughness and PSR are among the universe data, but are required to be updated for sample sections as well. Other data, such as type and year of improvement, lane width, shoulder type, etc., will change only as a result of physical improvement to the section.

When applicable, the donut area sample section data must also be maintained. Updating for the donut area sample elements applies primarily to Items 26, 28 and 41, the Donut Area AADT Volume Group, the AADT and the Donut Area Expansion Factor, respectively. However, other items are also necessary to update, based on whether the section is a universe (donut area sample section only) or is also a standard sample section.

This section provides guidelines for keeping sample section data current, with detailed instructions and update schedules for the collection and submittal of the data. The instructions contained in this section are concerned with data item updates and not with changes in the panels of sample sections. The updated data is to be included in the annual data submission. Statistical procedures for verifying or revising the sample panels will be discussed later in this chapter.

Data Item

Update Cycle

39. Sample Number

N.C.P. - This number is used for all subdivisions of the section, and never changes.

40. Sample Subdivision

C.A.N. - This item is provided for those cases where the original sample section is no longer uniform. For example, if part of a section is widened while the other is not, two segments numbered "1" and "2" will replace the original segment "0" with two updated section records submitted, both having the original (same) sample number. Consecutive numbers may be assigned without replacement as any additional sample subdivisions are established. For example, if segment 2 is later subdivided into two parts the segment numbers could be 1, 3 and 4.

Recombine contiguous subdivisions that again become homogeneous at any time.

41. Donut Area Sample Expansion Factor

C.A.N. - As sample or total (universe) length within volume groups changes, the expansion factor must be recalculated. This is normally redone prior to every submittal.

42. Standard Sample Expansion Factor

C.A.N. - As sample or total (universe) length within volume groups changes, the expansion factor must be recalculated. This is normally redone prior to every submittal.

43. Surface/Pavement Type

I.C.

44. Pavement Section

I.C.

45. SN or Slab Thickness

I.C.

46. Type of Base

I.C.

47. Type of Subgrade

I.C.

48. Overlay or Pavement Structure Thickness	I.C.
49. Year of Surface Improvement	I.C.
50. Type of Improvement	I.C.
51. Lane Width	I.C.
52. Shoulder Type	I.C.
53. Shoulder Width	I.C.
54. Peak Parking (Urban Only)	C.A.N. or I.C.
55. ROW Width	I.C.
56. Widening Feasibility	C.A.N.
57. Horizontal Alignment Adequacy (Rural Only)	I.C.
58. Curves by Class	I.C.
59. Type of Terrain (Rural Only)	N.C.P.
60. Vertical Alignment Adequacy (Rural Only)	I.C.
61. Grades by Class	I.C.
62. Percent Passing Sight Distance (Rural Only)	I.C.
63. Speed Limit	C.A.N.
64. Weighted Design Speed (Rural Only)	I.C.
65A. Percent Single Unit Trucks (Peak and Average Daily)	3 Year or C.A.N. when new monitoring data become available.
65B. Percent Combination Trucks (Peak and Average Daily)	3 Year or C.A.N. when new monitoring data become available.
66. K-Factor	3 Year minimum
67. Directional Factor	3 Year minimum

68. Peak Capacity	I.C. or C.A.N. due to capital improvements, new procedures, etc.
69. Volume/Service Flow (V/SF) Ratio	Generated - C.A.N.
70. Turning Lanes (Urban Only)	I.C. or C.A.N. (upon restriping, perhaps)
71. Prevailing Type Signalization (Urban Only)	C.A.N.
72. Typical Peak Percent Green Time (Urban Only)	C.A.N.
73. Future AADT	3 Year--Revise target year such that the future AADT is in the range of not less than 17 years nor more than 22 years when compared to the current AADT.
74. Year of Future AADT	C.A.N. in concert with Future AADT
75. Climate Zone	Generated; may be changed by the State, if necessary.
76. Drainage Adequacy	I.C. or 4 Year
77. Type of Development (Rural Only)	C.A.N.
78. No. of Grade Separated Interchanges	I.C.
79. No. of At-Grade Intersections	I.C.
80. No. of At-Grade RR Crossings	I.C.

Note: Supplemental data attached to universe OR sample section data, if applicable:

81. HOV Operations	I.C. or C.A.N.
82. Surveillance Systems	I.C. or C.A.N.

SAMPLE PANEL UPDATESStandard Sample

Each State must have panels of standard sample sections representing rural areas as a unit, small urban areas as a unit and urbanized areas in one of three possible ways:

1. Individually sampled as required for urbanized areas with \geq 200,000 population or that are in NAAQS nonattainment areas;
2. Grouped into one or more collective statewide panels similar to the rural and small urban panels for urbanized areas that have 200,000, or less population; or
3. A combination of some individual urbanized areas and collective panel(s) for other qualified areas.

The option and rules governing the grouping of urbanized areas into one or more collective panels is discussed in Appendix E. Although the collective procedure is applicable to some States, only those States having a large number of urbanized areas benefit significantly from collective urbanized area sampling since the precision level is higher for collective sampling. This tends to offset the difference in the number of required samples between the sum of the individual urbanized area samples and the total collective samples for a small number of the same urbanized areas.

Donut Area Sample

Those States that contain one or more NAAQS nonattainment areas must have panels of donut area sample sections representing specific functional systems of the rural and small urban areas within each nonattainment area boundary, but outside of any urbanized areas as one areal unit. The rural and small urban minor arterial systems are sampled as one system, while the rural major collector and small urban collector systems are sampled as another system.

Updating of rural, small urban, and individual or collective urbanized area standard sample panels, as well as the donut area sample panels is a continuous activity. Although the panels of sampled sections are to remain as fixed as possible, there can be various changes, deletions, and additions in the size of the panels over time. The causes and corrective actions needed to maintain a valid sample are discussed in the following section.

REASONS TO UPDATE THE SAMPLE PANEL (STANDARD AND DONUT AREA)

Census

The decennial census of population is likely to cause changes in the panels of sample sections. As a result, the sampling bases of most States will change in varying degrees because the numbers of small urban areas (5,000 - 49,999 population), and individual urbanized areas (50,000 population and over) may change, and because the FHWA approved, adjusted Census urban boundaries of existing urban areas may be altered. The addition of new areas and the expansion of current urban boundaries will require the functional reclassification of additional length within the new boundaries. This will likely require transfers of universe and sample sections from one areal panel to another and the drawing of additional samples to satisfy urban area requirements. In addition, the loss of samples that move from rural to small urban or from rural or small urban to urbanized areas may cause a deficiency in the rural or small urban area panels. However, since universe length also must be moved to accommodate these changes, the stability of the sample panel may remain intact, but checks for this will still have to be made. The suggested procedures for adjusting to area sample assimilations, newly designated small urban and individual urbanized areas, and functional system revisions follow:

- All universe length falling within new or expanded urban areas must be functionally classified in accordance with urban classification criteria. In the cases of small urban areas becoming an urbanized area and expansions of existing boundaries, a judgment will have to be made as to whether the small urban area systems' length will have to be reclassified or if all of the urbanized systems' length within the area will need to be reclassified.
- Functional system universe length within the new or expanded urban areas will need to be stratified into traffic volume groups consistent with those groups established for the latest HPMS sample.
- Transfer rural sample sections taken over by small urban or urbanized areas into the appropriate functional systems and volume groups.
- Transfer small urban area sample sections taken over by urbanized areas into the appropriate functional systems and volume groups.

August 30, 1993

- Establish the required standard sample sizes (via Appendix G procedures) for the revised rural, small urban, and urbanized area panels, and draw additional samples where necessary. In nonattainment areas, the same must be done for applicable donut area sample panels (rural and small urban area systems combined). Procedures to draw additional samples are discussed below.
- Although changes in Census designation of small urban areas to rural and urbanized areas to small urban areas or to rural could possibly occur, such changes will be uncommon and will not usually require sample base verification. Universe and sample sections affected by such changes should be assigned to the correct functional system and volume group in the new panel.
- Standard and donut area sample panels are to be checked independently.

Whenever a new NAAQS nonattainment area is designated or there are changes in an existing nonattainment area such as size or system length, or there are traffic volume group changes, the selection or adjustment of a sample panel for the nonurbanized area portion of the nonattainment area will be necessary. The donut area panel is divided into the minor arterial (rural and small urban areas) and collector (rural major collector and small urban areas) categories. Each panel category uses the available standard samples in the appropriate system categories (rural and small urban areas combined) plus supplementary samples, as needed. The minimum number of samples (standard plus supplementary) needed for each volume group is calculated based on the procedures in Appendix S. If a new urbanized nonattainment area is designated by the EPA, a new donut area sample must be drawn for that nonattainment area. The procedures contained in Appendix S are to be followed under this circumstance for the data year in which the new nonattainment area is established.

Functional Reclassification

Changes in the length of functional systems, other than those dictated by decennial Census changes, will result from:

- Reclassification of system length within panels as a result of functional system changes;
- Areal reassignment of existing road sections to adjust for expanding urban boundaries between decennial Censuses; and/or
- New road construction which does not replace existing sections.

In the case of areal reassignment, the adequacy of the gaining and losing sample base(s) should be checked. As for additional length resulting from functional reclassification or new road construction, a general "rule of thumb" may be applied: if the current universe length for a given functional system has increased from the base period length by 10 percent or more, additional randomly selected sections will probably have to be added to the functional system requirements. The base period is defined as the latest year of complete assessment of sample size requirements, by volume group, for a given functional system.

Volume Group Reassignments Within A Functional System

Standard Sample--Each volume group contained in a functional system is a separate sampling universe (see Appendix F). Normally, over the short term (less than 3 years) there should be only minor changes in sample section and universe length assignments to specific volume groups as a result of traffic increases (or decreases). Traffic increases can result from normal growth and/or capital improvements. Also, some volume group misassignments (inaccurate AADT) are inevitable and may be corrected when current and accurate AADT is assigned to the section.

If, for reasons other than Census period readjustments, a specific volume group loses 5 to 10 percent of its sample sections to other volume groups, the volume group should be checked for sample adequacy using the formula and procedure outlined in Appendix G. Since universe sections/length will also have changed volume groups, the sample adequacy may remain stable, but it is prudent to make this check anyway. The minimum requirement of 3 sample sections per volume group must be maintained, (or the State must sample/report all that exist where fewer than 3 are available). If volume group losses cause the sample adequacy to fall 5 percent or more below that required, new randomly selected sections are to be added to the affected volume groups to maintain the required precision level.

Where a volume group loses samples due to volume group reassignments to the extent that it is no longer represented (no samples), or a new volume group turns up because of AADT change, new samples must be selected in those groups.

Donut Area Sample--The donut sampling procedures apply only to roads functionally classified as rural and small urban minor arterial, rural major collector, and small urban collector within a defined NAAQS nonattainment donut area boundary. Update procedures are similar to those described for the standard samples above, but the sampling procedures described in Appendix S are to be followed for the donut areas. It is prudent to update the standard sample panels prior to updating the donut area sample panels, since standard samples that exist in the donut areas in the appropriate functional systems become donut area samples.

SAMPLE (STANDARD AND DONUT AREA) ADEQUACY REVIEWStandard Sample

The required sample size is a function of the variability of data (primarily AADT) within a volume group, the functional system volume group precision level and the number of sections available for sampling in the volume group (the universe). The term "precision level" in this Manual is defined as the degree of confidence that the sampling error of a produced estimate will fall within a desired fixed range. Thus, for a precision level of 90-percent confidence with 10-percent allowable error (90-10), there is the probability that 90 times out of 100, the error of a data element estimate will be no greater or less than 10 percent of its true value. The prescribed precision levels for volume groups by functional system and geographic area are contained in Appendix F, Tables F-1 to F-4.

The purpose of the procedure contained in Appendix G is to determine the required sample size. There are varying precision levels for the rural, small urban, and urbanized areas, depending on whether the individual or collective method of sampling is being used, whether the urbanized area is within an NAAQS nonattainment area, and according to how many urbanized areas are being sampled individually. The reader is referred to Appendix E for further discussion and to Appendix F (Tables F-1 to F-4) for the precision levels.

If the total number of sections available for sampling is not known (i.e., the State groups some or all of its nonsampled universe length), an estimate of this total may be obtained by dividing the total universe volume group length by an estimate of the average section length in that stratum. Alternatively, the average length of the samples already existing in the volume group may be used.

The AADT coefficient of variation is an important part of the procedure (formula) to obtain the required number of samples for each stratum. Estimates of the AADT coefficients of variation for a particular State can be derived from its existing HPMS data using standard statistical computer packages. Alternatively, FHWA headquarters can supply the coefficients from any State tape submittal upon request. A booklet entitled "Estimates of Sample Adequacy" can be generated from any State's HPMS tape submittal by FHWA Headquarters. The booklet contains the coefficients (generated both from the sample section AADT's and from the universe section AADT's, if they exist), the number of existing, unique sample sections, the required number of samples based on the generated coefficients, an estimate of the number of universe sections in each volume group, and other estimates and information useful for doing a sample size review. FHWA Headquarters (HPM-20) will prepare the computer analysis (the booklet) upon request.

Another procedure to be used in the standard sample updating process is contained in Appendix H, Sample Size Requirements for Estimating Proportions. **This procedure applies only to the standard sample; the donut area sample does not require this check to be made.** Although a formula exists, Figure H-1, "Functional System Sample Size Needed to Detect a 10 Percent Change in Proportions," provides a curve that can be used by a State to determine if its sample size meets the criteria set forth in the appendix. Just as statewide precision level requirements are to be maintained for functional system volume group estimates of data element averages and aggregates, there is also a minimum sample size level needed to satisfy the statistical design requirements for estimating changes in the proportions of data item attributes (i.e., percentage of rough pavement) at the statewide functional system level. It is required that the design sample size at the statewide functional system level for all three geographic areas be such that the smallest detectable change in proportions is no greater than 10 percent, and preferably less, at the 80-percent confidence level. Normally, the sum of the volume group sample sizes for average and aggregates as determined by the formula in Appendix G exceeds the minimum functional system sample size requirements for the measurement of proportions, especially for rural and small urban areas. However, it is possible that the sample requirements for urbanized areas aggregated to statewide functional system levels may not satisfy the minimum criterion for proportions. This may also occur in any area (rural, small urban or urbanized) where the AADT coefficients of variation tend to be small.

The formula in Appendix H, or the curve in Figure H-1 is used to ensure minimum sample compliance in all areas. Sample size deficiencies, as determined from this formula or curve for any functional system, are to be prorated among the volume groups within the undersampled functional system according to the initial sample sizes obtained from the Appendix G formula. Further discussion of proportions is contained in Appendix H.

The "Estimates of Sample Adequacy" booklet also contains a standard sample size estimation based on the Appendix H criteria.

Donut Area Sample

The size of the total donut area sample panel is determined based on procedures described in Appendix S. Most of the discussion for the standard sample size review is also applicable to the donut area sample size review. Reviews are especially needed if the boundaries to the donut area (nonattainment area) change. The software for developing the "Estimates of Sample Adequacy" booklet will also produce similar products for the donut areas, based on the procedures in Appendix S. Appendix F, Table F-5, and Appendix S contain the precision levels that must be maintained for the donut area sample panel.

SAMPLE (STANDARD AND DONUT AREA) SELECTION FOR PANEL UPDATES

The selection of additional sample sections for a given volume group is straightforward for most updates. Basically, the number of existing sample sections is compared to the required number as determined from the Appendix G procedures (and on previous pages), and additional sample sections are randomly drawn from the nonsampled universe sections to cover any shortfalls. This basic procedure is to be used for the standard sample panels in rural, small urban and individually sampled urbanized areas, and for the donut areas of nonattainment areas.

The only variation is for the standard sample procedure and occurs when new urbanized areas are designated. The State has the option of sampling these new urbanized areas as individual areas or grouping them with other new and/or current urbanized areas into a collective urbanized area panel. **(Note, however, that the urbanized areas must have < 200,000 population, and must not be part of an NAAQS nonattainment area.)** If a State chooses to sample new areas as individual areas or to group them as a new collective urbanized area, the selection process is as described above. Procedures for drawing a complete standard sample are discussed in Appendix H and those for the donut areas are found in Appendix S. In the case where new urbanized areas are to be grouped with current urbanized areas for the standard sample panel, it is likely that the new urbanized area length will not be adequately represented by the rural and small urban samples that make up the new area and that already exist in the new area or areas. For the new area road length to be adequately represented, the number of samples in the new urbanized area in a given volume group should be proportional to the new area universe length in the given volume group. To achieve the required balance between current areas and new area length, any standard sample need required by the formula in Appendix G that exceeds the number of existing standard samples must be randomly selected from the new area road length (if new area length exists in the volume group) until the new area length is proportionally represented. Once proportionality is achieved, new samples will be drawn from the complete universe of the volume group for all areas in the collective group.

A simplified example will best illustrate the procedure. It is assumed that a collective urbanized area composed of seven urbanized areas exists in a State. Three new urbanized areas are defined as a result of the Census, and a decision is made to incorporate them into the collective group. The procedure requires that every volume group stratum in every functional system be examined. However, for this hypothetical example only volume group two of the Interstate will be analyzed. The following table presents a summary of the Interstate part of the collective urbanized area for volume groups 1 through 6.

Example Interstate Sample Summary

Row #	Contents	NUMBER OF SECTIONS OR LENGTH IN VOLUME GROUPS					
		1	2	3	4	5	6
1	Existing Samples - Current 7 Areas	0	17	16	13	7	5
2	Existing Length	0	20	30	50	20	10
3	Existing Universe (Sections)	0	25	40	80	30	10
4	Additional Universe (Sections)	0	10	10	25	10	15
5	Additional Length	0	7	9	15	8	10
6	Required Sample (Sections)	0	23	17	14	8	7
7	Required minus Existing (Sections)	0	6	1	1	1	2
8	Existing Samples - New Areas	0	2	2	1	0	0
9	Samples to be Selected	0	4	0	0	1	2
10	Total Length	0	27	39	65	28	20

The first row lists the existing sample size in the existing collective urbanized area (7 individual areas), the second row lists the length, and the third the number of sections in the existing universe. The fourth and fifth rows list the additional number of sections and length from the three new urbanized areas. The sixth row lists the required overall sample size estimated from the formula in Appendix G for all 10 areas. The seventh row contains the number of additional samples needed to accommodate the formula results. The eighth row lists the rural and small urban samples already existing in the new areas, and the ninth row lists the number of sections which must be added to the sample. The last row lists the total length in the new collective urbanized area group consisting of all 10 areas.

To determine the number of samples to be selected from the added universe (the three new urbanized areas), compute the ratio of new length to total length ($7/27 = 26$ percent for volume group 2). It is determined that 26 percent of the length and 26 percent of the volume group 2 sample should be located in the "new" part of the collective urbanized area volume group length. Since only 9 percent ($2/23$) of the required number of samples exist in the new urbanized areas, all 4 of the additionally required samples should be selected from the three new urbanized areas. If any rural and small urban area samples exist in the three new areas, they should be deducted from the samples to be selected as has been done in row nine. Two sections exist in the second volume group for the Interstate in the three new urbanized areas; therefore, only four new sample sections need to be selected. Since the selection of four new samples in the new areas will bring the sample into proper balance ($6/23 = 26$ percent), any samples required in the future should be randomly selected from all available volume group 2 sections from all 10 areas.