August 2024

MIRE 2.1

Model Inventory of Roadway Elements

U.S. Department of Transportation
Federal Highway Administration
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ZERO IS OUR GOAL
A SAFE SYSTEM IS HOW WE GET THERE

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16. Abstract

A Safe System starts with quality data. Data-driven safety analysis (DDSA) is essential to making sound decisions on the safety, design, and operations of roadways for all road users. The Model Inventory of Roadway Elements Version 2.1 (MIRE 2.1) is the latest guideline resulting from two decades of Federal safety data policy and national best practices. The purpose of MIRE is to provide States with a national model of relevant roadway and traffic data inventory they can use to support data-driven decision making. Consistent with other MIRE updates, MIRE 2.1 includes a revised format to reflect modern database environments, better aligns with other Federal datasets and requirements across FHWA, updates operational and design elements that have become more widely implemented and serves as a resource for meeting Federal safety data requirements.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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Acronyms

AADT	Annual average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
AEGIST	Applications of Enterprise Geographic Information Systems for Transportation
ARNOLD	All Road Network of Linear Referenced Data
BIL	Bipartisan Infrastructure Law
BTS	Bureau of Transportation Statistics
DOT	Department of Transportation
DTM	digital terrain model
ETL	Express Toll Lanes
FARS	Fatality Analysis Reporting System
FAST Act	Fixing America's Surface Transportation Act
FDE	Fundamental Data Elements
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standard
FRA	Federal Railroad Administration
GIS	geographic information system
GNSS	Global Navigation Satellite System
GPS	global positioning system
HOT	High Occupancy Toll
HOV	High Occupancy Vehicle
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
HSIS	Highway Safety Information System
HSM	Highway Safety Manual
IHSDM	Interactive Highway Safety Design Model
IIJA	Infrastructure Investment and Jobs Act
IRI	International Roughness Index
ITS	intelligent transportation systems
KDOT	Kansas Department of Transportation
LiDAR	light detection and ranging
LRS	linear referencing system
LRSP	local road safety plan
mAP	mean average precision
MAP-21	Moving Ahead for Progress in the 21st Century
MDOT	Michigan Department of Transportation
MIRE	Model Inventory of Roadway Elements

MIS	Management Information System
ML	machine learning
MMUCC	Model Minimum Uniform Crash Criteria
MMIRE	Model Minimum Inventory of Roadway Elements
MnDOT	Minnesota Department of Transportation
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NCDOT	North Carolina Department of Transportation
NDOT	Nevada Department of Transportation
NHS	National Highway System
NRN	National Road Network
NRSS	National Roadway Safety Strategy
OTAT	Office of Transit and Active Transportation
PSR	Present Serviceability Rating
SAFE	System Analysis and Forecast Evaluation
SHSP	Strategic Highway Safety Plan
SOV	single-occupancy vehicle
SPF	safety performance function
S2Z	STRIDES 2 Zero
TMG	Traffic Monitoring Guide
TSU	Traffic Safety Unit
UAV	unmanned aerial vehicle
USDOT	United States Department of Transportation
USGS	United States Geological Survey
YOLO	You Only Look Once

Executive Summary

Background

Quality data are key to making sound decisions on the safety performance of roadways. Safety data have evolved and grown in the last decade; critical data include not only crash but also roadway, traffic, and other contextual data useful for making sound engineering and planning decisions. The Model Inventory of Roadway Elements Version 2.1 (MIRE 2.1) is the latest guideline resulting from two decades of Federal safety data policy and national best practices. The purpose of MIRE is to provide States with a national model of comprehensive roadway and traffic data inventory they can use to support data-driven decision making.

In 2007, the Federal Highway Administration (FHWA) published the Model Minimum Inventory of Roadway Elements (MMIRE) (FHWA-HRT-07-046) report (2007). This report introduced the concept of a formal listing of roadway and traffic data elements critical to transportation safety analysis. A subsequent version, MIRE 1.0 (FHWA-SA-10-018) (2010), revised several data elements and definitions from MMIRE in coordination with important safety analysis advances.

MIRE 1.0 served as a companion to the Model Minimum Uniform Crash Criteria (MMUCC)—a voluntary guideline of crash data element definitions. It also supplemented several Federal data programs and standard guidance that interacted with highway safety, including the Highway Performance Monitoring System (HPMS) and the Manual on Uniform Traffic Control Devices (MUTCD).

MIRE 2.0 & Data Collection

In 2017, FHWA released the MIRE Version 2.0 (FHWA, 2017a; FHWA-SA-17-048). MIRE 2.0 reassessed and expanded MIRE 1.0 by including additional data elements and retiring older ones. Like MIRE 1.0, MIRE 2.0 considered several contemporary Federal data resources, including the HPMS All Road Network of Linear Referenced Data (ARNOLD). The HPMS ARNOLD requirement expanded the obligation of States to include all public roads in their linear referencing system (LRS) base map (United States Department of Transportation [USDOT], 2012). This LRS requirement provides at least one means to geospatially locate MIRE data elements and maintain these data elements for all public roads.

Legislative Requirements

The Moving Ahead for Progress in the 21st Century (MAP-21) (Pub. L. 112-141) established a statutory framework requiring a data-driven approach to identifying and analyzing highway safety problems and opportunities [23 U.S.C. 148(c)(2)]. It also introduced the collection, analysis, and improvement of safety data as an eligible Highway Safety Improvement Program (HSIP) expense, which continues to remain an eligible activity [23 U.S.C. 148 (a)(4)(B)(xiv)]. Safety data, for the purpose of the HSIP is defined as crash, roadway, and traffic data on a public road, and includes, in the case of a railway-highway grade crossing, the characteristics of highway and train traffic, licensing, and vehicle data [23 U.S.C. 148 (a)(10)].

Subsequent legislation, including the 2015 Fixing America's Surface Transportation Act (FAST Act) (Pub. L. 114-94) and the 2021 Infrastructure Investment and Jobs Act (IIJA), (Pub. L. 117-58), also known as the Bipartisan Infrastructure Law (BIL) continued the State safety data system requirements established in MAP-21.

Fundamental Data Elements & HSIP Regulations

All MIRE data elements can help States, Tribes, and local agencies conduct data-driven safety analysis (DDSA), and agencies can choose to prioritize certain data elements based on their specific safety analysis needs. MAP-21 required FHWA to establish a subset of the MIRE and ensure that States adopt and use the subset for improved data collection [23 U.S.C. 148(f)(2)]. The FAST Act and BIL continued this requirement. FHWA has issued regulations that define a subset of MIRE, known as the MIRE Fundamental Data Elements (FDEs) (23 CFR 924.3). As part of HSIP implementation (23 CFR 924.11(b)), "States shall have access to a complete collection of the MIRE fundamental data elements on all public roads by September 30, 2026."[1]

Functional Classification: The terms local and non-local refer to the Federal functional classification of a road – it does **not** refer to the ownership or maintenance agreements associated with that road.

The MIRE FDEs are comprised of 37 data elements and must be collected on all public roads (23 CFR 924.17). Public roads are all highways, roads, or streets under the jurisdiction of and maintained by a public authority and open to public travel, including non-State-owned public roads and roads on Tribal land (23 CFR 924.3). For the purpose of MIRE FDE applicability, the term "open to public travel" means that the road section is available, except during scheduled periods, extreme weather, or emergency conditions, passable by four-wheel standard passenger cars, and open to the general public for use without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight, or class of registration. Toll plazas of public toll roads are not considered restrictive gates (23 CFR 924.17, 23 CFR 460.2(c)). Recognizing the challenges States would face in collecting all 37 elements on all public roads, FHWA tiered the FDEs based on functional classification and pavement status. This tiered system has three categories: non-local paved roads (based on functional classification), local paved roads (based on functional classification), and unpaved roads (regardless of functional classification). The States must have access to all 37 FDEs for non-local paved roads, a smaller subset of 9 FDEs for local paved roads, and 5 FDEs for unpaved roads.

[1] Under 23 CFR 924.3, "[u]nless otherwise specified in this part, the definitions in 23 U.S.C. 101(a) are applicable to this part." There's no definition of the term "State" in 23 CFR part 924, so the definition in 23 U.S.C. 101(a)(28) applies, which means that the term "States" refers to any of the 50 States, D.C., and Puerto Rico.

The FDEs for non-local paved roads are further categorized into data elements for roadway segments, intersections, and interchanges/ramps.

Data Integration

Having data with consistent geospatial location across datasets and systems allows agencies to combine diverse data for advanced highway safety analysis. Location information facilitates the integration of multiple safety-related datasets, including roadway, traffic, crash, roadside hardware, intelligent transportation systems (ITS), weather, and more. This also applies to community-level characteristics consistent with modern safety practices, including systemic safety (FHWA, 2013c), the Safe System Approach, and the USDOT's 2022 National Roadway Safety Strategy (NRSS). Many datasets that support these practices (e.g., demographic and socioeconomic characteristics) are spatially located, and the location of roadway and traffic assets are essential in effectively understanding potential safety risks.

Data integration results in expanded capabilities for monitoring system performance and supports analyses that are not possible with the individual data sources. As part of an enterprise-wide strategy, data integration avoids duplicating efforts in data collection and data management and improves access to data resources through established lines of communication; agencies do not need to collect the same data element for each individual database or business unit. Furthermore, data integration can improve data quality because it can uncover errors and inconsistencies in the source data. Data integration requires a linkage mechanism, either a common variable or spatial location in each of the to-be-integrated data files, as well as policies, technology, and staff roles to manage integration across business units and platforms.

MIRE focuses on safety-related roadway and traffic data elements. It is one of many USDOT transportation data programs that aim to support performance management on the Nation's roads. HPMS, MMUCC, and the Fatality Analysis Reporting System (FARS) all help support a holistic view of the roadway network as well. Data integration supports this common mission by linking individual data elements across these programs, supporting more robust analyses on public roads, and incorporating safety in all stages of transportation planning and engineering.

Emphasis on Safety and a Safe System

The American Association of State Highway Transportation Officials (AASHTO) First Edition of the Highway Safety Manual (HSM) has been the leading guide for safety planning and engineering in the United States for over a decade. It supports analyses that screen the network for safety issues, identify applicable safety improvements, and quantify potential safety benefits of those improvements. MIRE has supported HSM implementation since the HSM's inception, and MIRE can support enhancements to safety policy over time.

USDOT adopted the Safe System Approach as part of the NRSS (USDOT, 2022). As part of the NRSS, USDOT adopted, "the Safety System Approach as the guiding paradigm to address roadway safety" (p. 6). Quality data enable practitioners to break down data that might be otherwise siloed and allow the connections that enable the Safe System Approach. MIRE supports roadway and traffic data collection, which in turn supports analyses essential for practitioners to make informed decisions about the affected Safe System elements. Examples of data and analysis in the Safe System Approach context include FHWA's A Safe System-Based Framework and Analytical Methodology for Assessing Intersections (2021c). Several MIRE data elements such as posted speed limit, traffic volumes, and intersection geometry are necessary components for implementing this method. If an agency elected to pursue a Safe System Approach to evaluate its intersections, these data elements would be highest priority in terms of comprehensiveness of network and geographic coverage, as well as the quality of data collected.

Furthermore, MIRE can also support equity, a key priority noted in the NRSS, by providing context to data. The NRSS underscored roadway safety as "…a foundational pre-requisite to our success in addressing two other major priorities: equity and climate" (p. 7). Safety is related to neighborhood context and "…disproportionate safety impacts are especially true in underserved communities, where people face heightened exposure to risk" (p. 7). Spatially locatable MIRE data (using linear referencing and a State's ARNOLD file, for instance) can support analyses that promote safer people, roads, vehicles, and speeds in historically disadvantaged communities (USDOT, n.d.(a)) or other focus communities where safety improvements are needed.

General Recommendations

The goal of MIRE is to provide a model for a comprehensive roadway and traffic data inventory that a State could use to support data-driven decision making. Each iteration (MMIRE, MIRE 1.0 and 2.0) has adapted MIRE to meet modern safety challenges and reflect Federal transportation policy more broadly. MIRE 2.1 has taken a similar approach to improve the MIRE guidance in key ways:

- Coordinate data elements and definitions to align with the latest HPMS more closely, as well as MMUCC and FARS where applicable.
- Clarify data definitions and attributes based on practitioner community feedback.
- Provide recommendations on the extent, completeness, and timeliness of all 202 MIRE data elements based on their applicability to modern safety analyses, including:
    - Systemic safety and risk assessment frameworks.
    - Safe System Approach methods for intersections and roadway departure.
    - Predictive safety methods outlined in the HSM.

Data Collection Recommendations

The importance of each data element for safety analysis and policy, such as the HSM predictive method, systemic safety, and the Safe System Approach, informed data collection recommendations in this MIRE update. FHWA does not require States to collect all non-FDEs, and States can prioritize non-FDEs based on their specific needs. Additionally, while MIRE is an extensive list of elements, it does not include all elements that a DOT would collect for all operational and design purposes. The MIRE elements are oriented toward what an agency would need for safety management. Coordination with HPMS will allow States to report MIRE FDE progress and efficiently support their business processes.

Data Segmentation

Segmentation refers to the criteria that determine the length of an individual road segment or a single unit of safety analysis. Although there is no limitation to the minimum segment length for practical application of predictive methods, the HSM generally recommends a segment length of 0.1 miles for analysis purposes (AASHTO, 2010). There is no recommendation for a maximum segment length for the purposes of data collection and management. Subsequent research has indicated that more homogeneous segments (i.e., similar geometric and traffic characteristics) perform best in HSM-based network screening methods. Although MIRE does not require a specific method of segmentation when collecting and storing data elements, homogeneous segmentation (i.e., beginning and ending segments where characteristics change) is a recommended method for segmentation based on multiple data elements or "events." Beginning and ending locations (i.e., milepoints) reported through HPMS align nicely with the MIRE FDEs.

Organization of MIRE 2.1

FHWA updated MIRE 2.0 from MIRE 1.0 to reflect agencies' transitions to an enterprise approach. It condensed the categories and subcategories of elements from MIRE 1.0 into six simplified data types to better reflect how an agency would manage MIRE data in a modern database environment. Those six data types are:

1. Segments.
2. Intersections.
3. Intersection Legs.
4. Interchanges/Ramps.
5. Horizontal Curves.
6. Vertical Grade.

FHWA further evolved MIRE 2.1 to provide supplementary information for all data elements within these categories based on the *General Recommendations* described above, reviews of other Federal data systems, and input from the practitioner community. States are encouraged to refine MIRE elements and attributes to best meet their needs. This guide concludes with case study examples that help illustrate how MIRE can help improve modern safety research and analysis. For instance, if a State is implementing analysis software, either commercially available or developed in-house, they are encouraged to adopt the attributes needed for that software or other analysis needs. MIRE 2.1 also revises some attributes to be more consistent with other Federal datasets, such as HPMS, MMUCC, and FARS, and coordinated specific recommendations with the Applications of Enterprise Geographic Information Systems for Transportation (AEGIST) pooled fund study to help States achieve their data goals more efficiently and achieve economies of scale. However, the MIRE FDEs that apply to the September 2026 deadline per 23 CFR 924.17 have not been altered or changed.

MIRE is a guideline, and other than the MIRE FDE noted in regulations, it is not required for a State to collect every MIRE element, nor have all their element names and attributes match exactly. Rather, FHWA recommends that States adopt what is useful in MIRE to help improve their inventory, and ultimately lead to better data-driven decision making to improve safety.

Data Sustainability

States having access to a complete set of MIRE FDEs is only the beginning. The MIRE FDEs are the minimum set of data elements necessary to support States in their safety analysis and project implementation programs (e.g., HSIP). Emerging trends and technologies will necessitate States adjust to changing conditions. Data sustainability, including establishing and enforcing data standards, obtaining data through original collection, obtaining data through inter-agency sharing or data integration, and quality assurance and control procedures, are critical to supporting a robust and cost-effective safety program.

Sources of Change for MIRE

MIRE 2.1 provides recommendations for portions of the network based on the *Functional Class* and *Surface Type* of the roadway. As a result, States should consider potential impacts to MIRE applicability resulting from:

- Changes to functional classifications due to road improvements, freeway conversions, or changes in DOT policies.
- Changes in surface type due to paving currently unpaved roads.
- Changes in surface type where previously paved roads are allowed to deteriorate to a point where they functionally become unpaved. Although MIRE requirements do not comment on whether a road in this situation is paved or unpaved, States could consider these roads unpaved if there is no plan to pave the road in the future.

Furthermore, a State's priorities might also change as a result of updates to Federal or State safety policies. Alternatively, an update to a State's SHSP may revise priority emphasis areas or the implementation of a local road safety program may emphasize MIRE data elements on locally owned roads.

MIRE is often a collaboration between several units within a DOT. For example, planning, traffic, HPMS, maintenance, and safety bureaus can all contribute data to existing inventories that support MIRE, as well as help prioritize data needs for safety-related initiatives. As States review their priorities and coordinate between groups, the following considerations can help guide States as they improve their safety data capabilities:

- Creating methods for processing requests to change the functional classification of a road.
- Managing the process to obtain the latest centerline information from local agencies and integrate it with the statewide all roads basemap (i.e., ARNOLD) and LRS.
- Tracking changes in network surface condition, as well as plans to pave currently unpaved roads.
- Aligning with the State's planning priorities laid out in the SHSP and any HSIP implementation plan.
- Supporting a Safe System Approach that focuses on reducing speeds, reducing conflicts between road users, and protecting vulnerable road users.
- Selecting data collection methods that can be performed routinely and within the resources available to the agency.

Additional Resources

FHWA has developed many resources to help agencies better understand and use MIRE. FHWA maintains a "Roadway Safety Data and Analysis Toolbox" as a searchable, centralized source of information about safety data and analysis tools and resources. This also includes case studies dedicated to practical uses of safety data. Table 1 provides a list of these resources.

Table 1. MIRE-Related Resources.

Resource	Description
MIRE Version 2.0 Report	Provides a list of MIRE Version 2.0 recommended elements and attitudes.
HSM 1st Edition	Leading document, published by AASHTO, for incorporating quantitative safety analysis in the highway transportation project planning and development processes.
MIRE Data Collection Guidebook	Builds upon MIRE 1.0 and discusses methods of collecting the MIRE elements and potential limitations of those methods.
MIRE Element Collection Mechanisms and Gap Analysis	Presents the findings of an effort to 1) explore existing and emerging data collection technologies, and 2) narrow the gaps between the elements in the MIRE listing and the current data available from transportation agencies' inventories and supplemental databases.
MIRE Management Information System Lead Agency Data Collection Report	Presents the findings from an effort to assist two States to expand their roadway inventory data collection to include MIRE intersection data elements. Documents two different methods of data extraction used by the two pilot States.
The Exploration of the Application of Collective Information to Transportation Data for Safety White Paper	Explores the technique of collective information as a means of gathering data needed for transportation safety.
Development of a Structure for a MIRE Management Information System	Presents a conceptual model that identifies the business functions a State is likely to need from a safety management system.
Performance Measures for Roadway Inventory Data	Builds on National Highway Traffic Safety Administration (NHTSA) defined performance measures for timeliness, accuracy, completeness, uniformity, integration, and accessibility. Provides a detailed review of each of the measures proposed for roadway data and suggests modifications of and possible additions to that original list.
Priorities in Roadway Safety Data Guide	Provides safety engineers and analysts with information about data needs in planning, programming, and developing projects under all highway programs.

Resource	Description
Roadway Safety Data Program (RSDP) MIRE Webpage	Provides a list of MIRE-related resources, including reports of MIRE Management Information Systems (MIS) efforts and safety management tools.
RSDP Toolbox	Contains resources to help agencies build a new or strengthen an existing roadway safety data program, including managing, analyzing, and collecting data and research.
Safety Data Case Studies	Case studies of State and local agencies around roadway safety data collection, management, and analysis issues.
Roadway Safety Noteworthy Practices	Examples of how State and local agencies are implementing data-driven practices to successfully address roadway safety planning, implementation, and evaluation challenges.
MIRE and MIRE FDE Technical Assistance Report	Provides a summary of the technical assistance, support, and resources for improving MIRE and MIRE FDE collection and maintenance as part of the MIRE FDE Technical Assistance Program. Additionally, the program served as a platform for developing a MIRE FDE alignment database.
2016 HPMS Field Manual	Provides a comprehensive overview of the HPMS program and describes in detail the data collection and reporting requirements for HPMS. This manual includes detailed information on technical procedures, a glossary of terms, and various tables to be used as reference by those collecting and reporting HPMS data.
MMUCC Guideline: 6th Edition	Provides the technical details of the MMUCC 6th Edition data elements. This is the result of a collaboration between NHTSA, FHWA, the Federal Motor Carrier Safety Administration (FMCSA), the National Transportation Safety Board (NTSB), the Governors Highway Safety Association (GHSA), and subject matter experts from State DOTs, local law enforcement, emergency medical services, safety organizations, industry partners, and academia.
FARS/CRSS Coding and Validation Manual	Provides guidance for crash coders with respect to two NHTSA crash data systems: the 1) Fatality Analysis Reporting System (FARS) and the 2) Crash Report Sampling System (CRSS).

Resource	Description
Fatality Analysis Reporting System Analytical User's Manual	Provides documentation for crash analysts on the historical coding practices of FARS from 1975 to 2021.
AEGIST Guidebook	Provides guidance for FHWA and States to migrate to the enterprise level for creating, maintaining, and governing data related to roadways and their characteristics, elements, and events.

Introduction

Background

Quality data are key to making sound decisions on the safety performance of roadways. Safety data have evolved and grown in the last decade; critical data include not only crash but also roadway, traffic, and other contextual data for making sound engineering and planning decisions. The Model Inventory of Roadway Elements Version 2.1 (MIRE 2.1) is the latest update, resulting from two decades of Federal safety data policy and national best practices (figure 1). The purpose of MIRE is to provide States with a national model of comprehensive roadway and traffic data inventory they can use to support data-driven decision making.

Figure 1. Graphic. Evolution of MIRE.

In 2007, the Federal Highway Administration (FHWA) published the [Model Minimum Inventory of Roadway Elements (MMIRE) (FHWA-HRT-07-046) report](#) (2007). This report introduced the concept of a formal listing of roadway and traffic data elements critical to transportation safety analysis. MMIRE supported several goals of the transportation safety analysis process (p. 3-5):

- Identification of locations that would benefit most from safety treatments.
- Development of knowledge about roadway treatment effects.
- Use of the new generation of safety management tools.
- Development of knowledge about roadway elements and designs that increase or decrease crash risk.

A subsequent version, [MIRE 1.0 (FHWA-SA-10-018)](#), revised several data elements and definitions from MMIRE in coordination with important safety analysis advances (FHWA, 2010) including:

- The 2010 release of the American Association of State Highway Transportation Officials (AASHTO) Highway Safety Manual (HSM) and supporting Safety Analyst™ software (AASHTO, 2010).
- FHWA's Interactive Highway Safety Design Model (IHSDM).
- National Cooperative Highway Research Program (NCHRP) Series 500 Data and Analysis Guide.

MIRE 1.0 served as a companion to the Model Minimum Uniform Crash Criteria (MMUCC)—a voluntary guideline of crash data element definitions. It also supplemented several Federal data programs and standard guidance that interacted with highway safety, including the Highway Performance Monitoring System (HPMS) and Manual on Uniform Traffic Control Devices (MUTCD).

MIRE 2.0 & Data Collection

To support MIRE 1.0 and FDE implementation, FHWA published the MIRE Data Collection Guidebook (FHWA, 2013a; FHWA-SA-13-009). This guidebook helped evaluate the potential for MIRE to support an enterprise safety data system (e.g., the MIRE Management Information System—FHWA, 2013b; FHWA-SA-13-008) by evaluating different data collection methods and their applicability to several segment and intersection-related data elements. This guidebook included an accuracy statement, as well as other existing resources to help States prioritize data and make informed decisions in data investments.

In 2017, FHWA released MIRE Version 2.0 (FHWA, 2017a; FHWA-SA-17-048). MIRE 2.0 reassessed and expanded MIRE 1.0 by including additional data elements and retiring older ones. Like MIRE 1.0, this assessment considered several contemporary Federal data resources, including the HPMS All Road Network of Linear Referenced Data (ARNOLD). The HPMS ARNOLD requirement expanded the obligation of States to include all public roads in their linear referencing system (LRS) base map (United States Department of Transportation [USDOT], 2012). This LRS requirement provides at least one means to geospatially locate MIRE data elements and maintain these data elements for all public roads.

Other roadway related datasets, data standards, and dictionaries reviewed included the:

- Traffic Monitoring Guide (TMG).
- Financial Management Information System Users' Guide.
- National Budget Inventory Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges.
- Long-Term Pavement Performance Inventory Data Collection Guide.
- National Park Service Road Inventory Program Cycle 4 and 5 data dictionaries.

- Second Strategic Highway Research Program Naturalistic Driving Study: Development of the Roadway Information Database.

Legislative Requirements

The Moving Ahead for Progress in the 21st Century Act (MAP-21) (Pub. L. 112-141) established a statutory framework requiring a data-driven approach to identifying and analyzing highway safety problems and opportunities [23 U.S.C. 148(c)(2)]. It also introduced the collection, analysis, and improvement of safety data as an eligible Highway Safety Improvement Program (HSIP) expense, which continues to remain an eligible activity [23 U.S.C. 148 (a)(4)(B)(xiv)]. Safety data, for the purpose of the HSIP is defined as crash, roadway, and traffic data on a public road, and includes, in the case of a railway-highway grade crossing, the characteristics of highway and train traffic, licensing, and vehicle data [23 U.S.C. 148 (a)(10)].

Subsequent legislation, including the 2015 Fixing America's Surface Transportation Act (FAST Act) (Pub. L. 114-94) and the 2021 Infrastructure Investment and Jobs Act (IIJA), (Pub. L. 117-58), also known as the Bipartisan Infrastructure Law (BIL), have furthered MIRE as part of highway safety data and analysis in the United States. The FAST Act and BIL continued the State safety data system requirements established in MAP-21.

Fundamental Data Elements & HSIP Regulations

All MIRE data elements can help States, Tribes, and local agencies conduct data-driven safety analysis (DDSA), and agencies can choose to prioritize certain data elements based on their specific safety analysis needs (refer to the *Data Sustainability* chapter for more discussion). MAP-21 required FHWA to establish a subset of the MIRE and ensure that States adopt and use the subset for improved data collection [23 U.S.C. 148(f)(2)]. The FAST Act and BIL continued this requirement. FHWA has issued regulations that define a subset of MIRE, known as the MIRE Fundamental Data Elements (FDEs) (23 CFR 924.3). As part of HSIP implementation (23 CFR 924.11(b)), "States shall have access to a complete collection of the MIRE fundamental data elements on all public roads by September 30, 2026."[2]

The MIRE FDEs are comprised of 37 data elements and must be collected on all public roads (23 CFR 924.17). Public roads are all highways, roads, or streets under the jurisdiction of and maintained by a public authority and open to public travel, including non-State-owned public roads and roads on Tribal land (23 CFR 924.3). For the purpose of MIRE FDE applicability, the term "open to public travel" means that the road section is available, except during scheduled periods, extreme weather, or emergency conditions, passable by four-wheel standard passenger cars, and open to the general public for use without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight, or class of registration. Toll plazas of

[2] Under 23 CFR 924.3, "[u]nless otherwise specified in this part, the definitions in 23 U.S.C. 101(a) are applicable to this part." There's no definition of the term "State" in 23 CFR part 924, so the definition in 23 U.S.C. 101(a)(28) applies, which means that the term "States" refers to any of the 50 States, D.C., and Puerto Rico.

public toll roads are not considered restrictive gates (23 CFR 924.17, 23 CFR 460.2(c)). Recognizing the challenges States would face in collecting all 37 elements on all public roads, FHWA tiered the FDEs based on functional classification and pavement status. This tiered system has three categories: non-local paved roads (based on functional classification), local paved roads (based on functional classification), and unpaved roads (regardless of functional classification). The States must have access to all 37 FDEs for non-local paved roads, a smaller subset of 9 FDEs for local paved roads, and 5 FDEs for unpaved roads. The FDEs for non-local paved roads are further categorized into data elements for roadway segments, intersections, and interchanges/ramps.

Functional Classification: The terms local and non-local refer to the Federal functional classification of a road – it does **not** refer to the ownership or maintenance agreements associated with that road.

The MIRE FDEs are provided in table 1, table 2, and table 3 for non-local paved roads, local paved roads, and unpaved roads, respectively. The recommendations for each element in subsequent chapters reflect and expand upon the regulatory requirements for the geographic extent of MIRE FDE coverage.

Table 1. MIRE FDEs (MIRE 2.1 Element Number) for non-local paved roads based on functional classification.

* Existing HPMS Data Item or Derive-able from HPMS

No[3].	MIRE Name	Roadway Segment	Intersection	Interchange/ Ramp
1	Route Number*	Yes	--	--
2	Route/Street Name*	Yes	--	--
3	Begin Point Segment Descriptor*	Yes	--	--
4	End Point Segment Descriptor*	Yes	--	--
5	Type of Governmental Ownership*	Yes	--	Yes
6	Segment Identifier	Yes	--	--
7	Segment Length*	Yes	--	--
8	Direction of Inventory	Yes	--	--
9	Functional Class*	Yes	--	Yes
10	Rural/Urban Designation*	Yes	--	--
11	Federal-Aid	Yes	--	--
12	Route Type*	Yes	--	--
13	Access Control*	Yes	--	--
14	Surface Type*	Yes	--	--
15	Number of Through Lanes*	Yes	--	--
16	Median Type	Yes	--	--
17	Annual Average Daily Traffic (AADT)*	Yes	Yes	--
18	AADT Year*	Yes	Yes	--
19	One/Two-Way Operations*	Yes	--	--
107	Unique Junction Identifier	--	Yes	--
108	Location Identifier for Road 1 Crossing Point	--	Yes	--
109	Location Identifier for Road 2 Crossing Point	--	Yes	--
110	Intersection/Junction Geometry	--	Yes	--
111	Intersection/Junction Traffic Control	--	Yes	--
125	Unique Approach Identifier	--	Yes	--
165	Unique Interchange Identifier	--	--	Yes
166	Interchange Type	--	--	Yes
167	Ramp Length*	--	--	Yes
168	Ramp AADT*	--	--	Yes
169	Year of Ramp AADT*	--	--	Yes
170	Roadway Type at Beginning Ramp Terminal	--	--	Yes
171	Location Identifier for Roadway at Beginning Ramp Terminal	--	--	Yes
172	Roadway Type at Ending Ramp Terminal	--	--	Yes
173	Location Identifier for Roadway at Ending Ramp Terminal	--	--	Yes

[3] Changes in data element numbers between MIRE 1.0 and 2.1 can be found in *Appendix B: MIRE Changes Over Time.*

Table 2. MIRE FDEs (MIRE 2.1 Element Number) for local paved roads based on functional classification.

* Existing HPMS Data Item or Derive-able from HPMS

No.	MIRE Name
3	Begin Point Segment Descriptor*
4	End Point Segment Descriptor*
5	Type of Governmental Ownership*
6	Segment Identifier
9	Functional Class*
10	Rural/Urban Designation*
14	Surface Type*
15	Number of Through Lanes*
17	AADT*

Table 3. MIRE FDEs (MIRE 2.1 Element Number) for unpaved roads.

* Existing HPMS Data Item or Derive-able from HPMS

No.	MIRE Name
3	Begin Point Segment Descriptor*
4	End Point Segment Descriptor*
5	Type of Governmental Ownership*
6	Segment Identifier
9	Functional Class*

Importance of Geospatial Location & the ARNOLD Requirement

Having data with consistent geospatial location across data sets and systems allows agencies to combine diverse data for advanced highway safety analysis. Location information facilitates the integration of multiple safety-related data sets including roadway, traffic, crash, roadside hardware, intelligent transportation systems (ITS), weather, and more. This also applies to community-level characteristics consistent with modern safety practices, including systemic safety (FHWA, 2013c), the Safe System Approach, and the USDOT's 2022 National Roadway Safety Strategy (NRSS). Many datasets that support these practices (e.g., demographic and socioeconomic characteristics) are spatially located, and the location of roadway and traffic assets are essential in effectively understanding potential safety risks.

The FHWA Office of Highway Policy Information and Office of Planning, Environment, and Realty issued the Memorandum on Geospatial Network for All Public Roads on August 7, 2012, requiring each State to update their LRS to include all public roadways. FHWA refers to this requirement as HPMS ARNOLD, and this policy supports the HSIP under 23 U.S.C. 148. This national LRS is a means to geolocate all safety data on a common highway basemap that includes all public roads. In 2020, FHWA initiated the National Road Network (NRN) Pilot Program to improve the intra/inter-state connectivity and spatial accuracy of HPMS ARNOLD data. FHWA's Applications of Enterprise Geographic Information Systems for Transportation (AEGIST) (FHWA-HEP-20-014) pooled fund study (2019) aims to help States advance to an enterprise level for creating, maintaining, and governing roadway data elements.

The location of crashes, roadway elements, and traffic data should be consistent with Federal and State practices to integrate MIRE data elements with other transportation data. These linkages support States' safety analysis and evaluation capabilities.

Data Integration

Data integration results in expanded capabilities for monitoring system performance and supports analyses that are not possible with the individual data sources. As part of an enterprise-wide strategy, data integration avoids duplicating efforts in data collection and data management and improves access to data resources through established lines of communication; agencies do not need to collect the same data element for each individual database or business unit. Furthermore, data integration can improve data quality because it can uncover errors and inconsistencies in the source data. Data integration requires a linkage mechanism, either a common variable or spatial location in each of the to-be-integrated data files, as well as policies, technology, and staff roles to manage integration across business units and platforms.

MIRE focuses on safety-related roadway and traffic data elements. It is one of many USDOT transportation data programs that aim to support performance management on the Nation's roads. HPMS, MMUCC, and the Fatality Analysis Reporting System (FARS) all help support a holistic view of the roadway network (figure 2). Data integration supports this common mission by linking individual data elements across these programs, supporting more robust analyses on public roads, and incorporating safety in all stages of transportation planning and engineering.

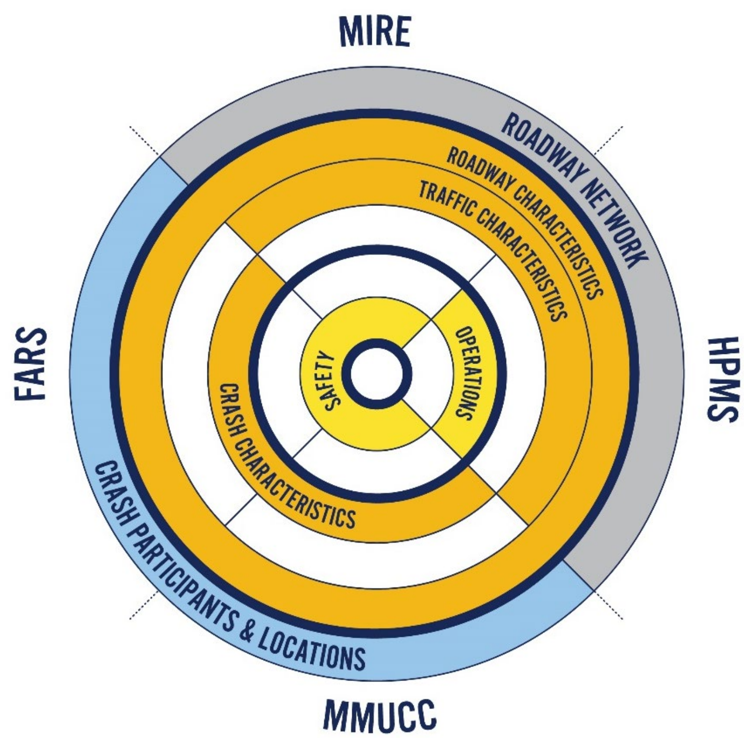

Figure 2. Graphic. MIRE in the context of other Federal data programs.

Key Definitions

The MIRE FDE requirement applies to all public roads [23 CFR 924.9(a)(1)]. Definitions for several key concepts that can help States determine where MIRE FDEs must be collected are provided below.

Public Road

"Public road means any highway, road, or street under the jurisdiction of and maintained by a public authority and open to public travel, including non-State-owned public roads and roads on Tribal land." [23 CFR 924.3].

Public Authority

"Public authority means a Federal, State, county, town, or township, Indian tribe, municipal or other local government or instrumentality with authority to finance, build, operate or maintain toll or toll-free highway facilities." [23 U.S.C. 101(a)(22))].

Open to Public Travel

"Open to public travel means that the road section is available, except during scheduled periods, extreme weather or emergency conditions, passable by four-wheel standard passenger cars, and open to the general public for use without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight, or class of registration. Toll plazas of public toll roads are not considered restrictive gates." [23 CFR 924.17; 23 CFR 460.2(c)].

Maintenance

"Maintenance means the preservation of the entire highway, including surfaces, shoulders, roadsides, structures, and such traffic control devices as are necessary for its safe and efficient utilization." [23 CFR 460.2(d)].

Emphasis on Safety and a Safe System

The HSM has been the leading guide for safety planning and engineering in the United States for over a decade. It supports analyses that screen the network for safety issues, identify applicable safety improvements, and quantify potential safety benefits of those improvements. MIRE has supported HSM implementation since the HSM's inception, and MIRE can support enhancements to safety policy over time. For instance, USDOT adopted the Safe System Approach (figure 3) as, "…the guiding paradigm to address roadway safety," (p. 6) in the NRSS (USDOT, 2022).

Figure 3. Graphic. The Safe System Approach.

The Safe System Approach is a proactive approach to safety that builds redundancy in the system and provides several layers of protection to reduce the likelihood of fatal and serious injury crashes. There are six key principles of a Safe System:

1. Death and serious injuries are unacceptable.
2. Humans make mistakes.
3. Humans are vulnerable.
4. Responsibility is shared.
5. Safety is proactive.
6. Redundancy is crucial.

Making a commitment to zero traffic deaths and serious injuries means addressing all aspects of safety through the following five Safe System elements that, together, create a holistic approach with layers of protection for road users:

1. Safer People.
2. Safer Roads.
3. Safer Vehicles.
4. Safer Speeds.
5. Post-Crash Care.

Quality data enable practitioners to break down data that might be otherwise siloed and allow the connections that enable the Safe System Approach. MIRE supports roadway and traffic data collection, which in turn supports analyses essential for practitioners to make informed decisions about the affected Safe System elements.

The *Importance of Geospatial Location & the ARNOLD Requirement* section of this chapter discusses the importance of geolocation and MIRE data, and the importance of spatial data integration in MIRE extends to supporting a Safe System Approach. For instance, examples of data and analysis in the Safe System Approach context include FHWA's A Safe System-Based Framework and Analytical Methodology for Assessing Intersections (2021c). Several MIRE data elements such as posted speed limit, traffic volumes, and intersection geometry are necessary components for implementing this method. If an agency elected to pursue a Safe System Approach to evaluate its intersections, these data elements would be highest priority in terms of comprehensiveness of network and geographic coverage, as well as the quality of data collected.

Furthermore, MIRE can also support equity, a key priority noted in the NRSS, by providing context to data. The NRSS underscored roadway safety as, "…a foundational pre-requisite to our success in addressing two other major priorities: equity and climate" (p. 7). Safety is related to neighborhood context and "…disproportionate safety impacts are especially true in underserved communities, where people face heightened exposure to risk" (p. 7). Spatially locatable MIRE data (using linear referencing and a State's ARNOLD file, for instance) can support analyses that promote safer people, roads, vehicles, and speeds in historically disadvantaged communities (USDOT, n.d.(a)) or other focus communities where safety improvements are needed.

General Recommendations

The goal of MIRE is to provide a model for a comprehensive roadway and traffic data inventory that a State could use to support data-driven decision making. Each iteration (MMIRE, MIRE 1.0 and 2.0) has adapted MIRE to meet modern safety challenges and reflect Federal transportation policy more broadly. MIRE 2.1 has taken a similar approach to improve the MIRE guidance in key ways:

- Coordinate data elements and definitions to align with the latest HPMS more closely, as well as MMUCC and FARS where applicable.
- Clarify data definitions and attributes based on practitioner community feedback.
- Provide recommendations on the extent, completeness, and timeliness of all 202 MIRE data elements based on their applicability to modern safety analyses, including:
  - Systemic safety and risk assessment frameworks.
  - Safe System Approach methods for intersections and roadway departure.
  - Predictive safety methods outlined in the HSM.

Data Collection Recommendations

The importance of each data element for safety analysis, such as the HSM predictive method, systemic safety, and the Safe System Approach, informed data collection recommendations in this MIRE update. Data collection recommendations generally fall within the following four typical categories:

1. MIRE or HPMS requires full-extent collection, and the most expansive requirement should be followed.
2. MIRE does not specify collection extent, but the applicability of the data element to modern safety analysis recommends extensive collection of the data element.
3. MIRE does not specify a collection extent, but HPMS requires the data element for a portion of the network (e.g., a sample); the data element is supplementary to safety analysis, and HPMS requirements can generally be followed.
4. Data element is not specified in HPMS and has limited applicability to safety analysis. These are the lowest priority in terms of data coverage and accuracy.

FHWA does not require States to collect all non-FDEs, and States can prioritize non-FDEs based on their specific needs. Additionally, while MIRE is an extensive list of elements, it does not include all elements that a DOT would collect for all operational and design purposes. **If a recommended FDE attribute does not apply to a State (e.g., a specific category of ownership such as "Tennessee Valley Authority") then the attribute does not need to be used.** The MIRE elements are oriented toward what an agency would need for safety management. Coordination with HPMS will allow States to report MIRE FDE progress and efficiently support their business processes.

Data Segmentation

Segmentation refers to the criteria that determine the length of an individual road segment or a single unit of safety analysis. Although there is no limitation to the minimum segment length for practical application of predictive methods, the HSM generally recommends a segment length of 0.1 miles for analysis purposes (AASHTO, 2010). There is no recommendation for a maximum segment length for the purposes of data collection and management. Subsequent research has indicated that more homogeneous segments (i.e., similar geometric and traffic characteristics) perform best in HSM-based network screening methods. **Although MIRE does not require a specific method of segmentation when collecting and storing data elements, homogeneous segmentation (i.e., beginning and ending segments where characteristics change) is a recommended method for segmentation based on multiple data elements or "events."** Beginning and ending locations (i.e., milepoints) reported through HPMS can satisfy MIRE FDE requirements for these data elements.

Organization of MIRE 2.1

FHWA updated MIRE 2.0 from MIRE 1.0 to reflect agencies' transitions to an enterprise approach. It condensed the categories and subcategories of elements from MIRE 1.0 into six simplified data types to better reflect how an agency would manage MIRE data in a modern database environment. FHWA further evolved MIRE 2.1 to provide supplementary information for all data elements within these categories based on the *General Recommendations* described above, reviews of other Federal data systems, and input from the practitioner community.

Appendix B documents specific changes from MIRE 1.0 to MIRE 2.1. States are encouraged to refine MIRE elements and attributes to best meet their needs. This guide concludes with case study examples that help illustrate how MIRE can help improve modern safety research and analysis. For instance, if a State is implementing analysis software, either commercially available or developed in-house, they are encouraged to adopt the attributes needed for that software or other analysis needs. MIRE 2.1 also revises some attributes to be more consistent with other Federal datasets, such as HPMS, MMUCC, and FARS, and coordinated specific recommendations with the AEGIST pooled fund study to help States achieve their data goals more efficiently and achieve economies of scale. However, the MIRE FDEs that apply to the September 2026 deadline per 23 CFR 924.17 have not been altered or changed.

> MIRE is a guideline, and other than the MIRE FDE noted in regulations, it is not required for a State to collect every MIRE element, nor have all their element names and attributes match exactly. Rather, FHWA recommends that States adopt what is useful in MIRE to help improve their inventory, and ultimately lead to better data-driven decision making.

Safety Data and MIRE

MIRE data represents roadway geometry and traffic characteristics that help support safety analysis on all public roads. Data that supports MIRE and safety analysis more broadly can be represented in many formats, and States have the ability to select a format and approach that works well for them. However, the following sections provide general recommendations for States when:

- Segmenting roads in their network.
- Defining components of the network such as intersections and interchanges.
- Developing a plan to collect and maintain MIRE data.

Linear Referencing and Segmentation

Segmentation is the process by which roadway centerlines are grouped into homogeneous sections. Traditionally, segmentation is accommodated by intersections, by route, or by a combination of intersections and routes to meet multiple business needs. MIRE does not specify a specific segment length, and multiple segments may exist between any two intersections. For the purposes of data collection and management, data elements can be stored independently as linear or point events in a database, and linear referencing allows States to dynamically segment their road network and generate segments between (or beyond) intersections (figure 4).

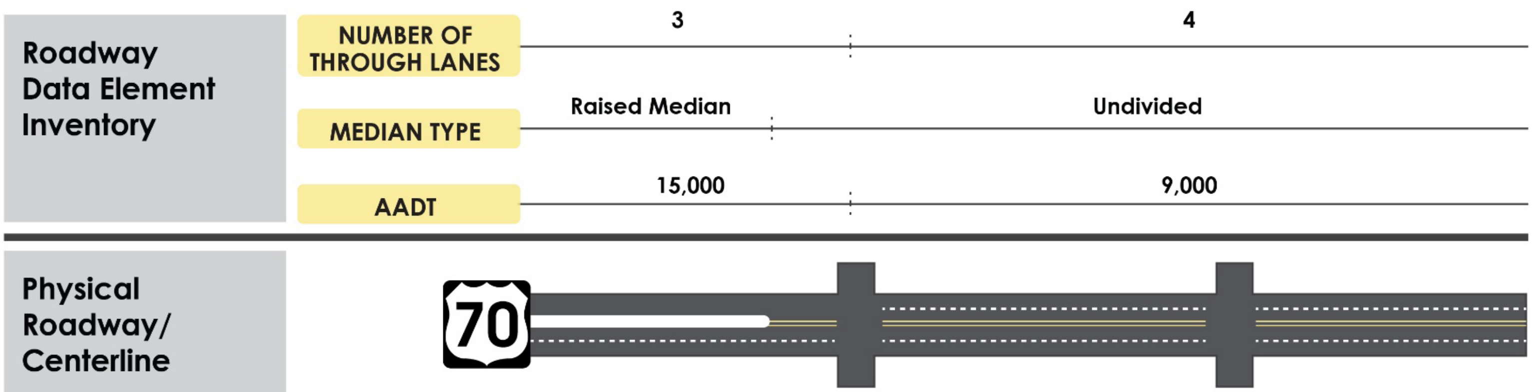

Figure 4. Graphic. Example of individual data elements representing a physical roadway stored separately as linear events.

Linear referencing and dynamic segmentation provide a framework for segmenting these data elements in a method that allows States to generate analysis-ready segments based on desired characteristics (figure 5); this approach is key for modern safety analysis (FHWA, 2021b). As segments are generated for safety analysis purposes, either through dynamic segmentation (i.e., segments of homogeneous characteristics) or another method, unique *Segment Identifiers*, *Begin Point Segment Descriptors*, and *End Point Segment Descriptors* can be generated as needed. The ability to generate these segment locations and identifiers is the core component of a MIRE-ready database.

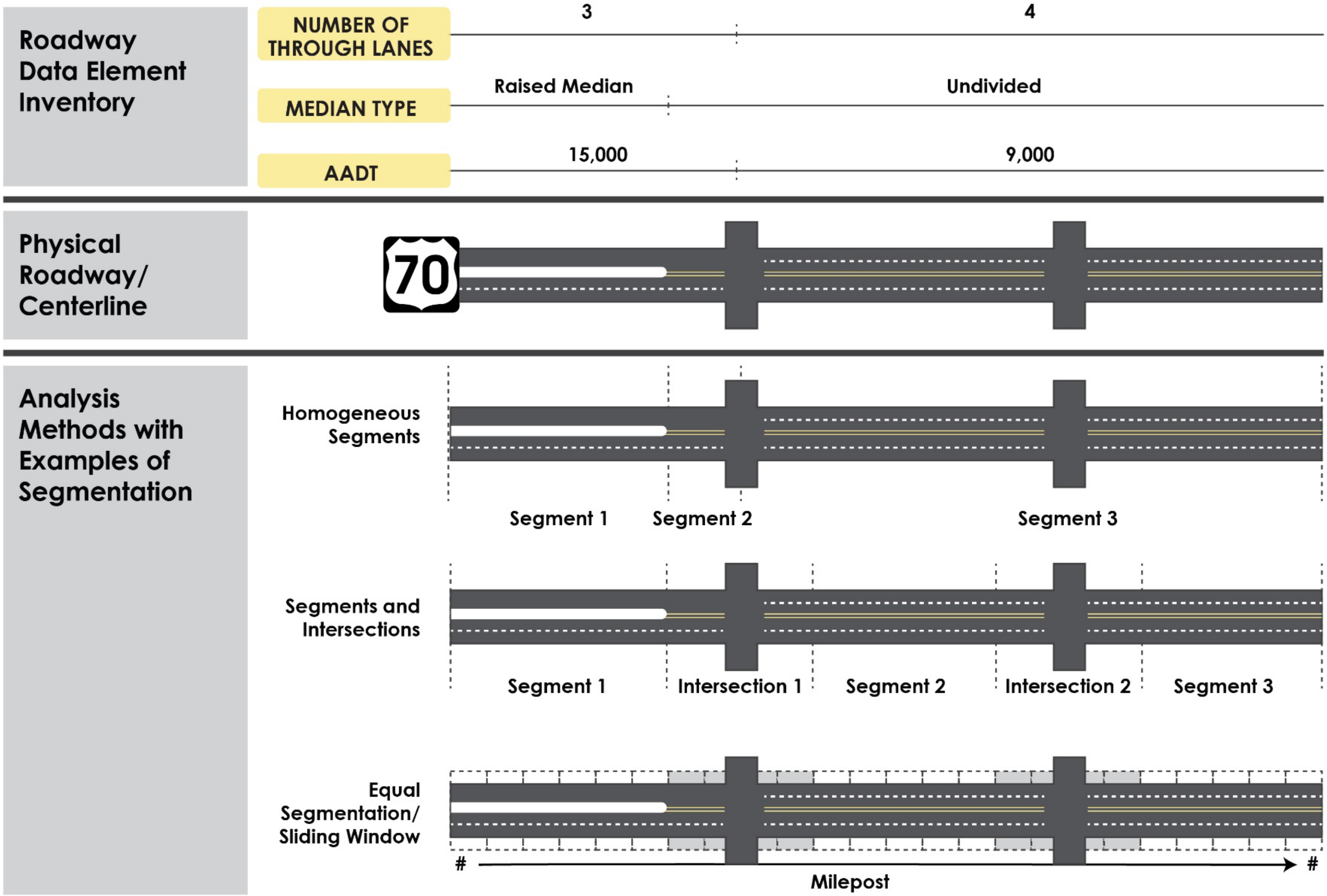

Figure 5. Graphic. Example of analysis-ready datasets based on segmentation of data elements.

Like *Segment* data elements, data elements in the *Horizontal Curve* and *Vertical Grade* data type categories can vary in length according to the lengths of a horizontal curve, vertical curve, or length of consistent grade. MIRE recommends that *Segment*, *Horizontal Curve*, and *Vertical Grade* data elements be stored separately according to a State's applicable LRS. This approach allows flexibility for analysis as States can compile segments according to changes in characteristics rather than more rigid, prescribed lengths (i.e., between intersections) where characteristics may change in the middle of a segment.

Intersections and Interchanges in MIRE

Intersections are at-grade locations where road users from different modes may cross or conflict along the network. Examples include intersecting roads; midblock crossings where trails, greenways, or other non-motorized roadway users cross; or railroad crossings. Geographic Information System (GIS) is a common format for digitally representing and storing data for intersections in a public road network.

Figure 6 provides a framework for representing intersections, intersection legs, and interchanges in a GIS compatible format. This compilation of points (i.e., nodes), lines, and polygons can be used to design a database that can manage and analyze MIRE data.

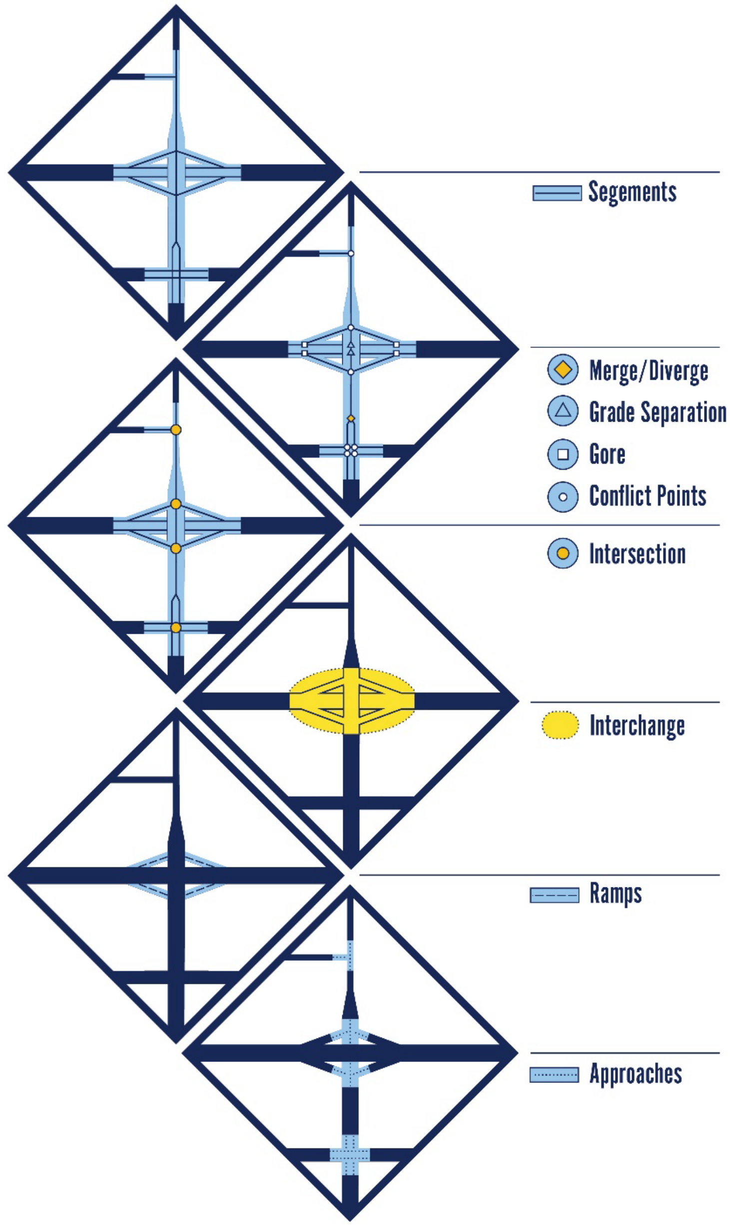

Figure 6. Graphic. MIRE Intersection Framework.

Node Inputs

Nodes are point representations of connections between linear segments. The following node types can be represented as singular points in a geospatial context.

Merge/Diverge: Merge and Diverge GIS nodes represent locations where digital centerlines meet because of the begin or end points of a median-divided dual carriageway. These are **not** considered intersections in MIRE but are useful for safety analysis.

Grade Separation: Grade Separation GIS nodes represent the point at which digital centerlines representing two or more routes intersect; however, there is no conflict between road users because of a bridge or tunnel separation. These are **not** considered intersections in MIRE.

Gore: Gore GIS nodes represent ramp connections to a freeway mainline. These may include add lane, drop lane, acceleration lane, and deceleration lane locations. These are **not** considered intersections in MIRE but are useful for safety analysis.

Conflict Points: Conflict Point GIS nodes represent the point at which digital centerlines representing two or more routes intersect and road users potentially conflict. These may be at-grade intersections or ramp terminals on the cross-street, and approaches can be part of a single centerline or direction of travel as part of a dual carriageway. Conflict Points are the individual digital components of an intersection.

MIRE FDEs and Intersections: Intersections can contain approaches with different functional classifications and surface types. Any intersection of public roads with at least one approach leg classified as a non-local paved road is included in the MIRE FDE requirements.

Intersections: Intersections are comprised of one or more Conflict Points. These **are** considered intersections in MIRE. If more than one Conflict Point is included in a single intersection, these locations would share the common *Unique Junction Identifier*.

Linear Inputs

There is a key distinction between the digital representation of a roadway (i.e., intersection approaches and departures) and the physical design of the road (i.e., intersection legs) in MIRE:

Intersection Approaches: Intersection approaches are digital linear features representing the approaches and departures at intersections carrying **1) entering and exiting traffic for two-way approaches, 2) entering or exiting traffic for one-way approaches, and 3) entering or exiting traffic for one-way approaches as part of a divided highway**. Intersection approaches digitally represent at-grade roadway segments approaching intersections as well as ramp segments approaching ramp terminals with the cross-street. Intersection approaches share the *Unique Junction Identifier* of the Intersection node, as well as the applicable *Location Identifier* for each approach.

Figure 7 illustrates a typical four-leg intersection with a median-divided dual carriageway at each leg. In a typical GIS format, this creates a diagram where four directional road centerlines create four nodes (i.e., conflict points) and 16 approaches and departures from these nodes (left portion of figure 7). The right half of figure 7 illustrates the relevant digital features for the purposes of reporting the location and unique ID of all approaches (and departures).

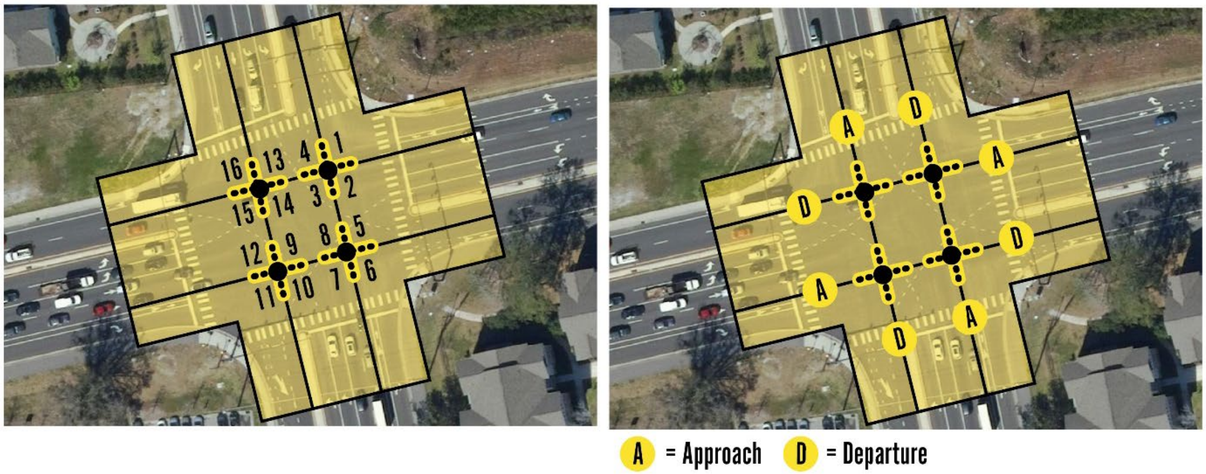

Figure 7. Graphic. Illustration of intersection approaches and departures at a four-leg intersection represented in GIS.

Intersection Legs: Intersection legs are physical roadway features representing the functional design of the intersection. For the purposes of calculating intersection geometry (e.g., a four-leg intersection), legs represent approaches and departures at intersections carrying **1) entering and exiting traffic for two-way, undivided approaches, 2) entering or exiting traffic for one-way approaches, and 3) the combined entering and exiting traffic as part of a divided highway**. Intersection legs are at-grade roadway segments approaching intersections, as well as ramp segments approaching ramp terminals with the cross-street. Figure 8 illustrates how the digital representation in figure 7 should be reported for the purposes of the *Intersection/Junction Geometry* FDE.

Figure 8. Graphic. Illustration of intersection legs at a four-leg intersection.

Polygon Areas

Polygons are a potential method for digitally representing intersection and interchange areas in GIS data systems. Although not required by MIRE, polygons can envelope the linear and point features that comprise intersections and interchanges; this can be useful in crash analyses, as safety analysts can join crash locations to specific intersections using the polygon envelope. The following is an example for the components that would comprise the overall intersection and interchange area:

Intersection: Intersection polygon areas represent the combined area for at-grade intersections and ramp terminals, including intersections legs. Key elements of the intersection include:

- **Intersection nodes (if intersection includes a dual carriageway or other channelized turn lanes).** These include location information.
- **Intersection FDEs.** These might include the unique junction identifier, intersection geometry, and intersection traffic control at the intersection.
- **Intersection leg FDEs.** These might include number of lanes, median type, functional classification, and access control.

Interchange: *"An interchange is a system of interconnecting roadways in conjunction with one or more grade separations, providing for the movement of traffic between two or more roadways on different levels"* (Association of Transportation Safety Information Professionals, 2017, p. 26). Interchange polygon areas represent the combined area for a grade separated interchange on an access-controlled freeway. Key elements of the interchange include:

- **Cross-street segment FDEs.** These might include number of lanes, median type, and functional classification.
- **Mainline freeway FDEs.** These might include number of lanes, median type, functional classification, and access control.
- **Intersection nodes and associated FDEs at ramp terminals.** These might include the unique junction identifier, intersection geometry, and intersection traffic control at the intersection with the cross-street.
- **Ramp segments and associated FDEs at ramp terminals at the cross-street and connections (i.e., Gore points) with the mainline freeway.** These might include the ramp length and roadway types at the begin and end of the ramp.

Developing a Plan for Data Elements

The following chapters of MIRE 2.1 present a listing of the MIRE elements. The elements are sorted into six data type categories, with the FDEs listed at the beginning of each applicable section:

1. Segment.
2. Intersection.
3. Intersection Leg.
4. Interchange/Ramp.
5. Horizontal Curve.
6. Vertical Grade.

Each chapter begins with a listing of the elements in that section, followed by detailed information for each element. The information includes an element name, description, recommended attributes, recommended data field type(s), remarks, and a crosswalk table showing the relationship between MIRE and other national datasets. Each MIRE FDE has an annotation noting that it is a Fundamental Data Element (e.g. Route Number [FDE]). New to MIRE 2.1 are FHWA's recommendations for a data collection approach:

Collection Cycle: FHWA has defined general timeframes for data collection based on the relevance to safety analysis, as well as the likelihood for the condition to change over time. This refers to FHWA's recommendation about how often data should be updated and collected, not frequency of State submissions to HPMS or other Federal reporting standards.

- *Annually* – Data should be refreshed annually to support safety performance management.
- *Medium Term* – Data should be refreshed routinely (at least every five years) or as conditions change to capture relevant changes that could impact safety performance.
- *Long Term* – Data should be refreshed on a regular cycle (e.g., at least every ten years), but conditions are expected to change slowly, and the data element is supplementary to safety analysis needs.
- *Ad-Hoc* – Data can be collected as resources permit since conditions are expected to change slowly, if at all. Data may also not be essential for modern safety analyses.

Where applicable, MIRE also notes relevant countermeasure service life spans to help States plan recurring collection of infrastructure presence and condition (FHWA, 2021a).

Level of Accuracy: FHWA has provided general remarks for the level of accuracy desirable to use the data element in safety analysis. However, States have discretion to collect data to their desired level of accuracy (i.e., within a certain measurement threshold) based on their needs.

- *High* – Data are highly important to safety analysis, and a high degree of accuracy (i.e., design-level) associated with measured or known observations will produce highly reliable results. Data elements with a recommended high level of accuracy could be collected from field measurements, construction plans, or derived from State data systems (e.g., the *Begin Point Segment Descriptor* and *End Point Segment Descriptor*, usually close to a 1 meter accuracy).
- *Moderate* – Data are moderately important to safety analysis; data do not require a high-level of accuracy (i.e., planning-level) or supplementary estimates may be acceptable to make informed safety decisions. This could include desktop collection using aerial or street view imagery, digital terrain models (DTMs), and manual measurements in software applications.
- *Low* – Data are not essential for safety analysis (i.e., supplementary); data can be collected at an ad-hoc level of accuracy or data can be mostly estimate results.

Validation Checks: FHWA has provided a list of validation checks that States can consider adopting to maintain accurate and reliable data.

Collection Extent: FHWA has provided general recommendations for the geographic extent of data. Collection extents sometimes vary between MIRE and HPMS; HPMS often discusses collection extents in terms of the National Highway System (NHS) or Federal Aid system, a subset by functional classification, or all public roads. For the purposes of MIRE FDE requirements, all are based on the **functional classification** and pavement status categories:

- Non-Local Paved Roads.
- Local Paved Roads.
- Unpaved Roads.

Categories for extent on these facility types include:

- *Full Extent* – States should strive for complete and comprehensive coverage of this data element for the applicable portion of the network (e.g., non-local paved, local paved, and unpaved).
- *Partial Extent* – States can target data collection on portions of the network where safety is a priority at their discretion; this can be based on planning priorities, such as a Strategic Highway Safety Plan (SHSP), or other analysis needs, such as a systemic analysis.

Collection Methods

FHWA has developed methods for States to consider as they assess potential procedures for data collection or updates. Collection cycle, extent, and accuracy thresholds are all important aspects of any chosen method. When reviewing potential methods for their data collection program, States should consider both the variety of methods and potential sources for these data.

Data Collection Methods

This guide provides a high-level summary of potential data collection methods that States can use to gather the essential information needed for safety management and analysis (FHWA, 2018; FHWA, 2020a; USDOT, n.d.(b); Xu et al., 2022). Although specifics may vary by context and resource availability, this compilation is intended to provide a starting point for potential data collection programs. The named list is provided in alphabetical order:

- **Aerial imagery**: Aerial imagery is a method of data collection that involves capturing high-resolution photographs of roadways and surrounding areas from fixed-wing aircraft or unmanned aerial vehicles (UAVs). This imagery can be used to identify road features, conditions, and changes over time. State and local agencies can review aerial imagery manually using trained staff, or features can be extracted using image classification on trained algorithms; these algorithms can also use open-source and proprietary machine learning (ML) packages to provide a probability (i.e., statistical confidence) associated with certain features in the imagery that can be reviewed by staff, thereby reducing labor resource needs.
- **Construction records and local public works databases**: Construction records are documents and data collected during the planning, design, and construction phases of a roadway project. Likewise, public works or DOT records from local governments may provide existing conditions or estimates for many roadway and transportation assets. State and local agencies maintain these records, which can provide valuable information about the design, materials, and structural elements for all public roads.
- **Field survey**: A field survey is a direct, on-site method of data collection where personnel use handheld mapping applications, either connected or disconnected to mobile internet access, to inventory observations and measurements. Examples of field surveys include road safety audits, diagnostic condition diagrams for sites identified during network screening, field verification for traffic forecasts, and other site visits. Field surveyors often use global positioning system (GPS)/Global Navigation Satellite System (GNSS)-enabled devices for accurate geospatial data collection. This method is effective for capturing specific details about the roadway, such as signs, markings, and surface conditions, that may be critical to safety management.
- **Light detection and ranging (LiDAR)**: LiDAR is a highly accurate method for extracting information within the roadway and along the roadside. Generally, LiDAR can be obtained in in three methods, aerial, mobile, and terrestrial capture.

- *Aerial LiDAR:* Aerial LiDAR is a remote sensing technology that uses laser to measure distances between an airborne sensor and the ground. This method generates high-resolution, three-dimensional models (computer representations) of roadways and surrounding terrain, allowing for detailed analysis of roadway elements and features. This method combines the advantages of LiDAR technology with the wide view, safety (for data collection staff), and speed of aerial imagery (FHWA, 2018). The advancement of small drones has made aerial LiDAR more accessible, economically viable, reliable, and easy to operate. Commercial low-altitude drones (i.e., flying below 500 ft) equipped with LiDAR sensors, such as multirotor quadcopters or hexacopters, can come with integrated software systems that enable automated data collection from a defined area with minimal pilot interference. This simplification in data collection and analysis is a key benefit of aerial LiDAR.

  It is important to note the distinction between LiDAR data collection using low-altitude multirotor drones and higher-flying aircraft or fixed-wing drones. While aircraft or fixed-wing drones can be more economical at large scales, they provide relatively lower-resolution data that might not be suitable for deriving all road features required for design purposes (FHWA, 2018). Aerial LiDAR is particularly useful for assessing the topography, vegetation, and structures around roadways that may impact safety.

- *Mobile LiDAR:* Mobile LiDAR is similar to aerial and terrestrial LiDAR, but the sensors are mounted on a vehicle instead of an aircraft or stationary tripod. This method is highly versatile and has gained popularity in recent years for roadway data collection. The potential for LiDAR data to be used for various applications, combined with the speed and accuracy of data collection, makes this method an ideal choice for many States (FHWA, 2018). Mobile LiDAR has become the dominant source of data for creating 3D models of roads and detecting roadside objects.

  Typical mobile LiDAR configurations involve a LiDAR sensor coupled with high-definition cameras for image capture mounted on a specially instrumented vehicle. The ability of mobile LiDAR to capture measurements safely and quickly is a significant advantage over other techniques, especially when data are used for surveying or digital 3D model development. Mobile LiDAR addresses the challenges of locating road features automatically and accurately from ground-based images, which lack precise spatial measurements or depth information. Mobile LiDAR, particularly when mounted on vehicles, can capture detailed information about the roadway's geometry, pavement markings, and roadside features, providing a comprehensive view of the road environment for safety analysis.

Before considering a program of LiDAR data collection, States and local governments should consider the following limitations and equipment needs:

- Frequency of collection, often on a multi-year cycle for most States, may be slow to capture changing conditions in real-time.
- Cost of equipment, including equipment purchases, rentals, and technical assistance. These may require substantial upfront costs, as well as ongoing maintenance costs.
- Data size can be substantial, often several petabytes or more, and data often need to be retained for several years. Technical expertise is also required to process raw data outputs into meaningful data for safety analysis.
- Frequent obstructions, such as heavy vegetation and vehicles, may inhibit detailed collection and require several collection runs to obtain sufficient detail.

- **Mobile street-level imagery and sensors**: Mobile street-level imagery involves capturing high-resolution photographs of roadways and the pavement surface using cameras mounted on data collection vehicles. This category includes supplementary three-dimensional (3D) cameras and sensors that can assess pavement roughness and surface issues. This method provides detailed visual data of the roadway environment, including signs, markings, and infrastructure; however, it may lack reliability for tracking topography or features on roadsides. Like aerial imagery, ML algorithms can be trained to review the imagery for feature extraction, asset location, and condition assessment.
- **Probe/connected vehicle data**: This category encompasses a wide variety of data sources, with variations in accuracy depending on the source or sensor of the transmitted data. Probe data often refers to information collected from smartphones or in-vehicle devices that often rely on connection via cellular, while connected vehicle data is typically generated from the vehicles equipped with communication technologies often including GPS, typically installed by the original equipment manufacturers, that can share information with other vehicles, communicate with select roadway infrastructure and is often shared to cloud resources. These data sources provide valuable information about vehicle origins, destinations, positions, paths taken, travel speeds, travel times, and driving behaviors. Among the many uses of data from these sources include the ability to develop counts that provide a general estimate of traffic volumes, turning movement characteristics and typical speeds which can be used to identify potential safety concerns and inform traffic management strategies.
- **Statistical models/estimation**: Statistical models and estimation techniques involve using existing count or condition data to predict or estimate traffic counts, as well as roadway characteristics and condition. These methods can help States identify trends, assess the effectiveness of safety countermeasures, and prioritize investments in roadway improvements; however, States should take care as research has shown that predictive methods in the HSM perform best with actual traffic count data, rather than statistically generated estimates (Alluri & Ogle, 2012). Examples of statistical models used in transportation analysis include regression models, Bayesian models, and ML algorithms.

- **Traffic data**: Traffic data refer to the process of collecting data on several traffic characteristics, including volume, classification, weight, travel time (i.e., speed), and origins-destinations (FHWA, 2022e). This information is essential for understanding traffic patterns, identifying potential safety issues, and informing transportation planning and safety improvement efforts. Traffic volume counts can be conducted using various methods, such as manual counts, automated counters, or video-based systems. Traffic counts often encompass continuous count stations and short-duration counts. FHWA's Traffic Monitoring Guide (2022e) provides a framework for establishing traffic data programs to capture traffic volume, speed, and vehicle classification MIRE data elements.
- **Other agency data**: Not all safety-related data are exclusive to roadway characteristics within the right-of-way. Land use, terrain, demographic, and socioeconomic data are important in safety analysis, and can contribute to MIRE data elements. These can often be linked to roadways through routine GIS processes. Examples in this category include:
    - Elevation and digital terrain models.
    - Land use categorized in local property tax records.
    - Zoning ordinances and maps.
    - Data submitted to the NBI and HPMS.
    - Census estimates.

Data Sources

State, regional, Tribal, and local transportation agencies can collaborate to identify existing sources of information, and several sources can apply to a single data element (i.e., based on road ownership or jurisdictional differences). For instance, State agencies may be able to capture direct measurements or counts on a State highway system; however, general or indirect estimates may be available to local governments or obtainable from proprietary non-governmental sources. Data governance efforts can help set and enforce data standards, identify and fill data gaps, and document data element definitions and metadata, including the sources for data in State databases. The HPMS Field Manual conceptualizes this mixture of method (type) and source in an example framework for traffic count information in table 4.

Table 4. HPMS example data source options.

Code	Source	Method Type	Method
A	State or local government agency	Actual count	Consistent with short term count factoring procedures outlined in the Traffic Monitoring Guide (TMG)
B	State or local government agency	Travel demand model output, statistical trend analysis, cellular data modeling, or similar	Alternative methods not identified in the TMG
C	Private business or non-governmental agency	Actual count	Consistent with short term count factoring procedures outlined in the TMG
D	Private business or non-governmental agency	Travel demand model output, statistical trend analysis, cellular data modeling, or similar	Alternative methods not identified in the TMG
E	Data are developed or acquired using a method not identified in A, B, C, or D		

Key potential sources of safety data include:

- **Federal agencies:** Several Federal agencies may have data that can help States address gaps in MIRE data. Examples include bicycle and pedestrian infrastructure available through the Bureau of Transportation Statistics (BTS), as well as elevation and topographical information provided by the United States Geological Survey (USGS).

- **State DOT or other State agencies:** Data relevant to MIRE can be stored across various business units within a State DOT (e.g., planning, pavement, or construction), or they could be maintained by other State agencies (e.g., school locations or toll records).

- **Local government agencies:** Like State agencies, local governments collect and maintain data relevant to MIRE. Local DOTs or public works agencies are clear beneficiaries and users of MIRE data, and local utility departments and departments of revenue can supplement key MIRE elements (e.g., lighting installations, construction documents, and land use records). Data sharing arrangements, both formal and informal, between State and local/regional agencies perform well when the data being shared are redistributed by the State DOT to the original providing agency (i.e., local government). This reciprocal relationship provides value to both groups and encourages collaboration versus one-way transactions where mutual benefits may not be clear to all parties.

- **Private business or non-governmental agency:** Several entities either have access to existing data (e.g., aerial imagery or LiDAR), or they can partner with State DOTs to help collect and process existing data (e.g., public universities). These entities can also help with statistical modeling that can provide estimates based on sample data (e.g., traffic estimates on local and unpaved roads).

Appendix A provides general recommendations for sources and methods for collecting applicable MIRE data elements. Although this guidance does not recommend a single source for any particular data element, States should evaluate the sufficiency of planning level or estimated data from non-State agency sources based on the presented levels of accuracy, collection extent, and collection cycle.

SEGMENTS

Segments

1. Route Number [FDE]
2. Route/Street Name [FDE]
3. Begin Point Segment Descriptor [FDE]
4. End Point Segment Descriptor [FDE]
5. Type of Governmental Ownership [FDE]
6. Segment Identifier [FDE]
7. Segment Length [FDE]
8. Direction of Inventory [FDE]
9. Functional Class [FDE]
10. Rural/Urban Designation [FDE]
11. Federal Aid [FDE]
12. Route Type [FDE]
13. Access Control [FDE]
14. Surface Type [FDE]
15. Number of Through Lanes [FDE]
16. Median Type [FDE]
17. AADT [FDE]
18. AADT Year [FDE]
19. One/Two-Way Operations [FDE]
20. County Name
21. County Code
22. Highway District
23. Specific Governmental Ownership
24. City/Local Jurisdiction Name
25. City/Local Jurisdiction Urban Code
26. Route Signing
27. Route Signing Qualifier
28. Coinciding Route Indicator
29. Coinciding Route – Minor Route Information
30. Total Paved Surface Width
31. Surface Friction
32. Surface Friction Date
33. International Roughness Index (IRI)
34. International Roughness Index (IRI) Date
35. Pavement Condition (Present Serviceability Rating [PSR])
36. Pavement Condition (PSR) Date
37. Outside Through Lane Width
38. Inside Through Lane Width
39. Cross Slope
40. Auxiliary Lane Presence/Type
41. Auxiliary Lane Length
42. Managed Lane Operations Type
43. Managed Lanes
44. Reversible Lanes
45. Presence/Type of Bicycle Facility
46. Width of Bicycle Facility
47. Number of Peak Period Through Lanes
48. Right Shoulder Type
49. Right Shoulder Total Width
50. Right Paved Shoulder Width
51. Right Shoulder Rumble Strip Presence/Type
52. Left Shoulder Type
53. Left Shoulder Total Width
54. Left Paved Shoulder Width
55. Left Shoulder Rumble Strip Presence/Type
56. Sidewalk Presence
57. Curb Presence
58. Curb Type
59. Median Width
60. Median Barrier Presence/Type
61. Median (Inner) Paved Shoulder Width

62. Median Shoulder Rumble Strip Presence/Type
63. Median Sideslope
64. Median Sideslope Width
65. Median Crossover/Left-Turn Lane Type
66. Roadside Clear Zone Width
67. Right Sideslope
68. Right Sideslope Width
69. Left Sideslope
70. Left Sideslope Width
71. Roadside Rating
72. Tapered Edge
73. Major Commercial Driveway Count
74. Minor Commercial Driveway Count
75. Major Residential Driveway Count
76. Minor Residential Driveway Count
77. Major Industrial/Institutional Driveway Count
78. Minor Industrial/Institutional Driveway Count
79. Other Driveway Count
80. Terrain Type
81. AADT Annual Escalation Percentage
82. Percent Single Unit Trucks or Single Truck AADT
83. Percent Combination Trucks or Combination Truck AADT
84. Percentage Trucks or Truck AADT
85. Total Daily Two-Way Pedestrian Count/Exposure
86. Bicycle Count/Exposure
87. Motorcycle Count or Percentage
88. Hourly Traffic Volumes (or Peak and Off peak AADT)
89. K-Factor
90. Design Hour Directional Factor
91. Speed Limit
92. Truck Speed Limit
93. Nighttime Speed Limit
94. 85th Percentile Speed
95. Mean Speed
96. School Zone Indicator
97. On-Street Parking Presence
98. On-Street Parking Type
99. Roadway Lighting
100. Toll Charged
101. Toll Type
102. Edgeline Presence/Width
103. Centerline Presence/Width
104. Centerline Rumble Strip Presence/Type
105. Passing Zone Percentage
106. Bridge Numbers for Bridges in Segment

1. Route Number FDE

Description:	The signed route number.
Recommended Attributes:	1. Signed numeric value for the roadway segment.
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS reporting measures. Any descriptive route name information should be included in *Route/Street Name*.

For example, if the official route number contains an alphabetic character (e.g., 32A), FHWA recommends using the numeric portion of this value and the entire value in *Route/Street Name* (figure 9). Where a route is designated with alphabetic characters only (e.g., W), FHWA recommends leaving value *NULL* and using *Route/Street Name* for the route name.

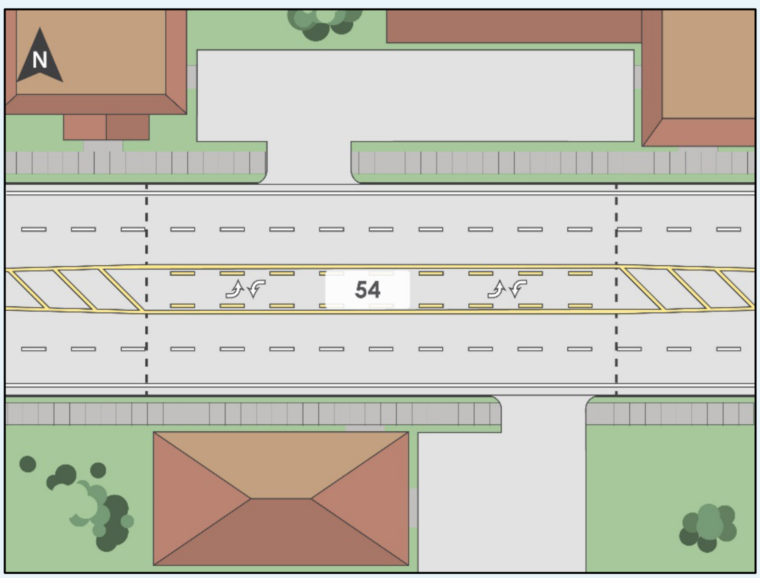

Figure 9. Graphic. Route number example.

If a route number is not known, States can review several potential sources for route information:

- Census TIGER files.
- Local 911 or E-911 records.
- Local parcel and address information.

Crosswalk with other Data Systems: • **HPMS:** Route Number • **FARS:** Trafficway Identifier • **NBI:** Route Number			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for all non-local paved roads.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

2. Route/Street Name FDE

Description:	The route or street name where different from *Route Number*.
Recommended Attributes:	1. The alphanumeric route or street name.
Recommended Field Type:	Text

Remarks: States are encouraged to align their data collection with HPMS reporting measures (figure 10).

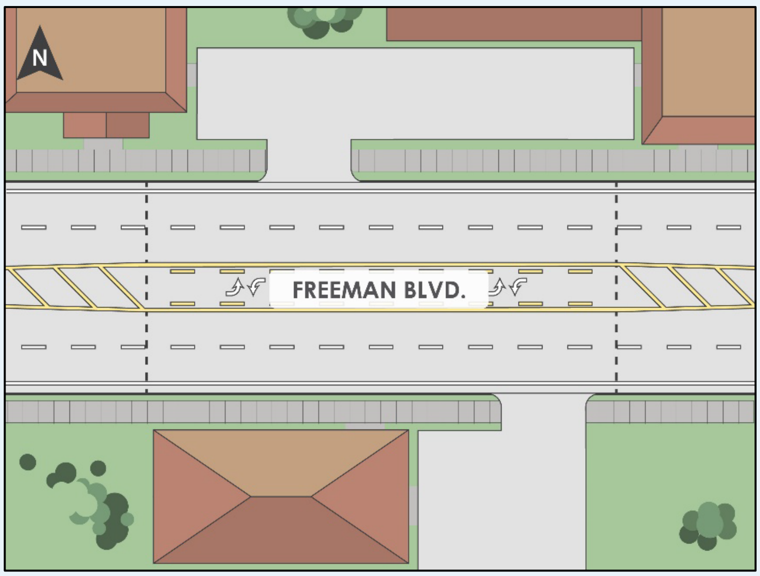

Figure 10. Graphic. Route/street name example.

If a route or street name is not known, States can review several potential sources for route information:

- Census TIGER files.
- Local 911 or E-911 records.
- Local parcel and address information.

Crosswalk with other Data Systems:

- **HPMS:** Road Name
- **FARS:** Trafficway Identifier

Collection Cycle:	Ad-Hoc
Level of Accuracy:	High

<table>
<tr><td>Validation Checks:</td><td colspan="3">Value does not equal NULL for all non-local paved roads.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>Full Extent</td></tr>
</table>

3. Begin Point Segment Descriptor [FDE]

Description:	Location information defining the beginning of the segment.
Recommended Attributes:	1. Begin point defined by the user agency.
Recommended Field Type:	Numeric

Remarks: Generally, this will be based on homogeneity of chosen attributes throughout the segment. Begin point segment descriptors can be either linked to an LRS (e.g., Route-beginning milepoint) or to a spatial data system (i.e., longitude/latitude for begin). Street address could also possibly be used for urban areas. The descriptor types used must be common across all MIRE files and compatible with crash data location coding.

States are encouraged to align their data collection with HPMS annual reporting measures (i.e., HPMS Begin_Point), as this data element should be a valid location on an ARNOLD route. Generally, this will be based on homogeneity of chosen attributes throughout the segment.

Begin point segment descriptors can be either linked to an LRS (e.g., Route-beginning milepoint) or to a spatial data system (i.e., longitude/latitude for begin). Street address could also possibly be used for urban areas.

Crosswalk with other Data Systems:

- **HPMS:** Begin Point

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL.* • Value is less than *END POINT SEGMENT DESCRIPTOR.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

4. End Point Segment Descriptor [FDE]

Description:	Location information defining the end of the segment.
Recommended Attributes:	1. End Point defined by the user agency.
Recommended Field Type:	Numeric

Remarks: Generally, this will be based on homogeneity of chosen attributes throughout the segment). End point segment descriptors can be either linked to an LRS (e.g., Route-ending milepoint) or to a spatial data system (i.e., longitude/latitude for end points). Street address could also possibly be used for urban areas. The descriptor types used must be common across all MIRE files and compatible with crash data location coding.

States are encouraged to align their data collection with HPMS annual reporting measures (i.e., HPMS End_Point), as this data element should be a valid location on an ARNOLD route. Generally, this will be based on homogeneity of chosen attributes throughout the segment).

End point segment descriptors can be either linked to an LRS (e.g., Route-ending milepoint) or to a spatial data system (i.e., longitude/latitude for end points). Street address could also possibly be used for urban areas.

Crosswalk with other Data Systems:

- **HPMS:** End Point

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than *BEGIN POINT SEGMENT DESCRIPTOR*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

5. Type of Governmental Ownership FDE

Description:	The entity that has legal ownership of a roadway.
Recommended Attributes:	1. State Highway Agency 2. County Highway Agency 3. Town or Township Highway Agency 4. City or Municipal Highway Agency 11. State Park, Forest, or Reservation Agency 12. Local Park, Forest, or Reservation Agency 21. Other State Agency 25. Other Local Agency 26. Private (other than Railroad) 27. Railroad 31. State Toll Authority 32. Local Toll Authority 40. Other Public Instrumentality (i.e., Airport) 50. Indian Tribe Nation 60. Other Federal Agency 62. Bureau of Indian Affairs 63. Bureau of Fish and Wildlife 64. U.S. Forest Service 66. National Park Service 67. Tennessee Valley Authority 68. Bureau of Land Management 69. Bureau of Reclamation 70. Corps of Engineers 72. Air Force 73. Navy/Marines 74. Army 80. Other
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS reporting measures (FHWA, 2016, pp. 4-27 – 4-29). This is the level of government that best represents the highway owner irrespective of whether agreements exist for maintenance or other purposes. If more than one code applies, code the lowest numerical value. In cases where ownership responsibilities are shared between multiple entities, FHWA recommends that States code based on the primary owner (i.e., the entity that has the larger degree of ownership), if applicable.

For LRS purposes, this must be reported independently for both directions of travel associated with divided highway sections, for which dual carriageway GIS network representation is required.

"State" means owned by one of the 50 States, the District of Columbia, or the Commonwealth of Puerto Rico, including quasi-official State commissions or organizations.

“County, local, municipal, town, or township” means owned by one of the officially recognized governments established under State authority.

“Federal” means owned by one of the branches of the U.S. Government or independent establishments, government corporations, quasi-official agencies, organizations, or instrumentalities.

“Other” means any other group not already described above or nongovernmental organizations with the authority to build, operate, or maintain toll or free highway facilities.

For the purposes of attribute “26 (Private (other than Railroad)),” refer to the *Definition of a Public Road* as to whether the MIRE FDE requirements apply.

Crosswalk with other Data Systems:

- **HPMS:** Ownership
- **FARS:** Ownership
- **NBI:** Owner

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is consistent with *SPECIFIC GOVERNMENTAL OWNERSHIP*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

6. Segment Identifier FDE

Description:	Unique segment identifier.
Recommended Attributes:	1. Segment identifier
Recommended Field Type:	Text

Remarks: Any unique identifier can be used based on the specific enterprise systems available to the State. Unique identifiers do not necessarily need to remain consistent over the years as segment extents change over time or the agency retires them.

Derived from other elements (e.g., combination of route number, county location, and beginning and ending milepoints).

Collection Cycle:	Ad-Hoc (as segmentation is adjusted due to changing conditions)		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is unique (i.e., not duplicated) in the database.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

7. Segment Length FDE

Description:	The length of the segment.
Recommended Attributes:	1. Segment length (miles)
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS reporting measures. States may report either the inventory or LRS-based length for a given segment of road, per the State's preference. This length should be consistent with the length that is reported in the State's Certified Public Road Mileage. Segment length should also be consistent with *Begin Point Segment Descriptor* and *End Point Segment Descriptor* data elements.

For **undivided facilities**, the inventoried length is measured along the centerline in the designated inventory direction (i.e., cardinal direction).

For **divided highways**, the length is measured in accordance with the designated inventory direction for both the cardinal and non-cardinal sides of the roadway.

For **"one-way pairs"** (i.e., divided non-Interstate roadway sections located along a given route), measure and report the length of each roadway segment independently; do not average the length of the two roadways.

Crosswalk with other Data Systems:

- **HPMS:** Section Length

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to *END POINT SEGMENT DESCRIPTOR* minus the *BEGIN POINT SEGMENT DESCRIPTOR*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

8. Direction of Inventory FDE

Description:	Direction of inventory if divided roads are inventoried in each direction.
Recommended Attributes:	1. Predominate compass direction of travel (e.g., North, South, East, West) 2. Both directions of travel
Recommended Field Type:	Text

Remarks: Predominate direction of inventory should reflect the direction of increasing milepoints. Direction of inventory may vary along a route, and it can be different for individual segments on the same route.

"Predominate compass direction of travel" (e.g., North, South, East, West) – if roads are inventoried as a single direction of travel (i.e., due to different characteristics on each roadway).

"Both directions of travel" – if inventoried in only one direction (e.g., the inventory applies to both directions of a single-carriageway roadway).

Crosswalk with other Data Systems:

- **NBI:** Route Direction

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

9. Functional Class FDE

Description:	The FHWA approved functional classification system.
Recommended Attributes:	1. Interstate 2. Principal arterial – other freeways and expressways 3. Principal arterial – other 4. Minor arterial 5. Major collector 6. Minor collector 7. Local
Recommended Field Type:	Numeric

Remarks: Functional class assignment should follow FHWA's Highway Functional Classification Concepts, Criteria and Procedures (2023c). If a segment is defined as a ramp, then it should be coded the same as the highest order functional system roadway that traverses the interchange.

Crosswalk with other Data Systems:

- **HPMS:** Functional Classification
- **FARS:** Functional System
- **NBI:** Functional Classification

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal NULL.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

10. Rural/Urban Designation [FDE]

Description:	The rural or urban designation based on Census urban boundary and population and adjusted by the State (if applicable).
Recommended Attributes:	1. Rural 2. Urban
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS reporting measures.

"Urban" – areas designated as urban places by the Bureau of the Census having a population of 5,000 or more, within boundaries fixed by responsible State and local officials. Urban areas include FHWA defined small urban areas (population of 5,000 – 49,999) and urbanized areas (population of 50,000 or more) [23 U.S.C. 101(a)(35)].

"Rural" – for purposes of data collection, all areas of a State not included in urban areas [23 U.S.C. 101(a)(25)].

Crosswalk with other Data Systems:

- **FARS:** Land Use

Collection Cycle:	Long Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value equals "1 (Rural)" where *CITY/LOCAL JURISDICTION URBAN CODE* equals *NULL*. • Value equals "2 (Urban)" where *CITY/LOCAL JURISDICTION URBAN CODE* does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Partial Extent

11. Federal-Aid FDE

Description:	Indicator that the route is eligible for the Federal-aid Highway Program.
Recommended Attributes:	1. Route is non-Federal-aid 2. Route is Federal-aid, but not on the NHS 3. Route is on NHS
Recommended Field Type:	Numeric

Remarks:

"Federal-aid highway systems" – means the NHS and the Dwight D. Eisenhower National System of Interstate and Defense Highways (the "Interstate System"). [23 CFR 470.103]

"Federal-aid highways" – means highways on the Federal-aid highway systems and all other public roads not classified as local roads or rural minor collectors. [23 CFR 470.103]

"National Highway System" – the NHS consists of interconnected urban and rural principal arterials and highways (including toll facilities) which serve major population centers, international border crossings, ports, airports, public transportation facilities, other intermodal transportation facilities and other major travel destinations; meet national defense requirements; and serve interstate and interregional travel. All routes on the Interstate System are a part of the National Highway System. The NHS also includes the Strategic Highway Corridor Network (STRAHNET) and its highway connectors to major military installations, as designated. [23 CFR 470.107(b)].

Collection Cycle:	Long Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for paved roads. • Value equals "1 (Route is non-Federal-aid)" if *FUNCTIONAL CLASS* is equal to "7 (Local)." • Value equals "1 (Route is non-Federal-aid)" if *FUNCTIONAL CLASS* is equal to "6 (Minor Collector)" and *RURAL URBAN DESIGNATION* is equal to "1 (Rural)." • Value equals "3 (Route is on NHS)" if *ROUTE TYPE* does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

12. Route Type FDE

Description:	National Highway System (NHS) route type.
Recommended Attributes:	1. Non-Connector NHS 2. Major Airport 3. Major Port Facility 4. Major Amtrak Station 5. Major Rail/Truck Terminal 6. Major Inter City Bus Terminal 7. Major Public Transportation or Multi-Modal Passenger Terminal 8. Major Pipeline Terminal 9. Major Ferry Terminal
Recommended Field Type:	Numeric

Remarks: Value for this data element can be NULL if recommended attributes do not apply.

Crosswalk with other Data Systems:

- **HPMS:** National Highway System
- **FARS:** National Highway System[4]
- **NBI:** NHS Designation[5]

Collection Cycle:	Long Term		
Level of Accuracy:	High		
Validation Checks:	• Value equals *NULL* if *FEDERAL-AID* is not equal to "3 (Route is on NHS)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[4] Data Element is only binary in FARS database.
[5] Data Element is only binary in NBI database.

13. Access Control FDE

Description:	The degree of access control for a given segment of road.
Recommended Attributes:	1. Full access control 2. Partial access control 3. No access control
Recommended Field Type:	Numeric

Remarks:

"**Full access control"** – Preference given to through traffic movements by providing interchanges with selected public roads and by prohibiting crossing at-grade and direct driveway connections (i.e., limited access to the facility).

"Partial access control" – Preference 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. Control of curb cuts is not access control.

"No access control" – No degree of access control exists (i.e., full access to the facility is permitted).

Crosswalk with other Data Systems:

- **HPMS:** Access Control

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

14. Surface Type FDE

Description:	Surface type on a given section.
Recommended Attributes:	(see table below)
Recommended Field Type:	Numeric

HPMS No.	Existing HPMS Surface Type Attribute Values	MIRE Group No.	MIRE Surface Type Attribute Group Values
1	Unpaved	1	Unpaved Surface
2	Bituminous	2	Asphalt Pavement
3	Asphalt-Concrete (AC) Overlay over Existing AC Pavement	2	Asphalt Pavement
4	AC Overlay over Existing Jointed Concrete Pavement	2	Asphalt Pavement
5	AC (Bi Overlay over Existing CRCP)	2	Asphalt Pavement
6	JPCP – Jointed Plain Concrete Pavement	3	Concrete Pavement
7	JRCP – Jointed Reinforced Concrete Pavement	3	Concrete Pavement
8	CRCP – Continuously Reinforced Concrete Pavement	3	Concrete Pavement
9	Unbonded Jointed Concrete Overlay on Portland Cement Concrete (PCC) Pavements	3	Concrete Pavement
--	Unbonded CRCP Overlay on PCC Pavements	3	Concrete Pavement
10	Bonded PCC Overlays on PCC Pavements	3	Concrete Pavement
11	Other (e.g., plank, brick, cobblestone, etc.)	4	Other Paved Surface

Remarks: States are encouraged to align their data collection with HPMS reporting measures. The detailed HPMS surface type attribute values should be collected on the full extent of the interstate system and NHS, as well as sample panel collection for the federal aid-system. The new MIRE surface type attribute group values are applicable for all remaining non-local paved roads.

The following general categories are intended to align with applicable HPMS attributes.

"Unpaved Surface" includes 'Dirt,' 'Gravel,' or 'Other' unpaved surfaces.

"Asphalt Pavement" includes 'Bituminous,' 'Asphalt-Concrete (AC) Overlay over Existing AC Pavement,' 'AC Overlay over Existing Jointed Concrete Pavement,' or 'AC (Bi Overlay over Existing CRCP).

"Concrete Pavement" includes 'JPCP – Jointed Plain Concrete Pavement,' 'JRCP – Jointed Reinforced Concrete Pavement,' 'CRCP – Continuously Reinforced Concrete Pavement,' 'Unbonded Jointed Concrete Overlay on Portland Cement Concrete (PCC) Pavements,' or 'Bonded PCC Overlays on PCC Pavements'.

"Other Paved Surface" includes plank, brick, cobblestone, and other not specified surface types.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years associated with paving or resurfacing a paved road (p. 50).

Crosswalk with other Data Systems:

- **HPMS:** Surface Type[6]
- **FARS:** Roadway Surface Type[7]

Collection Cycle:	• **Annually** where *FUNCTIONAL CLASS* is equal to "1 (Interstate)" or *ROUTE TYPE* is not equal to *NULL*. • **Medium Term** for all other non-local paved roads. • **Long Term** for local paved and all unpaved roads.		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[6] Categories contain applicable HPMS attributes.

[7] Attribute values in FARS are substantially different than MIRE and HPMS.

15. Number of Through Lanes FDE

Description:	The total number of lanes designated for through traffic in the off-peak period.
Recommended Attributes:	1. Number of through lanes
Recommended Field Type:	Numeric

Remarks: This is the number of through lanes in the direction of inventory according to the marking, if present, on multilane facilities, or according to traffic use or State/local design guidelines if no marking or only centerline marking is present (FHWA, 2016, p. 4-29). If the road is inventoried in both directions together, this would be the number of through lanes in both directions (figure 11). If the road is inventoried separately for each direction, this would be the number of through lanes in one direction.

For one-way roadways, two-way roadways, and couplets, exclude all ramps and segments defined as auxiliary lanes, such as collector-distributor lanes, weaving lanes, frontage road lanes, parking and turning lanes, acceleration/deceleration lanes, toll collection lanes, passing lanes, transit lanes, shoulders, and truck climbing lanes. These types of auxiliary lanes are captured in separate elements.

Managed lanes, such as High Occupancy Vehicle (HOV), High Occupancy Toll (HOT), and Express Toll Lanes (ETL), operating during the off-peak period should be included in the total count of through lanes (FHWA, 2016, p. 4-30).

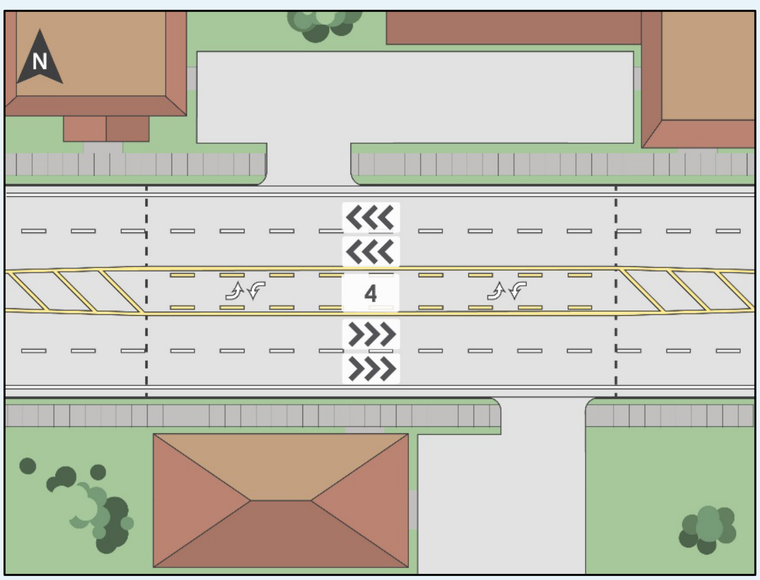

Figure 11. Graphic. Number of through lanes example.

Crosswalk with other Data Systems: • **HPMS:** Through Lanes • **FARS:** Total Lanes in Roadway • **MMUCC (v6):** Number of Open Lanes in Vehicle's Environment[8] • **NBI:** Lanes On Highway			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[8] Includes lanes that may be actively in operation during a crash.

16. Median Type [FDE]

Description:	The type of median present on the segment.
Recommended Attributes:	1. Undivided 2. Flush paved median (at least 4 ft in width) 3. Raised median 4. Depressed median 5. Two-way left-turn lane 6. Railroad or rapid transit 7. Divided, separate grades without retaining wall (figure 12) 8. Divided, separate grades with retaining wall (figure 13) 9. Other divided
Recommended Field Type:	Numeric

Remarks: The portion of a divided highway separating the traveled way for traffic in opposing directions. Include median if segment is one direction of travel for divided roadways. Value of "9 (Other divided)" can also refer to wide native medians on freeways.

A raised median normally consists of a guardrail or concrete barrier, but could consist of thick, impenetrable vegetation. All raised medians, regardless of their width, are considered medians for data purposes.

Although not considered a median in HPMS and FARS, "5 (Two-way left-turn lanes)" are considered a median type in MIRE. These facilities are relevant for HSM analysis in urban and suburban contexts, and they should be a priority in data collection for SPF development. This attribute is also included in the *Median Crossover/Left-Turn Lane Type* data element.

The principal functions of a median are to:

- Minimize interference of opposing traffic;
- Provide a recovery area for out-of-control vehicles;
- Provide a stopping area in case of emergencies;
- Provide open or green space;
- Minimize headlight glare from opposing vehicles;
- Provide width for future lanes;
- Provide space for speed-change lanes and storage areas for left- and U-turn vehicles; and
- Restrict left-turns except where median openings are provided.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for installing flush, depressed, or raised medians (p. 37).

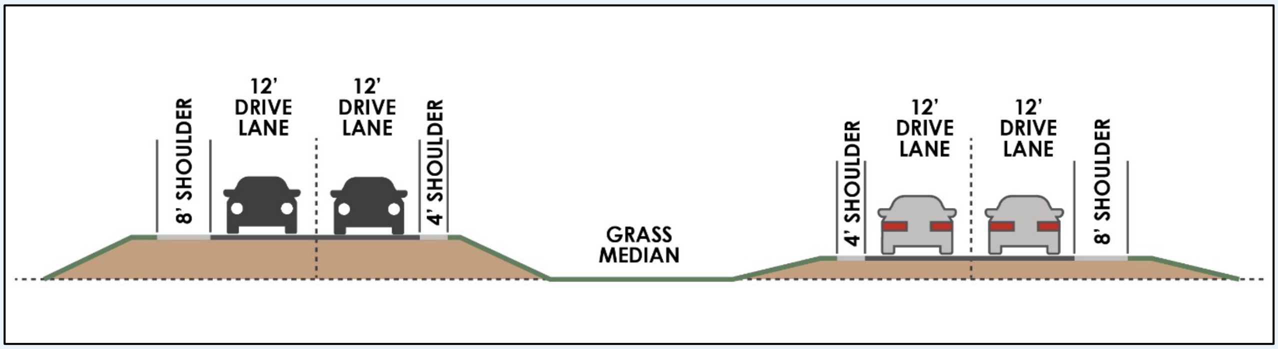

Figure 12. Graphic. Illustration of a median divided segment at separate grades without retaining wall.

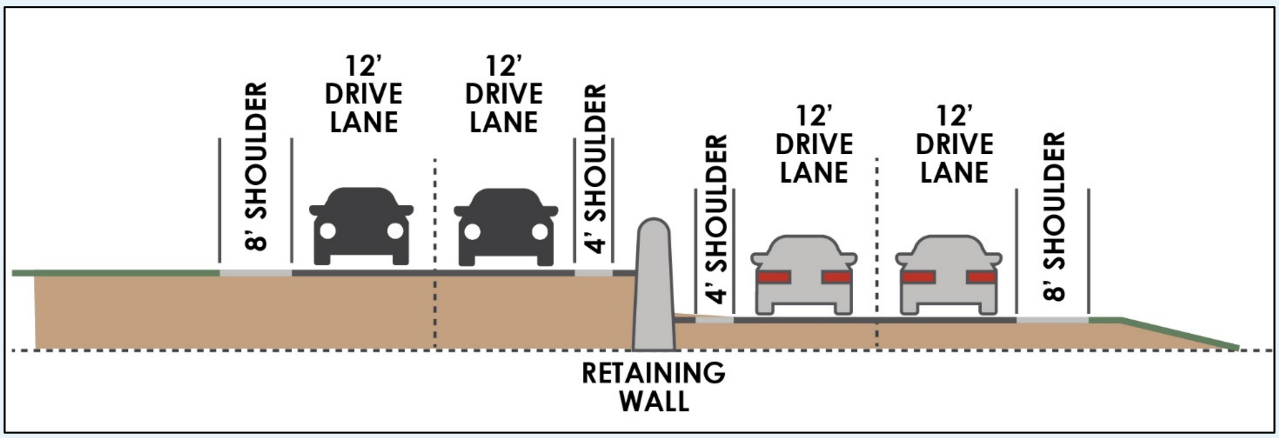

Figure 13. Graphic. Illustration of a median divided segment at separate grades with retaining wall.

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value equals "1 (Undivided)" and *MEDIAN WIDTH* is equal to "0". • Value does not equal "1 (Undivided)" and *MEDIAN WIDTH* is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

17. AADT FDE

Description:	Annual Average Daily Traffic (AADT) value to represent the current data year.
Recommended Attributes:	1. Average vehicles per day
Recommended Field Type:	Numeric

Remarks: AADT is an average daily value that represents all days of the data/inventory year. For two-way facilities, provide the bidirectional AADT; for one-way roadways and ramps, provide the directional AADT (FHWA, 2016, p. 4-52).

States are encouraged to align their data collection with HPMS methodologies for functionally classified non-local paved roads. For functionally classified local paved roads or unpaved roads, other methods may be used to estimate or interpolate AADT values. FHWA's Informational Guide on Data Collection and Annual Average Daily Traffic Estimation for Non-Federal Aid-System Roads (2020b) provides transportation agencies with information about collecting data and developing AADT estimates for non-Federal aid-system (NFAS) roads.

Crosswalk with other Data Systems:

- **HPMS:** Annual Average Daily Traffic
- **NBI:** Annual Average Daily Traffic

Collection Cycle:	• **Annually** where *FEDERAL-AID* equals "3 (Route is on NHS)". • **Medium Term** where *FEDERAL-AID* equals "2 (Route is Federal-aid, but not on NHS)". • **Long Term** (or estimated) where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)"		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

18. AADT Year FDE

Description:	Year of AADT.
Recommended Attributes:	1. Year (YYYY)
Recommended Field Type:	Numeric

Remarks: If AADT is derived from an actual count, this data element should reflect the year of that count. If a State applies another estimation or interpolation method to develop AADT, the applicable year, such as the year of input data (e.g., the base year from a travel demand model) or appropriate year reflecting estimate timeframe (e.g., the future year from a travel demand model), can be used.

Crosswalk with other Data Systems:

- **NBI:** Year of Annual Average Daily Traffic

Collection Cycle:	• **Annually** where *FEDERAL-AID* equals "3 (Route is on NHS)" • **Medium Term** where *FEDERAL-AID* equals "2 (Route is Federal-aid, but not on NHS)" • **Long Term** (or estimated) where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)"
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	Full Extent

19. One/Two-Way Operations FDE

Description:	Indication of whether the segment operates as a one- or two-way roadway (figure 14).
Recommended Attributes:	1. One-way 2. Two-way 3. One direction of travel for divided roadways
Recommended Field Type:	Numeric

Remarks: Frontage roads and service roads that are public roads are coded either as 'One-way' or 'Two-way' roadways.

"One-way" – Roadway that operates with traffic moving in a single direction during non-peak period hours.

"Two-way" – Roadway that operates with traffic moving in both directions during non-peak period hours. Use this for the inventory direction (i.e., direction of increasing milepoints) on dual carriageway facilities.

"One direction of travel for divided roadways" – Individual road/roads of a multi-road facility that is/are not used for determining the primary length for the facility. Use this for the non-inventory direction (i.e., direction of decreasing milepoints) on dual carriageway facilities.

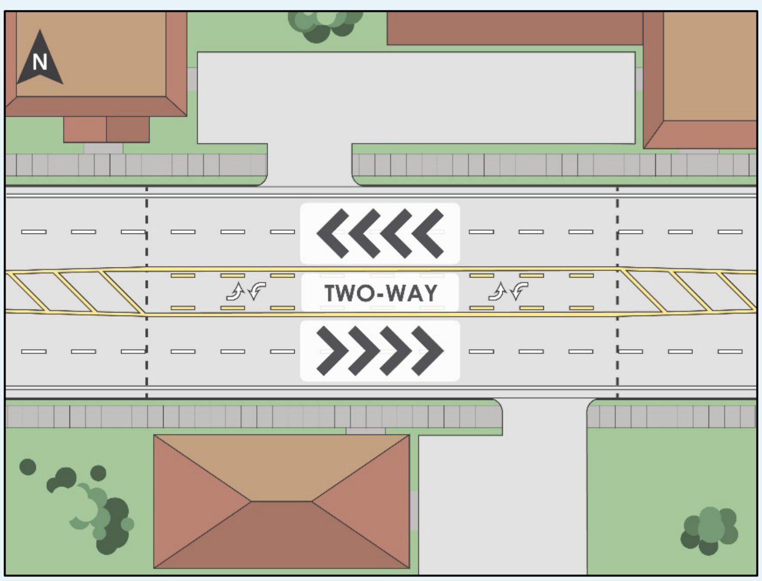

Figure 14. Graphic. Two-way operation example.

Crosswalk with other Data Systems: • **HPMS:** Facility Type[9] • **FARS:** Trafficway Description[10]	
Collection Cycle:	• **Annually** where *FEDERAL-AID* does not equal "1 (Route is non-Federal-aid)". • **Long Term** where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)".
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL/* • Value equals "1 (One-way)" and *MEDIAN TYPE* is equal to "1(Undivided)". • Value equals "1 (One-way)" and *MEDIAN WIDTH* is equal to "0". • Value equals "1 (One-way)" and *MEDIAN BARRIER PRESENCE/TYPE* is equal to "1 (None)". • Value equals "1 (One-way)" and *MEDIAN (INNER) PAVED SHOULDER WIDTH* is equal to "0". • Value equals "1 (One-way)" and *MEDIAN SHOULDER RUMBLE STRIP PRESENCE/TYPE* does not equal "1 (None)". • Value equals "1 (One-way)" and *MEDIAN SIDESLOPE* is equal to *NULL*. • Value equals "1 (One-way)" and *MEDIAN SIDESLOPE WIDTH* is equal to "0". • Value equals "1 (One-way)" and *MEDIAN CROSSOVER/LEFT-TURN LANE TYPE* is equal to "1 (None)". • Value equals "3 (One direction of travel for divided roadways)" and *MEDIAN TYPE* does not equal "1 (Undivided)" • Value equals "3 (One direction of travel for divided roadways)" and *MEDIAN WIDTH* is greater than "0". • Value equals "3 (One direction of travel for divided roadways)" and *MEDIAN BARRIER PRESENCE/TYPE* does not equal "1 (None)". • Value equals "3 (One direction of travel for divided roadways)" and *MEDIAN SIDESLOPE* does not equal *NULL*. • Value equals "3 (One direction of travel for divided roadways)" and *MEDIAN SIDESLOPE WIDTH* is greater than "0".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[9] Not an exact match of attributes. See remarks for applicable codes to match 3 (One direction of travel for divided roadways) to HPMS codes.

[10] Not an exact match of attributes. FARS attribute codes are a blend of *One/Two-Way Operations* and *Median Barrier Presence/Type*.

20. County Name

Description:	The name of the county or equivalent entity where the segment is located.
Recommended Attributes:	1. County name or equivalent entity name
Recommended Field Type:	Text
Crosswalk with other Data Systems: • **MMUCC (v6):** County or Equivalent	
Collection Cycle:	Ad-Hoc
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value matches respective county in *COUNTY CODE*.

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	Full Extent

21. County Code

Description:	Census defined County Federal Information Processing Standard (FIPS) code or equivalent entity where the segment is located.
Recommended Attributes:	1. Census defined County FIPS code
Recommended Field Type:	Numeric

Remarks: If state-assigned codes are used, they should be convertible to the Census defined County FIPS format.

Crosswalk with other Data Systems:

- **HPMS:** County Code
- **FARS:** County[11]
- **MMUCC (v6):** County or Equivalent
- **NBI:** County Code

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value matches respective county in *COUNTY NAME*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[11] Attributes based on the General Services Administration's (GSA) publication of worldwide Geographic Location Codes (GLC).

22. Highway District

Description:	The highway district where the segment is located.		
Recommended Attributes:	1. Numeric district number (as defined by the State)		
Recommended Field Type:	Numeric		
Crosswalk with other Data Systems: • **NBI:** Highway Agency District			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

23. Specific Governmental Ownership

Description:	The specific governmental owner of the segment.
Recommended Attributes:	1. City name or equivalent entity (e.g., Tribal jurisdiction) name
Recommended Field Type:	Text

Remarks: If codes are used instead of name, use the GSA GLCs that can be found at: https://www.gsa.gov/reference/geographic-locator-codes-glcs-overview. If state-assigned codes are used, they should be convertible to the GSA/FIPS format.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL.* • Value is consistent with *TYPE OF GOVERNMENTAL OWNERSHIP.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

24. City/Local Jurisdiction Name

Description:	The applicable name of the city or local jurisdiction/agency where the segment is located.
Recommended Attributes:	The city name or equivalent entity (e.g., Tribal jurisdiction)
Recommended Field Type:	Text

Remarks: Segments should typically begin and end at jurisdictional boundaries. If a segment is allowed to cross a jurisdictional boundary, States should apply the jurisdiction that contains the majority of the segment.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

25. City/Local Jurisdiction Urban Code

Description:	The applicable Census urban area code of the city or local jurisdiction/agency where the segment is located.
Recommended Attributes:	1. Census urban code (https://www.census.gov/en.html)
Recommended Field Type:	Numeric

Remarks: Data element should align with urban areas as defined in the Rural/Urban Designation data element. Segments should typically begin and end at urban area boundaries.

Use "99998" for small urban roadway segments and "99999" for rural area roadway segments. Small urban areas are those with a Census defined population between 5,000 and 49,999.

Crosswalk with other Data Systems:

- **HPMS:** Urban Code
- **NBI:** Urban Code

Collection Cycle:	Long Term		
Level of Accuracy:	High		
Validation Checks:	• Value is equal to "99999" where *RURAL URBAN DESIGNATION* is equal to "1 (Rural)". • Value does not equal "99999" where *RURAL URBAN DESIGNATION* is equal to "2 (Urban)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

26. Route Signing

Description:	The type of route signing on the segment.
Recommended Attributes:	1. Interstate 2. U.S. Highway 3. State Highway 4. County 5. Township 6. Municipal 7. Parkway marker or forest route marker 8. Off-interstate business marker 9. Secondary route 10. Bureau of Indian Affairs 11. Other 12. Unknown 13. Not signed
Recommended Field Type:	Numeric

Remarks: When a segment is signed with two or more identifiers (e.g., Interstate 83 and U.S. 32), select the highest order identifier on the route (i.e., lowest number). Follow the hierarchy as ordered in the recommended attributes (FHWA, 2016, p. 4-49).

If two or more routes of the same functional system are signed along a roadway segment (e.g., Interstate 64 and Interstate 81), select the lowest route number (i.e., Interstate 64).

If two or more routes of differing functional systems are signed along a roadway segment (e.g., Interstate 83 and U.S. 32), select the route in accordance with the highest functional system on the route (i.e., Interstate).

Crosswalk with other Data Systems:

- **HPMS:** Route Signing
- **FARS:** Route Signing
- **NBI:** Route Type[12]

Collection Cycle:	Ad-Hoc

[12] Not an exact match of attributes.

Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

27. Route Signing Qualifier

Description:	The descriptive qualifier for the route sign.
Recommended Attributes:	1. No qualifier or not signed 2. Alternate 3. Business route 4. Bypass Business 5. Spur 6. Loop 7. Proposed 8. Temporary 9. Truck 10. Other
Recommended Field Type:	Numeric

Remarks: If a segment has more than one applicable qualifier, code the highest order identifier on the route (i.e., lowest number). Follow the hierarchy as ordered in the recommended attributes.

Crosswalk with other Data Systems:

- **HPMS:** Route Qualifier

Collection Cycle:	Ad-Hoc
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL* for non-local paved roads.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

28. Coinciding Route Indicator

Description:	Indication of whether the route segment is a "primary" coinciding route (i.e., the route to which crashes are referenced and which carries the attribute data) or a "minor" coinciding route which is not linked to crashes and does not include attribute data.		
Recommended Attributes:	1. Segment does not contain coinciding routes 2. Coinciding route – Primary (i.e., crashes linked to this route and attributes included for segment) 3. Coinciding route – Minor (i.e., crashes not linked to this route)		
Recommended Field Type:	Numeric		
Remarks: Note that minor-route segments might not appear in the inventory since the primary route inventory information is the same for both routes.			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

29. Coinciding Route Indicator – Minor Route Information

Description:	If this segment has a coinciding minor route segment, enter the route number for the minor route.
Recommended Attributes:	1. Signed coinciding minor route number
Recommended Field Type:	Text

Remarks: Additional elements may be needed to handle instances of more than one coinciding minor route.

Crosswalk with other Data Systems:

- **FARS:** Trafficway Identifier

Collection Cycle:	Ad-Hoc
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL* for non-local paved roads.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

30. Total Paved Surface Width

Description:	The total paved surface width.
Recommended Attributes:	1. Paved surface width (feet)
Recommended Field Type:	Numeric

Remarks: This element can be derived if all paved lane and paved shoulder widths are captured. For dual carriageways, capture this element for a single direction of travel.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" if *SURFACE TYPE* is not equal to "1 (Unpaved)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

31. Surface Friction

Description:	The surface friction indicator for the segment.		
Recommended Attributes:	1. Measured skid number		
Recommended Field Type:	Numeric		
Remarks: Agencies should decide how to code segments with no measured number or multiple skid numbers and whether one number is indicative of friction on the entire segment.			
Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads. • Value is not equal to *NULL* if *SURFACE TYPE* is not equal to "1 (Unpaved)". • Value does not equal *NULL* if *SURFACE FRICTION DATE* is not *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

32. Surface Friction Date

Description:	Date surface friction was last measured.		
Recommended Attributes:	1. Date (MM/DD/YYYY)		
Recommended Field Type:	Date		
Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads. • Value is not equal to *NULL* if *SURFACE TYPE* is not equal to "1 (Unpaved)". • Value does not equal *NULL* if *SURFACE FRICTION* is not equal to *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

33. International Roughness Index (IRI)

Description:	The numeric value used to indicate pavement roughness.
Recommended Attributes:	1. IRI (reported as an integer to the nearest inch per mile)
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS reporting measures. IRI is the road roughness index most commonly used worldwide for evaluating and managing road systems. Road roughness is the primary indicator of the utility of a highway network to road users. IRI is defined as a statistic used to estimate the amount of roughness in a measured longitudinal profile.

Existing IRI values should continue to be reported until they are replaced by new measured values.

Crosswalk with other Data Systems:

- **HPMS:** IRI

Collection Cycle:	• **Annually** where *FUNCTIONAL CLASS* is equal to "1 (Interstate)". • **Bi-Annually** where *FUNCTIONAL CLASS* is equal to "2 (Principal arterial – other freeways and expressways)" or "3 (Principal arterial – other)" or where *ROUTE TYPE* is not *NULL*. • **Medium Term** for all other non-local paved roads. • **Long Term** for local paved roads.
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL* for non-local paved roads. • Value is not equal to *NULL* if *SURFACE TYPE* is not equal to "1 (Unpaved)", • Value does not equal *NULL* if *INTERNATIONAL ROUGHNESS INDEX (IRI) DATE* is not equal to *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

34. International Roughness Index (IRI) Date

Description:	Date pavement roughness (i.e., IRI) was collected.		
Recommended Attributes:	1. Date (MM/YYYY)		
Recommended Field Type:	Date		
Remarks: States are encouraged to align their data collection with HPMS reporting measures. A default date may be used if the exact date of collection is unknown.			
Collection Cycle:	• **Annually** where *FUNCTIONAL CLASS* is equal to "1 (Interstate)". • **Bi-Annually** where *FUNCTIONAL CLASS* is equal to "2 (Principal arterial – other freeways and expressways)" or "3 (Principal arterial – other)" or where *ROUTE TYPE* is not *NULL*. • **Medium Term** for all other non-local paved roads. • **Long Term** for local paved roads.		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads. • Value is not equal to *NULL* if *SURFACE TYPE* is not equal to "1 (Unpaved)". • Value does not equal *NULL* if *INTERNATIONAL ROUGHNESS INDEX (IRI)* is not equal to *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

35. Pavement Condition (Present Serviceability Rating)

Description:	Descriptive rating of pavement condition.
Recommended Attributes:	1. 4.0 – 5.0 2. 3.0 - 4.0 3. 2.0 - 3.0 4. 1.0 - 2.0 5. 0.1 - 1.0
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS reporting measures. Code a Present Serviceability Rating (PSR) or equivalent value, to the nearest tenth (x.x), for all paved segments where IRI is not reported. Code "0.0" for unpaved facilities. Use full range of values.

"4.0 – 5.0" Only new (or nearly new) superior 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 in this category.

"3.0 - 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.

"2.0 - 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/or cracking, and some pumping.

"1.0 - 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 raveling, cracking, rutting and occurs over 50 percent of the surface. Rigid pavement distress includes joint spalling, patching, cracking, scaling, and may include pumping and faulting.

"0.1 - 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.

Crosswalk with other Data Systems:

- **HPMS:** PSR

Collection Cycle:	• **Annually** where *FUNCTIONAL CLASS* is equal to "1 (Interstate)" or *ROUTE TYPE* is not *NULL*. • **Medium Term** for all other non-local paved roads. • **Long Term** for local paved and all unpaved roads.		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads. • Value is not equal to *NULL* if *SURFACE TYPE* is not equal to "1 (Unpaved)". • Value does not equal *NULL* if *PSR Date* is not equal to *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

36. Pavement Condition (PSR) Date

Description:	Date PSR was last assigned.
Recommended Attributes:	1. Date (MM/YYYY)
Recommended Field Type:	Date

- **Remarks:** States are encouraged to align their data collection with HPMS reporting measures. A default date may be used if the exact date of collection is unknown.

Collection Cycle:	• **Annually** where *FUNCTIONAL CLASS* is equal to "1 (Interstate)" or *ROUTE TYPE* is not *NULL*. • **Medium Term** for all other non-local paved roads. • **Long Term** for local paved and all unpaved roads.		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* for non-local paved roads. • Value is not equal to *NULL* if *SURFACE TYPE* is not equal to "1 (Unpaved)". • Value does not equal *NULL* if *PAVEMENT CONDITION (PRESENT SERVICEABILITY RATING)* is not equal to *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

37. Outside Through Lane Width

Description:	Width of the outside (i.e., roadside adjacent) through lane (not including parking area, bicycle lanes, gutter pan, etc.).
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: The purpose of this data element is to document travel way area on the outside of the roadway that might be converted to a bicycle facility, shoulder, or other feature.

States are encouraged to align their data collection with HPMS reporting measures. Lane width should be collected according to where the pavement/shoulder surface changes, or to the pavement lane marking (if the shoulder and pavement surface are the same).

Where there is no delineation between the through-traffic lane and the shoulder or parking lane, or where there is no centerline, estimate a reasonable split between the actual width used by traffic and the shoulder or parking lane based on State/local design guides.

When marking is placed inside the edge of the pavement (within approximately one foot) to keep traffic from breaking the pavement edge, ignore the marking and measure from the pavement edge to the center of a single centerline stripe. Or, if double centerline marking exists, measure to the center of the two stripes.

If lane widths vary over the extent of the segment, use the predominant width(s) for measuring and reporting purposes.

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

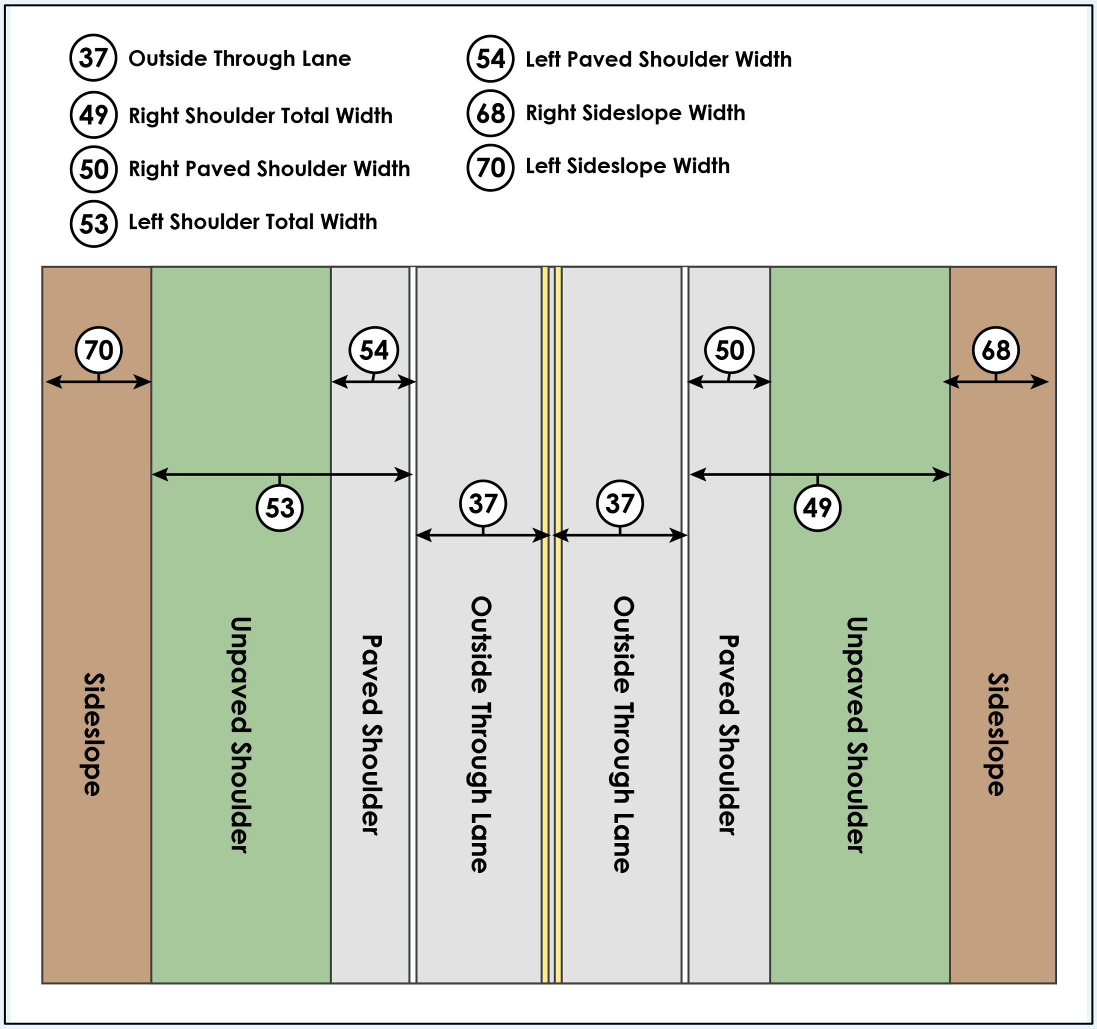

Figure 15. Graphic. Illustration of cross section, two-lane roadway.

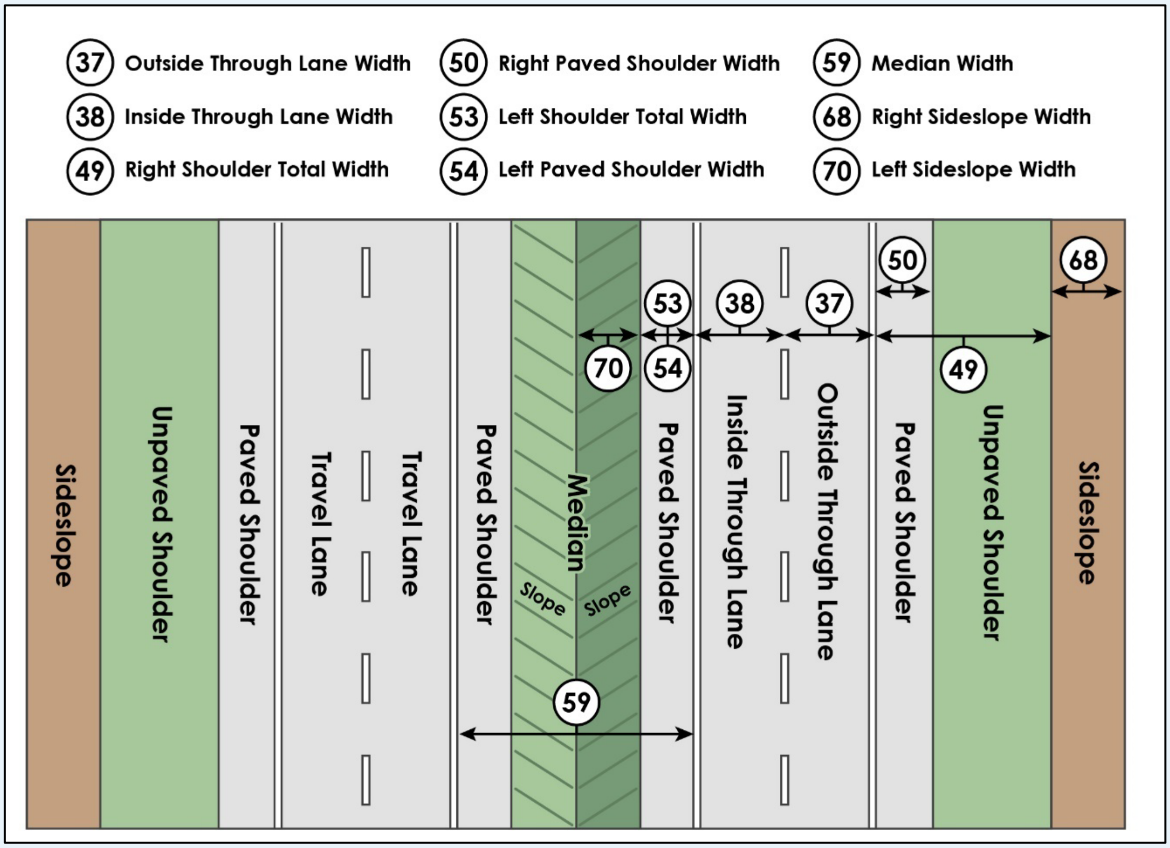

Figure 16. Graphic. Illustration of cross section, multilane divided roadway inventoried in two directions (each direction inventoried separately).

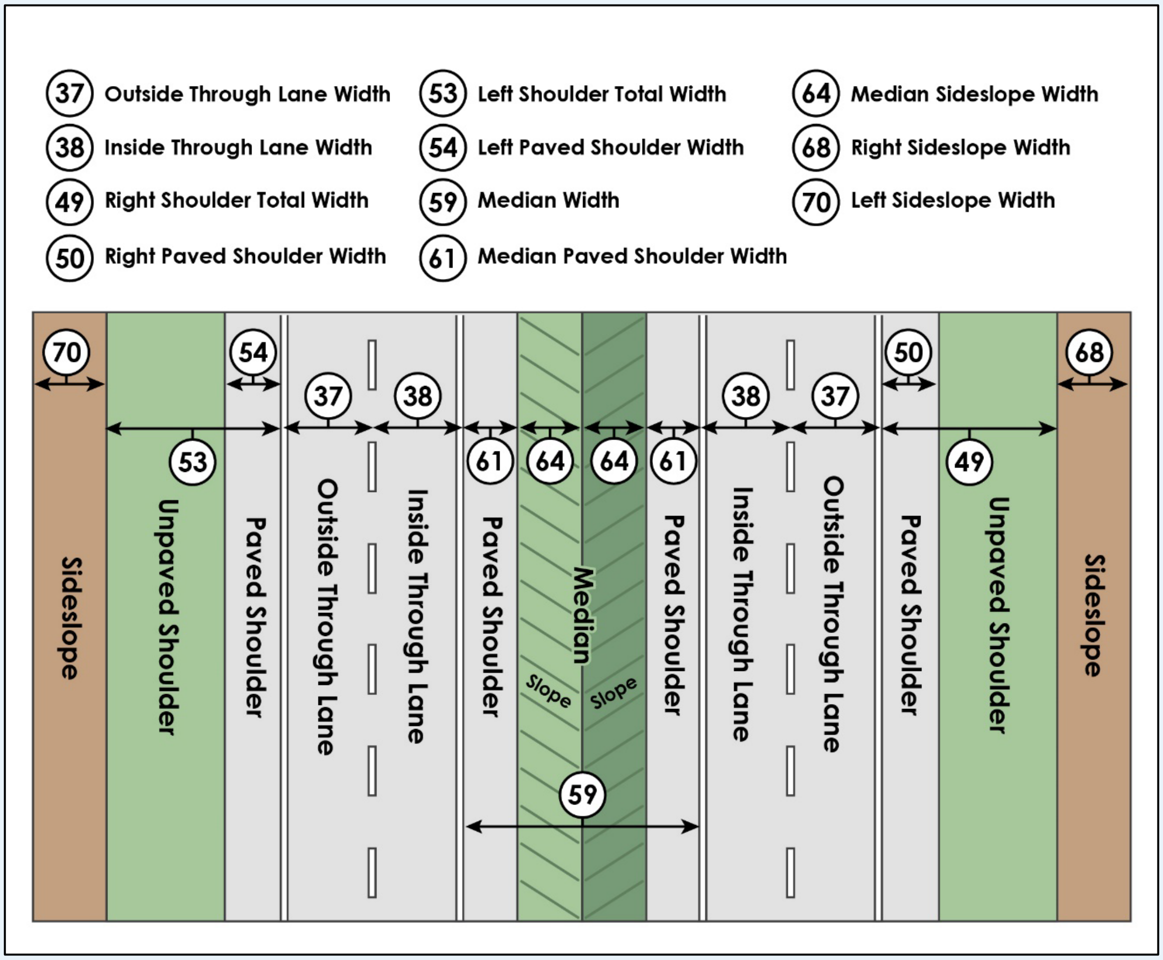

Figure 17. Graphic. Illustration of cross section, multilane divided roadway inventoried in one direction (both directions inventoried together).

Crosswalk with other Data Systems:

- **HPMS:** Lane Width[13]

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Values less than "9" should be scrutinized.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Partial Extent

[13] Note that HPMS represents average lane width for all lanes.

38. Inside Through Lane Width

Description:	Average lane width of all inside through lanes, not including outside through lane (i.e., *Outside Through Lane Width*).
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: Refer to *Outside Through Lane Width* for applicable lane width measurement remarks. If more than one lane exists, measure all lanes in the inventory direction and use the average value to the nearest foot. For a two-lane, two-way road, leave this element blank.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

Crosswalk with other Data Systems:

- **HPMS:** Lane Width[14]

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Values less than "9" should be scrutinized.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Partial Extent

[14] Note that HPMS represents average lane width for all lanes.

39. Cross Slope

Description:	The cross slope for each lane starting with the leftmost lane according to direction of inventory.		
Recommended Attributes:	1. Cross Slope (sign (+/-) and percent)		
Recommended Field Type:	Numeric		
Remarks: If cross slope is captured for each lane individually, multiple elements will be needed.			
Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

40. Auxiliary Lane Presence/Type

Description:	The presence and type of auxiliary lane present on the segment.
Recommended Attributes:	1. Climbing lane 2. Passing lane 3. Exclusive continuous right-turn lane 4. Part-time shoulder use 5. Part-time lane use 6. Special use lane 7. Other
Recommended Field Type:	Numeric

Remarks: Auxiliary lanes are lanes marked for use, but not assigned for use by through traffic. HOV lanes are included under *Managed Lane Operations Type*.

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (None)" and *AUXILIARY LANE LENGTH* is "0".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

41. Auxiliary Lane Length

Description:	Length of auxiliary lane if not full segment length.
Recommended Attributes:	1. Auxiliary lane length (feet)
Recommended Field Type:	Numeric
Remarks: Length does not include taper.	
Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" and *AUXILIARY LANE PRESENCE/TYPE* is *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

42. Managed Lane Operations Type

Description:	The type of managed lane operations (e.g., HOV, HOT, ETL, etc.).
Recommended Attributes:	1. Full-time Managed Lanes 2. Part-time Managed Lanes – Normal Lanes 3. Part-time Managed Lanes – Shoulder or Parking Lanes
Recommended Field Type:	Numeric

Remarks: If more than one type of managed lane is present for the segment, select the lesser of the two applicable *Managed Lane Operations Type* codes (e.g., if codes "1 (Full-time Managed Lanes)" and "2 (Part-time Managed Lanes – Normal Lanes)" are applicable for a segment, then the segment should be coded as a code "1 (Full-time Managed Lanes)"). This information may be indicated by either managed lane signing, pavement markings (e.g., the presence of a large diamond shaped HOV marking), or both (FHWA, 2016, p. 4-31).

"Full-time Managed Lanes" – Segment has 24-hour exclusive managed lanes (e.g., HOV use only; no other use permitted).

"Part-time Managed Lanes" – Normal through lanes used for exclusive managed lanes during specified time periods or shoulder/parking lanes used for exclusive managed lanes during specified time periods.

Crosswalk with other Data Systems:

- **HPMS:** Managed Lane Operations Type

Collection Cycle:	Annually
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal NULL where *MANAGED LANES* is greater than "0".

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	N/A

43. Managed Lanes

Description:	Maximum number of managed lanes in both directions on the segment.		
Recommended Attributes:	1. Number of managed lanes		
Recommended Field Type:	Numeric		

Remarks: Indicate the number of lanes by *Managed Lane Operations Type.*

Crosswalk with other Data Systems:

- **HPMS:** Managed Lanes

Collection Cycle:	Annually		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL.* • Value is greater than "0" and *MANAGED LANE OPERATIONS TYPE* does not equal *NULL.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

44. Reversible Lanes

Description:	Number of reversible lanes on the segment.		
Recommended Attributes:	1. Number of lanes		
Recommended Field Type:	Numeric		
Remarks: States should count all reversible lanes. **Crosswalk with other Data Systems:** • **HPMS:** Peak Lanes and Counter-Peak Lanes[15]			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

[15] These HPMS Data Items include other lane types in addition to reversible lanes.

45. Presence/Type of Bicycle Facility

Description:	The presence and type of bicycle facility on the segment.
Recommended Attributes:	1. None 2. Wide curb lane with no bicycle markings 3. Wide curb lane with bicycle markings (e.g., sharrows) 4. Marked bicycle lane 5. Buffered bicycle lane (i.e., horizontal separation only) 6. Separated bicycle lane (i.e., horizontal and vertical separation) 7. Sidepath 8. Signed bicycle route only (no designated bicycle facility) 9. Other
Recommended Field Type:	Numeric

Remarks: Figure 18 through figure 24 provide examples of bicycle facility type.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 1 year for standard paint bicycle lanes and boxes, 5 years for durable marking bicycle lanes and boxes, and 20 years for bicycle lanes, dedicated bicycle facilities, and raised bicycle crossings (p. 40).

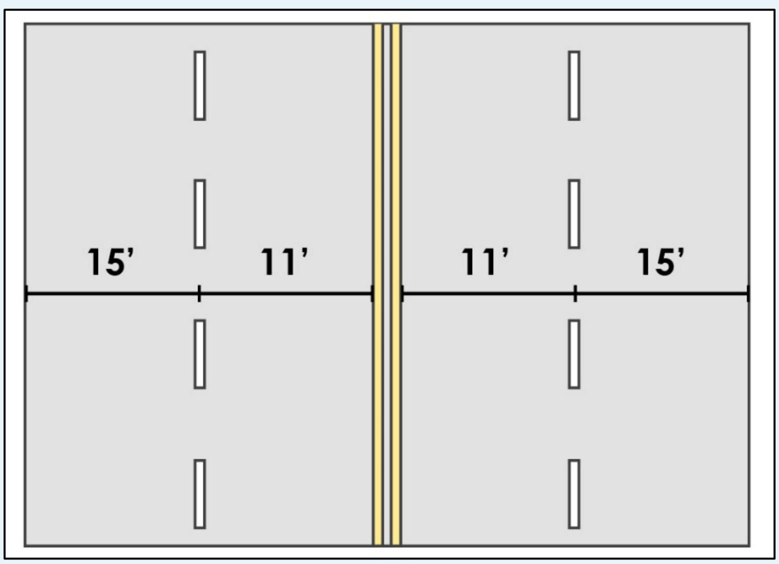

Figure 18. Graphic. Illustration of wide curb lane with no bicycle markings.

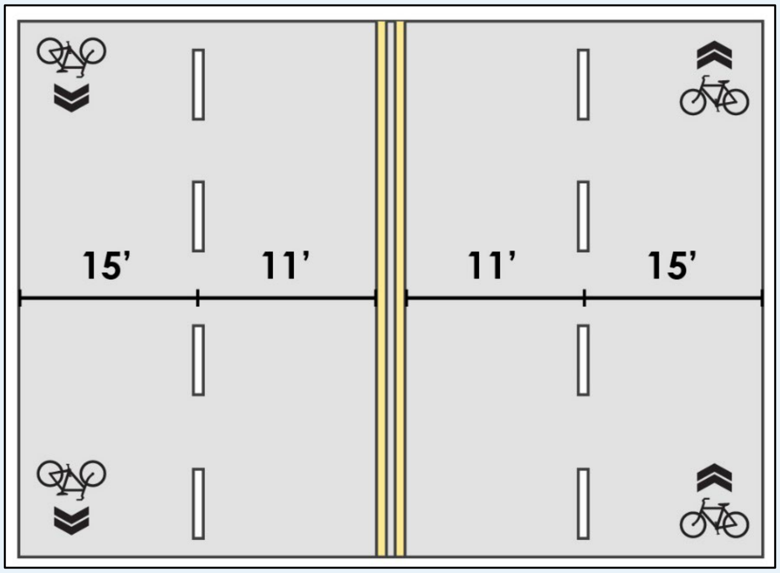

Figure 19. Graphic. Illustration of wide curb lane with bicycle markings (e.g., sharrows).

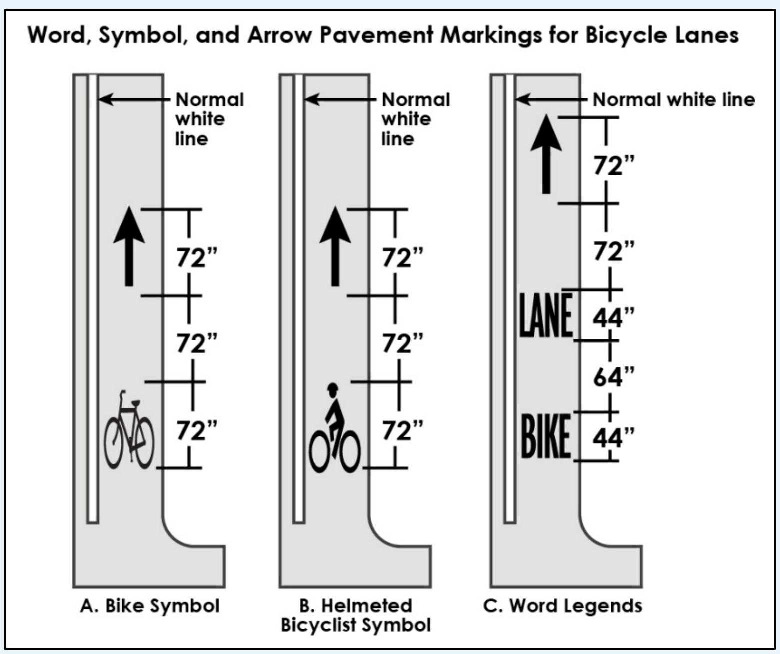

Figure 20. Graphic. Illustration of marked bicycle lanes.

Figure 21. Photo. Illustration of a buffered bicycle lane (i.e., horizontal separation only).

Figure 22. Photo. Illustration of a separated bicycle lane (i.e., horizontal and vertical separation).

Figure 23. Photo. Illustration of a sidepath.

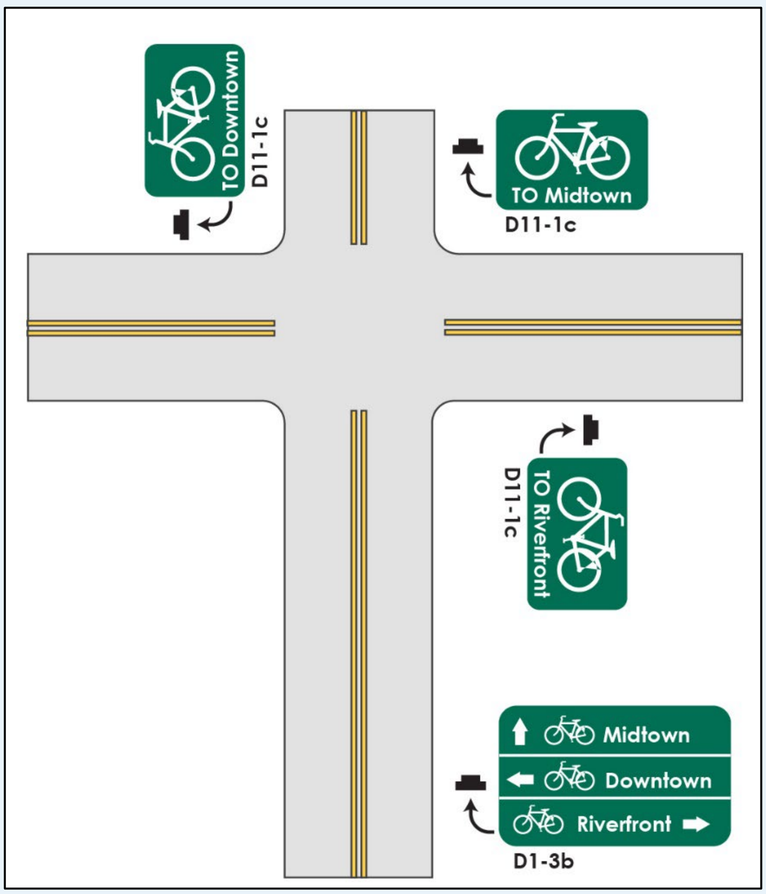

Figure 24. Graphic. Illustration of signed bicycle route only (no designated bicycle facility).

Collection Cycle:	Medium Term

<table>
<tr><td>Level of Accuracy:</td><td colspan="3">Moderate</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">Value does not equal NULL.
Value does not equal “1 (None)” and ACCESS CONTROL is not equal to “3 (No access control)”.
Value does not equal “1 (None)” and WIDTH OF BICYCLE FACILITY is greater than “0”.
Value equals “1 (None)” and WIDTH OF BICYCLE FACILITY equals “0”.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

46. Width of Bicycle Facility

Description:	The width of the bicycle facility.		
Recommended Attributes:	1. Width (feet)		
Recommended Field Type:	Numeric		
Remarks: Applies to either the width of the marked bicycle lane or bicycle path.			
Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" and *ACCESS CONTROL* does not equal "3 (No access control)". • Value is greater than "0" and *PRESENCE/TYPE OF BICYCLE FACILITY* does not equal "1 (None)". • Value is "0" and *PRESENCE/TYPE OF BICYCLE FACILITY* is equal to "1 (None)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

47. Number of Peak Period Through Lines

Description:	The number of through lanes used in peak period in the peak direction.
Recommended Attributes:	1. Number of peak period through lanes
Recommended Field Type:	Numeric

Remarks: The peak period is represented by the period of the day when observed traffic volumes are the highest. This includes reversible lanes, parking lanes, or shoulders that legally are used for through traffic whether for single-occupancy vehicle (SOV) or HOV operation (FHWA, 2016, p. 4-33).

For inventory covering both directions, code total number of through lanes. For directional inventory (i.e., “3 (One direction of travel for divided roadways)” for the *One/Two-Way Operations* data element), code total number of lanes for this inventory direction.

Crosswalk with other Data Systems:

- **HPMS:** Peak Lanes
- **MMUCC (v6):** Number of Open Lanes in Vehicle’s Environment[16]

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

[16] Includes lanes that may only be actively in operation during a crash.

48. Right Shoulder Type

Description:	The predominant shoulder type on the right (i.e., outside) side of road (i.e., consistent with the *Direction of Inventory*).
Recommended Attributes:	1. None 2. Surfaced shoulder exists – asphalt pavement 3. Surfaced shoulder exists – concrete pavement 4. Stabilized shoulder exists (stabilized gravel or other granular material with or without admixture) 5. Combination shoulder exists (shoulder width has two or more surface types; e.g., part of the shoulder width is surfaced and part of the width is earth) 6. Earth shoulder exists 7. Curb exists; no shoulder in front of curb
Recommended Field Type:	Numeric

Remarks: If the shoulder type varies over the extent of the segment, select the predominant type. If a bike lane abuts the through lane, there cannot be a shoulder unless it is used as a combined shoulder/bike lane (sometimes indicated by signage or symbols on the pavement).

If a bike lane or parking is completely separated from the roadway, it should not be considered. If the segment has parking abutting the through lane, there cannot be a shoulder. A shoulder cannot exist between a traffic lane and a parking lane (FHWA, 2016, p. 4-75).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for shoulder type-related countermeasure treatments (p. 53).

Crosswalk with other Data Systems:

- **HPMS:** Shoulder Type

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value equals "1 (None)" and *RIGHT SHOULDER TOTAL WIDTH* is equal to "0". • Value equals "1 (None)" and *RIGHT PAVED SHOULDER WIDTH* is equal to "0".

<table>
<tr><td></td><td colspan="3">

- Value does not equal “1 (None)” and *RIGHT SHOULDER TOTAL WIDTH* is greater than “0”.
- Value does not equal “1 (None)” and *RIGHT PAVED SHOULDER WIDTH* is greater than “0”.

</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

49. Right Shoulder Total Width

Description:	The total width of the right (i.e., outside) shoulder including both paved and unpaved parts.
Recommended Attributes:	1. Total width (feet)
Recommended Field Type:	Numeric

Remarks: Right shoulder should be measured from the center of the edgeline outward. Do not include parking or bicycle lanes in the shoulder width measurement; select the predominant width where it changes back and forth along the roadway segment. The total width of combination shoulders should be reported. Include rumble strips and gutter pans on outside of shoulder in shoulder width (FHWA, 2016, p. 4-77).

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for shoulder width-related countermeasure treatments (p. 53).

Crosswalk with other Data Systems:

- **HPMS:** Right Shoulder Width

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL.* • Value equals “0” and *RIGHT SHOULDER TYPE* is equal to “1 (None)”. • Value is greater than “0” and *RIGHT SHOULDER TYPE* is not equal to “1 (None)”. • Value is greater than *RIGHT PAVED SHOULDER WIDTH.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

50. Right Paved Shoulder Width

Description:	The width of paved portion of right (i.e., outside) shoulder.
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: Right paved shoulder should be measured from the center of the edgeline outward. Do not include parking or bicycle lanes in the paved shoulder width measurement; code the predominant width if it changes back and forth along the roadway segment. Include rumble strips and gutter pans on outside of shoulder in shoulder width.

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for shoulder width-related countermeasure treatments (p. 53).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value equals "0" and *RIGHT SHOULDER TYPE* is equal to "1 (None)". • Value is greater than "0" and *RIGHT SHOULDER TYPE* is not equal to "1 (None)". • Value is less than *RIGHT SHOULDER TOTAL WIDTH*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

51. Right Shoulder Rumble Strip Presence/Type

Description:	Presence and type of rumble strips on the right (i.e., outside) shoulder.
Recommended Attributes:	1. None 2. Milled beyond edgeline 3. Rolled beyond edgeline 4. Milled or rolled on/under edgeline (e.g., rumble stripes) 5. Edgeline-rumble strip combination (e.g., raised/inverted thermoplastic profile marker)
Recommended Field Type:	Numeric

Remarks: Shoulder rumble strip presence/type is related to shoulder treatments as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 5 years for raised rumble strips and 10 years for milled and rolled rumble strips (p. 53).

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (None)" and *RIGHT SHOULDER TOTAL WIDTH* is greater than "0".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

52. Left Shoulder Type

Description:	Shoulder type on left (i.e., outside shoulder on the opposing direction of travel) side of roadway (i.e., consistent with the *Direction of Inventory*).
Recommended Attributes:	1. None 2. Surfaced shoulder exists – asphalt pavement 3. Surfaced shoulder exists – concrete pavement 4. Stabilized shoulder exists (stabilized gravel or other granular material with or without admixture) 5. Combination shoulder exists (shoulder width has two or more surface types; e.g., part of the shoulder width is surfaced and part of the width is earth) 6. Earth shoulder exists 7. Curb exists; no shoulder in front of curb
Recommended Field Type:	Numeric

Remarks: If the shoulder type varies over the extent of the segment, select the predominant type. For undivided roads and divided roads with one direction of inventory, this will be the outside shoulder on the opposing side. Note that information on paved width of the inner (left) shoulder is included under median descriptors (see *Median (Inner) Paved Shoulder Width*).

If a bike lane abuts the through lane, there cannot be a shoulder unless it is used as a combined shoulder/bike lane (sometimes indicated by signage or symbols on the pavement). If a bike lane or parking is completely separated from the roadway, it should not be considered. If the segment has parking abutting the through lane, there cannot be a shoulder. A shoulder cannot exist between a traffic lane and a parking lane (FHWA, 2016, pp. 4-75).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for shoulder type-related countermeasure treatments (p. 53).

Crosswalk with other Data Systems:

- **HPMS:** Shoulder Type[17]

Collection Cycle:	Medium Term
Level of Accuracy:	High

[17] If left shoulder differs from right shoulder, HPMS only collects the right shoulder type. Left shoulder should be reported independently for MIRE.

Validation Checks:	• Value does not equal *NULL*. • Value equals "1 (None)" and *LEFT SHOULDER TOTAL WIDTH* is equal to "0". • Value equals "1 (None)" and *LEFT PAVED SHOULDER WIDTH* is equal to "0". • Value does not equal "1 (None)" and *LEFT SHOULDER TOTAL WIDTH* is greater than "0". • Value does not equal "1 (None)" and *LEFT PAVED SHOULDER WIDTH* is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

53. Left Shoulder Total Width

Description:	Width of left shoulder (i.e., outside shoulder on the opposing direction of travel), including both paved and unpaved parts.
Recommended Attributes:	1. Total width (feet)
Recommended Field Type:	Numeric

Remarks: Left shoulder should be measured from the center of the edgeline outward. Do not include parking or bicycle lanes in the shoulder width measurement; select the predominant width where it changes back and forth along the roadway segment. The total width of combination shoulders should be reported. Include rumble strips and gutter pans on outside of shoulder in shoulder width (FHWA, 2016, p. 4-80).

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for shoulder width-related countermeasure treatments (p. 53).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value equals "0" and *LEFT SHOULDER TYPE* is equal to "1 (None)". • Value is greater than "0" and *LEFT SHOULDER TYPE* is not equal to "1 (None)". • Value is greater than *LEFT PAVED SHOULDER WIDTH*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

54. Left Paved Shoulder Width

Description:	The width of the paved portion of left shoulder (i.e., outside shoulder on the opposing direction of travel).
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: Left paved shoulder should be measured from the center of the edgeline outward. Do not include parking or bicycle lanes in the paved shoulder width measurement; code the predominant width if it changes back and forth along the roadway segment. Include rumble strips and gutter pans on outside of shoulder in shoulder width (FHWA, 2016, p. 4-80). Note that information on paved width of the inner (left) shoulder is included under median descriptors (see *Median (Inner) Paved Shoulder Width*).

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for shoulder width-related countermeasure treatments (p. 53).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value equals "0" and *LEFT SHOULDER TYPE* is equal to "1 (None)". • Value is greater than "0" and *LEFT SHOULDER TYPE* is not equal to "1 (None)". • Value is less than *LEFT SHOULDER TOTAL WIDTH*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

55. Left Shoulder Rumble Strip Presence/Type

Description:	Presence and type of rumble strips on the left shoulder (i.e., outside shoulder on the opposing direction of travel).
Recommended Attributes:	1. None 2. Milled beyond edgeline 3. Rolled beyond edgeline 4. Milled or rolled on/under edgeline (e.g., rumble stripes) 5. Edgeline-rumble strip combination (e.g., raised/inverted thermoplastic profile marker)
Recommended Field Type:	Numeric

Remarks: Shoulder rumble strip presence/type is related to shoulder treatments as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 5 years for raised rumble strips and 10 years for milled and rolled rumble strips (p. 53).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (None)" and *LEFT SHOULDER TOTAL WIDTH* is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

56. Sidewalk Presence

<table>
<tr><td>Description:</td><td colspan="3">The presence of a paved sidewalk along the segment.</td></tr>
<tr><td>Recommended Attributes:</td><td colspan="3">1. None
2. Continuous left-side
3. Discontinuous left-side
4. Continuous right-side
5. Discontinuous right-side
6. Continuous both sides
7. Discontinuous both sides</td></tr>
<tr><td>Recommended Field Type:</td><td colspan="3">Numeric</td></tr>
<tr><td colspan="4">Remarks: Left and right sides should be consistent with the Direction of Inventory. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for sidewalk installation (p. 48).</td></tr>
<tr><td>Collection Cycle:</td><td colspan="3">Long Term</td></tr>
<tr><td>Level of Accuracy:</td><td colspan="3">Low</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">• Value does not equal NULL.
• Value does not equal "1 (None)" and ACCESS CONTROL is not equal to "1 (Full access control)".</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

57. Curb Presence

Description:	The presence of curb along the segment.		
Recommended Attributes:	1. No curb 2. Curb on left 3. Curb on right 4. Curb on both sides		
Recommended Field Type:	Numeric		
Remarks: Left and right sides should be consistent with the *Direction of Inventory*.			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*. • Value equals "1 (No curb)" and *CURB TYPE* is equal to "1 (No curb)". • Value does not equal "1 (No curb)" and *CURB TYPE* is not equal to "1 (No curb)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

58. Curb Type

Description:	The type of curb present on the segment.
Recommended Attributes:	1. No curb 2. Sloping curb 3. Vertical curb
Recommended Field Type:	Numeric

Remarks: AASHTO's *A Policy on Geometric Design of Highways and Streets, 7th Edition* (2018) provides information on curb design.

"Sloping curb" – A traversable curb that does not exceed a 4-inch height (for a slope steeper than 1V:1H) or a 6-inch height (for a slope between 1V:1H and 1V:2H).

"Vertical curb" – A curb that is greater than 8-inches in height and steeper than 1V:1H.

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*. • Value equals "1 (No curb)" and *CURB PRESENCE* is equal to "1 (No curb)". • Value does not equal "1 (No curb)" and *CURB PRESENCE* does not equal "1 (No curb)".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

59. Median Width

Description:	The width of the median.
Recommended Attributes:	1. Median width (feet)
Recommended Field Type:	Numeric

Remarks: Select the predominant median width including left shoulders (i.e., inside), if any, measured between the inside edges of the left-most through lanes in both directions, to the nearest foot.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for changing median width (pp. 37 and 51).

Crosswalk with other Data Systems:

- **HPMS:** Median Width

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value equals "0" and *MEDIAN TYPE* is equal to "1 (Undivided)". • Value is greater than "0" and *MEDIAN TYPE* is not equal to "1(Undivided)". • Value equals "0" and *MEDIAN BARRIER PRESENCE/TYPE* is equal to "1 (None)".

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	N/A

60. Median Barrier Presence/Type

Description:	The presence and type of median barrier on the segment.
Recommended Attributes:	1. None 2. Unprotected 3. Curbed 4. Positive Barrier – unspecified 5. Positive Barrier – flexible 6. Positive Barrier – semi-rigid 7. Positive Barrier – rigid
Recommended Field Type:	Numeric

Remarks: If no median exists, value should be "1 (None);" if median exists but without a barrier, value should be "2 (Unprotected)."

"Curbed" – Mountable curbs with a minimum height of 4 inches (FHWA, 2016, p. 4-72).

"Positive Barrier – unspecified" – Prevents vehicles from crossing median (FHWA, 2016, p. 4-72).

"Positive Barrier – flexible" – Considerable deflection upon impact (FHWA, 2016, p. 4-72).

"Positive Barrier – semi-rigid" – Some deflection upon impact (FHWA, 2016, p. 4-72).

"Positive Barrier – rigid" – No deflection upon impact (FHWA, 2016, p. 4-72).

Chapter 5 of AASHTO's 4th Edition of the Roadside Design Guide (2011) provides examples of flexible, semi-rigid, and rigid positive barrier systems.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 25 years for changing the barrier type, installing a cable median barrier, a concrete median barrier, a steel median barrier, and upgrading the median barrier (p. 51).

Crosswalk with other Data Systems:

- **HPMS:** Median Type
- **FARS:** Trafficway Description[18]

Collection Cycle:	Medium Term

[18] Not an exact match of attributes. FARS attribute codes are a blend of *One/Two-Way Operations* and *Median Barrier Presence/Type*.

<table>
<tr><td>Level of Accuracy:</td><td colspan="3">High</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">Value does not equal NULL.
Value equals “1 (None)” and MEDIAN WIDTH is equal to “0”.
Value does not equal “1 (None)” and MEDIAN WIDTH is not equal to “0”.
Value does not equal “1 (None)” and MEDIAN TYPE does not equal “1 (Undivided)”.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

61. Median (Inner) Paved Shoulder Width

Description:	The width of the paved shoulder on the median (i.e., inside) side of the roadway.
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: Inside shoulder measured from the center of the left-most lane edgeline outward. Data element only applies where a median divided road is represented as a single centerline; all other circumstances are captured within the *Left Paved Shoulder Width* data element.

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for changing shoulder widths (p. 53).

Crosswalk with other Data Systems:

- **HPMS:** Left Shoulder Width

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" and *MEDIAN TYPE* does not equal "1 (Undivided)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

62. Median Shoulder Rumble Strip Presence/Type

Description:	Presence and type of median shoulder rumble strip.
Recommended Attributes:	1. None 2. Milled beyond edgeline 3. Rolled beyond edgeline 4. Milled or rolled on/under edgeline (e.g., rumble stripes) 5. Edgeline-rumble strip combination (e.g., raised/inverted thermoplastic profile marker)
Recommended Field Type:	Numeric

Remarks: Data element only applies where a road is median divided. If the roadway segment is divided and inventoried in two directions, this is captured as part of *Left Shoulder Rumble Strip Presence/Type*. Undivided, two-way roads with centerline rumble strips are counted as part of the *Centerline Rumble Strip Presence/Width* data element.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 5 years for raised rumble strips and 10 years for milled and rolled rumble strips (p. 53).

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (None)" and *MEDIAN TYPE* does not equal "1 (Undivided)".

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	N/A

63. Median Sideslope

Description:	The sideslope in the median adjacent to the median shoulder or travel lane.
Recommended Attributes:	1. Sideslope (percent)
Recommended Field Type:	Numeric

Remarks: This can be positive (if backslope) or negative (if foreslope). If the sideslope varies along the segment, code the predominant sideslope. Data element only applies where a median divided road is represented as a single centerline; all other circumstances are captured within the *Left Sideslope* data element.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for flattening sideslopes (p. 51).

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" and *ONE/TWO-WAY OPERATIONS* is equal to "2 (Two-way)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	N/A

64. Median Sideslope Width

Description:	The width of the median sideslope adjacent to the median shoulder or travel lane.
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: If width varies along the segment, code the predominant width. Data element only applies where a median divided road is represented as a single centerline; all other circumstances are captured within the *Left Sideslope Width* data element.

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for flattening sideslopes (p. 51).

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" and *ONE/TWO-WAY OPERATIONS* is equal to "2 (Two-way)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	N/A

65. Median Crossover/Left-Turn Lane Type

Description:	The presence and type of crossover/left-turn bay in the median along the segment.
Recommended Attributes:	1. None 2. Median crossover, no left-turn bay 3. Median crossover, left-turn bay 4. Median crossover, directional left-turn lane bays (to prevent crossing traffic from driveways) 5. Two-way left-turn lane
Recommended Field Type:	Numeric

Remarks: This element is intended to capture the typical median characteristic along the segment at non-intersection locations. The "5 (Two-way left-turn lane)" attribute is also included in the *Median Type* data element.

Intersection-related turn lanes should be captured in relevant intersection (approach) databases (figure 25).

Median crossover/left-turn lane type is related to access management and roadside treatments as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for replacing two-way left-turn lanes with a raised median, creating directional median openings, and closing crossover (pp. 37 and 51).

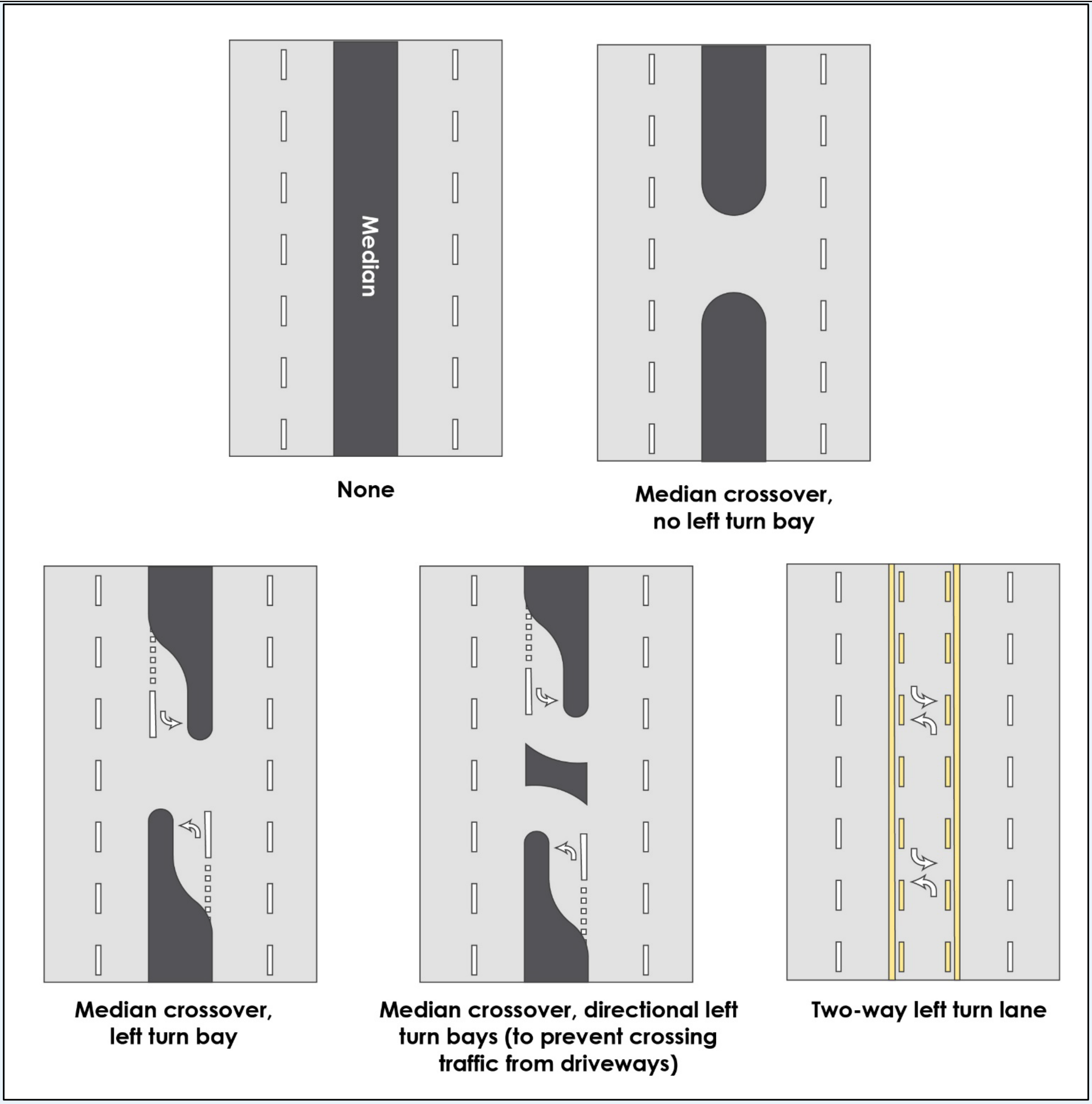

Figure 25. Graphic. Illustration of types of median crossover/left-turn lanes.

Collection Cycle:	Long Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (None)" and *MEDIAN TYPE* is no equal to "1 (Undivided)".

	Non-Local Paved	Local Paved	Unpaved
Collection Extent:	Full Extent	Partial Extent	N/A

66. Roadside Clear Zone Width

Description:	Predominate or average roadside clear zone width.
Recommended Attributes:	1. Clear zone width (feet)
Recommended Field Type:	Numeric

Remarks: A clear zone is the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles. The clear zone includes shoulders, bike lanes, and auxiliary lanes, except those auxiliary lanes that function like through lanes. Clear zone can vary significantly along a segment, and States should select the predominant width along a segment (figure 26).

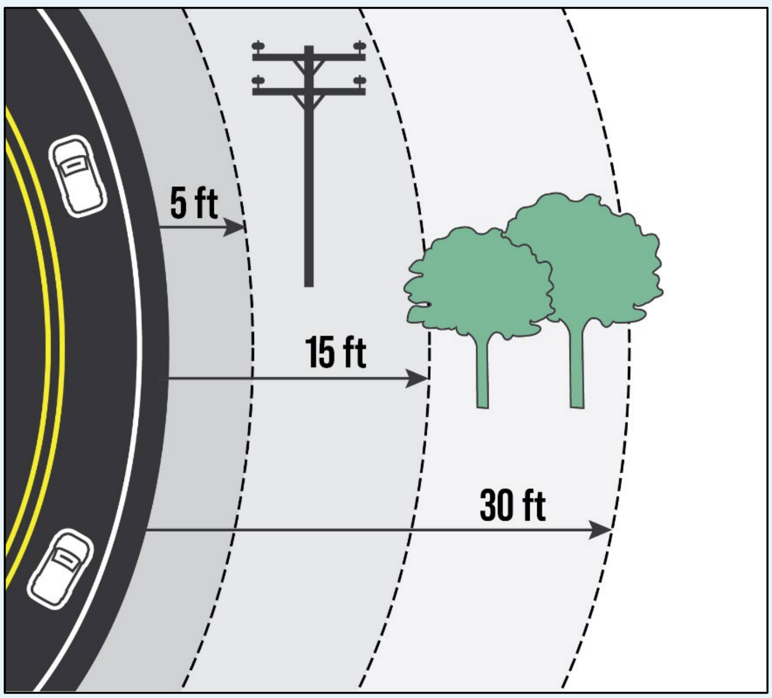

Figure 26. Graphic. Illustration of roadside clear zone along a curve.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years for changing the clear zone width (p. 51).

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate

Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

67. Right Sideslope

Description:	The sideslope (foreslope or backslope) on the right side of roadway immediately adjacent to the travel lane, shoulder edge, or drainage ditch based on the *Direction of Inventory*.
Recommended Attributes:	1. Sideslope (percent)
Recommended Field Type:	Numeric

Remarks: If sideslope varies within the section, code the predominant sideslope. This can be positive (if backslope) or negative (if foreslope).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for flattening sideslopes (p. 51).

Collection Cycle:	Long Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL* if *CURB PRESENCE* is equal to "1 (No curb)". • Value does not equal *NULL* if *CURB TYPE* is equal to "1 (No curb)".

	Non-Local Paved	**Local Paved**	**Unpaved**
Collection Extent:	Full Extent	Partial Extent	Partial Extent

68. Right Sideslope Width

Description:	The width of the sideslope on the right side of roadway immediately adjacent to the travel lane, shoulder edge, or drainage ditch based on the *Direction of Inventory*.
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: If the width varies along the segment, select the predominant width.

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for flattening sideslopes (p. 51).

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL* if *CURB PRESENCE* is equal to "1 (No curb)". • Value does not equal *NULL* if *CURB TYPE* is equal to "1 (No curb)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

69. Left Sideslope

Description:	The sideslope (foreslope or backslope) on the left side of roadway immediately adjacent to the travel lane, shoulder edge, or drainage ditch based on the *Direction of Inventory*.
Recommended Attributes:	1. Sideslope (percent)
Recommended Field Type:	Numeric

Remarks: If sideslope varies within the section, code the predominant sideslope. This can be positive (if backslope) or negative (if foreslope). For undivided roads and divided roads with one direction of inventory, this will be the outside shoulder on the opposing side.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for flattening sideslopes (p. 51).

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL* if *CURB PRESENCE* is equal to "1 (No curb)". • Value does not equal *NULL* if *CURB TYPE* is equal to "1 (No curb)". • Value equals *NULL* and *ONE/TWO-WAY OPERATIONS* does not equal "2 (Two-way)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

70. Left Sideslope Width

Description:	The width of the sideslope on the left side of roadway immediately adjacent to the travel lane, shoulder edge, or drainage ditch based on the *Direction of Inventory*.
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: If the width varies along the segment, select the predominant width.

Refer to figure 15 for an example of this data element on a two-lane road.

Refer to figure 16 for an example of this data element on a multilane, divided road that is inventoried in two directions (i.e., each direction is inventoried separately and contains data elements for only one direction of travel).

Refer to figure 17 for an example of this data element on a multilane, divided road that is inventoried in one direction (i.e., both directions inventoried together, and a single record contains data elements for both directions of travel).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for flattening sideslopes (p. 51).

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL* if *CURB PRESENCE* is equal to "1 (No curb)". • Value does not equal *NULL* if *CURB TYPE* is equal to "1 (No curb)". • Value equals *NULL* and *ONE/TWO-WAY OPERATIONS* does not equal "2 (Two-way)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

71. Roadside Rating

Description:	A qualitative rating of the safety of the roadside, ranked on a seven-point categorical scale from 1 (best) to 7 (worst).
Recommended Attributes:	1. 1 2. 2 3. 3 4. 4 5. 5 6. 6 7. 7
Recommended Field Type:	Numeric

Remarks: Data element can be partially derived from other MIRE data, including *Roadside Clear Zone Width*, *Right Sideslope*, and *Left Sideslope*.

Rating = 1 (figure 27)

- Wide clear zones greater than or equal to 30 ft from the pavement edgeline.
- Sideslope flatter than 1:4.
- Recoverable.

Figure 27. Graphic. Illustration of a Roadside Rating 1.

Rating = 2 (figure 28)

- Clear zone between 20 and 25 ft from pavement edgeline.
- Sideslope about 1:4.
- Recoverable.

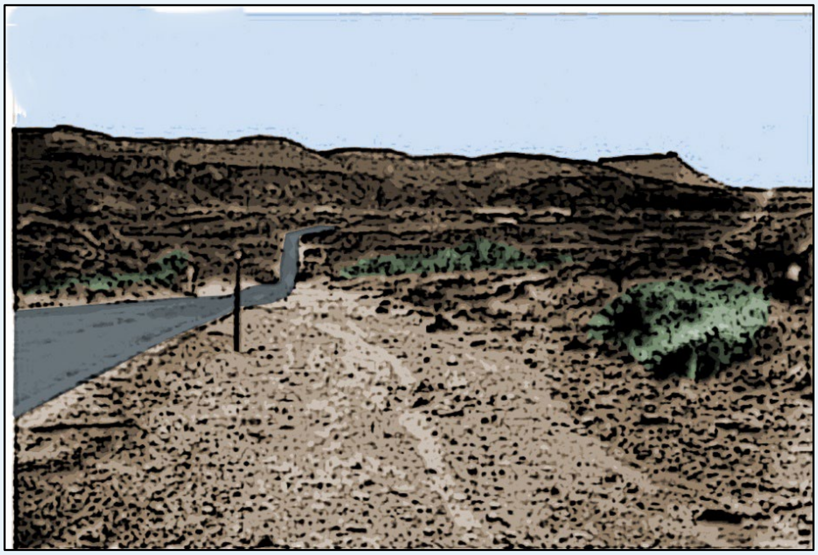

Figure 28. Graphic. Illustration of a Roadside Rating 2.

Rating = 3 (figure 29)

- Clear zone about 10 ft from pavement edgeline.
- Sideslope about 1:3 or 1:4.
- Rough roadside surface.
- Marginally recoverable.

Figure 29. Graphic. Illustration of a Roadside Rating 3.

Rating = 4 (figure 30)

- Clear zone between 5 to 10 ft from pavement edgeline.
- Sideslope about 1:3 or 1:4.
- May have guardrail (5 to 6.5 ft from pavement edgeline).
- May have exposed trees, poles, or other objects (about 10 ft from pavement edgeline).
- Marginally forgiving, but increased chance of a reportable roadside collision.

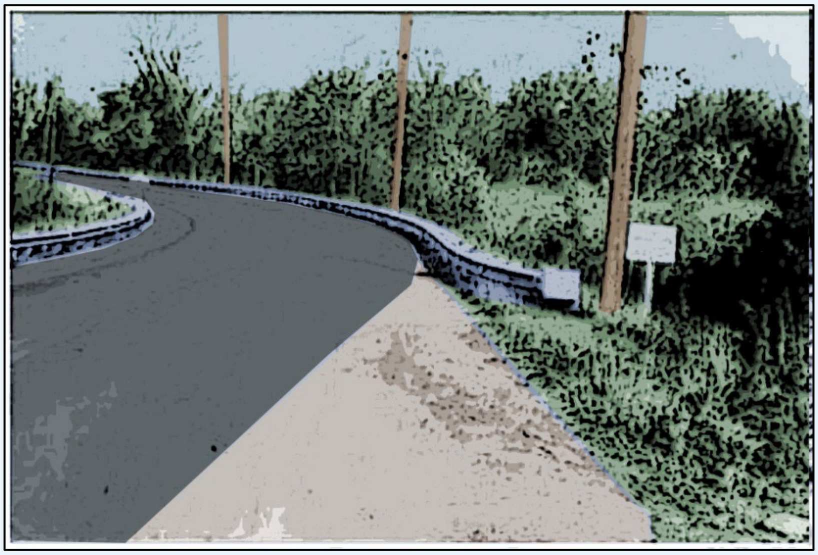

Figure 30. Graphic. Illustration of a Roadside Rating 4.

Rating = 5 (figure 31)

- Clear zone between 5 to 10 ft from pavement edgeline.
- Sideslope about 1:3.
- May have guardrail (0 to 5 ft from pavement edgeline).
- May have rigid obstacles or embankment within 6.5 to 10 ft of pavement edgeline.
- Virtually non-recoverable.

Figure 31. Graphic. Illustration of a Roadside Rating 5.

Rating = 6 (figure 32)

- Clear zone less than or equal to 5 ft.
- Sideslope about 1:2.
- No guardrail.
- Exposed rigid obstacles within 0 to 6.5 ft of the pavement edgeline.
- Non-recoverable.

Figure 32. Graphic. Illustration of a Roadside Rating 6.

Rating = 7 (figure 33)

- Clear zone less than or equal to 5 ft.
- Sideslope 1:2 or steeper.
- Cliff or vertical rock cut.
- No guardrail.
- Non-recoverable with high likelihood of severe injuries from roadside collision.

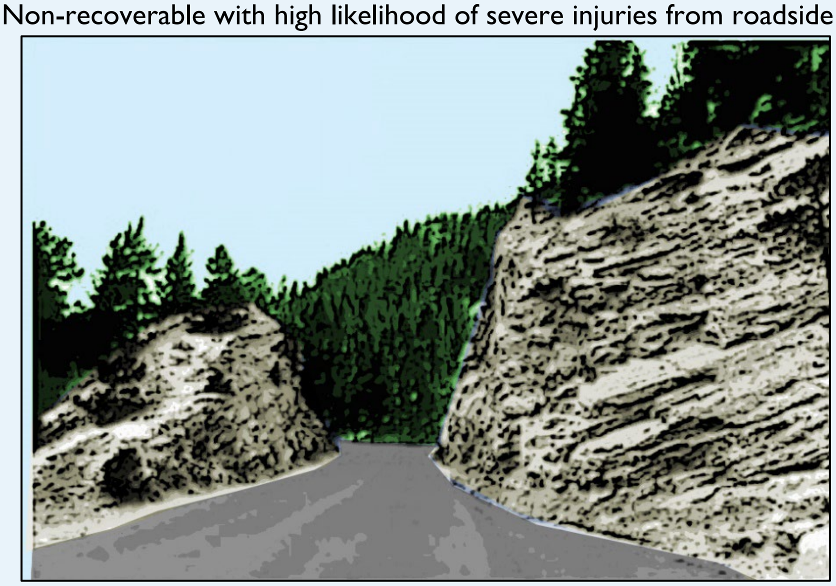

Figure 33. Graphic. Illustration of a Roadside Rating 7.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

72. Tapered Edge

Description:	A pavement edge treatment that provides a tapered transition from the edge of the paved roadway surface to the unpaved shoulder.
Recommended Attributes:	1. Yes 2. No
Recommended Field Type:	Numeric

Remarks: Data element includes application of SafetyEdge[SM] (FHWA, n.d.). This feature involved shaping the edge of the pavement at approximately 30 degrees from the pavement cross slope during the paving process (figure 34).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years for installing a safety edge treatment (p. 51).

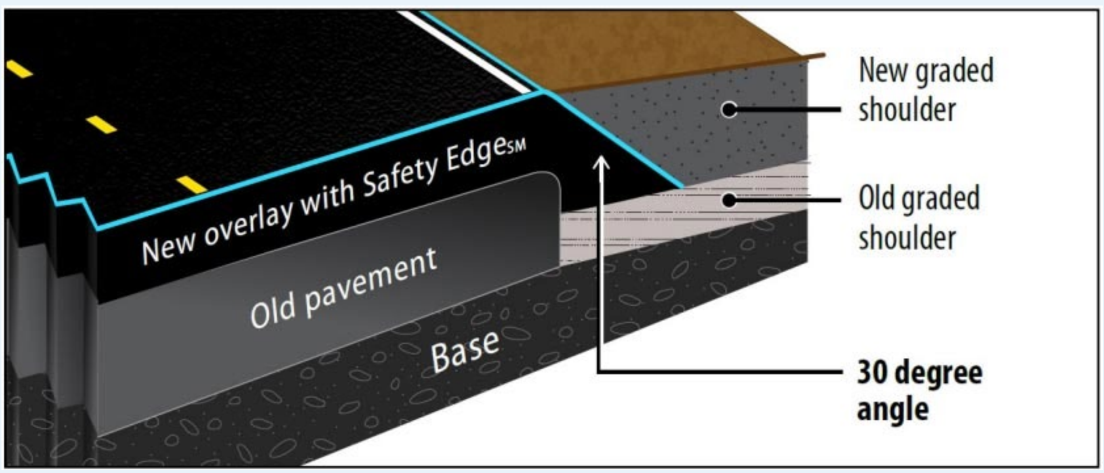

Figure 34. Graphic. Illustration of tapered edge (FHWA, 2017b).

Collection Cycle:	Long Term
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*. • Value equals "2 (No)" if SURFACE TYPE equals "1 (Unpaved)".

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Partial Extent	N/A

73. Major Commercial Driveway Count

Description:	Count of commercial driveways in segment serving 50 or more parking spaces.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Mixed use developments (i.e., parcels with both commercial and residential tenant uses) should be included in this category.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value. Commercial properties with no restriction on access along the entire property frontage are generally counted as two driveways. The Highway Safety Manual (2010) provides the following (p. 12-23):

> *"It is not intended that an exact count of the number of parking spaces be made for each site. Driveways can be readily classified as major or minor form a quick review of aerial photographs that show parking areas or through user judgment based on the character of the establishment served by the driveway."*

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

74. Minor Commercial Driveway Count

Description:	Count of commercial driveways in segment serving fewer than 50 parking spaces.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Mixed use developments (i.e., parcels with both commercial and residential tenant uses) should be included in this category.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value. Commercial properties with no restriction on access along the entire property frontage are generally counted as two driveways. The Highway Safety Manual (2010) provides the following (p. 12-23):

> *"It is not intended that an exact count of the number of parking spaces be made for each site. Driveways can be readily classified as major or minor form a quick review of aerial photographs that show parking areas or through user judgment based on the character of the establishment served by the driveway."*

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

75. Major Residential Driveway Count

Description:	Count of residential driveways in segment serving 50 or more parking spaces.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Mixed use developments (i.e., parcels with both commercial and residential tenant uses) should be included in *Major Commercial Driveway Count* or *Minor Commercial Driveway Count*.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value.

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

76. Minor Residential Driveway Count

Description:	Count of residential driveways in segment serving fewer than 50 parking spaces.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Mixed use developments (i.e., parcels with both commercial and residential tenant uses) should be included in *Major Commercial Driveway Count* or *Minor Commercial Driveway Count*.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value.

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

77. Major Industrial/Institutional Driveway Count

Description:	Count of industrial/institutional driveways in segment serving 50 or more parking spaces.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Institutional uses include schools, libraries, sporting venues, places of worship, and other community resources.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value. The Highway Safety Manual (2010) provides the following (p. 12-23):

> *"It is not intended that an exact count of the number of parking spaces be made for each site. Driveways can be readily classified as major or minor form a quick review of aerial photographs that show parking areas or through user judgment based on the character of the establishment served by the driveway."*

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

78. Minor Industrial/Institutional Driveway Count

Description:	Count of industrial/institutional driveways in segment serving fewer than 50 parking spaces.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Institutional uses include schools, libraries, sporting venues, places of worship, and other community resources.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value. The Highway Safety Manual (2010) provides the following (p. 12-23):

> *"It is not intended that an exact count of the number of parking spaces be made for each site. Driveways can be readily classified as major or minor form a quick review of aerial photographs that show parking areas or through user judgment based on the character of the establishment served by the driveway."*

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

79. Other Driveway Count

Description:	Count of "other" driveways in segment.
Recommended Attributes:	1. Count
Recommended Field Type:	Numeric

Remarks: Include all driveways in a segment not already captured in *Major Commercial Driveway Count*, *Minor Commercial Driveway Count*, *Major Residential Driveway Count*, *Minor Residential Driveway Count*, *Major Industrial/Institutional Driveway Count*, or *Minor Industrial/Institutional Driveway Count*.

States can apply a representative average value (i.e., number of driveway entrances per mile) for a series of segments; in other words, the average value for an entire corridor could apply to several consecutive segments. Other types of driveways can include access points for public land, agricultural uses, or other land uses not readily accommodated by other driveway data elements.

Signalized driveways are not included in this data element, and both sides of the road are combined to create a total segment value.

Driveway count is related to access management as a potential safety countermeasure. FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for driveway density-related countermeasures (p. 37).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

80. Terrain Type

Description:	The basic terrain type for the roadway segment.
Recommended Attributes:	1. Level 2. Rolling 3. Mountainous
Recommended Field Type:	Numeric

Remarks: This is a (less than desirable) surrogate for detailed data on curvature, grade, and the nature of the roadside. This would only be collected in the absence of those elements.

When coding this data item, consider the terrain of connecting roadway segments, rather than solely the grade characteristics associated with the individual segment. The extended roadway segments may be several miles long and contain a number of upgrades, downgrades, and level segments.

General vertical grade thresholds for each terrain type include:

- **Level** – Less than 2 percent. Any combination of grades and horizontal or vertical alignment that permits heavy vehicles to maintain the same speed as passenger cars; this generally includes short grades of no more than 2 percent (FHWA, 2016, p. 4-87).

- **Rolling** – From 2-8 percent. Any combination of grades and horizontal or vertical alignment that causes heavy vehicles to reduce their speeds substantially below those of passenger cars but that does not cause heavy vehicles to operate at crawl speeds for any significant length of time (FHWA, 2016, p. 4-87).

- **Mountainous** – More than 8 percent. Any combination of grades and horizontal or vertical alignment that causes heavy vehicles to operate at extremely low speeds for significant distances or at frequent intervals (FHWA, 2016, p. 4-87).

Crosswalk with other Data Systems:

- **HPMS:** Terrain Type

Collection Cycle:	Long Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

81. AADT Annual Escalation Percentage

Description:	Expected annual percent growth in AADT.
Recommended Attributes:	1. AADT escalation (percent)
Recommended Field Type:	Numeric

Remarks: *AADT Year* can be used as a base year to calculate this data element. The same methodology used to calculate the "Future AADT" data item in HPMS can be applied to derive this data element.

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

82. Percent Single Unit Trucks or Single Unit Truck AADT

Description:	Percentage single unit truck or single truck AADT.
Recommended Attributes:	1. Single unit truck AADT (percent or count)
Recommended Field Type:	Numeric

Remarks: This data element reflects vehicle classification data from traffic monitoring programs for vehicle classes 4 through 7 (as defined in the TMG). States are encouraged to follow HPMS and TMG guidance. If actual measured values are not available, then an estimate can be made based on the most readily available information.

The most credible method would be to use other site-specific measured values from sites located on the same route (FHWA, 2016, p. 4-54). Refer to table 4 for potential sources of this data element.

For two-way facilities, provide the bidirectional Single Unit Truck AADT; for one-way roadways, and ramps, provide the directional Single Unit Truck AADT.

Single Unit Truck AADT is representative of all single-unit truck and bus activity based on vehicle classification count data from both the State's and other agency's traffic monitoring programs over all days of the week and all seasons of the year (FHWA, 2022e; p. 5-11).

Percent Single Unit Trucks can be calculated by dividing the number of single-unit trucks and buses during the hour with the highest total volume (i.e., the design hour) by the AADT (i.e., the total daily traffic). Note that this data element is based on the truck traffic during the design hour and not the hour with the most truck traffic (FHWA, 2022e, p. 5-11).

Crosswalk with other Data Systems:

- **HPMS:** Single-Unit Truck and Bus AADT and Percent Design Hour Single Unit Trucks and Buses

Collection Cycle:	• **Medium Term** where *FEDERAL-AID* is equal to "3 (Route is on NHS)". • **Long Term** for all other paved and unpaved roads.
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • *SINGLE UNIT TRUCK AADT* values greater than 50 percent of *AADT* should be scrutinized. • *SINGLE UNIT TRUCK AADT* + *COMBINATION TRUCK AADT* should be less than *AADT*.

	• *SINGLE UNIT TRUCK AADT* should be less than (*PERCENT SINGLE UNIT TRUCKS*/100) * *AADT*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

83. Percent Combination Trucks or Combination Truck AADT

Description:	Percentage combination truck or combination truck AADT.
Recommended Attributes:	1. Combination truck AADT (percent or count)
Recommended Field Type:	Numeric

Remarks: This data element reflects vehicle classification data from traffic monitoring programs for vehicle classes 8 through 13, including four-or-less axle, single-trailer trucks through seven-or-more axle, multi-trailer trucks (as defined in the TMG). States are encouraged to follow HPMS and TMG guidance. If actual measured values are not available, then an estimate should be made based on the most readily available information.

The most credible method would be to use other site-specific measured values from sites located on the same route (FHWA, 2016, p. 4-57). Refer to table 4 for potential sources of this data element.

For two-way facilities, provide the bidirectional Combination Truck AADT; for one-way roadways, and ramps, provide the directional Combination Truck AADT. Specific guidance for the frequency and size of vehicle classification data collection programs, factor development, age of data, and other applications is contained in the TMG.

Combination Truck AADT is representative of all combination truck activity based on vehicle classification count data from both the State's and other agencies' traffic monitoring programs over all days of the week and all seasons of the year. (FHWA, 2022e, p. 5-12).

Percent Combination Trucks can be calculated by dividing the number of combination trucks during the hour with the highest total volume (i.e., the design hour) by the AADT (i.e., the total daily traffic). Note that this data element is based on the truck traffic during the design hour and not the hour with the most truck traffic (FHWA, 2022e, p. 5-12).

Crosswalk with other Data Systems:

- **HPMS:** Combination Truck AADT and Design Hour Combination Trucks

Collection Cycle:	• **Medium Term** where *FEDERAL-AID* is equal to "3 (Route is on NHS)". • **Long Term** for all other paved and unpaved roads.
Level of Accuracy:	Moderate
Validation Checks:	• *COMBINATION TRUCK AADT* values greater than 50 percent of *AADT* should be scrutinized. • *COMBINATION TRUCK AADT* should be less than (*PERCENT COMBINATION TRUCKS*/100).

	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

84. Percentage Trucks or Truck AADT

Description:	Percentage truck or truck AADT.
Recommended Attributes:	1. Total truck AADT (percent or count)
Recommended Field Type:	Numeric

Remarks: This can be derived if *Single Unit Truck AADT* and *Combination Truck AADT* are available.

Crosswalk with other Data Systems:

- **NBI:** Annual Average Daily Truck Traffic

Collection Cycle:	• **Medium Term** where *FEDERAL-AID* is equal to "3 (Route is on NHS)". • **Long Term** for all other paved and unpaved roads.
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

85. Total Daily Two-Way Pedestrian Count/Exposure

Description:	Total daily pedestrian flow along the roadway in both directions (unless directional segment).
Recommended Attributes:	1. Average daily count
Recommended Field Type:	Numeric

Remarks: Represents pedestrian flow parallel to the roadway (i.e., not crossing the roadway). This is a (less than desirable) surrogate for crossing pedestrian counts. A high number of pedestrian crossings is generally 100 or more per hour; however, a high or typical number of pedestrian crossings will vary by context (FHWA, 2022d; FHWA, 2023b). More moderate crossing numbers typically fall between 10 and 100 per hour, with 10 or fewer crossings per hour being considered lower crossing volume.

Key differences between motorized and non-motorized count programs include (FHWA, 2022e, p. 1-12):

- The limited number of monitoring sites in most city, county, or State count programs that might limit statistical extrapolation.
- Greater use of lower functional classification roads by non-motorists, as well as off-road paths.
- Prevalence of short-term counts (i.e., 2 hours) in existing non-motorized count data and monitoring practices.

Agencies should take care to address or modify count programs or statistical estimates accordingly. NCHRP Report 797 (2014) provides some additional guidance on developing a non-motorized count program.

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value is greater than "0" if *ACCESS CONTROL* is not equal to "1 (Full access control)". • Values greater than "100" per hour should be scrutinized if *CITY/LOCAL JURISDICTION NAME* is *NULL* and *CITY/LOCAL JURISDICTION URBAN CODE* is equal to "1 (Rural)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

86. Bicycle Count/Exposure

Description:	The total daily bicycle flow in both directions along the roadway (unless directional segment).
Recommended Attributes:	1. Average daily count
Recommended Field Type:	Numeric

Remarks: Key differences between motorized and non-motorized count programs include (FHWA, 2022e, p. 1-12):

- The limited number of monitoring sites in most city, county, or State count programs that might limit statistical extrapolation.
- Greater use of lower functional classification roads by non-motorists, as well as off-road paths.
- Prevalence of short-term counts (i.e., 2 hours) in existing non-motorized count data and monitoring practices.

Agencies should take care to address or modify count programs or statistical estimates accordingly. NCHRP Report 797 provides some additional guidance on developing a non-motorized count program.

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value is greater than "0" if *ACCESS CONTROL* is not equal to "1 (Full access control)". • Values greater than "10" per hour should be scrutinized if *CITY/LOCAL JURISDICTION NAME* is *NULL* and *CITY/LOCAL JURISDICTION URBAN CODE* is equal to "1 (Rural)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

87. Motorcycle Count or Percentage

Description:	Motorcycle daily count or percentage of AADT.
Recommended Attributes:	1. Average daily count or percentage
Recommended Field Type:	Numeric

Remarks: FHWA's TMG (2022e) notes the following with respect to motorcycle counts (p. 2-15):

"The relatively small amount of metal in many motorcycles combined with the fact that many motorcyclists ride near lane lines to give themselves more time to avoid cars moving into their lanes means that inductive loop detectors and half lane axle sensors often undercount motorcycles. When motorcycles ride in closely spaced groups, the closely spaced axles and cycles often confuse available traffic monitoring equipment, which have not been designed to identify the resulting pattern of closely spaced axles and vehicles.

Four aspects of traffic counting can be changed to improve accuracy of counting motorcycles:

1. *Use of full lane width axle sensors.*
2. *Use of wide loops of (8-ft-wide) in the lane for motorcycle counting.*
3. *Counting by wheel path.*
4. *Video detection (might be limited to detection during daytime only)."*

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

88. Hourly Traffic Volumes (or Peak and Off peak AADT)

Description:	Hourly traffic volumes (or peak and off peak AADT).
Recommended Attributes:	1. Hourly traffic volumes
Recommended Field Type:	Numeric

Remarks: Refer to FHWA's TMG (2022e) for discussion on how to conduct traffic counts. Hourly traffic volumes are a component of the overall traffic volume record. Refer to table 4 for potential sources of this data element.

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*.

	Non-Local Paved	Local Paved	Unpaved
Collection Extent:	Partial Extent	Partial Extent	Partial Extent

89. K-Factor

Description:	The design hour volume (the 30th largest hourly volume for a given calendar year) as a percentage of total AADT
Recommended Attributes:	1. K-Factor (percent)
Recommended Field Type:	Numeric

Remarks: A common source of this data is from continuous traffic monitoring sites. If continuous data is not available, a State may use values derived from continuous count station data on the same route or on a similar route with similar traffic characteristics in the same area.

When utilizing traffic count data gathered from continuous traffic monitoring sites, the 30th highest hourly volume for a given year is used for the purposes of calculating K-factor. Refer to table 4 for potential sources of this data element (FHWA, 2016, p. 4-59).

Crosswalk with other Data Systems:

- **HPMS:** K-factor

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

90. Design Hour Directional Factor

Description:	The percent of design hour volume (often the 30th largest hourly volume for a given calendar year) flowing in the higher volume direction.
Recommended Attributes:	1. Design hour directional factor
Recommended Field Type:	Numeric

Remarks: Per TMG guidance, the peak hour is the hourly volume during the maximum traffic volume hour of the day divided by 15-minute volume multiplied by four, and is a measure of traffic demand fluctuation within the peak hour. It represents one hour of data at the peak time.

For two-way facilities, the directional factor normally ranges from 50 to 70 percent; one-way facilities should be 100 percent (FHWA, 2016, p. 4-60).

Crosswalk with other Data Systems:

- **HPMS:** Directional Factor

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*.

	Non-Local Paved	Local Paved	Unpaved
Collection Extent:	Partial Extent	Partial Extent	Partial Extent

91. Speed Limit

Description:	The daytime regulatory speed limit for automobiles posted or legally mandated (i.e., statutory).
Recommended Attributes:	1. Miles per hour (mph)
Recommended Field Type:	Numeric

Remarks: For segments where minimum and maximum posted speed limits are present or where dynamically or variably controlled speed limits are present, code the maximum posted speed limit. Truck speeds are coded in *Truck Speed Limit*.

If the speed limit for these segments during the peak period is lower than the posted speed limit, code the lower value (i.e., peak period speed limit).

If no posted or legally mandated speed limit is present, code "999."

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 15 years for changing the posted speed limit (p. 58).

Crosswalk with other Data Systems:

- **HPMS:** Speed Limit
- **FARS:** Speed Limit
- **MMUCC (v6):** Motor Vehicle Posted/Statutory Speed Limit

Collection Cycle:	• **Annually** where *FEDERAL-AID* does not equal "1 (Route is non-Federal-aid)". • **Long Term** (or estimated) for all other paved and all unpaved roads.		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

92. Truck Speed Limit

Description:	The regulatory speed limit for trucks posted or legally mandated (i.e., differential speed limit).
Recommended Attributes:	1. Miles per hour (mph)
Recommended Field Type:	Numeric

Remarks: Only code if the speed limit for trucks is different than the limit for automobiles.

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• *Value is not greater than SPEED LIMIT.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

93. Nighttime Speed Limit

Description:	The regulatory speed limit for vehicles at night posted or legally mandated on the greater part of the segment (i.e., differential speed limit).
Recommended Attributes:	1. Miles per hour (mph)
Recommended Field Type:	Numeric

Remarks: Only code if the speed limit at night is different than the limit during daylight hours.

Crosswalk with other Data Systems:

- **MMUCC (v6):** Motor Vehicle Posted/Statutory Speed Limit

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Moderate
Validation Checks:	• Value is not greater than *SPEED LIMIT*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

94. 85th Percentile Speed

Description:	Traffic speed exceeded by 15 percent of the vehicles in the flow for this section.
Recommended Attributes:	1. Miles per hour (mph)
Recommended Field Type:	Numeric
Remarks: Refer to table 4 for potential sources of this data element.	
Collection Cycle:	Ad-Hoc
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

95. Mean Speed

Description:	The arithmetic mean (average) of all observed vehicle speeds in the segment (i.e., the sum of all spot speeds divided by the number of recorded speeds).		
Recommended Attributes:	1. Miles per hour (mph)		
Recommended Field Type:	Numeric		
Remarks: Refer to table 4 for potential sources of this data element.			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

96. School Zone Indicator

Description:	Indication of whether the segment is located at least partially within a school zone.
Recommended Attributes:	1. Yes 2. No
Recommended Field Type:	Numeric

Remarks: A standard uniform geographic buffer (typically within 1,000 ft) based on the school building or school parcel boundary can be used in lieu of the actual signage- or pavement marking-delineated school zone area.

Crosswalk with other Data Systems:

- **FARS:** School Zone[19]

Collection Cycle:	Long Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

[19] Definition is based on signed or marked school zones during periods when school is in session.

97. On-Street Parking Presence

Description:	Time-based parking restrictions.
Recommended Attributes:	1. Permitted 24 hrs/day 2. Prohibited 24 hrs/day 3. Permitted during specified times
Recommended Field Type:	Numeric

Remarks: Data element should reflect the permitted use, even if the segment is not formally signed or striped for parking (FHWA, 2016, p. 4-81). Do not count parking that occurs beyond the shoulder or the pavement-edge where there is no shoulder. If parking lanes are legally used for through-traffic or turning lanes during the peak period, apply the appropriate in-use condition.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 15 years for prohibiting on-street parking and implementing time-limited parking restrictions, and 20 years for removing curb parking (p. 58).

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

98. On-Street Parking Type

Description:	Type of on-street parking present on the segment.
Recommended Attributes:	1. No parking allowed or none available 2. Head-in/back-out angle parking on one side 3. Head-in/back-out angle parking on both sides 4. Back-in/head-out angle parking on one side 5. Back-in/head-out angle parking on both sides 6. Parallel parking on one side 7. Parallel parking on both sides
Recommended Field Type:	Numeric

Remarks: Data element should reflect the permitted use, even if the segment is not formally signed or striped for parking. Do not count parking that occurs beyond the shoulder or the pavement-edge where there is no shoulder (FHWA, 2016; p. 4-81).

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

99. Roadway Lighting

Description:	The type of roadway lighting present on the segment.
Recommended Attributes:	1. None 2. Spot on one side 3. Spot on both sides 4. Continuous on one side 5. Continuous on both sides
Recommended Field Type:	Numeric

Remarks: The AASHTO Roadway Lighting Design Guide 7th Edition (AASHTO, 2018) and the Illuminating Engineering Society (IES) Recommended Practice: Lighting Roadway and Parking Facilities (IES, 2022) guides are helpful resources for determining the appropriate amount of lighting at roadway facilities.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 15 years for modifying, improving, or providing segment lighting (p. 42).

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

100. Toll Charged

Description:	Presence and type of toll facility on the segment.
Recommended Attributes:	1. Toll charged in one direction only. 2. Toll charged in both directions. 3. No toll charged.
Recommended Field Type:	Numeric

Remarks: Data element applies only when a toll facility is present. States should consider each toll and non-toll portion of contiguous toll facilities as separate sections.

If tolls are charged in both directions, but only one direction at a given time, then use code "1 (Toll charged in one direction only)." Include HOT lanes and other special toll lanes. Code "3 (No toll charged)" for subsegments of a toll facility that do not have tolls (FHWA, 2016, p. 4-45).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years associated with "Install Toll Collection System" (p. 38)

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value equals "3 (No Toll Charged)" and *TOLL TYPE* does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

101. Toll Type

Description:	Presence of special tolls (i.e., HOT lane[s] or other managed lanes).
Recommended Attributes:	1. Has toll lanes but no special tolls (e.g., HOT lanes) 2. Has HOT lanes 3. Has other special tolls
Recommended Field Type:	Numeric

Remarks: This may not be an HOV facility, but has special lanes identified where users would be subject to tolls. HOT lanes are HOV lanes where a fee is charged, sometimes based on occupancy of the vehicle or the type of vehicle. Vehicle types can include buses, vans, or other passenger vehicles (FHWA, 2016, p. 4-46).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years associated with "Install Toll Collection System" (p. 38)

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*.

	Non-Local Paved	Local Paved	Unpaved
Collection Extent:	Full Extent	Full Extent	Full Extent

102. Edgeline Presence/Width

Description:	Presence and width of marked edgeline.
Recommended Attributes:	1. Width (inches)
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 5 years for installing profile edge line markings (p. 41).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (No marked edgeline)" and *SURFACE TYPE* equals "1 (Unpaved)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

103. Centerline Presence/Width

Description:	Presence and width of marked centerline.
Recommended Attributes:	1. Width (inches)
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 5 years for installing profile center line markings (p. 41).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (No marked centerline)" and *SURFACE TYPE* equals "1 (Unpaved)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

104. Centerline Rumble Strip Presence/Width

Description:	Presence and type of centerline rumble strips on the segment.
Recommended Attributes:	1. None 2. Milled adjacent to centerline 3. Rolled adjacent to centerline 4. Milled or rolled on/under centerline (e.g., rumble stripes) 5. Centerline-rumble strip combination (e.g., raised/inverted thermoplastic profile marker)
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 5 years for raised rumble strips and 10 years for milled and rolled rumble strips (p. 52).

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value does not equal "1 (None)" and *MEDIAN TYPE* is not equal to "1 (Undivided)".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

105. Passing Zone Percentage

Description:	Percent of segment length marked for passing.
Recommended Attributes:	1. Passing zone percentage (percent)
Recommended Field Type:	Numeric

Remarks: This is coded based on the extent to which passing is permitted in the inventory direction. When there is a discernable directional difference in permitted passing per the roadway marking, code for the more restrictive direction (i.e., the direction that produces the lower value; FHWA, 2016, p. 4-90).

Crosswalk with other Data Systems:

- **HPMS:** Percent Passing Sight Distance

Collection Cycle:	Long Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0" and *SURFACE TYPE* is not equal to "1 (Unpaved)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

106. Bridge Numbers for Bridges in Segment

Description:	The official structure number for each bridge in a segment.
Recommended Attributes:	1. Bridge number(s)
Recommended Field Type:	Text

Remarks: Code the bridge numbers for each individual bridge within the segment. A bridge is a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads. All spans of a superstructure spanning from one abutment to another, having an opening measured along the center of the roadway of more than 20 ft, are recorded as one bridge, not as multiple bridges.

Per the *Specifications for the National Bridge Inventory*, it is preferable that a new and unique bridge number be assigned when a bridge is replaced. When any portion of the existing bridge is retained for a rehabilitated or partially replaced bridge, it is preferable to retain the existing bridge number.

Crosswalk with other Data Systems:

- **HPMS:** Structure ID
- **NBI:** Bridge Number

Collection Cycle:	Long Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

INTERSECTIONS

At-Grade Intersections/Junctions

107. Unique Junction Identifier [FDE]
108. Location Identifier for Road 1 Crossing Point [FDE]
109. Location Identifier for Road 2 Crossing Point [FDE]
110. Intersection/Junction Geometry [FDE]
111. Intersection/Junction Traffic Control [FDE]
112. Type of Intersection/Junction
113. Location Identifier for Additional Road Crossing Points
114. Intersection/Junction Number of Legs
115. School Zone Indicator
116. Railroad Crossing Number
117. Intersecting Angle
118. Intersection/Junction Offset Distance
119. Signalization Presence/Type
120. Intersection/Junction Lighting
121. Circular Intersection - Number of Circulatory Lanes
122. Circular Intersection - Circulatory Lane Width
123. Circular Intersection - Inscribed Diameter
124. Circular Intersection - Bicycle Facility

107. Unique Junction Identifier FDE

Description:	A unique junction identifier.
Recommended Attributes:	1. Unique junction identifier
Recommended Field Type:	Text

Remarks: Value is agency defined, consisting of a node number (numeric), combination of route IDs and associated milepoints (text), etc. Any unique identifier can be used based on the specific enterprise systems available to the State. Identifiers need not remain consistent over the years if segment extents change over time or the agency retires them.

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

108. Location Identifier for Road 1 Crossing [FDE]

Description:	Location of the center of the junction on the first intersecting route (e.g., route-milepoint).
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates).
Recommended Field Type:	Text and/or Numeric

Remarks: The location identifier is the location information for the digital record associated with an *intersection approach or departure*. States can use the milepoint associated with the major approach for this data element. Generally, AADT should determine which approach is major, although the *Functional Class* and *Number of Through Lanes* data elements can be used if AADT are unavailable. If spatial coordinates are included, these would be consistent for all crossing roads.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

109. Location Identifier for Road 2 Crossing [FDE]

Description:	Location of the center of the junction on the second intersecting route (e.g., route- milepoint).
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates).
Recommended Field Type:	Text and Numeric

Remarks: The location identifier is the location information for the digital record associated with an *intersection approach or departure*. This is not applicable if intersecting route is not an inventoried road (i.e., a railroad or bicycle path). States can use the milepoint associated with the minor approach for this data element. Generally, AADT should determine which approach is major, although the *Functional Class* and *Number of Through Lanes* data elements can be used if AADT are unavailable. If spatial coordinates are included, these would be consistent for all crossing roads.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

110. Intersection/Junction Geometry FDE

Description:	The type of geometric configuration that best describes the intersection/junction.
Recommended Attributes:	1. T-Intersection 2. Y-Intersection 3. Cross-Intersection (four legs) 4. Five or more legs and not circular 5. Roundabout 6. Other circular intersection (e.g., rotaries, neighborhood traffic circles) 7. Midblock pedestrian crossing 8. Restricted crossing U-turn (i.e., RCUT, J-turn, Superstreet) intersection 9. Median U-turn (i.e., MUT, Michigan Left, Thru-turn) intersection 10. Displaced left-turn (i.e., DLT, continuous flow, CFI) intersection 11. Jughandle (i.e., New Jersey jughandle) intersection 12. Continuous green T-intersection 13. Quadrant (i.e., quadrant roadway) intersection 14. Other
Recommended Field Type:	Numeric

Remarks: This data element should be generally consistent with *Intersection/Junction Number of Legs*. Certain geometries can be inferred from the number of legs, although States should take care to capture more nuanced categories (e.g., roundabouts). Figure 35 through figure 47 provide examples of each geometry type.

Roundabouts tend to have an inscribed diameter greater than 90 ft (i.e., neighborhood traffic circles) and less than 300 ft (i.e., rotaries):

- **Single lane roundabout (Code 5):** 90-180 ft.
- **Multi-lane roundabout (Code 5):** 180-300 ft.
- **Mini roundabout (Code 5):** <90 ft, fully traversable center island, yield-controlled entry.
- **Rotary (Code 6):** >300 ft, often requires lane changes while circulating.
- **Neighborhood traffic circle (Code 6):** <90 ft, no mountable center island, may be stop-controlled.

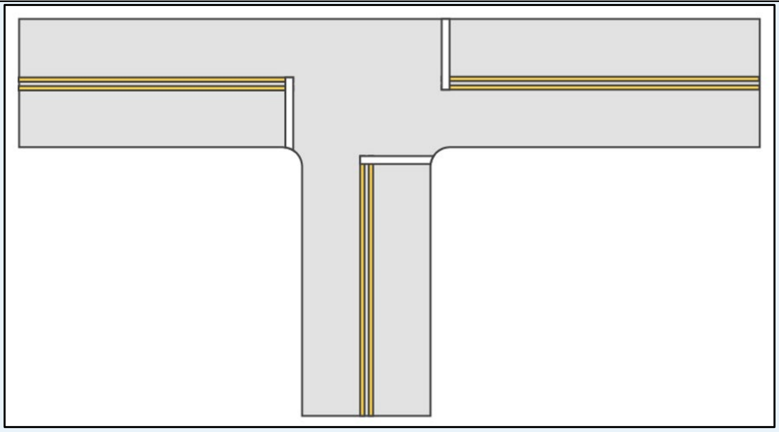

Figure 35. Graphic. Illustration of a T-intersection.

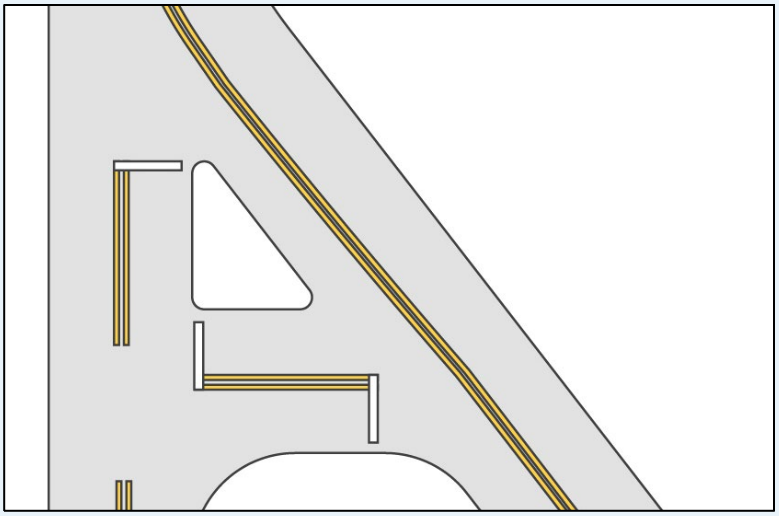

Figure 36. Graphic. Illustration of a Y-intersection.

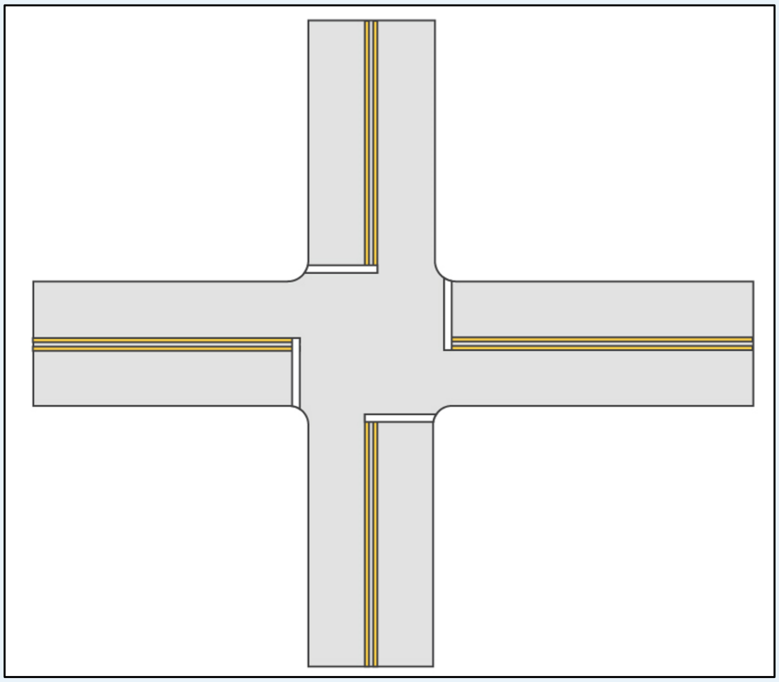

Figure 37. Graphic. Illustration of a cross-intersection (four legs).

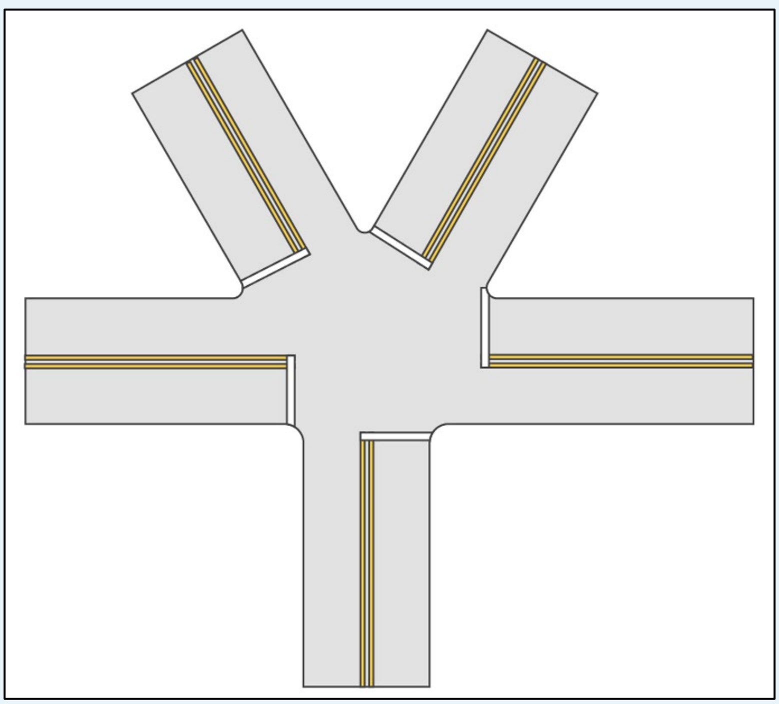

Figure 38. Graphic. Illustration of an intersection with five or more legs and not circular.

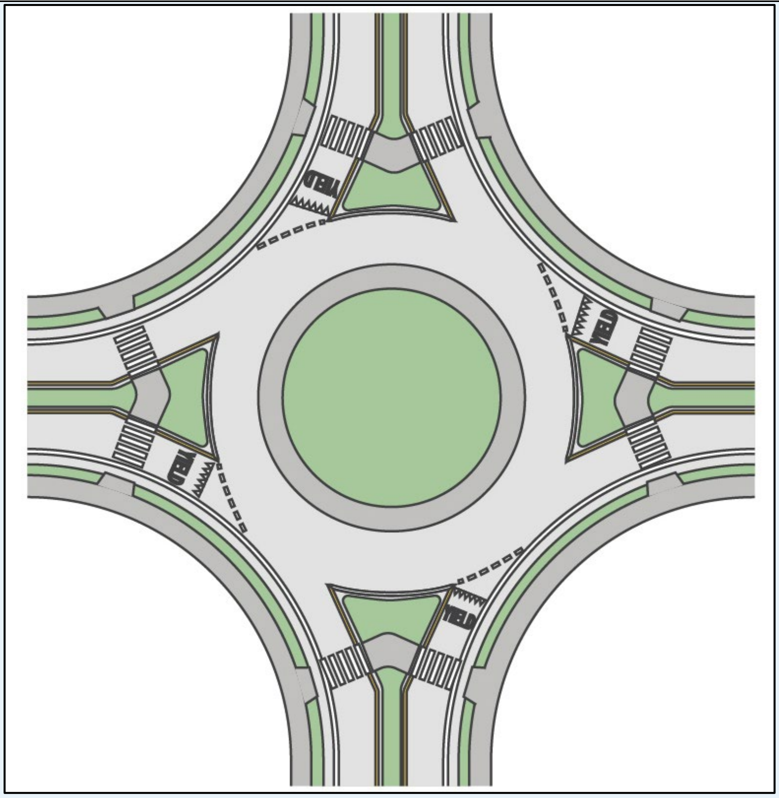

Figure 39. Graphic. Illustration of a roundabout.

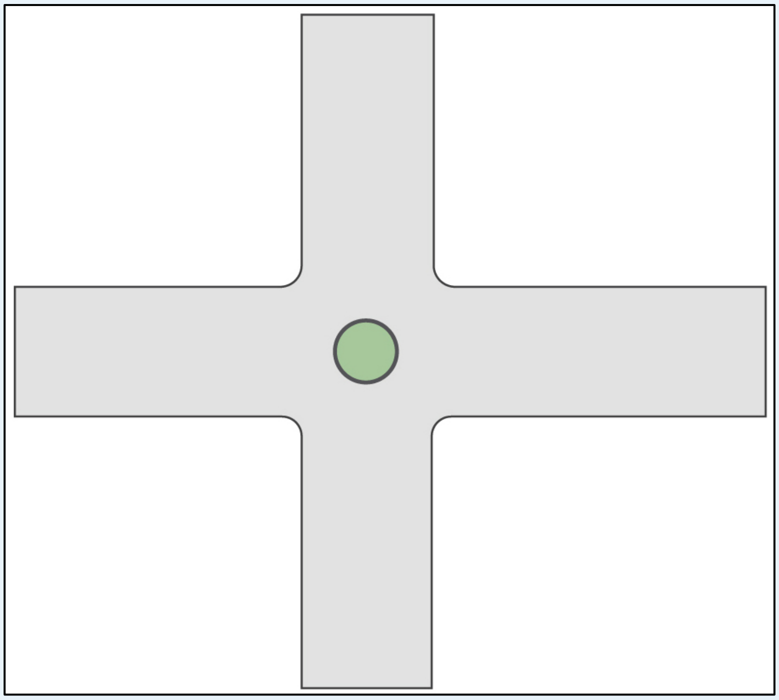

Figure 40. Graphic. Illustration of a non-roundabout circular intersection.

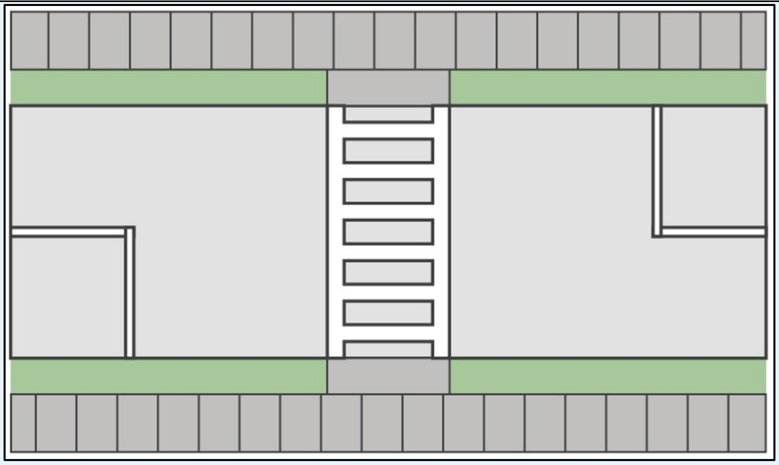

Figure 41. Graphic. Illustration of a midblock pedestrian crossing.

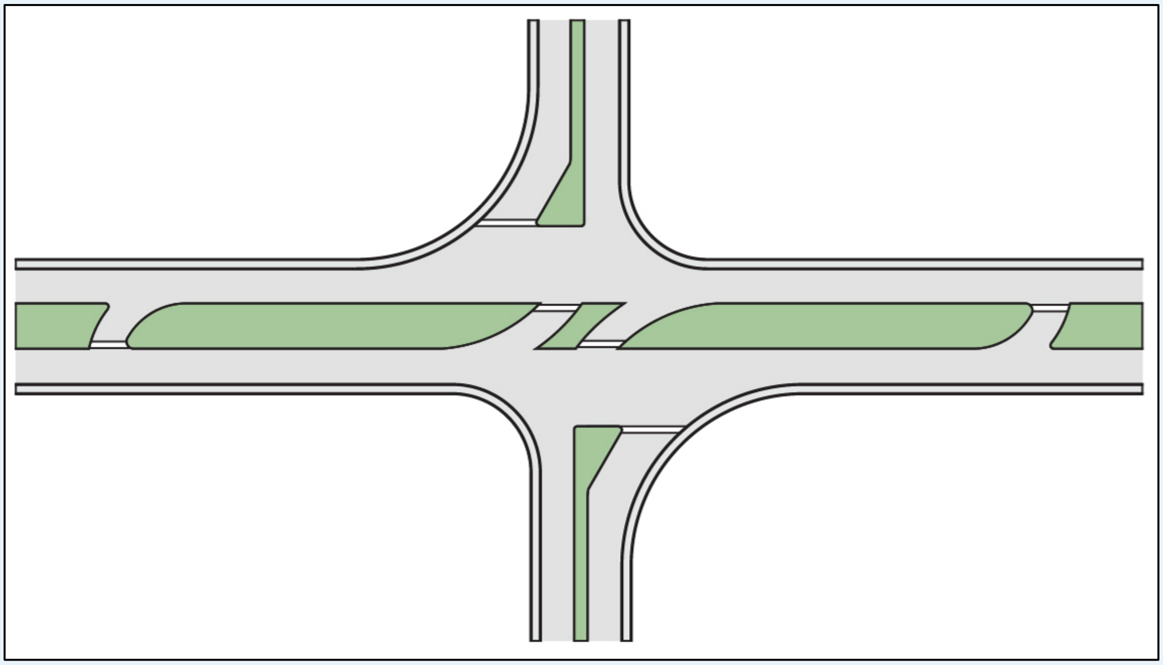

Figure 42. Graphic. Illustration of a restricted crossing U-turn intersection.

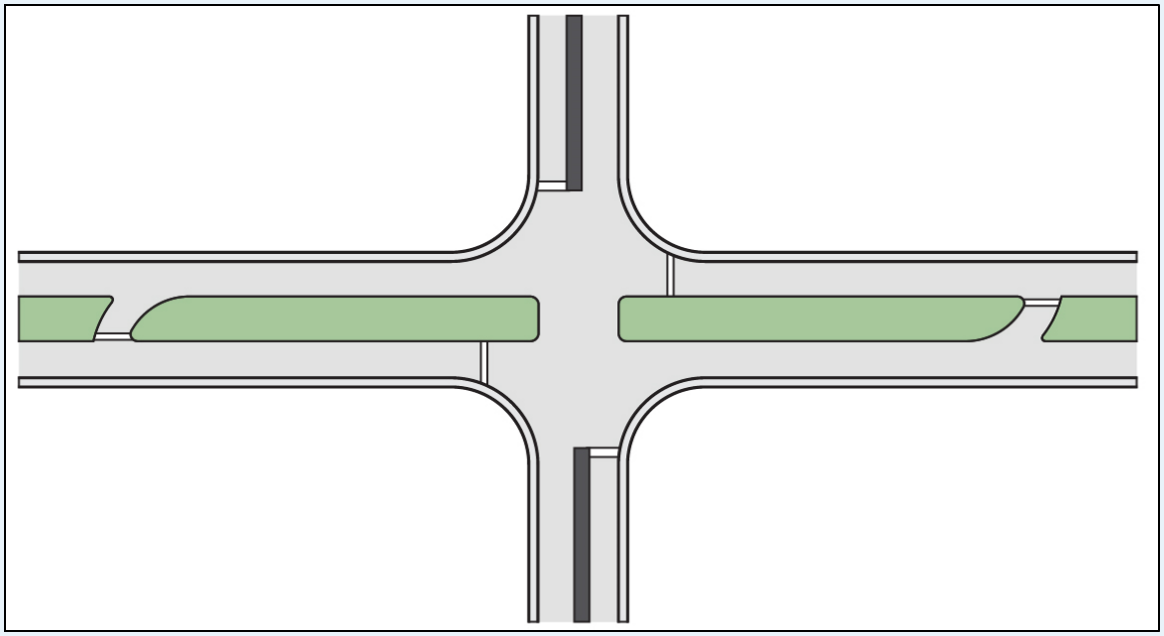

Figure 43. Graphic. Illustration of a median u-turn intersection.

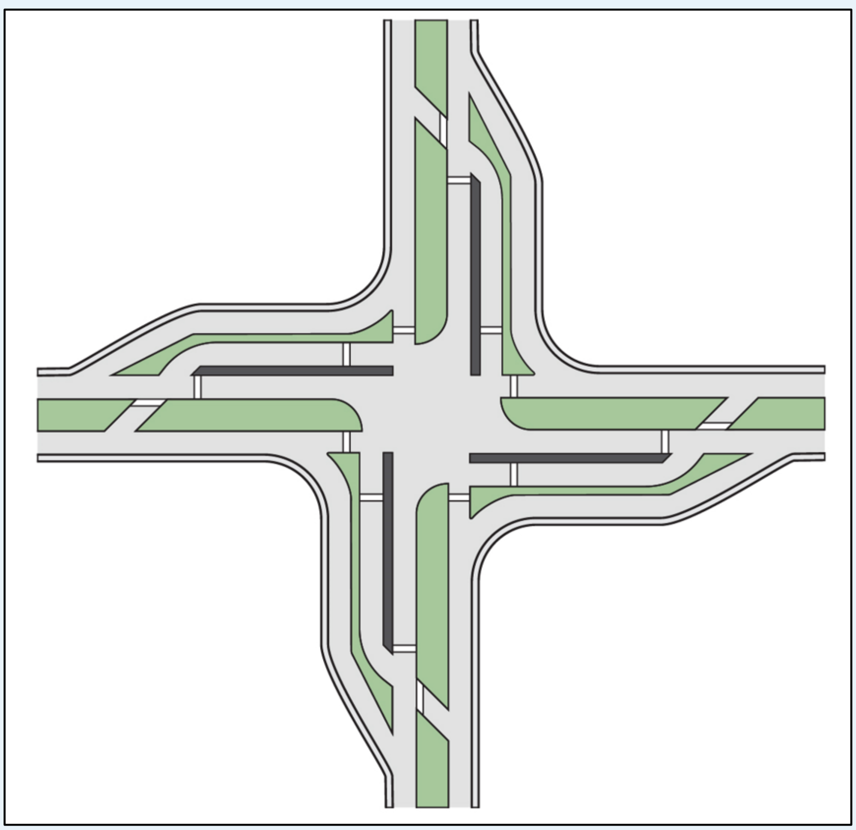

Figure 44. Graphic. Illustration of a displaced left-turn intersection.

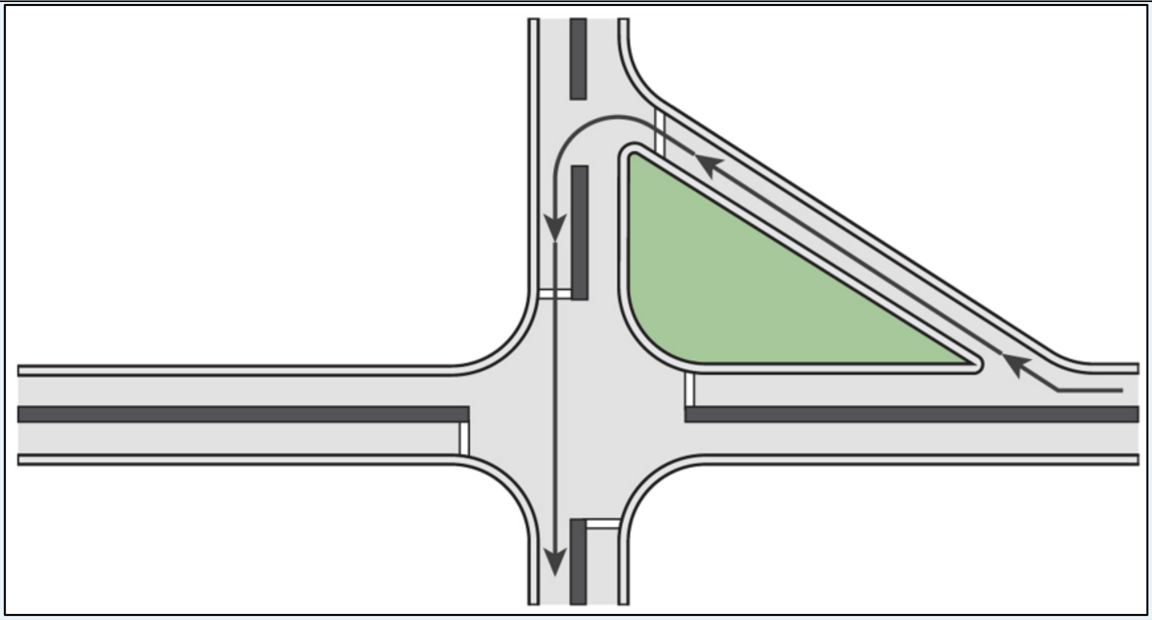

Figure 45. Graphic. Illustration of a jughandle intersection.

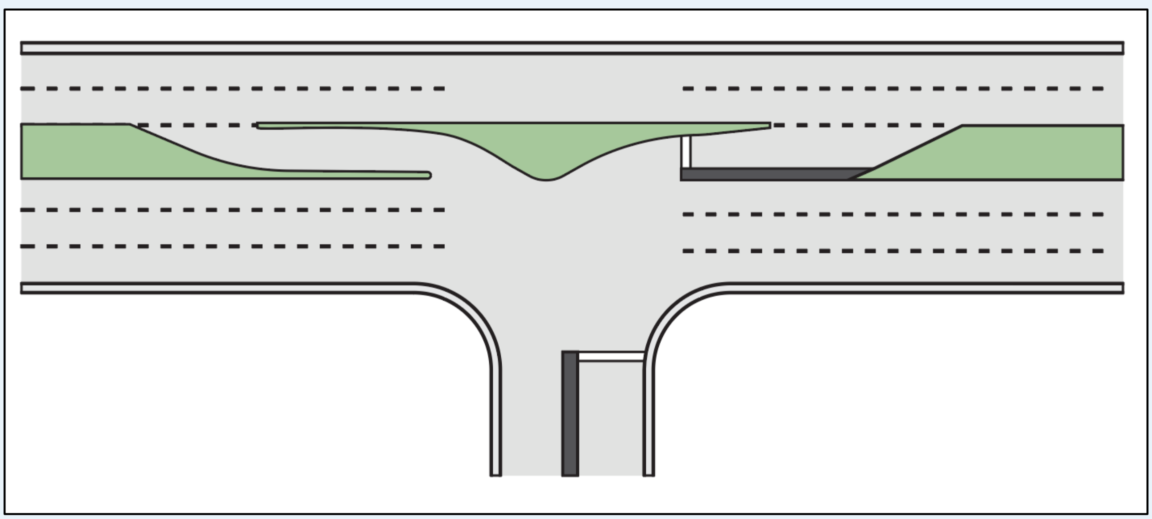

Figure 46. Graphic. Illustration of a continuous green T intersection.

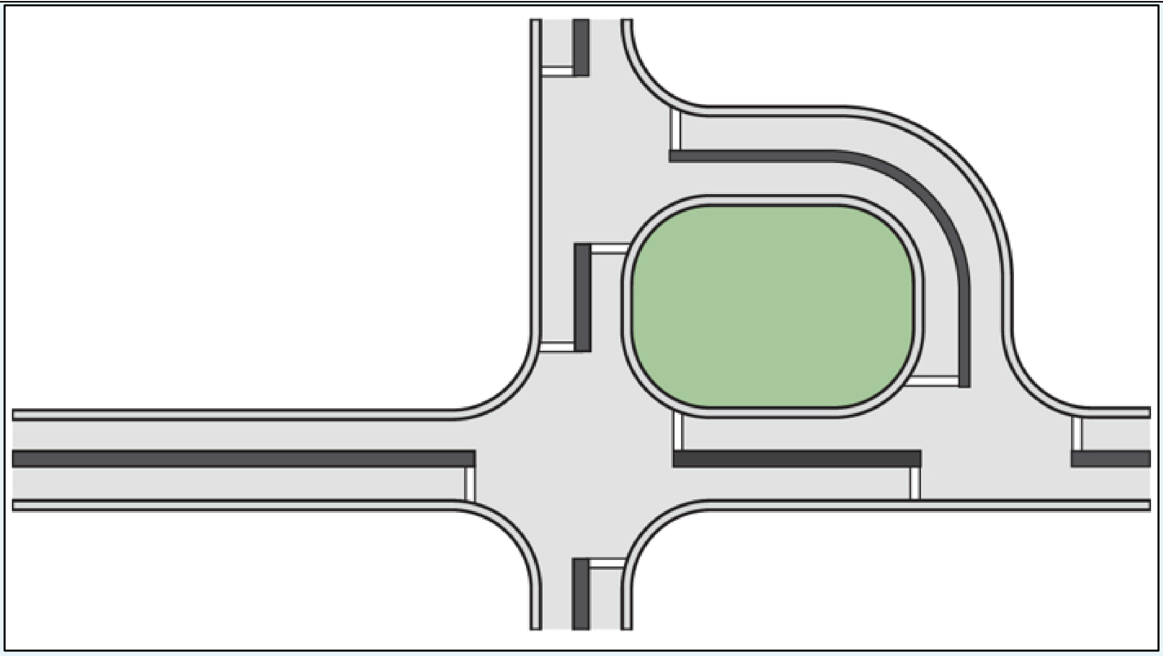

Figure 47. Graphic. Illustration of a quadrant roadway intersection.

Crosswalk with other Data Systems:

- **FARS:** Type of Intersection[20]
- **MMUCC (v6):** Type of Intersection[21]

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "1 (T-Intersection)" and *INTERSECTION/JUNCTION NUMBER OF LEGS* is equal to "3". • Value is equal to "2 (Y-Intersection)" and *INTERSECTION/JUNCTION NUMBER OF LEGS* is equal to "3". • Value is equal to "3 (Cross-Intersection (four legs))" and *INTERSECTION/JUNCTION NUMBER OF LEGS* is equal to "4". • Value is equal to "4 (Five or more legs and not circular)" and *INTERSECTION/JUNCTION NUMBER OF LEGS* greater than or equal to "5". • Value is equal to "5 (Roundabout)" and *INTERSECTION/JUNCTION TRAFFIC CONTROL* is equal to "4 (Yield sign)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[20] Not an exact match of attributes.

[21] Not an exact match of attributes.

111. Intersection/Junction Traffic Control FDE

Description:	Traffic control present at intersection/junction.
Recommended Attributes:	1. Uncontrolled 2. Two-way 3. All-way stop 4. Yield sign 5. Signalized 6. Pedestrian Hybrid Beacon (PHB or High-Intensity Activated Crosswalk [HAWK]) 7. Flash Beacon (include Rectangular Rapid Flash Beacon) 8. Railroad crossing, gates and flashing lights 9. Railroad crossing, flashing lights only 10. Railroad crossing, stop-sign controlled 11. Railroad crossing, crossbucks only 12. Other
Recommended Field Type:	Numeric

Remarks: Note that the "2 (Two-way)" attribute includes all partial stop-controlled (i.e., not all-way stop) intersections.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years associated with installing an all way stop control, traffic signal, flashing beacons, PHB, or RRFB (p. 47).

Crosswalk with other Data Systems:

- **FARS:** Traffic Control Device[22]
- **MMUCC (v6):** Traffic Control Device[23]

Collection Cycle:	Medium Term
Level of Accuracy:	High

[22] Not an exact match of attributes.
[23] Not an exact match of attributes.

<table>
<tr><td>Validation Checks:</td><td colspan="3">

- Value does not equal *NULL*.
- Value is equal to “6 (Pedestrian Hybrid Beacon (PHB or High-Intensity Activated Crosswalk [HAWK]))” and *TYPE OF INTERSECTION/JUNCTION* is equal to “4 (Roadway/pedestrian crossing (e.g., midblock crossing, pedestrian path or trail))” or “5 (Roadway/bicycle path or trail)”.
- Value is equal to “8 (Railroad crossing, gates and flashing lights)” and *RAILROAD CROSSING NUMBER* does not equal *NULL*.
- Value is equal to “9 (Railroad crossing, flashing lights only)” and *RAILROAD CROSSING NUMBER* does not equal *NULL*.
- Value is equal to “10 (Railroad crossing, stop-sign controlled)” and *RAILROAD CROSSING NUMBER* does not equal *NULL*.
- Value is equal to “11 (Railroad crossing, crossbucks only)” and *RAILROAD CROSSING NUMBER* does not equal *NULL*.

</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>Partial Extent</td></tr>
</table>

112. Type of Intersection/Junction

Description:	Type of junction based on converging modes.
Recommended Attributes:	1. Roadway/roadway (not interchange related) 2. Roadway/roadway (interchange ramp terminal) 3. Roadway/railroad grade crossing 4. Roadway/pedestrian crossing (e.g., midblock crossing, pedestrian path or trail) 5. Roadway/bicycle path or trail 6. Other
Recommended Field Type:	Numeric

Remarks: If more than one recommended attribute applies, States should record the lowest recommended code. For collocated roadway/roadway and roadway/rail crossings, *Railroad Crossing Number* can capture relevant rail crossings along with all roadway attributes.

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

113. Location Identifier for Additional Road Crossing Points

Description:	Location of the center of the junction on the third and subsequent intersecting route (e.g., route-milepoint).
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates).
Recommended Field Type:	Text and Numeric

Remarks: The location identifier is the location information for the digital record associated with an *intersection approach or departure*. This is not applicable if intersecting route is not an inventoried road (i.e., a railroad or bicycle path). States can use the milepoint associated with any additional minor approaches for this data element. Generally, AADT should determine which approach is major, although the *Functional Class* and *Number of Through Lanes* data elements can be used if AADT are unavailable.

If spatial coordinates are included, these would be consistent for all crossing roads.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

114. Intersection/Junction Number of Legs

Description:	The number of legs carrying traffic entering and/or exiting an at-grade intersection/junction.
Recommended Attributes:	1. Number of legs
Recommended Field Type:	Numeric

Remarks: This data element should generally be consistent with *Intersection/Junction Geometry*. A single leg can include one-way (i.e., entering or exiting) or two-way (i.e., entering and exiting) traffic. A dual carriageway (i.e., two centerlines representing entering and exiting traffic separated by a median) is considered a single *intersection leg*.

Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "3" and *INTERSECTION/JUNCTION GEOMETRY* is equal to "1 (T-Intersection)" or "2 (Y-Intersection)". • Value is equal to "4" and *INTERSECTION/JUNCTION GEOMETRY* is equal to "3 (Cross-Intersection (four legs))". • Value is greater than "4" and *INTERSECTION/JUNCTION GEOMETRY* is equal to "4 (Five or more legs and not circular)".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

115. School Zone Indicator

Description:	An indication of whether the intersection/junction is in a school zone.
Recommended Attributes:	1. Yes. 2. No.
Recommended Field Type:	Numeric

Remarks: The Highway Safety Manual (2010) considers a school zone to be any area within 1,000 ft of any portion of the school building or grounds for urban and suburban arterial models (p. 12-46).

States can apply individual discretion to determine that an intersection falls within a school zone (e.g., if the school zone ends prior to the intersection proper); however, if intersection-related design elements (e.g., turn lane queues) are within a school zone, the intersection could be considered within the school zone as well.

Crosswalk with other Data Systems:

- **FARS:** School Zone[24]

Collection Cycle:	Medium Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[24] Definition is based on signed or marked school zones only during periods when school is in session.

116. Railroad Crossing Number

Description:	Railroad crossing number if intersection includes a railroad grade crossing.
Recommended Attributes:	1. Unique railroad crossing number.
Recommended Field Type:	Text

Remarks: States can capture at-grade crossings only or both at-grade and grade separated rail crossings. If rail crossing applies to freight or other inter-city rail, States should use the Federal Railroad Administration (FRA) Crossing Inventory Number. If rail crossing is another rail mode (i.e., light or heavy rail transit), States can apply their own unique identifier.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL* if *TYPE OF INTERSECTION/JUNCTION* equals "3 (Roadway/railroad grade crossing)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

117. Intersecting Angle

Description:	The measurement in degrees of the smallest angle between any two legs of the intersection.
Recommended Attributes:	1. Intersecting angle (degrees)
Recommended Field Type:	Numeric

Remarks: This value will always be within a range of 0 to 90 degrees; for non-zero angles, measure the acute rather than the obtuse angle (figure 48). This can be derived from spatial files, although more precise measurements should consider the approach of a vehicle as it enters the intersection (i.e., crosses a stop bar or other pavement demarcation).

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for changing intersection angle (p. 44).

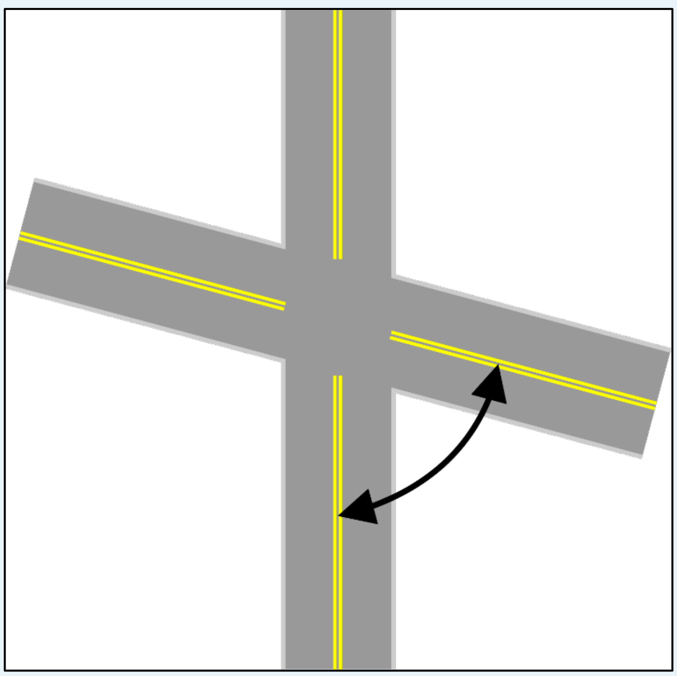

Figure 48. Graphic. Illustration of intersecting angle.

Collection Cycle:	Long Term
Level of Accuracy:	Low

Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

118. Intersection/Junction Offset Distance

Description:	The offset distance between the centerlines of the intersecting legs (minor road) at the intersection (figure 49).
Recommended Attributes:	1. Intersection/Junction offset distance (feet)
Recommended Field Type:	Numeric

Remarks: A value of 0 should be used if crossing road centerlines are not offset.

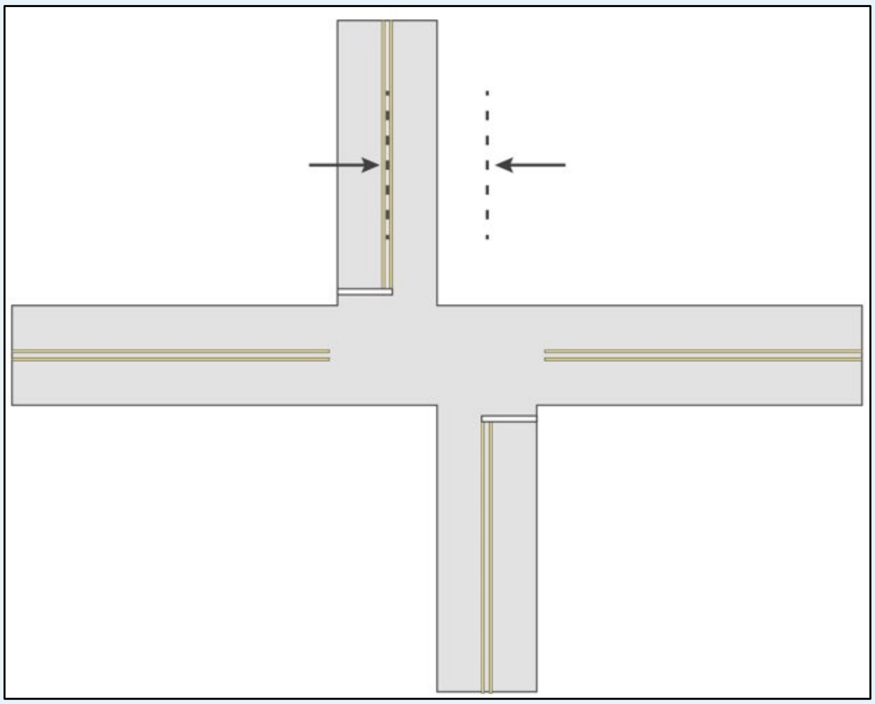

Figure 49. Graphic. Illustration of intersection/junction offset distance.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

119. Signalization Presence/Type

Description:	Presence and type of signalization at intersection/junction.
Recommended Attributes:	1. Uncoordinated fixed time. 2. Uncoordinated traffic actuated. 3. Coordinated progressive. 4. Coordinated real-time adaptive. 5. No signal systems exist. 6. Railroad crossing signal (signal, gates, bells). 7. Other.
Recommended Field Type:	Numeric

Remarks: Data element only applies to signalized intersections/junctions. States could collect this information on a case-by-case basis in coordination with HPMS sample procedures.

"Uncoordinated fixed time" – may include pre-programmed changes for peak or other time periods.

"Coordinated progressive" - coordinated signals through several intersections.

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "5 (No signal systems exist)" and *INTERSECTION/JUNCTION TRAFFIC CONTROL* does not equal "5 (Signalized)". • Value does not equal "5 (No signal systems exist)" and *INTERSECTION/JUNCTION TRAFFIC CONTROL* is equal to "5 (Signalized)". • Value is equal to "6 (Railroad crossing signal (signal, gates, bells))" and *INTERSECTION/JUNCTION TRAFFIC CONTROL* is equal to "8 (Railroad crossing, gates and flashing lights)".

	Non-Local Paved	Local Paved	Unpaved
Collection Extent:	Full Extent	Partial Extent	Partial Extent

120. Intersection/Junction Lighting

Description:	Presence of lighting at intersection/junction.
Recommended Attributes:	1. Yes 2. No
Recommended Field Type:	Numeric

Remarks: The Illuminating Engineering Society (IES) Recommended Practice: Lighting Roadway and Parking Facilities (IES, 2022) guide is a helpful resource for determining the appropriate amount of lighting at intersections.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 15 years for modifying, improving, or providing intersection lighting (p. 42).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

121. Circular Intersection – Number of Circulatory Lanes

Description:	Number of circulatory lanes in circular intersection.
Recommended Attributes:	1. Number of circulatory lanes
Recommended Field Type:	Numeric

Remarks: Data element should only count lanes that make a complete circumnavigation of the roundabout, rotary, or other circular intersection (figure 50). Refer to FHWA's *Roundabouts: An Informational Guide* (2000) for detailed discussion of roundabout design elements, as well as key differences between roundabouts and other traffic circles.

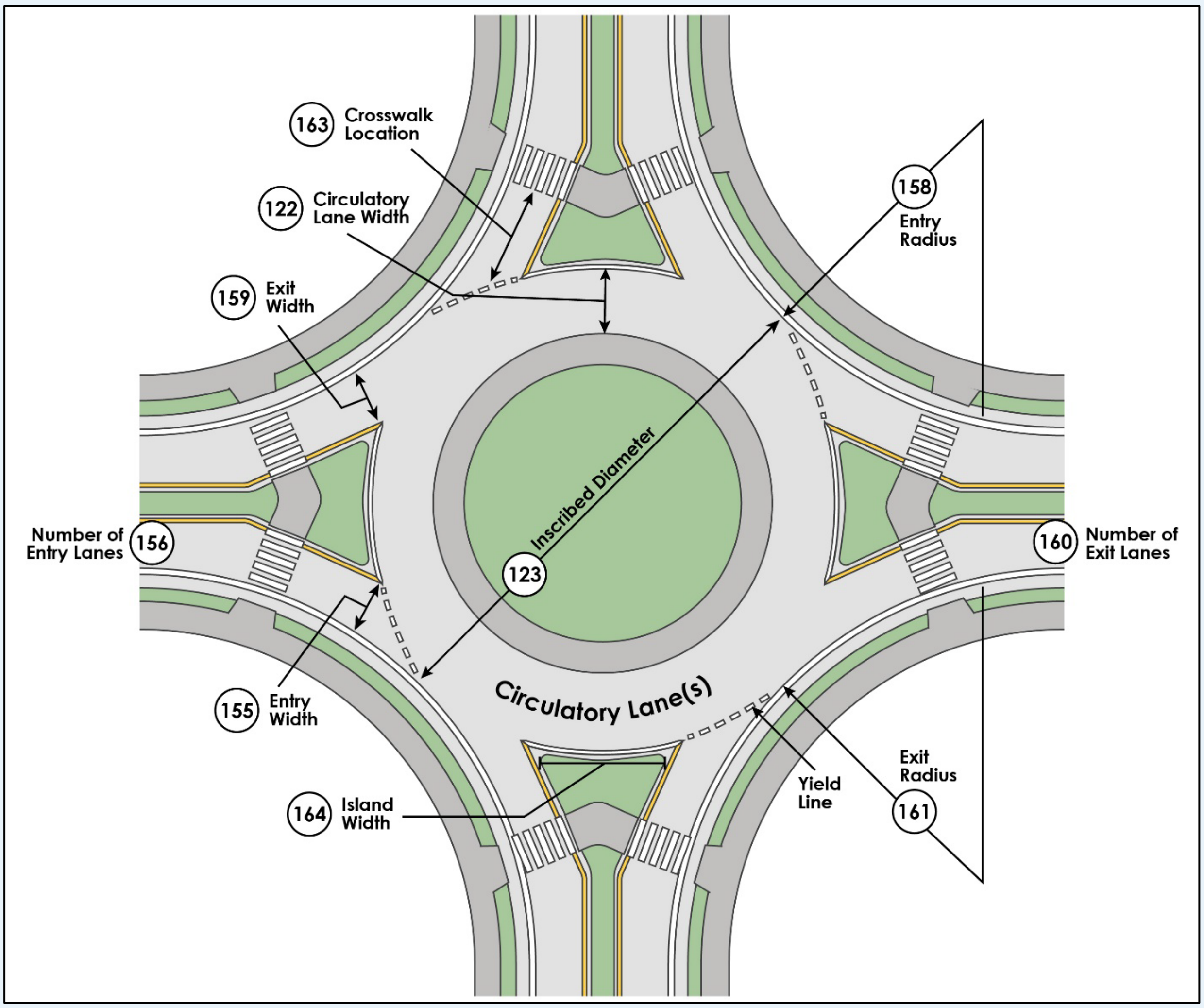

Figure 50. Graphic. Illustration of a circular intersection.

<table>
<tr><td>Collection Cycle:</td><td colspan="3">Annually</td></tr>
<tr><td>Level of Accuracy:</td><td colspan="3">High</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">Value is greater than “0” and INTERSECTION/JUNCTION GEOMETRY is equal to “5 (Roundabout)”.
Value is equal to “0” and INTERSECTION/JUNCTION GEOMETRY is not equal to “5 (Roundabout)”.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

122. Circular Intersection – Circulatory Lane Width

Description:	Average width of lanes in the circular intersection.
Recommended Attributes:	1. Circulatory lane width (feet)
Recommended Field Type:	Numeric

Remarks: Data element should only consider lanes that make a complete circumnavigation of the roundabout, rotary, or other circular intersection. See figure 50 for example.

For multilane circular intersections, select the lane width for the narrowest lane that makes a complete circumnavigation of the intersection.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value is greater than “0” and *INTERSECTION/JUNCTION GEOMETRY* is equal to “5 (Roundabout)”. • Value is equal to “0” and *INTERSECTION/JUNCTION GEOMETRY* is not equal to “5 (Roundabout)”.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

123. Circular Intersection – Inscribed Diameter

Description:	Distance between the outer edges (i.e., edgelines) of the circulatory roadway of a circular intersection.
Recommended Attributes:	1. Inscribed diameter (feet)
Recommended Field Type:	Numeric

Remarks: See figure 50 for example.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value is greater than "0" and *INTERSECTION/JUNCTION GEOMETRY* is equal to "5 (Roundabout)". • Value is equal to "0" and *INTERSECTION/JUNCTION GEOMETRY* is not equal to "5 (Roundabout)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

124. Circular Intersection – Bicycle Facility

Description:	Presence and type of bicycle facility at circular intersection.
Recommended Attributes:	1. None 2. Separate bicycle path 3. Circulatory bicycle lane
Recommended Field Type:	Numeric

Remarks: Note figure 50 is an example of a circular intersection without a bicycle facility. See figure 51 for examples of bicycle facilities at circular intersections.

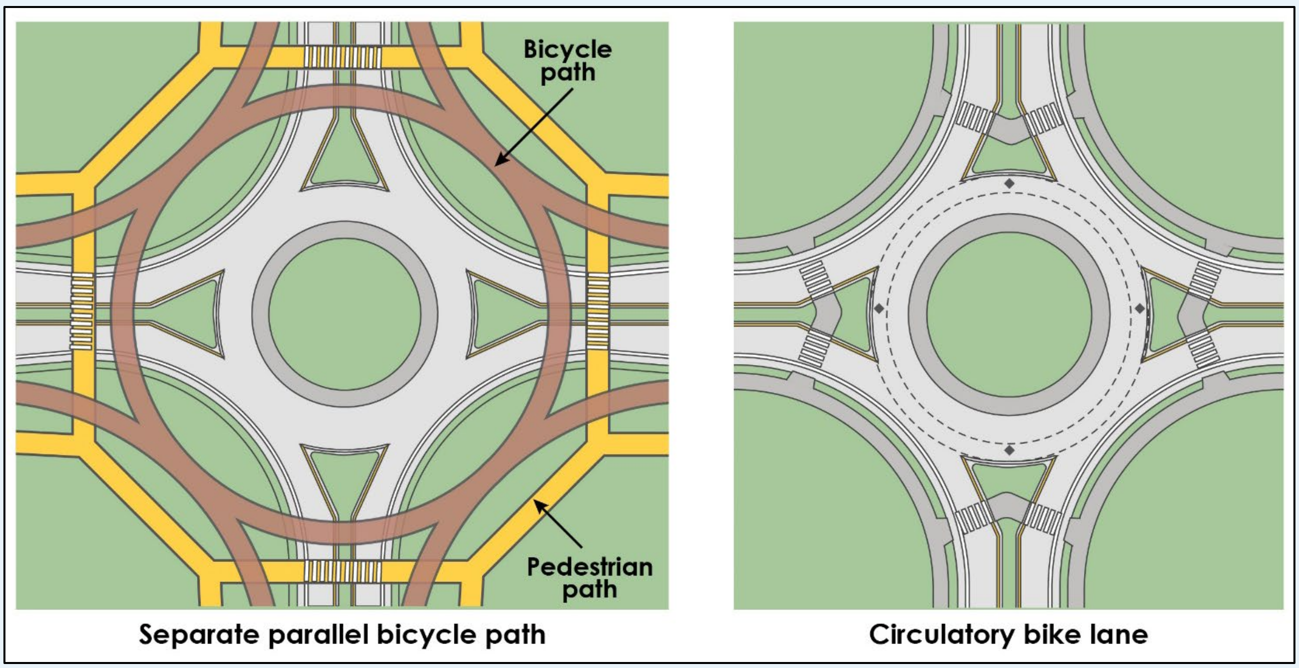

Figure 51. Graphic. Illustration of types of bicycle facilities at circular intersections.

Collection Cycle:	Ad-Hoc
Level of Accuracy:	Low
Validation Checks:	• Value is equal to "1" and *INTERSECTION/JUNCTION GEOMETRY* is not equal to "5 (Roundabout)".

	• Value is not equal to "1" and *INTERSECTION/JUNCTION GEOMETRY* is equal to "5 (Roundabout)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

INTERSECTION LEGS

Intersection Legs

125. Unique Approach Identifier [FDE]
126. Intersection Identifier for this Approach
127. Approach AADT
128. Approach AADT Year
129. Approach Mode
130. Approach Directional Flow
131. Number of Approach Through Lanes
132. Left-Turn Lane Type
133. Number of Exclusive Left-Turn Lanes
134. Length of Exclusive Left-Turn Lanes
135. Amount of Left-Turn Lane Offset
136. Right-Turn Channelization
137. Traffic Control of Exclusive Right-Turn Lanes
138. Number of Exclusive Right-Turn Lanes
139. Length of Exclusive Right-Turn Lanes
140. Approach Median Type
141. Approach Traffic Control
142. Approach Left-Turn Protection
143. Signal Progression
144. Crosswalk Presence/Type
145. Pedestrian Signal Activation Type
146. Pedestrian Signal Presence/Type
147. Crossing Pedestrian Count/Exposure
148. Left/Right-Turn Prohibitions
149. Right-Turn-On-Red Prohibitions
150. Left-Turn Counts/Percent
151. Year of Left-Turn Counts/Percent
152. Right-Turn Counts/Percent
153. Year of Right-Turn Counts/Percent
154. Transverse Rumble Strip Presence
155. Circular Intersection – Entry Width
156. Circular Intersection – Number of Entry Lanes
157. Circular Intersection – Presence/Type of Exclusive Right-Turn Lane

158. Circular Intersection – Entry Radius
159. Circular Intersection – Exit Width
160. Circular Intersection – Number of Exit Lanes
161. Circular Intersection – Exit Radius
162. Circular Intersection – Pedestrian Facility
163. Circular Intersection – Crosswalk Location
164. Circular Intersection – Island Width

125. Unique Approach Identifier [FDE]

Description:	A unique identifier for each approach of an intersection.
Recommended Attributes:	1. Unique identifier for each approach
Recommended Field Type:	Text

Remarks: The approach identifier is a unique identifier for the digital record associated with an *intersection approach or departure*. States can assign any identifier that is unique for each approach within a single intersection. Route and milepoint information as part of the *Location Identifier for Road 1 Crossing*, *Location Identifier for Road 2 Crossing*, and *Location Identifier for Additional Road Crossing Points* data elements can apply.

Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

126. Intersection Identifier for this Approach

Description:	The unique junction identifier assigned to the intersection in element, *Unique Junction Identifier*, that includes this approach.
Recommended Attributes:	1. *Unique Junction Identifier*
Recommended Field Type:	Text

Remarks: This element provides a link from an intersection to all related approaches for the same at-grade intersection.

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL.* • *Matches the relevant UNIQUE JUNCTION IDENTIFIER.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

127. Approach AADT

Description:	The AADT on the approach leg of the intersection/junction.
Recommended Attributes:	1. Approach AADT
Recommended Field Type:	Numeric

Remarks: Segment *AADT* values can apply. If approach carries bidirectional traffic (i.e., entering and exiting vehicles) combined AADT should apply.

Crosswalk with other Data Systems:

- **HPMS:** Annual Average Daily Traffic
- **NBI**: Annual Average Daily Traffic

Collection Cycle:	• **Annually** where *FEDERAL-AID* equals "3 (Route is on NHS)". • **Medium Term** where *FEDERAL-AID* equals "2 (Route is Federal-aid, but not on NHS)". • **Long Term** (or estimated) where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)".		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

128. Approach AADT Year

Description:	The year of the AADT on the approach leg of the intersection/junction.
Recommended Attributes:	1. Approach AADT year (YYYY)
Recommended Field Type:	Numeric

Remarks: Segment *AADT Year* values can apply.

Crosswalk with other Data Systems:

- **NBI**: Year of Annual Average Daily Traffic

Collection Cycle:	• **Annually** where *FEDERAL-AID* equals "3 (Route is on NHS)" • **Medium Term** where *FEDERAL-AID* equals "2 (Route is Federal-aid, but not on NHS)". • **Long Term** (or estimated) where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)".
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	Full Extent

129. Approach Mode

Description:	Intended mode for the approach.
Recommended Attributes:	1. Vehicles only or shared use (e.g., vehicles, pedestrians, bicyclists) 2. Pedestrians only 3. Bicycles only 4. Pedestrians and bicycles 5. Railroad 6. Other
Recommended Field Type:	Numeric

Remarks: For safety analysis purposes, 'Pedestrian' and 'Bicycle' attributes have been related to FARS non-motorist person type attributes used in coding fatal crashes.

"Pedestrians" – include all persons defined by FARS as a "Pedestrian" or "Person on Personal Conveyance" (e.g., persons using manual or motorized scooters, wheelchairs, skates, etc.).

"Bicycles" – include all persons defined by FARS as a "Bicyclist" or "Other Cyclist", motorized and non-motorized.

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Partial Extent

130. Approach Directional Flow

Description:	Indication of one-way or two-way flow on approach.
Recommended Attributes:	1. One-way 2. Two-way
Recommended Field Type:	Numeric

Remarks: Segment *One/Two-Way Operations* values can apply.

"One-way" – roadway that operates with traffic moving in a single direction during non-peak period hours.

"Two-way" – roadway that operates with traffic moving in both directions during non-peak period hours. Use this for the inventory direction on dual carriageway facilities.

Crosswalk with other Data Systems:

- **HPMS:** Facility Type[25]
- **FARS:** Trafficway Description[26]

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL.* • Value is equal to "1 (One-way)" and *MEDIAN TYPE AT INTERSECTION* is equal to "1 (Undivided)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[25] Not an exact match of attributes. See remarks for applicable codes to match 3 (One direction of travel for divided roadways) to HPMS codes.

[26] Not an exact match of attributes. FARS attribute codes are a blend of *One/Two-Way Operations* and *Median Barrier Presence/Type*.

131. Number of Approach Through Lanes

Description:	Total number of through lanes on approach (both directions if two-way, one direction if one-way).
Recommended Attributes:	1. Number of through lanes
Recommended Field Type:	Numeric

Remarks: Segment *Number of Through Lanes* values can apply. Count all non-exclusive turn lanes, including approaches at the "stem" of a T-Intersection, where multiple movements are possible.

Crosswalk with other Data Systems:

- **HPMS:** Through Lanes
- **FARS:** Total Lanes in Roadway
- **MMUCC (v6):** Number of Open Lanes in Vehicle's Environment[27]
- **NBI:** Lanes On Highway

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[27] Includes lanes that may only be actively in operation during a crash.

132. Left-Turn Lane Type

Description:	Type of left-turn lane(s) that accommodate left-turns from this approach.
Recommended Attributes:	1. No left-turn lanes 2. Conventional left-turn lane(s) 3. U-turn followed by right-turn 4. Right turn followed by U-turn 5. Right turn followed by left-turn (e.g., jughandle near side) 6. Right turn followed by right-turn (e.g., jughandle far side) 7. Left-turn crossover prior to intersection (e.g., displaced left-turn) 8. Other.
Recommended Field Type:	Numeric

Remarks: See figure 52 through figure 58 for examples.

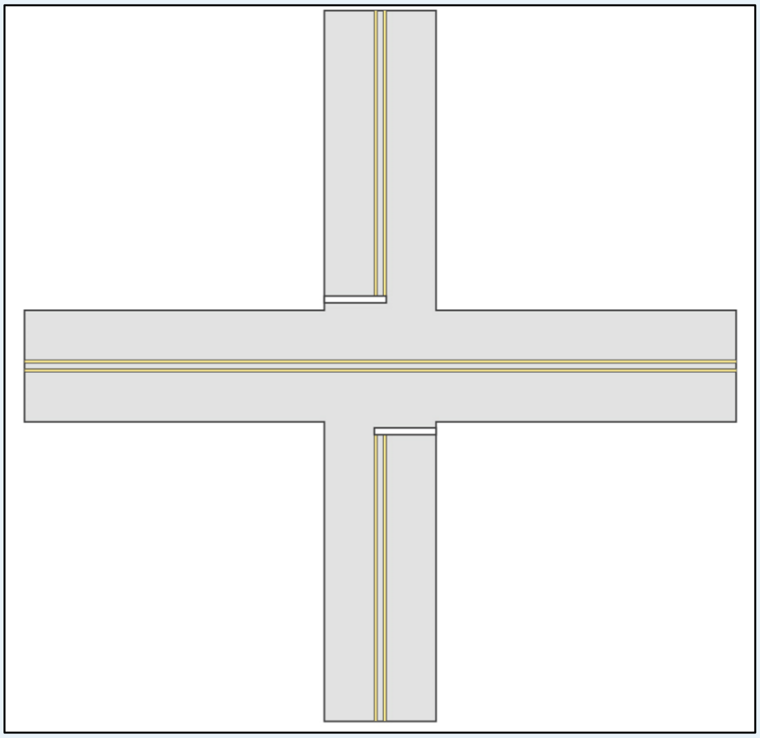

Figure 52. Graphic. Illustration of no left-turn lanes present.

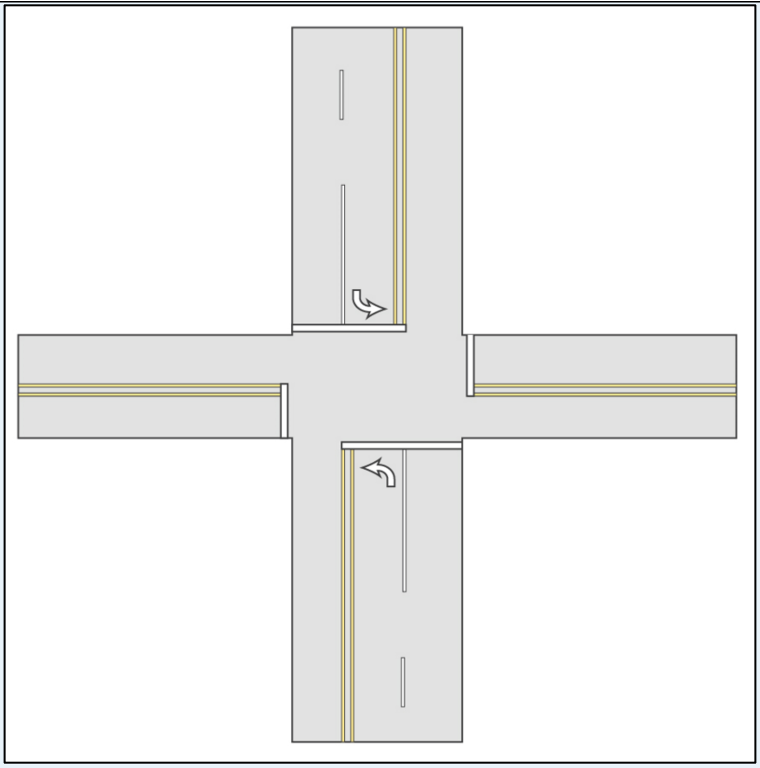

Figure 53. Graphic. Illustration of conventional left-turn lanes.

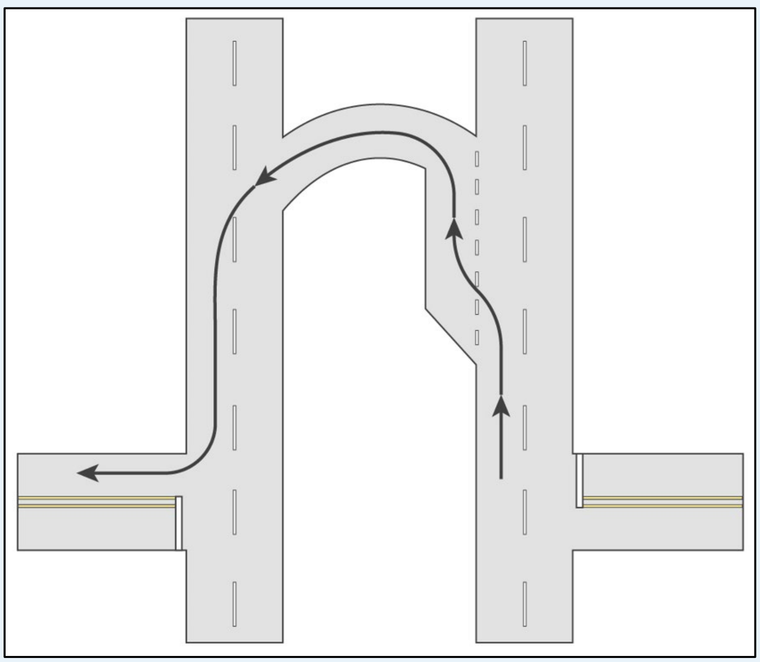

Figure 54. Graphic. Illustration of u-turn followed by right-turn.

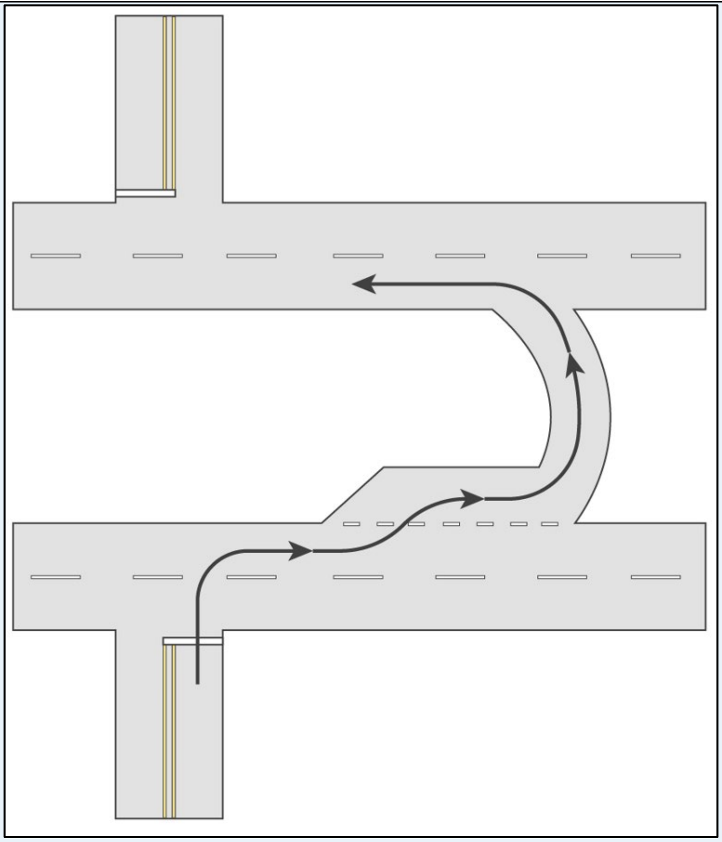

Figure 55. Graphic. Illustration of right-turn followed by U-turn.

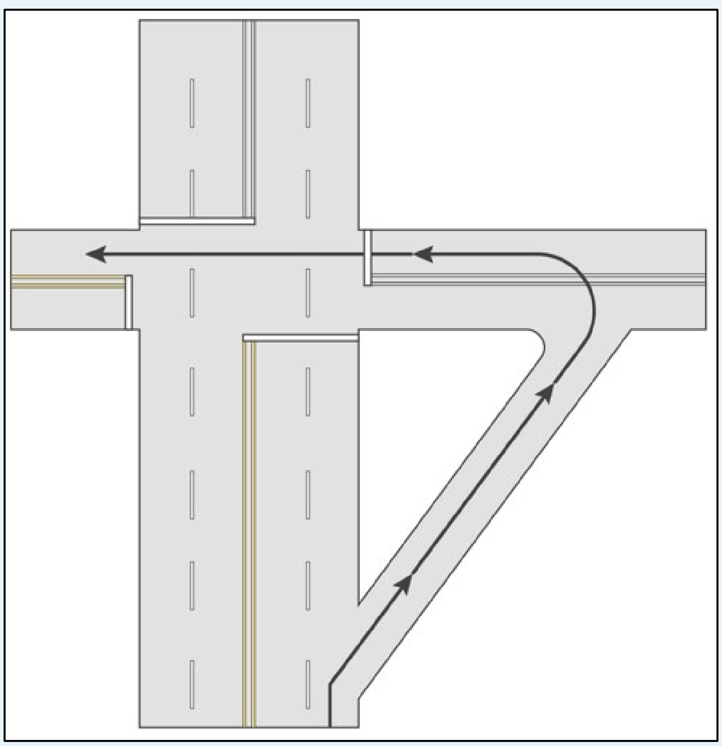

Figure 56. Graphic. Illustration of right-turn followed by left-turn.

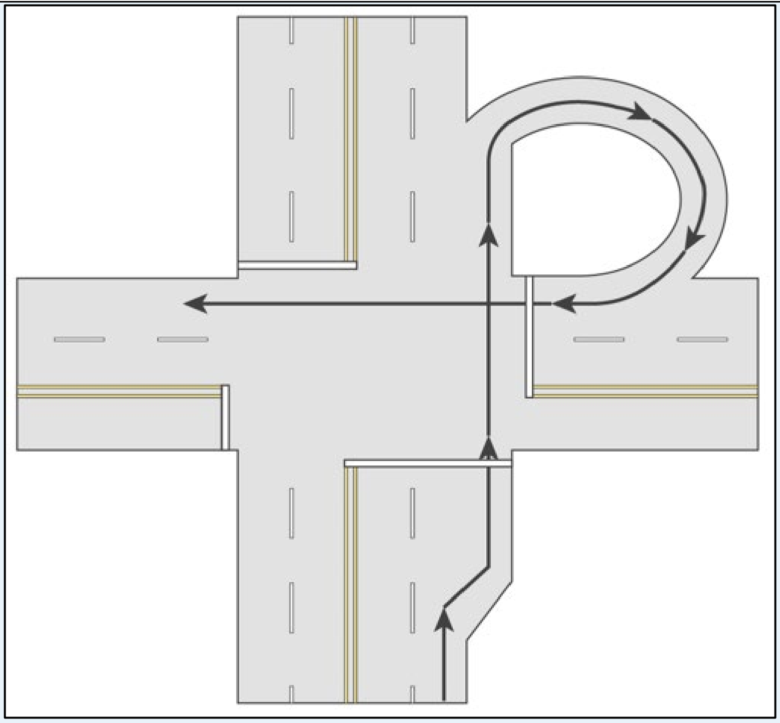

Figure 57. Graphic. Illustration of right-turn followed by right-turn.

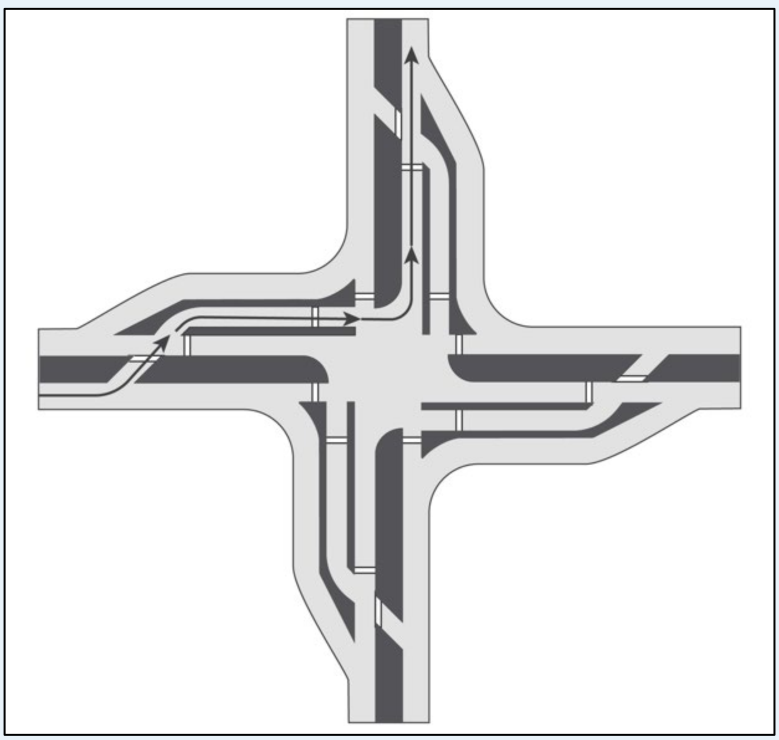

Figure 58. Graphic. Illustration of a left-turn crossover prior to intersection.

Collection Cycle:	Long Term

<table>
<tr><td>Level of Accuracy:</td><td colspan="3">Moderate</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">Value does not equal NULL.
Value is equal to “1 (No left-turn lanes)” and NUMBER OF EXCLUSIVE LEFT-TURN LANES is equal to “0”.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Partial Extent</td><td>N/A</td></tr>
</table>

133. Number of Exclusive Left-Turn Lanes

Description:	Number of exclusive left-turn lanes on this approach.
Recommended Attributes:	1. Number of exclusive left-turn lanes
Recommended Field Type:	Numeric

Remarks: States should only count lanes in which a left-turn only movement is explicitly indicated by signage or pavement markings (i.e., coded as 0). Center two-way left-turn lanes do not count as an exclusive left-turn lane unless pavement markings or signage clearly delineate that the lane is used for left turn movements only when approaching an intersection.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for providing a left-turn (p. 45).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "0" and *LENGTH OF EXCLUSIVE LEFT-TURN LANES* is equal to "0". • Value is greater than "0" and *LENGTH OF EXCLUSIVE LEFT-TURN LANES* is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

134. Length of Exclusive Left-Turn Lanes

Description:	Storage length of exclusive left-turn lane(s).
Recommended Attributes:	1. Length of exclusive left-turn lanes (feet)
Recommended Field Type:	Numeric

Remarks: Does not include taper (figure 59). If more than one left-turn lane is present, count the maximum turn lane length.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for increasing turn lane length (p. 44).

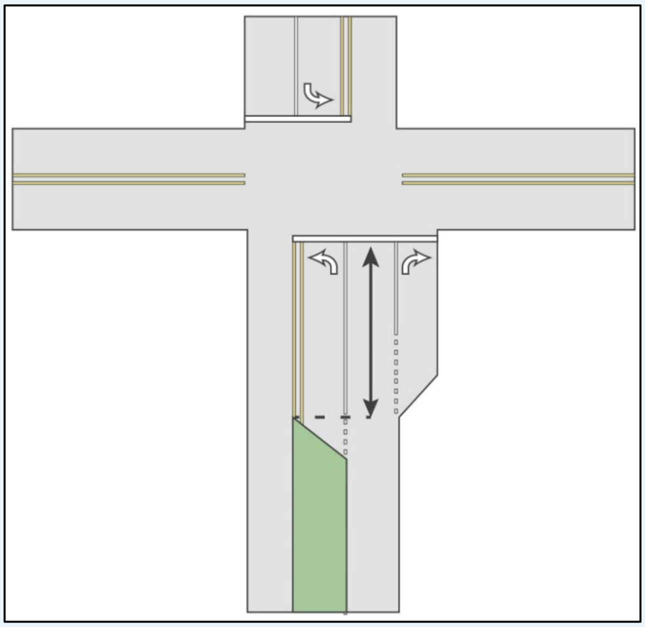

Figure 59. Graphic. Illustration of exclusive left-turn lane length.

Collection Cycle:	Long Term
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "0" and *NUMBER OF EXCLUSIVE LEFT-TURN LANES* is equal to "0". • Value is greater than "0" and *NUMBER OF EXCLUSIVE LEFT-TURN LANES* is greater than "0".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

135. Amount of Left-Turn Lane Offset

Description:	Amount of offset between conventional left-turn lane(s) on this approach and opposing approach.
Recommended Attributes:	1. Sign (+ or -) and distance (feet)
Recommended Field Type:	Numeric

Remarks: Offset refers to direction (plus or minus) and distance between the centerline of the left-turn lane on this approach and the centerline of the left-turn lane on the opposing approach (figure 60 through figure 62).

The direction is positive if the left-turn lane on this approach is to the left of the opposing left-turn lane and negative if to the right. States should apply "0" if the opposing left-turn lanes are aligned.

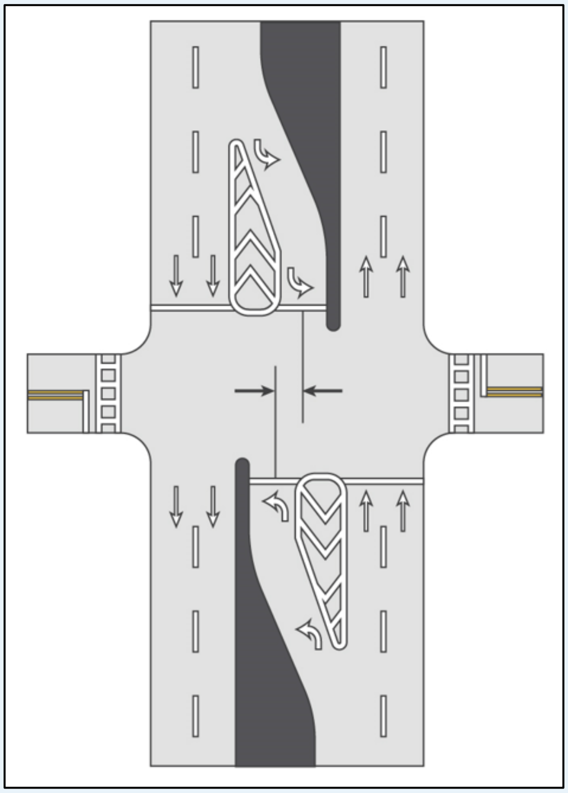

Figure 60. Graphic. Illustration of positive offset distance.

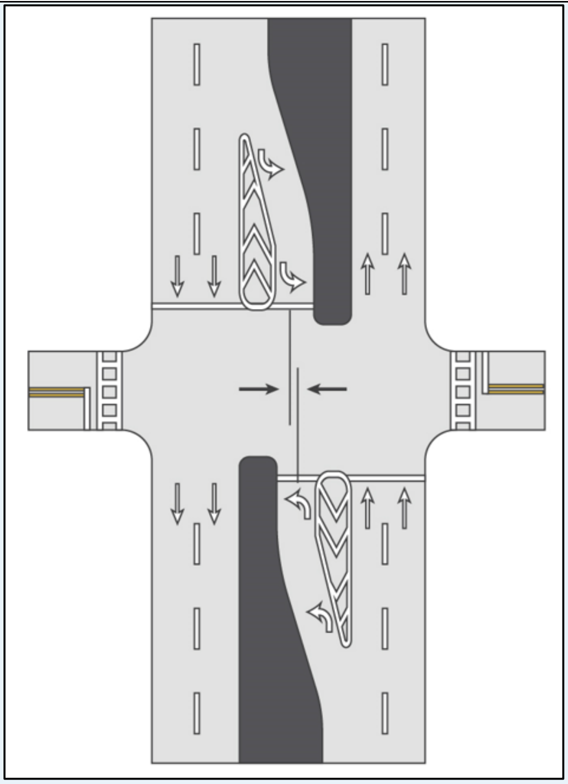

Figure 61. Graphic. Illustration of negative offset distance.

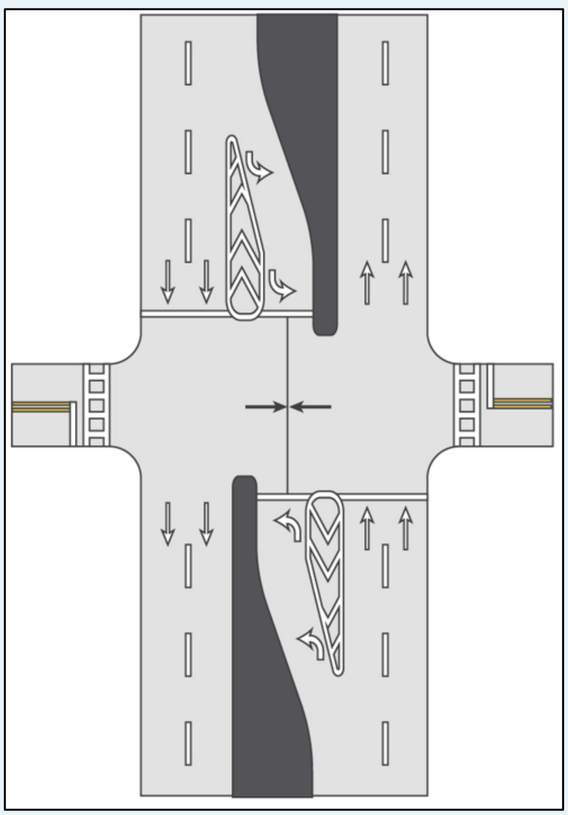

Figure 62. Graphic. Illustration of zero offset distance.

Collection Cycle:	Long Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

136. Right-Turn Channelization

Description:	Right-turn channelization on approach.
Recommended Attributes:	1. None 2. Painted island with receiving lane 3. Painted island without receiving lane 4. Raised island with receiving lane 5. Raised island without receiving lane
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for providing right-turn channelization (p. 45).

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

137. Traffic Control of Exclusive Right-Turn Lanes

Description:	Traffic control of exclusive right-turn lanes on approach.
Recommended Attributes:	1. Unsignalized 2. Permissive signal 3. Protected all day(s) 4. Protected, peak hour only 5. Protected - permissive with green arrow/green ball (all day) 6. Protected - permissive with green arrow/green ball (peak hour only) 7. Protected - permissive with flashing yellow arrow (all day) 8. Protected - permissive with flashing yellow arrow (peak hour only) 9. Yield sign 10. Stop sign 11. No control (e.g., free flow)
Recommended Field Type:	Numeric
Collection Cycle:	Long Term
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

138. Number of Exclusive Right-Turn Lanes

Description:	Number of exclusive right-turn lanes on this approach.
Recommended Attributes:	1. Number of exclusive right-turn lanes
Recommended Field Type:	Numeric

Remarks: Only count lanes in which a right-turn movement is explicitly indicated by signage or pavement markings.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for providing a right-turn (p. 45).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "0" and *LENGTH OF EXCLUSIVE RIGHT-TURN LANES* is equal to "0". • Value is greater than "0" and *LENGTH OF EXCLUSIVE RIGHT-TURN LANES* is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

139. Length of Exclusive Right-Turn Lanes

Description:	Storage length of exclusive right-turn lane(s).
Recommended Attributes:	1. Length of exclusive right-turn lanes (feet)
Recommended Field Type:	Numeric

Remarks: Does not include taper (figure 63). If more than one left-turn lane is present, count the maximum turn lane length.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for increasing turn lane length (p. 44).

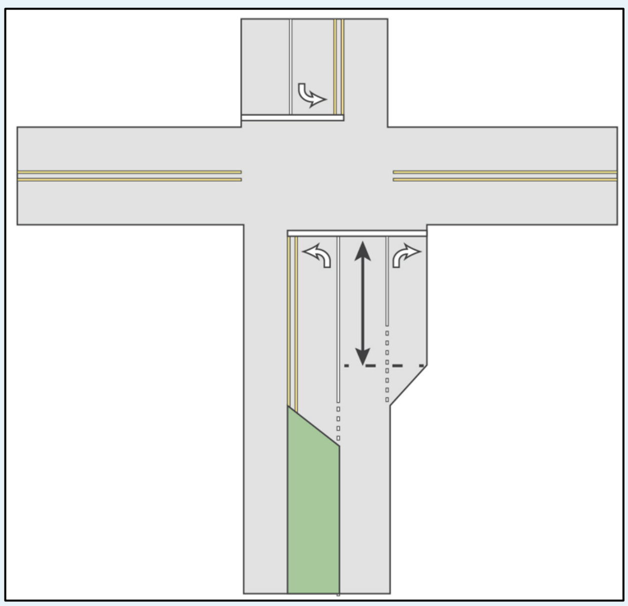

Figure 63. Graphic. Illustration of exclusive right-turn lane length.

Collection Cycle:	Long Term
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*. • Value is “0” and *NUMBER OF EXCLUSIVE RIGHT-TURN LANES* is greater than “0”. • Value is greater than “0” and *NUMBER OF EXCLUSIVE RIGHT-TURN LANES* is “0”.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

140. Approach Median Type

Description:	Median type at intersection separating opposing traffic lanes on this approach.
Recommended Attributes:	1. Undivided 2. Flush paved median (at least 4 ft in width) 3. Raised median with curb 4. Depressed median 5. Two-way left-turn lane 6. Railroad or rapid transit 7. Other divided
Recommended Field Type:	Numeric

Remarks: Segment *Median Type* values can apply. Pedestrian refuge islands are captured in the *Crosswalk Presence/Type* data element.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "1 (Undivided)" and *APPROACH DIRECTIONAL FLOW* is equal to "1 (One-way)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

141. Approach Traffic Control

Description:	Traffic control present on approach.
Recommended Attributes:	1. Uncontrolled 2. Stop sign 3. Yield sign 4. Signalized 5. Railroad crossing, gates and flashing lights 6. Railroad crossing, flashing lights only 7. Railroad crossing, stop-sign controlled 8. Railroad crossing, crossbucks only 9. Other
Recommended Field Type:	Numeric

Remarks: Approaches with one-way traffic exiting the intersection should be coded as "1 (Uncontrolled)." Pedestrian traffic control is captured in the *Pedestrian Signal Activation Type* data element.

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "4 (Signalized)" and is *APPROACH LEFT-TURN PROTECTION* is not equal to "1 (Unsignalized)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Partial Extent

142. Approach Left-Turn Protection

Description:	Presence and type of left-turn protection on the approach.
Recommended Attributes:	1. Unsignalized 2. Permissive signal 3. Protected all day(s) 4. Protected, peak hour only 5. Protected - permissive with green arrow/green ball (all day) 6. Protected - permissive with green arrow/green ball (peak hour only) 7. Protected - permissive with flashing yellow arrow (all day) 8. Protected - permissive with flashing yellow arrow (peak hour only) 9. Other
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years for changing signal left-turn phasing (p. 46).

Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal NULL. • Value is equal to "1 (Unsignalized)" and *APPROACH TRAFFIC CONTROL* is not equal to "4 (Signalized)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Partial Extent

143. Signal Progression

Description:	Signal progression on approach.		
Recommended Attributes:	1. Unsignalized 2. Uncoordinated fixed time 3. Uncoordinated traffic actuated 4. System coordination (time of day, traffic responsive and traffic adaptive) 5. Railroad crossing signal (includes signal-only and signal and gates) 6. Other		
Recommended Field Type:	Numeric		
Crosswalk with other Data Systems: • **HPMS:** Signal Type[28]			
Collection Cycle:	Long Term		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*. • Value is "1 (Unsignalized)" and *APPROACH TRAFFIC CONTROL* is not equal to "4 (Signalized)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

[28] Consistent recommended attributes, although HPMS Data Item applies to a linear segment.

144. Crosswalk Presence/Type

Description:	Presence and type of crosswalk crossing for this approach leg.
Recommended Attributes:	1. Unmarked crosswalk 2. Marked crosswalk and style (parallel bars, continental, etc.) 3. Marked crosswalk with supplemental devices (e.g., in-street yield signs, in-pavement warning lights, pedestrian bulb outs, etc.) 4. Marked crosswalk with refuge island 5. Marked with refuge island and supplemental devices (e.g., in-street yield signs, in- pavement warning lights, pedestrian bulb outs, etc.) 6. Raised crosswalk 7. Pedestrian crossing prohibited at this approach 8. Other
Recommended Field Type:	Numeric

Remarks: Many State laws assign an unmarked crossing where pedestrian access routes approach an intersection, and a marked crosswalk is not present. States should consult their applicable laws to determine where unmarked crosswalks may apply. Figure 64 through figure 69 provide crosswalk examples.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 1 year for installing standard paint crosswalks, 5 years for installing and providing improvements to a durable marking crosswalk, and 20 years for installing a pedestrian refuge island (p. 48).

Figure 64. Photo. Illustration of an unmarked crosswalk.

Figure 65. Photo. Illustration of a marked crosswalk.

Figure 66. Photo. Illustration of a marked crosswalk with supplemental devices.

Figure 67. Photo. Illustration of a marked crosswalk with refuge island.

Figure 68. Photo. Illustration of a marked crosswalk with refuge island and supplemental devices.

Figure 69. Photo. Illustration of a raised crosswalk.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

145. Pedestrian Signal Activation Type

Description:	Type of pedestrian signalization activation for crossing this approach.
Recommended Attributes:	1. None 2. Constant activation by traffic signal (e.g., ped recall) 3. Pushbutton actuated 4. Passive detection 5. Other
Recommended Field Type:	Numeric
Remarks: NCHRP Report 969 (2022) provides some additional discussion of traffic signal implementation for pedestrians, including accessible pedestrian signals (APS).	
Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value is equal "1 (None)" and *PEDESTRIAN SIGNAL PRESENCE/TYPE* is equal to "1 (None)".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

146. Pedestrian Signal Presence/Type

Description:	Presence and type of pedestrian signal for crossing this approach (figure 70 and figure 71).
Recommended Attributes:	1. None. 2. Pedestrian Signal with countdown indicator (with APS) 3. Pedestrian Signal with countdown indicator (without APS) 4. Pedestrian Signal without countdown indicator (with APS) 5. Pedestrian Signal without countdown indicator (without APS)
Recommended Field Type:	Numeric

Remarks: NCHRP Report 969 (2022) provides some additional discussion of traffic signal implementation for pedestrians, including APS.

FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years for improving a pedestrian signal (p. 48).

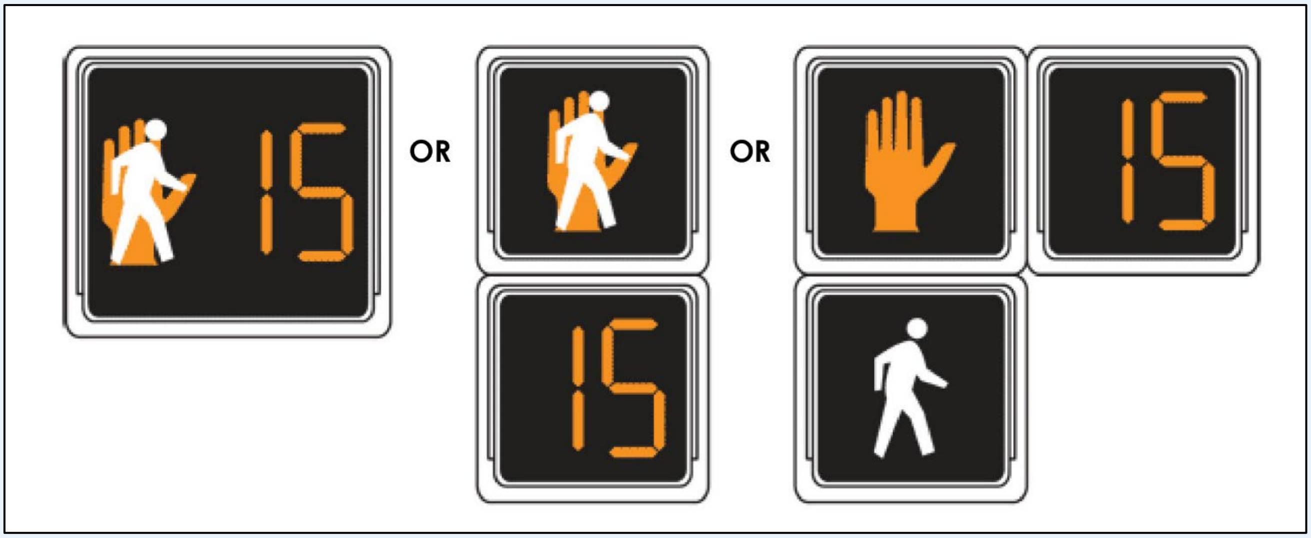

Figure 70. Graphic. Illustration of pedestrian signal types.

Figure 71. Graphic. Illustration of accessible pedestrian signals.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to "1 (None)" and *PEDESTRIAN SIGNAL ACTIVATION TYPE* is equal to "1 (None)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

147. Crossing Pedestrian Count/Exposure

Description:	Count or estimate of average daily pedestrian flow crossing perpendicularly across the approach.
Recommended Attributes:	1. Pedestrian count
Recommended Field Type:	Numeric

Remarks: Data element only applies to approaches with vehicular traffic. A high number of pedestrian crossings is generally 100 or more per hour; however, a high or typical number of pedestrian crossings will vary by context (FHWA, 2022d; FHWA, 2023b). More moderate crossing numbers typically fall between 10 and 100 per hour, with 10 or fewer crossings per hour being considered lower crossing volume.

Key differences between motorized and non-motorized count programs include (FHWA, 2022e, p. 1-12):

- The limited number of monitoring sites in most city, county, or State count programs that might limit statistical extrapolation.
- Greater use of lower functional classification roads by non-motorists, as well as off-road paths.
- Prevalence of short-term counts (i.e., 2 hours) in existing non-motorized count data and monitoring practices.

Agencies should take care to address or modify count programs or statistical estimates accordingly. NCHRP Report 797 (2014) provides some additional guidance on developing a non-motorized count program.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Values greater than "100" per hour should be scrutinized if *CITY/LOCAL JURISDICTION NAME* is *NULL* and *CITY/LOCAL JURISDICTION URBAN CODE* is equal to "1 (Rural)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

148. Left/Right-Turn Prohibitions

Description:	Signed left or right-turn prohibitions on this approach.
Recommended Attributes:	1. Not applicable 2. No prohibitions 3. No left-turns permitted at any time 4. No left-turn permitted during certain portions of the day 5. No right-turns permitted at any time 6. No right-turns permitted during certain portions of the day 7. No right or left-turns permitted at any time 8. No right or left-turns permitted during certain portions of the day 9. No U-turns
Recommended Field Type:	Numeric

Remarks: If turns are prohibited during a certain period of time, select "4 (No left-turn permitted during certain portions of the day)," "6 (No right-turns permitted during certain portions of the day)," or "8 (No right or left-turns permitted during certain portions of the day)" as applicable. Include locations where turns are prohibited more than one time period during the day, but not the full day.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

149. Right-Turn On Red Prohibitions

Description:	Prohibition of right-turns on red (RTOR) from this approach.
Recommended Attributes:	1. RTOR allowed at all times 2. RTOR prohibited at all times 3. RTOR prohibited during certain portions of the day 4. Not Applicable
Recommended Field Type:	Numeric

Remarks: The prohibition may be signed or unsigned if applied areawide. For example, some cities will prohibit RTOR citywide.

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

150. Left-Turn Counts/Percent

Description:	Count or estimate of average daily left-turns, or percent of total approach traffic turning left.		
Recommended Attributes:	1. Left-turning vehicles (count or percent)		
Recommended Field Type:	Numeric		
Remarks: This could also be captured for peak periods only or by hour of day. Refer to table 4 for potential sources of this data element.			
Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

151. Year of Left-Turn Counts/Percent

Description:	Year of count or estimate of average daily left-turns or percent of total approach traffic turning left.
Recommended Attributes:	1. Year (YYYY)
Recommended Field Type:	Numeric

Remarks: Refer to Table 4 for potential sources of this data element.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

152. Right-Turn Counts/Percent

Description:	Count or estimate of average daily right-turns, or percent of total approach traffic turning right.		
Recommended Attributes:	1. Right turning vehicles (count or percent)		
Recommended Field Type:	Numeric		
Remarks: This could be captured for peak periods only or by hour of day. Refer to table 4 for potential sources of this data element.			
Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

153. Year of Right-Turn Counts/Percent

Description:	Year of count or estimate of average daily right-turns or percent of total approach traffic turning right.		
Recommended Attributes:	1. Year (YYYY)		
Recommended Field Type:	Numeric		
Remarks: Refer to table 4 for potential sources of this data element.			
Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	Partial Extent

154. Transverse Rumble Strip Presence

Description:	Presence of transverse rumble strips on approach.
Recommended Attributes:	1. Yes 2. No
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years for installing transverse rumble strips (p. 52).

Collection Cycle:	Long Term
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

155. Circular Intersection – Entry Width

Description:	Full width of entry (i.e., in the direction of travel) on this approach where it meets the inscribed circle.
Recommended Attributes:	1. Entry width (feet)
Recommended Field Type:	Numeric
Remarks: See figure 50 for example.	
Collection Cycle:	Ad-Hoc
Level of Accuracy:	Low
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

156. Circular Intersection – Number of Entry Lanes

Description:	Number of entry lanes into circular intersection on this approach.
Recommended Attributes:	1. Number of entry lanes
Recommended Field Type:	Numeric

Remarks: Data element does not include right-turn only or auxiliary lanes. See figure 50 for example.

Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

157. Circular Intersection – Presence/Type of Exclusive Right-Turn Lane

Description:	Presence and type of exclusive right-turn lane(s) on this approach.
Recommended Attributes:	1. None 2. Exclusive right-turn bypass/slip lane with separating island 3. Exclusive right-turn bypass/slip lane without separating island
Recommended Field Type:	Numeric

Remarks: See figure 72 and figure 73 for examples.

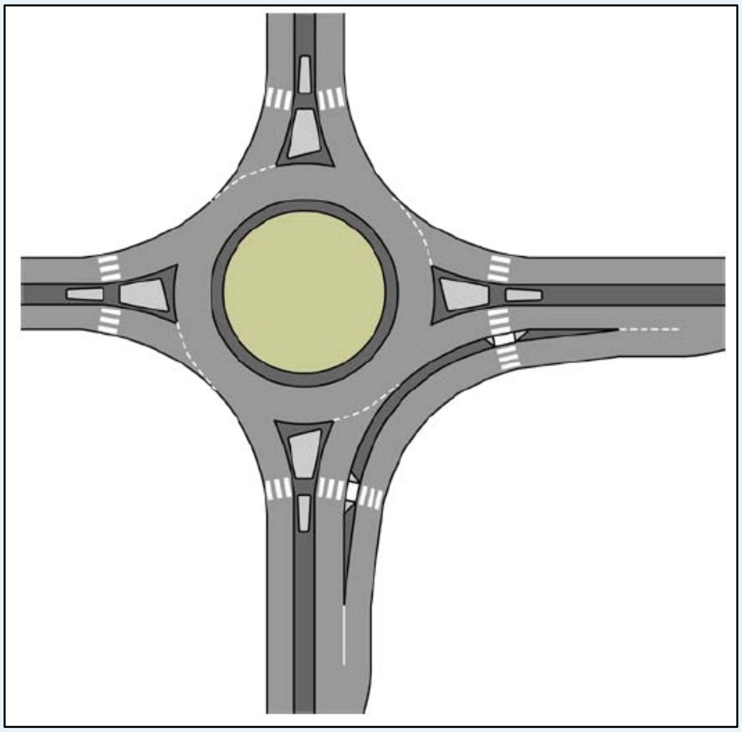

Figure 72. Graphic. Illustration of a roundabout with a right-turn bypass/slip lane with separating island.

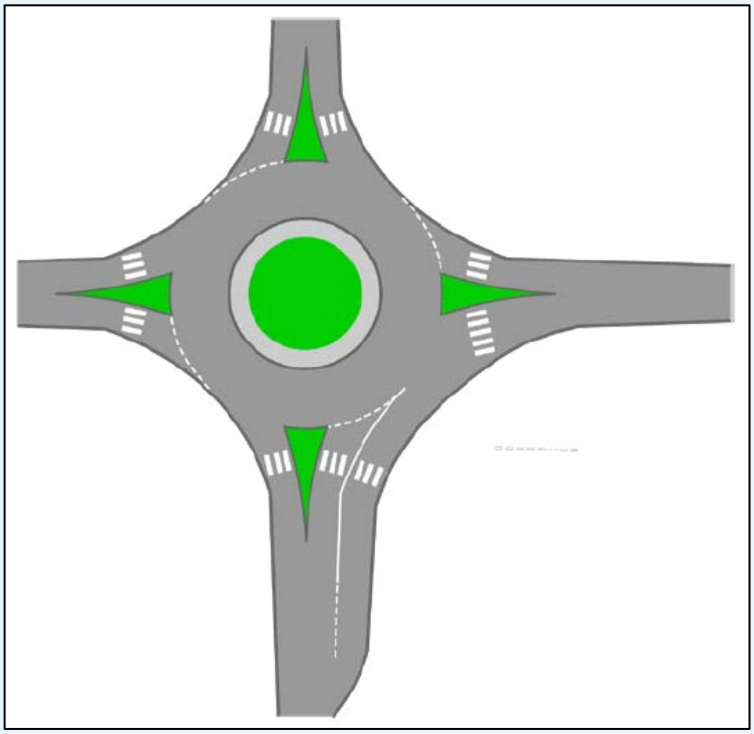

Figure 73. Graphic. Illustration of a roundabout with a right-turn bypass/slip lane without separating island.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

158. Circular Intersection – Entry Radius

Description:	Minimum radius of curvature of the curb on the right side of the entry.
Recommended Attributes:	1. Entry radius (feet)
Recommended Field Type:	Numeric
Remarks: See figure 50 for example.	
Collection Cycle:	Ad-Hoc
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

159. Circular Intersection – Exit Width

Description:	Full width of exit on this approach where it meets the inscribed circle.		
Recommended Attributes:	1. Exit width (feet)		
Recommended Field Type:	Numeric		
Remarks: See figure 50 for example.			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

160. Circular Intersection – Number of Exit Lanes

Description:	Number of exit lanes from roundabout on this approach leg.
Recommended Attributes:	1. Number of exit lanes
Recommended Field Type:	Numeric
Remarks: See figure 50 for example.	
Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

161. Circular Intersection – Exit Radius

Description:	Minimum radius of curvature of the curb on the left side of the approach, when facing the intersection.		
Recommended Attributes:	1. Exit radius (feet)		
Recommended Field Type:	Numeric		
Remarks: See figure 50 for example.			
Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

162. Circular Intersection – Pedestrian Facility

Description:	Type of facility for pedestrians perpendicularly crossing this approach.
Recommended Attributes:	1. Marked crosswalk with raised island 2. Marked crosswalk with flush island 3. Marked crosswalk with no island 4. Unmarked crosswalk with raised island 5. Unmarked crosswalk with flush island 6. Unmarked crosswalk with no island 7. Pedestrian crossing prohibited at this approach 8. Other
Recommended Field Type:	Numeric

Remarks: Many State laws assign an unmarked crossing to all *intersection legs* where a marked crosswalk is not present; States should consult their applicable laws to determine where unmarked crosswalks may apply.

For safety analysis purposes, 'Pedestrian' has been related to FARS non-motorist person type attributes used in coding fatal crashes.

"Pedestrians" – include all persons defined by FARS as a "Pedestrian" or "Person on Personal Conveyance" (e.g., persons using manual or motorized scooters, wheelchairs, skates, etc.).

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

163. Circular Intersection – Crosswalk Location

Description:	Location of marked pedestrian crosswalk line.
Recommended Attributes:	1. Distance of the marked crosswalk from yield markings (feet)
Recommended Field Type:	Numeric

Remarks: Data element is measured as the distance between the yield line and crosswalk markings closest to the intersection. See figure 50 for example.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

164. Circular Intersection – Island Width

Description:	Width of raised or painted island separating entry and exit.
Recommended Attributes:	1. Width (feet)
Recommended Field Type:	Numeric

Remarks: Data element is measured at the inscribed circle. If no island is present, record width as zero. See figure 50 for example.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

INTERCHANGES AND RAMPS

Interchanges and Ramps

165. Unique Interchange Identifier FDE
166. Interchange Type FDE
167. Ramp Length FDE
168. Ramp AADT FDE
169. Year of Ramp AADT FDE
170. Roadway Type at Beginning Ramp Terminal FDE
171. Location Identifier for Roadway at Beginning Ramp Terminal FDE
172. Roadway Type at Ending Ramp Terminal FDE
173. Location Identifier for Roadway at Ending Ramp Terminal FDE
174. Interchange Location Identifier for Road 1 Crossing Point
175. Interchange Location Identifier for Road 2 Crossing Point
176. Interchange Location Identifier for Additional Road Crossing Points
177. Interchange Lighting
178. Interchange Entering Volume
179. Interchange Identifier for this Ramp
180. Unique Ramp Identifier
181. Ramp Acceleration Lane Length
182. Ramp Deceleration Lane Length
183. Ramp Number of Lanes
184. Ramp Metering
185. Ramp Advisory Speed Limit
186. Roadway Feature at Beginning Ramp Terminal
187. Location of Beginning Ramp Terminal Relative to Mainline Flow
188. Roadway Feature at Ending Ramp Terminal
189. Location of Ending Ramp Terminal Relative to Mainline Flow

165. Unique Interchange Identifier FDE

Description:	Unique identifier for each interchange.
Recommended Attributes:	1. Interchange identifier
Recommended Field Type:	Text
Remarks: States define the unique interchange identifier, which may combine a node number, route identifiers and mileposts of crossing routes, exit numbers, etc.	
Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

166. Interchange Type FDE

Description:	Type of interchange.
Recommended Attributes:	1. Diamond 2. Diverging diamond (i.e., DDI, double-crossover diamond, DCD) interchange 3. Double roundabout (i.e., double raindrop) interchange 4. Four-leg all-directional 5. Full cloverleaf 6. Partial cloverleaf 7. Quadrant 8. Semi-directional 9. Single entrances and/or exits (partial interchange) 10. Single point interchange (SPI) 11. Single roundabout (i.e., single raindrop) interchange 12. Three-leg directional 13. Trumpet 14. Other
Recommended Field Type:	Numeric

Remarks: See figure 74 through figure 86 for illustrative diagrams.

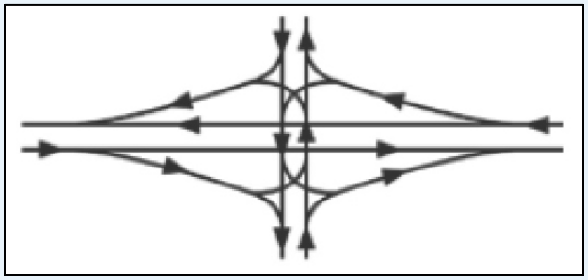

Figure 74. Graphic. Illustration of a diamond interchange.

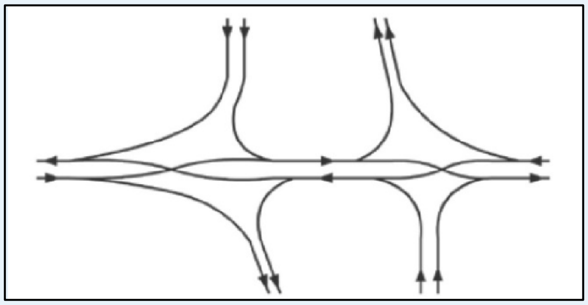

Figure 75. Graphic. Illustration of a diverging diamond interchange.

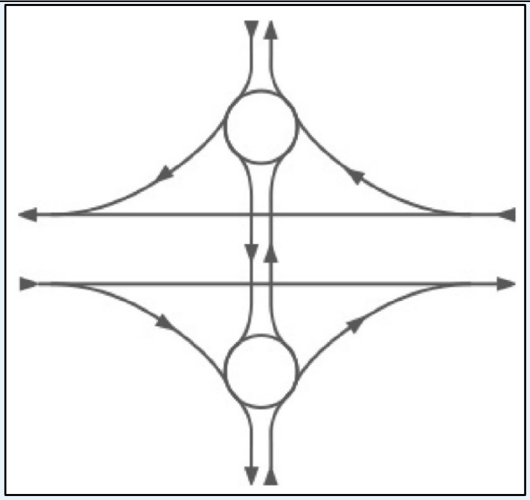

Figure 76. Graphic. Illustration of a double roundabout interchange.

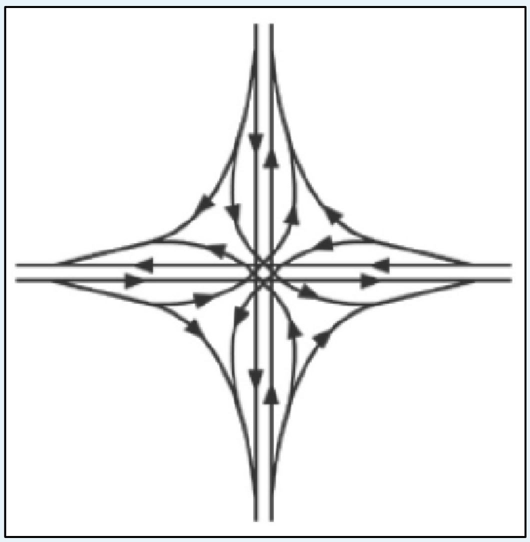

Figure 77. Graphic. Illustration of a four-leg all-directional interchange.

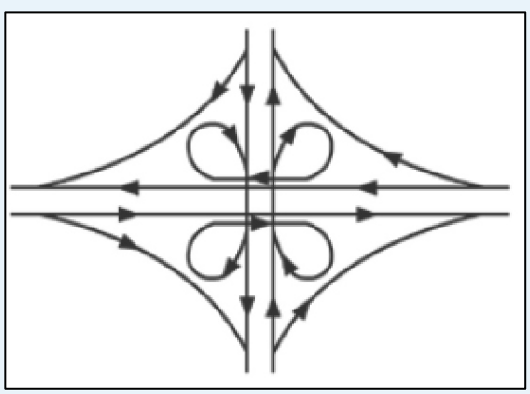

Figure 78. Graphic. Illustration of a full cloverleaf interchange.

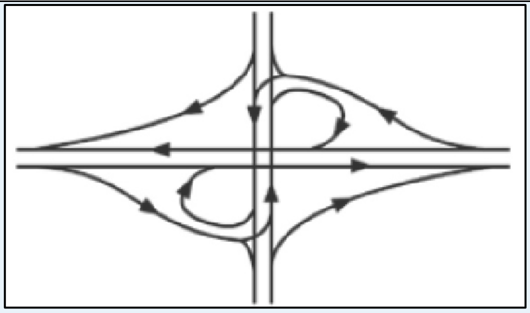

Figure 79. Graphic. Illustration of a partial cloverleaf interchange.

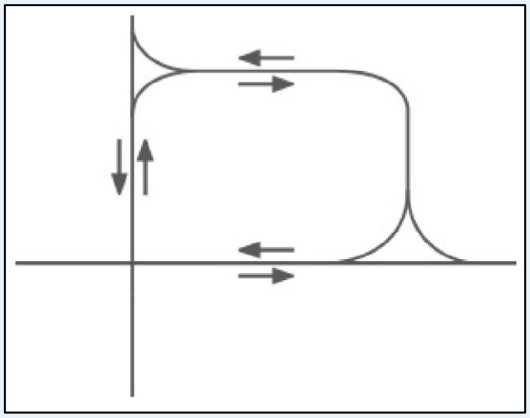

Figure 80. Graphic. Illustration of a quadrant interchange.

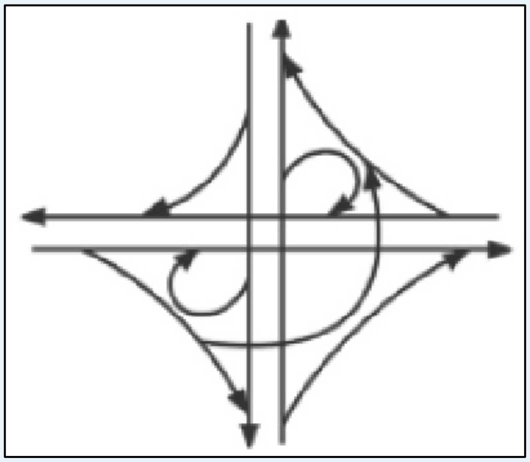

Figure 81. Graphic. Illustration of a semi-directional interchange.

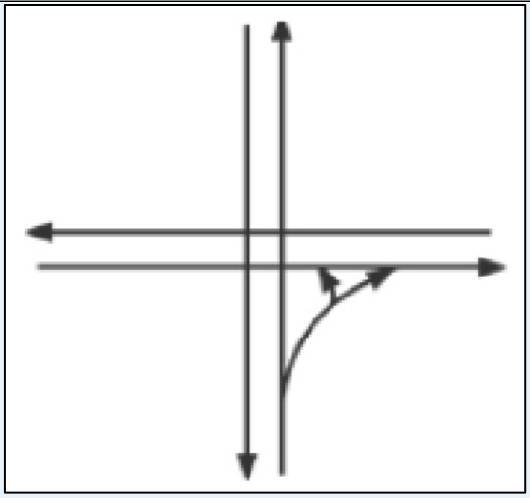

Figure 82. Graphic. Illustration of a single exit interchange.

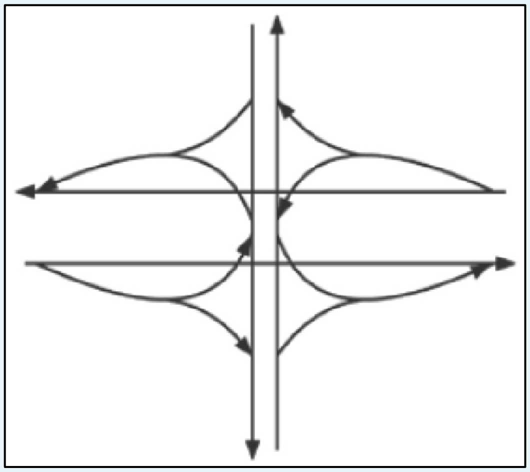

Figure 83. Graphic. Illustration of a single point interchange.

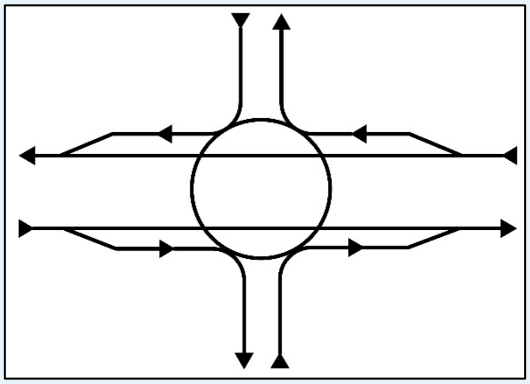

Figure 84. Graphic. Illustration of a single roundabout interchange.

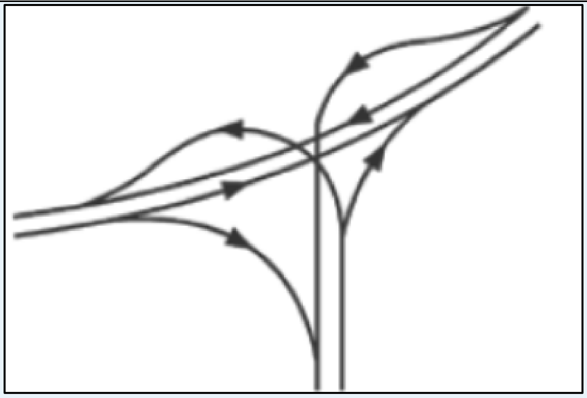

Figure 85. Graphic. Illustration of a three-leg directional interchange.

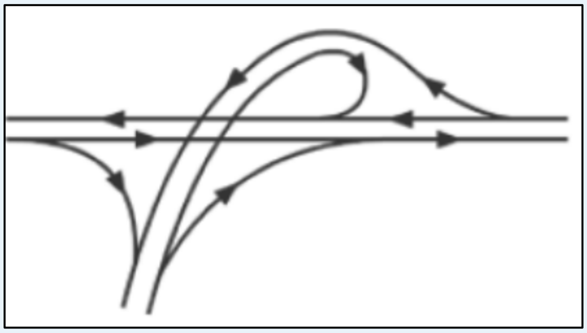

Figure 86. Graphic. Illustration of a trumpet interchange.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

167. Ramp Length FDE

Description:	Length of ramp.
Recommended Attributes:	1. Ramp length (miles)
Recommended Field Type:	Numeric

Remarks: The length should be measured from taper to taper (figure 87). The begin taper point is the point at which the exit (deceleration) lane separates from the outermost lane of the mainline roadway, becoming a separate lane. The end taper point is the point at which the entrance (acceleration) lane joins the outermost lane of the mainline roadway to become one lane.

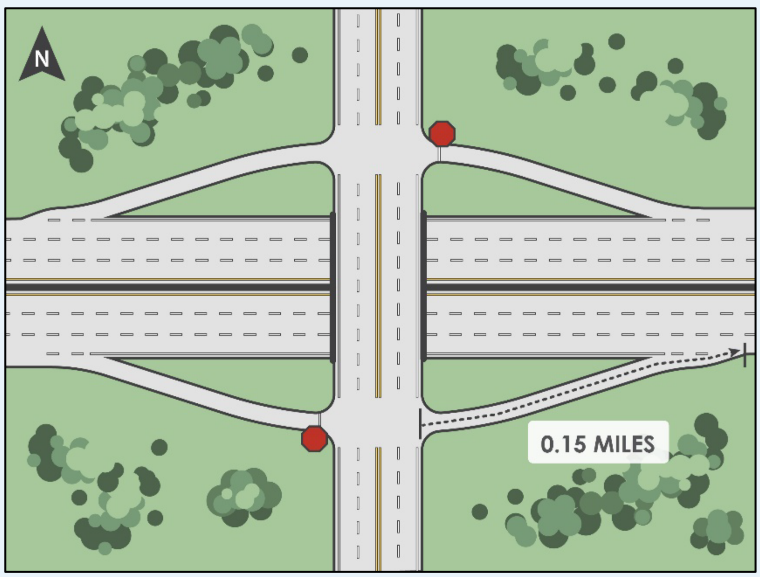

Figure 87. Graphic. Illustration of ramp length.

Crosswalk with other Data Systems:

- **HPMS:** Section Length

Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	N/A

168. Ramp AADT [FDE]

Description:	AADT on ramp.
Recommended Attributes:	1. AADT
Recommended Field Type:	Numeric

Remarks: States are encouraged to align their data collection with HPMS methodologies. To the extent possible, the same procedures used to develop AADTs on non-ramp segments should also be used to develop ramp AADT data.

Ramp AADT data may be available from freeway monitoring programs that continuously monitor travel on ramps and mainline facilities. Ramp balancing programs implemented by the States for ramp locations and on high volume roadways could also be used to gather traffic data on ramps.

It is important that this volume data be an AADT for comparison to other AADTs and for reasonable trend analysis. States are encouraged to use adjustment factors developed based on either entrance or exit travel patterns or the functional class of the ramp, and to use this procedure consistently statewide. For example, the factors used for the mainline road with subordinate flow may be appropriate for use on the ramp. In other cases, the factors from intersecting roads connected to the ramp may be more appropriate for use. Good judgment and experience should be applied regarding factor use. As a minimum, 48-hour ramp counts should be adjusted with axle correction factors as needed.

Ramp counts should be available from freeway monitoring programs that continuously monitor travel on ramps and mainline facilities. Ramp balancing programs implemented by States on ramp locations and on high volume roadways could also be used to provide AADTs. In the case where no ramp counts are available, a State may use traffic matrix estimation. The State's traffic modeling office may compute ramp traffic estimates as part of their modeling process.

Crosswalk with other Data Systems:

- **HPMS:** Annual Average Daily Traffic
- **NBI:** Annual Average Daily Traffic

Collection Cycle:	• **Annually** where *FEDERAL-AID* equals "3 (Route is on NHS)". • **Medium Term** where *FEDERAL-AID* equals "2 (Route is Federal-aid, but not on NHS)". • **Long Term** (or estimated) where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)".
Level of Accuracy:	High

<table>
<tr><td>Validation Checks:</td><td colspan="3">Value does not equal NULL.
Value is greater than “0”.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

169. Year of Ramp AADT [FDE]

Description:	Year of AADT on ramp.
Recommended Attributes:	1. AADT year (YYYY)
Recommended Field Type:	Numeric

Remarks: If AADT is derived from an actual count, this data element should reflect the year of that count. If a State applies another estimation or interpolation method to develop AADT, the applicable year, such as the year of input data (e.g., the base year from a travel demand model) or appropriate year reflecting estimate timeframe (e.g., the future year from a travel demand model), can be used.

Crosswalk with other Data Systems:

- **NBI:** Year of Annual Average Daily Traffic

Collection Cycle:	• **Annually** where *FEDERAL-AID* equals "3 (Route is on NHS)". • **Medium Term** where *FEDERAL-AID* equals "2 (Route is Federal-aid, but not on NHS)". • **Long Term** (or estimated) where *FEDERAL-AID* equals "1 (Route is non-Federal-aid)".		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

170. Roadway Type at Beginning Ramp Terminal [FDE]

Description:	Type of roadway intersecting with the ramp at the beginning terminal.
Recommended Attributes:	1. Freeway 2. Non-freeway (surface street) 3. Other Ramp 4. Frontage road 5. Other
Recommended Field Type:	Numeric

Remarks: A ramp is described by a beginning and ending ramp terminal in the direction of ramp traffic flow. The beginning of the ramp is based on the origin point of traffic entering the ramp (figure 88).

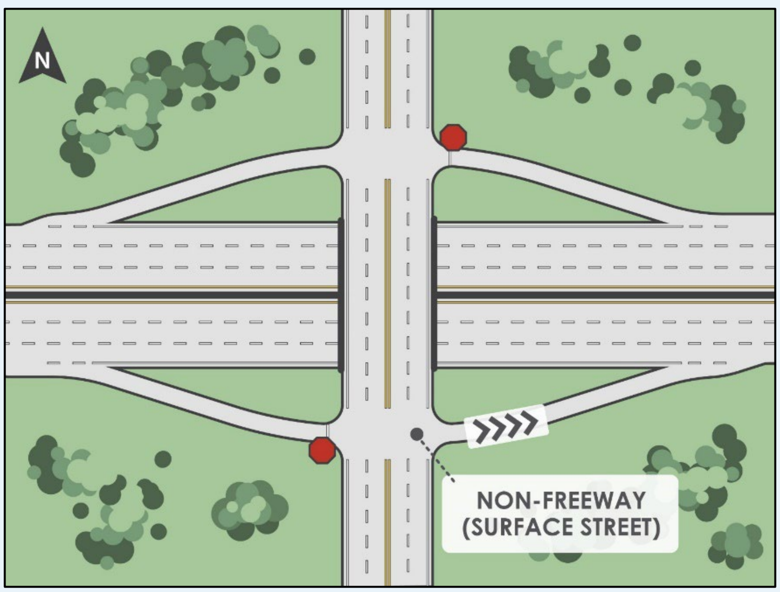

Figure 88. Graphic. Illustration of the roadway type at beginning ramp terminal.

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

171. Location Identifier for Roadway at Beginning Ramp Terminal FDE

Description:	Location on the roadway at the beginning ramp terminal (e.g., route-milepoint for that roadway) if the ramp connects with a roadway at that point.
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates)
Recommended Field Type:	Text and Numeric

Remarks: A ramp is described by a beginning and ending ramp terminal in the direction of ramp traffic flow. The beginning of the ramp is based on the origin point of traffic entering the ramp (figure 89).

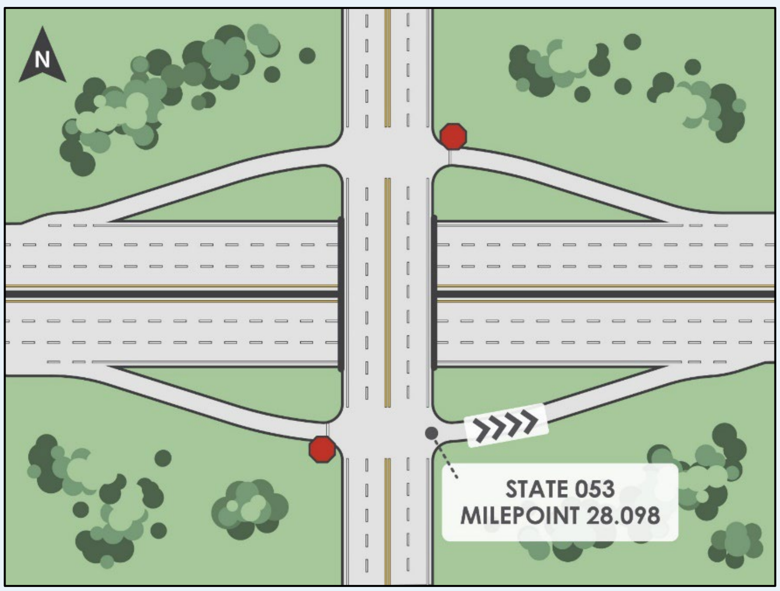

Figure 89. Graphic. Illustration of the location identifier for roadway at beginning ramp terminal.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint
- **NBI:** LRS Route ID and LRS Milepoint

Collection Cycle:	Annually
Level of Accuracy:	High

Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

172. Roadway Type at Ending Ramp Terminal FDE

Description:	Type of roadway intersecting with the ramp at the ending terminal.
Recommended Attributes:	1. Freeway 2. Non-freeway (surface street) 3. Other Ramp 4. Frontage road 5. Other
Recommended Field Type:	Numeric

Remarks: A ramp is described by a beginning and ending ramp terminal in the direction of ramp traffic flow. The end of the ramp is based on the destination point of traffic exiting the ramp (figure 90).

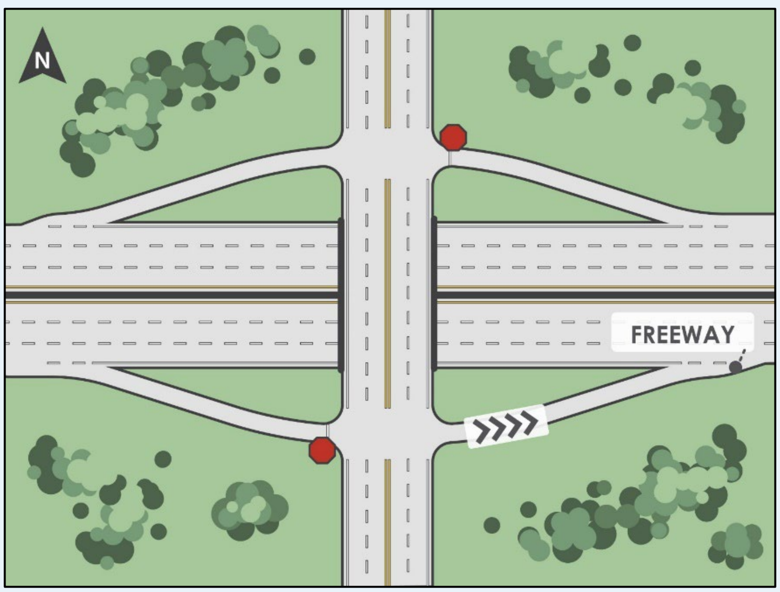

Figure 90. Graphic. Illustration of the roadway type at ending ramp terminal.

Collection Cycle:	Medium Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

173. Location Identifier for Roadway at Ending Ramp Terminal FDE

Description:	Location on the roadway at the ending ramp terminal (e.g., route-milepoint for that roadway) if the ramp connects with a roadway at that point.
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates)
Recommended Field Type:	Text and Numeric

Remarks: A ramp is described by a beginning and ending ramp terminal in the direction of ramp traffic flow. The end of the ramp is based on the destination point of traffic exiting the ramp (figure 91).

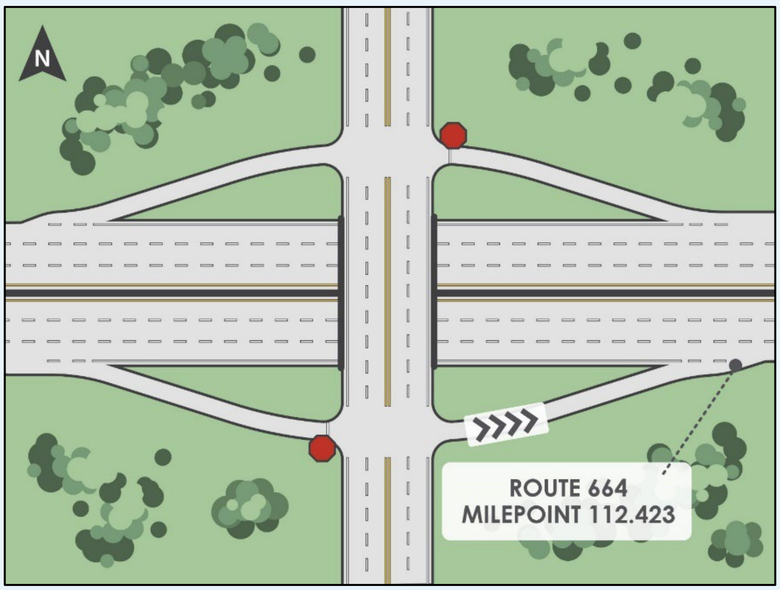

Figure 91. Graphic. Illustration of the location identifier for roadway at ending ramp terminal.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint

Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	Non-Local Paved	Local Paved	Unpaved
	Full Extent	Full Extent	N/A

174. Interchange Location Identifier for Road 1 Crossing Point

Description:	Location of midpoint of interchange (e.g., crossing route) on the first intersecting route (e.g., route-milepoint).
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates)
Recommended Field Type:	Text and Numeric

Remarks: States can use the milepoint associated with the approach for this data element. See point "A" in figure 92 for an example location. If spatial coordinates are included, these would be consistent for all crossing roads.

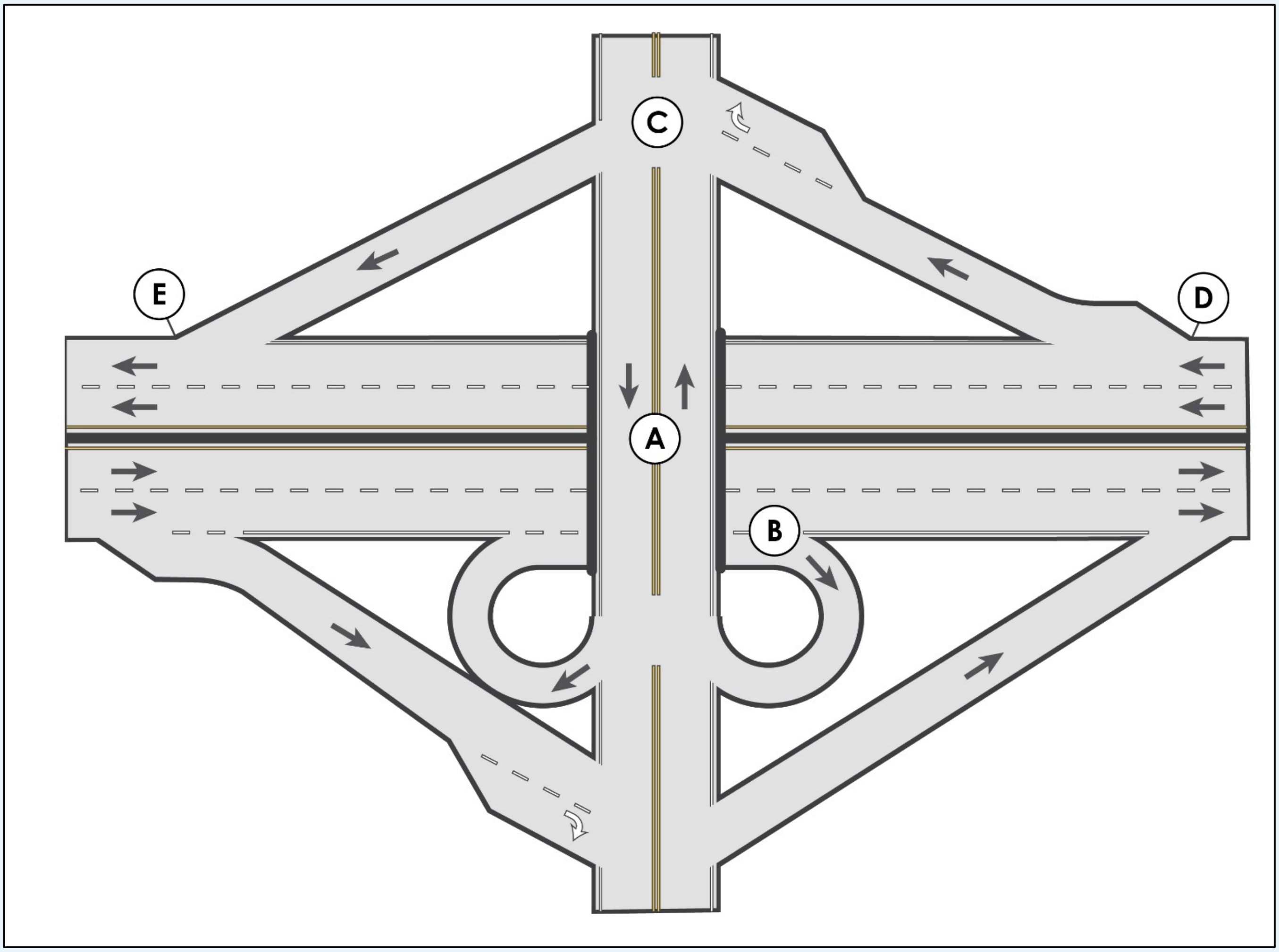

Figure 92. Graphic. Illustration of crossing locations at an interchange.

<table>
<tr><td colspan="4">Crosswalk with other Data Systems:
• HPMS: Route ID and Milepoint
• NBI: LRS Route ID and LRS Milepoint</td></tr>
<tr><td>Collection Cycle:</td><td colspan="3">Annually</td></tr>
<tr><td>Level of Accuracy:</td><td colspan="3">High</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">• Value does not equal NULL.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Full Extent</td><td>Full Extent</td><td>N/A</td></tr>
</table>

175. Interchange Location Identifier for Road 2 Crossing Point

Description:	Location of midpoint of interchange (e.g., crossing route) on the second intersecting route (e.g., route-milepoint).
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates)
Recommended Field Type:	Text and Numeric

Remarks: States can use the milepoint associated with the approach for this data element. See point "A" in figure 92 for an example location. If spatial coordinates are included, these would be consistent for all crossing roads.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint
- **NBI:** LRS Route ID and LRS Milepoint

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

176. Interchange Location Identifier for Additional Road Crossing Points

Description:	Location on the third and subsequent intersecting route (e.g., route-milepoint).
Recommended Attributes:	1. Route and location descriptors (e.g., route and milepoint or route and spatial coordinates)
Recommended Field Type:	Text and Numeric

Remarks: States can use the milepoint associated with the approach for this data element. See point "A" in figure 92 for an example location. If spatial coordinates are included, these would be consistent for all crossing roads.

Crosswalk with other Data Systems:

- **HPMS:** Route ID and Milepoint
- **NBI:** LRS Route ID and LRS Milepoint

Collection Cycle:	Annually
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

	Non-Local Paved	Local Paved	Unpaved
Collection Extent:	Full Extent	Full Extent	N/A

177. Interchange Lighting

Description:	Type of interchange lighting.
Recommended Attributes:	1. None 2. Full interchange-area lighting (high mast) 3. Full interchange-area lighting (other) 4. Partial interchange lighting 5. Other
Recommended Field Type:	Numeric

Remarks: The AASHTO Roadway Lighting Design Guide 7th Edition (AASHTO, 2018) is a helpful resource for determining the appropriate amount of lighting at interchanges.

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

178. Interchange Entering Volume

Description:	Sum of entering volumes for all routes entering interchange.
Recommended Attributes:	1. Average vehicles per day
Recommended Field Type:	Numeric

Remarks: For each entering route, this would be counted at a point prior to the first exit ramp.

Collection Cycle:	Annually		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

179. Interchange Identifier for this Ramp

Description:	The unique numeric identifier assigned to the interchange that this ramp is part of.		
Recommended Attributes:	1. The intersection identifier entered in *Unique Interchange Identifier*		
Recommended Field Type:	Text		
Remarks: This element provides linkage to the basic interchange information to all other ramps for the same interchange.			
Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL.* • Value matches relevant *UNIQUE INTERCHANGE IDENTIFIER.*		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

180. Unique Ramp Identifier

Description:	An identifier for each ramp that is part of a given interchange.
Recommended Attributes:	1. Unique identifier
Recommended Field Type:	Text

Remarks: Route and milepoint information as part of the *Interchange Location Identifier for Road 1 Crossing Point*, *Interchange Location Identifier for Road 2 Crossing Point*, and *Interchange Location Identifier for Additional Road Crossing Points* data elements can apply.

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

181. Ramp Acceleration Lane Length

Description:	Length of acceleration lane, not including taper.
Recommended Attributes:	1. Acceleration lane length (feet)
Recommended Field Type:	Numeric

Remarks: For tapered ramps, this would be measured from the point at which the painted gore is 2-ft wide (AASHTO, 2014, p. 18-16) to the point where the ramp lane taper ends (figure 93).

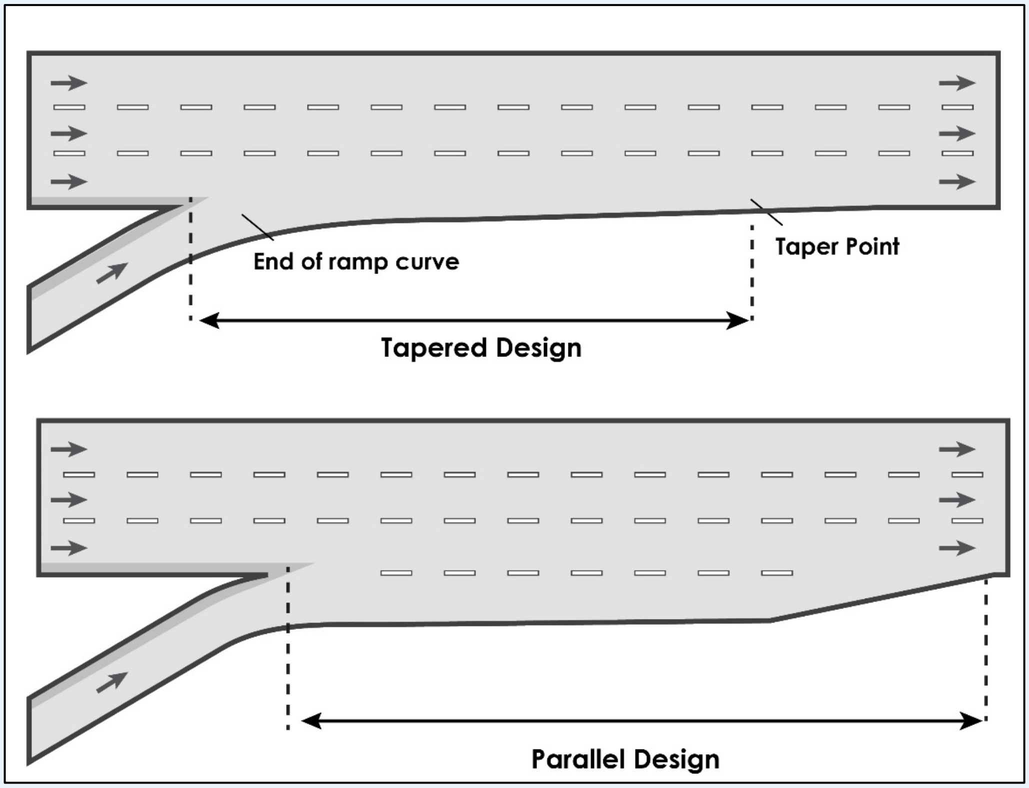

Figure 93. Graphic. Illustration of acceleration lane length for tapered and parallel designs.

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

182. Ramp Deceleration Lane Length

Description:	Length of deceleration lane, not including taper.
Recommended Attributes:	1. Deceleration lane length (feet)
Recommended Field Type:	Numeric

Remarks: For tapered ramps, this would be measured from the point where the ramp lane taper begins to the point at which the painted gore is 2-ft wide (AASHTO, 2014, p. 18-16; figure 94).

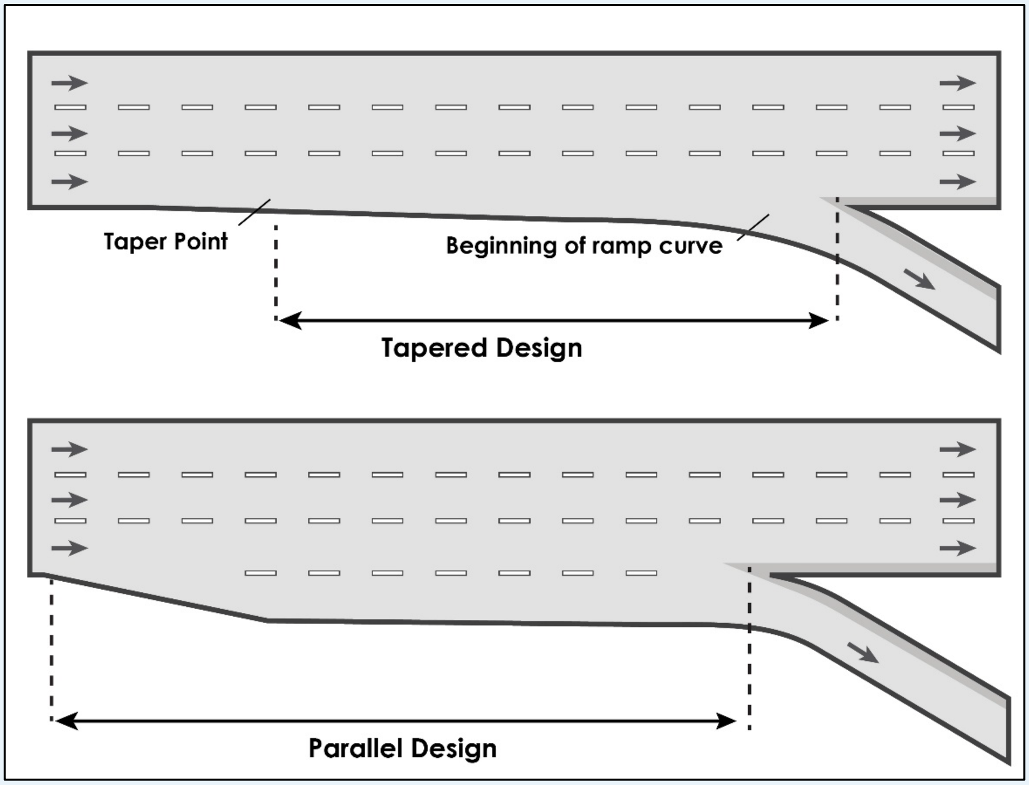

Figure 94. Graphic. Illustration of deceleration lane length for tapered and parallel designs.

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

183. Ramp Number of Lanes

Description:	Maximum number of lanes on ramp.
Recommended Attributes:	1. Number of lanes
Recommended Field Type:	Numeric

Remarks: Include the predominant number of (through) lanes on the ramp. Do not include turn lanes (exclusive or combined) at the termini unless they are continuous (turn) lanes over the entire length of the ramp.

Crosswalk with other Data Systems:

- **HPMS:** Through Lanes
- **FARS:** Total Lanes in Roadway
- **MMUCC (v6):** Number of Open Lanes in Vehicle's Environment[29]
- **NBI:** Lanes On Highway

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • Value is greater than "0".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

[29] Includes lanes that may only be actively in operation during a crash.

184. Ramp Metering

Description:	The presence and type of any metering of traffic entering mainline.
Recommended Attributes:	1. Pre-timed 2. Traffic actuated 3. No metering 4. Not applicable (i.e., ramp does not feed into mainline)
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 10 years for installing ramp meters (p. 38).

Collection Cycle:	Medium Term
Level of Accuracy:	Moderate
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

185. Ramp Advisory Speed Limit

Description:	The posted advisory speed limit on the ramp.
Recommended Attributes:	1. Advisory speed limit (mph) 2. No advisory limit (i.e., limit will be the same as on the connecting roadways)
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 15 years for changing the posted speed limit (p. 51).

Collection Cycle:	Medium Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

186. Roadway Feature at Beginning Ramp Terminal

Description:	The feature found at the beginning terminal of the ramp.
Recommended Attributes:	1. Acceleration Lane 2. Deceleration Lane 3. Weaving lane (e.g., the weaving area joining two ramps under an overpass in a cloverleaf interchange) 4. Signalized intersection 5. Stop/yield-controlled intersection 6. Uncontrolled intersection 7. Another ramp 8. Other
Recommended Field Type:	Numeric

Remarks: The beginning of the ramp is based on the origin point of traffic entering the ramp. See point "D" (figure 92) for an example deceleration lane, point "B" for an example weaving lane, and point "C" for an example intersection.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

187. Location of Beginning Ramp Terminal Relative to Mainline Flow

Description:	Identifies the side of the roadway flow intersected by the beginning ramp terminal.
Recommended Attributes:	1. Right side with respect to mainline traffic flow at intersecting point 2. Left side with respect to mainline traffic flow at intersecting point 3. Ramp does not intersect mainline at this point (e.g., ramp intersects another ramp)
Recommended Field Type:	Numeric

Remarks: Ramps can intersect with the traffic flow of a divided or undivided roadway on either of two sides. The beginning of the ramp is based on the origin point of traffic entering the ramp (figure 95).

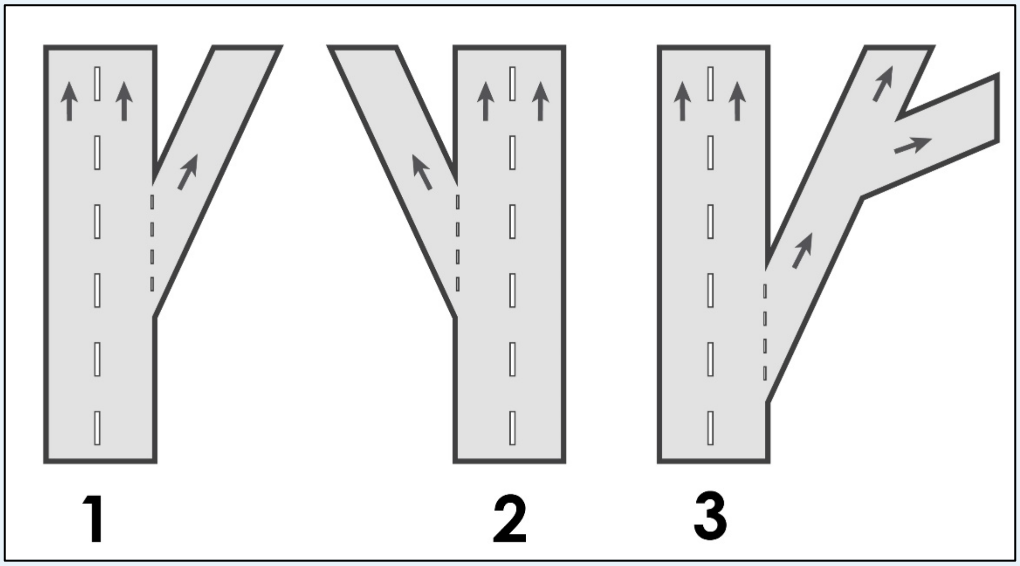

Figure 95. Graphic. Illustration of locations of beginning ramp terminal relative to mainline flow.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

188. Roadway Feature at Ending Ramp Terminal

Description:	The feature found at the end terminal of the ramp.
Recommended Attributes:	1. Acceleration Lane 2. Deceleration Lane 3. Weaving lane (e.g., the weaving area joining two ramps under an overpass in a cloverleaf interchange) 4. Signalized intersection 5. Stop/yield-controlled intersection 6. Uncontrolled intersection 7. Another ramp 8. Other
Recommended Field Type:	Numeric

Remarks: The end of the ramp is based on the destination point of traffic exiting the ramp. See point "C" (figure 92) for an example intersection and point "E" for an example acceleration lane.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	N/A

189. Location of Ending Ramp Terminal Relative to Mainline Flow

Description:	Identifies the side of the roadway flow intersected by the ending ramp terminal.
Recommended Attributes:	1. Right side with respect to mainline traffic flow at intersecting point 2. Left side with respect to mainline traffic flow at intersecting point 3. Ramp does not intersect mainline at this point (e.g., ramp intersects another ramp)
Recommended Field Type:	Numeric

Remarks: Ramps can intersect with the traffic flow of a divided or undivided roadway on either of two sides. The end of the ramp is based on the destination point of traffic exiting the ramp (figure 96).

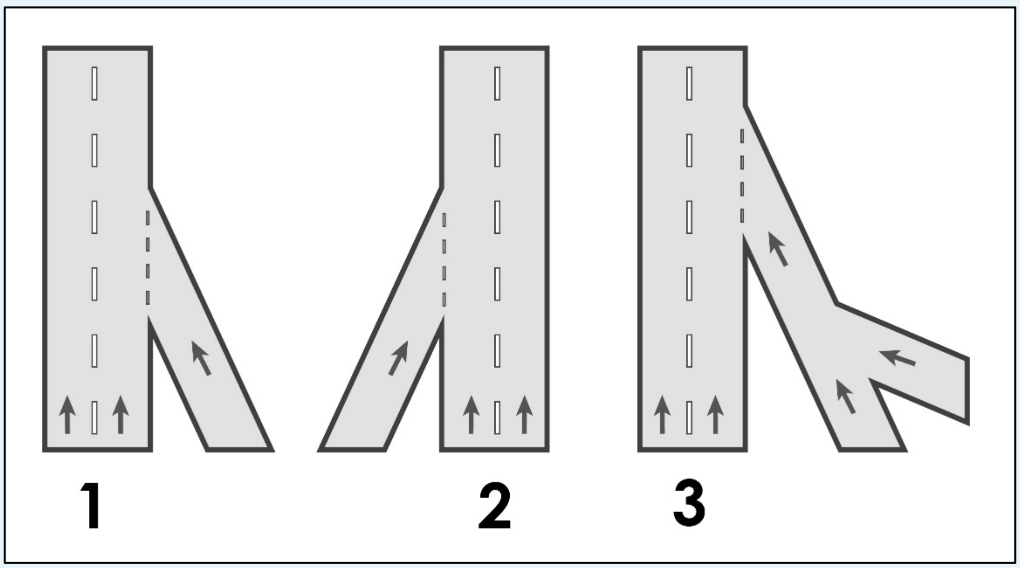

Figure 96. Graphic. Illustration of locations of ending ramp terminal relative to mainline flow.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Partial Extent	N/A

HORIZONTAL CURVES

Horizontal Curves

190. Curve Identifiers
191. Curve Feature Type
192. Horizontal Curve Degree or Radius
193. Horizontal Curve Length
194. Curve Superelevation
195. Horizontal Transition/Spiral Curve Presence
196. Horizontal Curve Intersection/Deflection Angle
197. Horizontal Curve Direction

190. Curve Identifiers

Description:	All elements needed to define location of each curve record.		
Recommended Attributes:	1. Route and location descriptors (e.g., route and beginning and ending milepoints)		
Recommended Field Type:	Text and Numeric		

Remarks: States can follow HPMS sample section guidance with respect to collecting relevant grade classification and location information (FHWA, 2016, p. 4-8); this includes the route identifier, beginning milepost, and ending milepost.

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

191. Curve Feature Type

Description:	Type of horizontal alignment feature (figure 97).
Recommended Attributes:	1. Horizontal angle point (i.e., joining of two tangents without a horizontal curve) 2. Independent horizontal curve 3. Component of compound curve (i.e., one curve in compound curve) 4. Component of reverse curve (i.e., one curve in a reverse curve)
Recommended Field Type:	Numeric

Remarks: Although the definition of an independent horizontal curve may vary according to analysis application, the MUTCD provides the following guidance (FHWA, 2023a; p. 155):

> *"Where there are two changes in roadway alignment in opposite directions that are separated by a tangent distance of less than 600 ft, the Reverse Turn (W1-3) sign should be used instead of multiple Turn (W1-1) signs, or the Reverse Curve (W1-4) sign should be used instead of multiple Curve (W1-2) signs."*

This threshold can be applied as a general definition of an independent curve as opposed to a compound or reverse curve from a countermeasure application perspective.

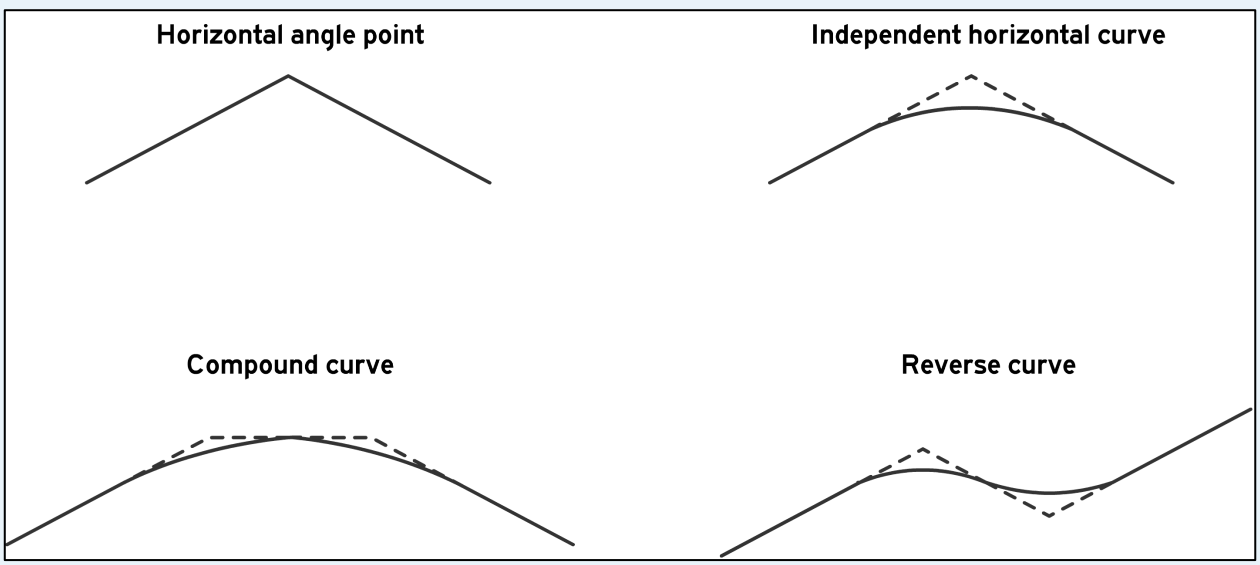

Figure 97. Graphic. Illustration of types of horizontal curve features.

Collection Cycle:	Long Term

<table>
<tr><td>Level of Accuracy:</td><td colspan="3">Moderate</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">• Value does not equal NULL.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Partial Extent</td><td>Partial Extent</td><td>Partial Extent</td></tr>
</table>

192. Horizontal Curve Degree or Radius

Description:	The horizontal degree or radius of the curve.
Recommended Attributes:	1. Horizontal curve degree or radius (feet)
Recommended Field Type:	Numeric

Remarks: HPMS categorizes curves according to degree of curvature, and the HSM predictive analysis for rural roads and freeways requires measurements in feet (FHWA, 2016). States can derive radius in feet from degree of curvature but would not be able to derive this from HPMS degree categories as specific measurements are required.

Crosswalk with other Data Systems:

- **HPMS:** Curve Classification[30]

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[30] Attribute is based on categories of degrees, whereas MIRE asks for the specific measure.

193. Horizontal Curve Length

Description:	Length of curve including spiral transitions.
Recommended Attributes:	1. Curve length (feet)
Recommended Field Type:	Numeric

Remarks: This data element is independent of *Segment*-related data elements and dynamically segmented study sections.

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

194. Curve Superelevation

Description:	The measured superelevation rate or percent of the curve.		
Recommended Attributes:	1. Superelevation (rate/percent)		
Recommended Field Type:	Numeric		
Remarks: Superelevation can vary throughout an individual curve. Strive for consistency in how this data element is collected; an option for consistently collecting this element for network-wide safety analysis could include taking the average observed measurement of the one-quarter (i.e., 25 percent of the length of the curve beyond the beginning of the curve), midpoint, and three-quarter (i.e., 75 percent of the length of the curve beyond the beginning of the curve) points of a horizontal curve.			
Collection Cycle:	Medium Term		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*. • States can consider a default value (e.g., "999") for a horizontal curve with a normal crown.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

195. Horizontal Transition/Spiral Curve Presence

Description:	Presence and type of transition from tangent to curve and curve to tangent.
Recommended Attributes:	1. No transition 2. Spiral transition 3. Other transition
Recommended Field Type:	Numeric
Remarks: A spiral curve has a radius that varies along its length.	
Collection Cycle:	Long Term
Level of Accuracy:	High
Validation Checks:	• Value does not equal *NULL*.

Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

196. Horizontal Curve Intersection/Deflection Angle

Description:	The angle between the two intersecting tangents in the *Direction of Inventory* (sometimes called the "deflection angle").
Recommended Attributes:	1. Degrees (absolute value)
Recommended Field Type:	Numeric

Remarks: Data element only applies to segments that represent a "1 (Horizontal Angle Points)" for the *Curve Feature Type* data element. It is not applicable if there is another horizontal curve type joining the tangents.

Collection Cycle:	Ad-Hoc		
Level of Accuracy:	Low		
Validation Checks:	• Value does not equal *NULL*. • Value is equal to *NULL* where *CURVE FEATURE TYPE* is not equal to "1 (Horizontal angle point)". • Value does not equal *NULL* where *CURVE FEATURE TYPE* is equal to "1 (Horizontal angle point)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

197. Horizontal Curve Direction

<table>
<tr><td>Description:</td><td colspan="3">Direction of curve in the Direction of Inventory.</td></tr>
<tr><td>Recommended Attributes:</td><td colspan="3">1. Right
2. Left</td></tr>
<tr><td>Recommended Field Type:</td><td colspan="3">Numeric</td></tr>
<tr><td>Collection Cycle:</td><td colspan="3">Ad-Hoc</td></tr>
<tr><td>Level of Accuracy:</td><td colspan="3">Low</td></tr>
<tr><td>Validation Checks:</td><td colspan="3">• Value does not equal NULL.</td></tr>
<tr><td rowspan="2">Collection Extent:</td><td>Non-Local Paved</td><td>Local Paved</td><td>Unpaved</td></tr>
<tr><td>Partial Extent</td><td>Partial Extent</td><td>Partial Extent</td></tr>
</table>

VERTICAL GRADE

Vertical Grade

198. Grade Identifiers and Linkage Elements
199. Vertical Alignment Feature Type
200. Percent of Gradient
201. Grade Length
202. Vertical Curve Length

198. Grade Identifiers and Linkage Elements

Description:	All elements needed to define location of each vertical feature.
Recommended Attributes:	1. Route and location descriptors (e.g., route and beginning and ending milepoints)
Recommended Field Type:	Text and Numeric

Remarks: States can follow HPMS sample section guidance with respect to collecting relevant grade classification and location information (FHWA, 2016, p. 4-8); this includes the route identifier, beginning milepost, and ending milepost.

Collection Cycle:	Annually		
Level of Accuracy:	High		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

199. Vertical Alignment Feature Type

Description:	Type of vertical alignment feature being described in the data record (figure 98).
Recommended Attributes:	1. Vertical angle point[31] 2. Vertical gradient 3. Sag vertical curve[32] 4. Crest vertical curve[33]
Recommended Field Type:	Numeric

Remarks: FHWA's Countermeasure Service Life Guide (2021a) recommends a service life of 20 years for changing the vertical alignment (p. 39).

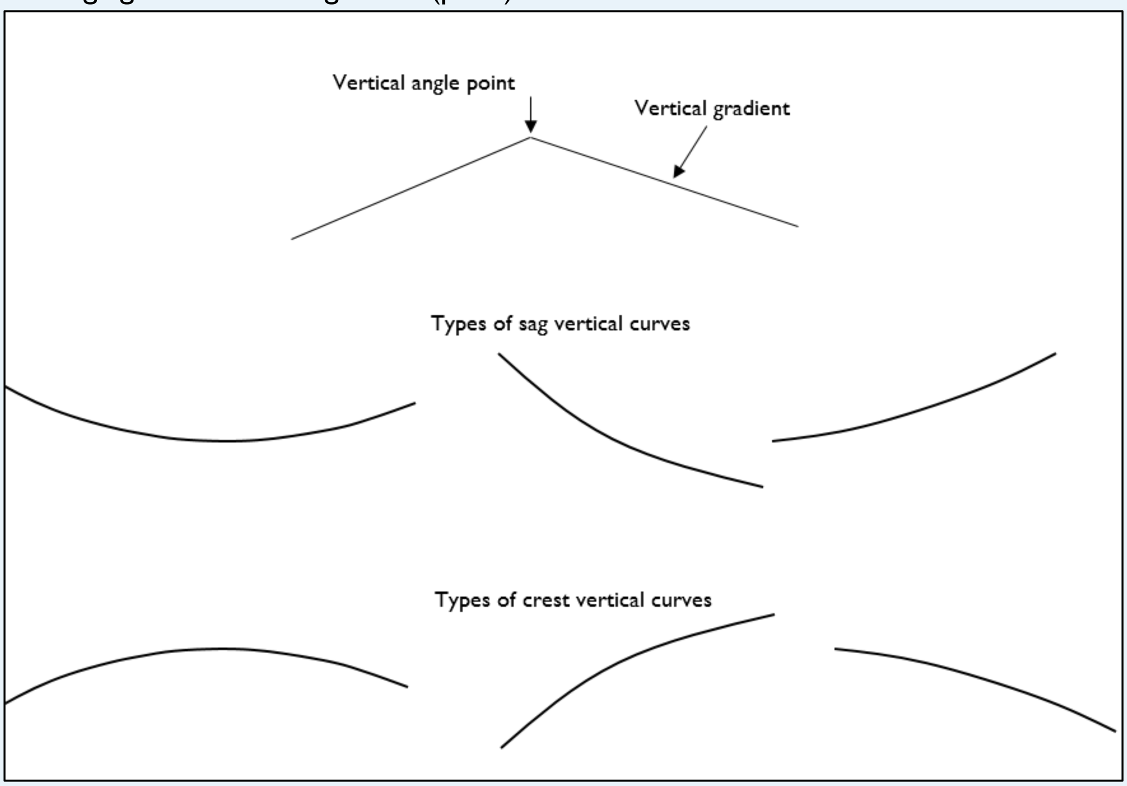

Figure 98. Graphic. Illustration of types of vertical curve features.

[31] A vertical angle point is the joining of two vertical gradients without a vertical curve; this should be the default value unless a curve is present.

[32] A sag vertical curve is a vertical curve that connects a segment of roadway with a segment of roadway that has a more positive grade.

[33] A crest vertical curve is a vertical curve that connects a segment of roadway with a segment of roadway that has a more negative grade.

Crosswalk with other Data Systems: • **FARS:** Roadway Grade[34] • **MMUCC (v6):** Roadway Grade[35]			
Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*.		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Partial Extent	Partial Extent	Partial Extent

[34] Not an exact match of attributes.

[35] Not an exact match of attributes.

200. Percent of Gradient

Description:	Percent of gradient.
Recommended Attributes:	1. Percent of gradient
Recommended Field Type:	Numeric

Remarks: Percent of gradient only applies to segments that represent a "2 (Vertical gradient)" (i.e., a consistent grade) for the *Vertical Alignment Feature Type* data element.

For safety analysis purposes, States can determine the average grade for study sites (e.g., horizontal curve or dynamically segmented tangent) in an ad-hoc manner (i.e., recalculated during each analysis based on study segment lengths). HPMS provides general guidance for collecting this data element, and the HSM generally uses the following categories as relevant thresholds for safety analysis (FHWA, 2016, p. 4-89):

- Less than or equal to three percent.
- More than three percent and less than or equal to six percent.
- Greater than six percent.

Crosswalk with other Data Systems:

- **HPMS:** Grade Classification[36]

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value does not equal *NULL* if *VERTICAL ALIGNMENT FEATURE TYPE* is equal to "2 (Vertical gradient)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

[36] Attribute is based on categories of percentages, whereas MIRE asks for the specific measure.

201. Grade Length

Description:	Grade length.		
Recommended Attributes:	1. Length of gradient (feet)		
Recommended Field Type:	Numeric		

Remarks: Length of segments that represent a "2 (Vertical gradient)" for the *Vertical Alignment Feature Type* data element. Other lengths for vertical alignment types should be reported by the *Vertical Curve Length* data element. This data element is independent of *Segment*-related data elements and dynamically segmented study sections.

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value does not equal *NULL* if *VERTICAL ALIGNMENT FEATURE TYPE* is equal to "2 (Vertical gradient)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

202. Vertical Curve Length

Description:	Vertical curve length.		
Recommended Attributes:	• Length of vertical curve (feet)		
Recommended Field Type:	Numeric		

Remarks: Data element applies if *Vertical Alignment Feature Type* is "3 (Sag vertical curve)" or "4 (Crest vertical curve)." This data element is independent of *Segment*-related data elements and dynamically segmented study sections.

Collection Cycle:	Long Term		
Level of Accuracy:	Moderate		
Validation Checks:	• Value does not equal *NULL*. • Value does not equal *NULL* if *VERTICAL ALIGNMENT FEATURE TYPE* is equal to "3 (Sag vertical curve)" or "4 (Crest vertical curve)".		
Collection Extent:	**Non-Local Paved**	**Local Paved**	**Unpaved**
	Full Extent	Full Extent	Full Extent

Data Sustainability

States having access to a complete set of MIRE FDEs is only the beginning. The MIRE FDEs are the minimum set of data elements necessary to support States in their safety analysis and project implementation programs (e.g., HSIP). Emerging trends and technologies will necessitate States adjust to changing conditions. Figure 99 illustrates the safety data life cycle in highway safety, as well as how MIRE data directly support DDSA and the subsequent roadway safety management process steps (countermeasure selection and evaluation). Data sustainability, including establishing and enforcing data standards, obtaining data through original collection, obtaining data through inter-agency sharing or data integration, and quality assurance and control procedures, are critical to supporting a robust and cost-effective safety program.

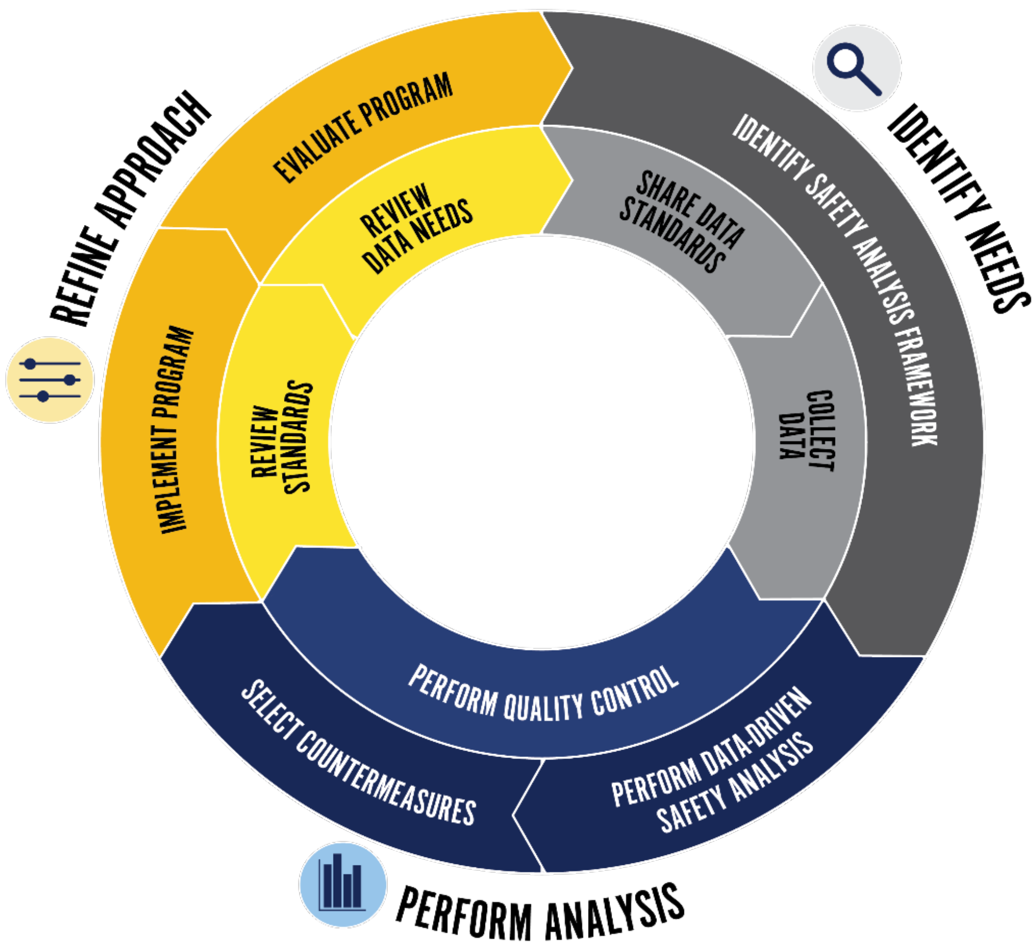

Figure 99. Graphic. Data life cycle in highway safety.

The purpose of this chapter is to provide a framework and resources for collecting and maintaining MIRE data inventories.

Sources of Change for MIRE

This document provides recommendations to portions of the network based on the *Functional Class* and *Surface Type* of the roadway. As a result, States will need to consider potential impacts to MIRE applicability resulting from:

- Changes to functional classifications due to road improvements, freeway conversions, or changes in DOT policies.
- Changes in surface type due to paving currently unpaved roads.
- Changes in surface type where previously paved roads are allowed to deteriorate to a point where they functionally become unpaved. Although MIRE requirements do not comment on whether a road in this situation is paved or unpaved, these roads could be considered unpaved if there is no plan to pave the road in the future.

A State's priorities might also change as a result of updates to Federal or State safety policies. For instance, an update to a State's SHSP may revise priority emphasis areas or the implementation of a local road safety program may emphasize MIRE data elements on locally owned roads.

MIRE is often a collaboration between several units within a DOT. For example, planning, traffic, HPMS, maintenance, and safety bureaus can all contribute data to existing inventories that support MIRE, as well as help prioritize data needs for safety-related initiatives. As States review their priorities and coordinate between groups, the following considerations can help guide States as they improve their safety data capabilities:

Example in Practice: Arizona DOT manages the State's roadway data supply chain through a series of tools that support requested changes to functional classification, promotes centerline uniformity across the State, and manages road ownership for all public roads.

- Creating methods for processing requests to change the functional classification of a road.
- Managing the process to obtain the latest centerline information from local agencies and integrate it with the statewide all roads basemap (i.e., ARNOLD) and LRS.
- Tracking changes in network surface condition, as well as plans to pave currently unpaved roads.
- Aligning with the State's planning priorities laid out in the SHSP and any HSIP implementation plan.
- Supporting a Safe System Approach that focuses on reducing speeds, reducing conflicts between road users, and protecting vulnerable road users.
- Selecting data collection methods that can be performed routinely and within the resources available to the agency.

Opportunities to Fund and Support Data Maintenance

States have several opportunities to fund data collection efforts that can support MIRE, as well as use policies to help make safety data a priority for all stakeholders:

- **HSIP [23 U.S.C. 148(b)(xiv)], Section 405 [23 U.S.C. 405(c)], and State Planning and Research (SP&R) [23 U.S.C. 505]** funds are all potential Federal funding sources for safety data collection and the systems that analyze these data. SP&R funds are further divided into Subpart A (planning and research-related activities) and Subpart B (research and technology transfer). Furthermore, activities conducted through these funds can also help States prioritize data element needs beyond the MIRE FDEs.

- **Several Federal discretionary grants** implemented through BIL are available to State DOTs, as well as Tribal agencies, MPOs, and other political subdivisions within a State. MIRE data directly supports these safety planning initiatives, and safety data collection can become a component of non-construction and construction grants.

- **Local road safety plan** support can be an incentivizing factor for agencies to collect and maintain MIRE FDEs and associated safety data. Furthermore, the planning process between State and local agencies can help facilitate data exchanges between various levels of public transportation agencies. For example, States can require local data in exchange for technical support and funding (i.e., the State will not fund projects on roads that are not in the official State basemap), while local agencies can receive data and tool support in return for participation in State initiatives.

- **Data governance** within a State DOT, between agencies within a State government, and between a State government and local or Tribal agencies can be an effective tool for managing and maintaining data over time. Key drivers for data governance with respect to MIRE-related data include:
  - Provide a single source of truth for reporting.
  - Ensure data accuracy and completeness.
  - Improve data quality and consistency.
  - Facilitate data sharing across departments and agencies.
  - Reduce risk and increase compliance.
  - Enhance decision-making capabilities.
  - Improve operational efficiency.
  - Increase customer satisfaction.
  - Increase transparency and accountability.

Furthermore, formal data governance programs can help distribute knowledge of safety and safety data-related activities. Coordination between bureaus, such as planning, traffic, HPMS, maintenance, and safety, can make data more accessible to safety analysts and reduce duplication of collection efforts by increasing awareness of available data and formally documenting a single source of truth. As a result, data governance can support State and local agencies as they manage change, such as when they experience staff turnover or encounter changes in policies and technologies.

Additional Resources

FHWA has developed many resources to help agencies better understand and use MIRE. FHWA maintains a "Roadway Safety Data and Analysis Toolbox" as a searchable, centralized source of information about safety data and analysis tools and resources. This also includes a host of case studies dedicated to practical uses of safety data. Table 5 provides a list of these resources.

Table 5. MIRE-related resources.

Resource	Description
MIRE Version 2.0 Report	Provides a list of MIRE Version 2.0 recommended elements and attitudes.
HSM 1st Edition	Leading Guidance document for incorporating quantitative safety analysis in the highway transportation project planning and development processes.
MIRE Data Collection Guidebook	Builds upon MIRE 1.0 and discusses methods of collecting the MIRE elements and potential limitations of those methods.
MIRE Element Collection Mechanisms and Gap Analysis	Presents the findings of an effort to 1) explore existing and emerging data collection technologies, and 2) to narrow the gaps between the elements in the MIRE listing and the current data available from transportation agencies' inventories and supplemental databases.
MIRE Management Information System Lead Agency Data Collection Report	Presents the findings from an effort to assist two States to expand their roadway inventory data collection to include MIRE intersection data elements. Documents two different methods of data extraction used by the two pilot States.
The Exploration of the Application of Collective Information to Transportation Data for Safety White Paper	Explores the technique of collective information as a means of gathering data needed for transportation safety.
Development of a Structure for a MIRE Management Information System	Presents a conceptual model that identifies the business functions a State is likely to need from a safety management system.
Performance Measures for Roadway Inventory Data	Builds on National Highway Traffic Safety Administration (NHTSA) defined performance measures for timeliness, accuracy, completeness, uniformity, integration, and accessibility. Provides a detailed review of each of the measures proposed for roadway data and suggests modifications of and possible additions to that original list.
Priorities in Roadway Safety Data Guide	Provides safety engineers and analysts with information about data needs in planning, programming, and developing projects under all highway programs.

Resource	Description
Roadway Safety Data Program (RSDP) MIRE Webpage	Provides a list of MIRE-related resources, including reports of MIRE MIS efforts and safety management tools.
RSDP Toolbox	Contains resources to help agencies build a new or strengthen an existing roadway safety data program, including manage, analyze, collect, and research.
Safety Data Case Studies	Case studies of State and local agencies around roadway safety data collection, management, and analysis issues.
Roadway Safety Noteworthy Practices	Examples of how State and local agencies are implementing data-driven practices to successfully address roadway safety planning, implementation, and evaluation challenges.
MIRE and MIRE FDE Technical Assistance Report	Provides a summary of the technical assistance, support, and resources for improving MIRE and MIRE FDE collection and maintenance as part of the MIRE FDE Technical Assistance Program. Additionally, the program served as a platform for developing a MIRE FDE alignment database.
2016 HPMS Field Manual	Provides a comprehensive overview of the HPMS program and describes in detail the data collection and reporting requirements for HPMS. This manual includes detailed information on technical procedures, a glossary of terms, and various tables to be used as reference by those collecting and reporting HPMS data.
MMUCC Guideline: 6th Edition	Provides the technical details of the MMUCC 6th Edition data elements. This is the result of a collaboration between NHTSA, FHWA, the Federal Motor Carrier Safety Administration (FMCSA), the National Transportation Safety Board (NTSB), the Governors Highway Safety Association (GHSA), and subject matter experts from State DOTs, local law enforcement, emergency medical services, safety organizations, industry partners, and academia.
FARS/CRSS Coding and Validation Manual	Provides guidance for crash coders with respect to two NHTSA crash data systems: the 1) Fatality Analysis Reporting System (FARS) and the 2) Crash Report Sampling System (CRSS).

Resource	Description
Fatality Analysis Reporting System Analytical User's Manual	Provides documentation for crash analysts on the historical coding practices of FARS from 1975 to 2022.
AEGIST Guidebook	Provides guidance for FHWA and States to migrate to the enterprise level for creating, maintaining, and governing data related to roadways and their characteristics, elements, and events.

Case Studies

The purpose of MIRE is to support safety analysis. These data elements have practical applicability to implementing the HSM, including the roadway safety management process and predictive methods, screening State and local road networks for risk factors, and supporting a Safe System Approach. While MIRE provides a robust framework, States can tailor their approach to collect and translate safety data into safety improvements. The following case studies provide examples where States have used MIRE data to effectively prioritize safety data and applied that data to improve their agency's safety analysis capabilities.

Florida

Background

The Florida Department of Transportation (FDOT)'s safety data program is an example of how coordinated data collection can be used to support HSM implementation. The State's data governance program helps support an array of data collection and analysis activities for the roadway safety management process and collection of the MIRE FDEs (FHWA, 2022b; 2022c). FDOT's program illustrates how innovative approaches to data collection and a focus on supporting safety analysis can effectively improve a State's safety program.

Setting Priorities: Data-Driven Determinants

FDOT's STRIDES 2 Zero (S2Z) program and the System Analysis and Forecast Evaluation (SAFE) subprogram reprioritized FDOT's roadway safety evaluations, shifting from a "hot spot" approach to predictive methods that align with HSM recommendations. FDOT's initial phase for the SAFE program emphasized signalized intersections, categorizing them based on factors such as land use context, number of legs, intersection type (both at-grade and ramp terminals), and presence of traffic control devices – MIRE-related data elements. The State collected data to develop and apply safety performance functions (SPFs) for signalized intersections and roadway segments; these predictive methods compare sites with similar characteristics and identify locations with a safety concern based on predicted, expected, and excess expected crashes. The SAFE program later expanded to arterial roadway segments on the State Highway System, which involved the collection of MIRE FDEs for roadway segments, as well as the development and application of SPFs for network screening.

With SAFE's data-centric strategy, FDOT can now pinpoint high-crash and high-risk areas and deploy effective safety measures. This data-driven emphasis is evident in the Safety Performance Measures dashboard, reflecting FDOT's commitment to transparent safety metrics. As FDOT looks to 2025, the objective remains a unified, centralized safety data system, ensuring that project funds are directed by a uniform, compliant methodology.

Data Collection: An Extensive Framework

FDOT's experience provides several insights in safety data collection and analysis:

- **Collaborations:** FDOT has expanded its data reach through collaborations with internal teams, local agencies, educational institutions, and third-party tech entities. This is supported by FDOT's formal data governance program.
- **Machine Learning and Imagery:** FDOT utilizes high-resolution aerial imagery, refreshed triennially. FDOT partnered with a university in 2022 to employ machine learning and detect crosswalks and pavement markings. This effort, beginning with a pilot in Orange County, Florida, aimed to cater to MIRE data needs at intersections.
- **Traffic Insights:** FDOT plans to collect traffic data for all roads, which includes 125,000 centerline miles. FDOT has a multi-approach strategy to obtain these data, including cooperation with local agencies (e.g., counties, cities, and MPOs) and application of probe and connected vehicle data to identify local road traffic volumes at intersections with State roads.
- **Data Update Cycles:** FDOT emphasizes timely data updates. While certain data categories have longer update intervals, crucial ones like traffic volumes undergo annual revisions. HSM Part B methods inform their approach to prioritizing data collection and aggregation, including obtaining relevant data from construction records. This effort not only streamlines data for safety analysis but also improves data update cycles for programs like HPMS.
- **Application in Practice:** The Traffic Engineering and Operations Office's SAFE S2Z program prioritized data collection for roadway entities to match the State's analysis needs. This began with data collection at signalized intersections, and the approach has expanded to segment-based applications.

Challenges and Mitigations

FDOT's roadmap wasn't without hurdles. Data governance and agency decentralization emerged as significant challenges. To address these, FDOT:

- Instituted a rigorous data governance protocol, encompassing a Data Governance Executive Team, Enterprise Data Stewards, Data Stewards, and Data Custodians for each business area, to promote data management through its life cycle, improve data reliability, ensure data accuracy, and simplify data sharing.
- Actively involved district staff in data processes, aligning decentralized components with a unified data collection and analysis strategy.

Conclusion

FDOT's methodical approach to MIRE data collection, combined with a structured safety analysis, underscores the State's commitment to enhancing road safety. This comprehensive process, from

MIRE data acquisition to insightful analysis and subsequent actionable strategies, offers valuable insights for other States aiming for data-driven safety improvements enabled through MIRE data collection.

Michigan and Kansas

Background

Roadway surface maintenance is a critical part of the transportation planning and analysis process. Inventories of pavement coverage by type and publicly maintained unpaved roads are essential to plan maintenance needs and allocate resources to keep the system in good order. However, many States lack accurate inventories of their paved and unpaved public road network; this distinction between paved and unpaved roads is also essential to the applicability of MIRE FDEs (table 1, table 2, and table 3). To address these issues, some States have applied machine learning techniques and image classification. Many of these approaches use open-source components, which can allow the broad adoption of these techniques nationwide.

Michigan's Experience

The Michigan Department of Transportation (MDOT), in collaboration with a university partner, initially developed a classification system for unpaved roads, leveraging remote sensing from aerial imagery in 2017. Their earlier approach employed machine learning to identify unpaved roads in local county road networks, specifically making use of high spatial resolution four-band imagery. These data were segmented and loaded into a specialized software application, configuring the study region with a 9.1-meter buffer sourced from county road centerline datasets. The research team applied a multi-step image classification method that aggregated spectrally similar areas into classifications, and segments were organized through a decision tree classifier into one of five categories; this allowed the research team to detect and separate unpaved roads from other surface types and locate them in GIS.

Building on the success of this methodology, the State advanced the techniques in a follow-up to the 2017 study. The research team continued to apply high-resolution 4-band aerial imagery in conjunction with the surface type attributes within the State's public road basemap. This refined process included the creation of training data polygons labeled by surface type for each county. The research team conducted ground-truth sampling field work to collect validated data for model training and testing. The research team developed a pixel classifier model to identify unpaved road surfaces and applied a purpose-built algorithm for more accurate outputs. The updated methods have been applied to 24 counties in Michigan, expanding to 59 more counties in 2024.

Kansas' Experience

Another case of machine learning applied to enhance pavement type classification in road inventories involves the Kansas Department of Transportation (KDOT). KDOT worked with the FHWA to pilot a methodology that could classify roads as paved or unpaved. The research applied a machine learning model using open-source python-based tools and observations every 250 ft along roads with a verified pavement type classification. The resulting model produced 89.1-percent accuracy of classification with just a Support Vector Model (SVM). The studies accuracy increased to 95.4 percent when the team applied a Bayes Theorem probability to the SVM.

Conclusion

The Michigan model created an automated classification system which can help organizations keep an updated road network with the collection of new aerial imagery. Michigan plans to classify unpaved roads for each county in the State, as well as detect changes to the surface of the road network over time. The Kansas model illustrates how these approaches can be applied using open-source tools with a high degree of accuracy. Future efforts could potentially derive more detailed surface type information, such as the detailed characteristics in the *Surface Type* data element.

Minnesota

Background

Minnesota has implemented a data-driven approach for its road safety measures, building on the framework of its Strategic Highway Safety Plan (SHSP). Local road safety plans (LRSP) have been instrumental for local agencies to receive HSIP funds and emphasize detailed safety countermeasures tailored to specific local needs. All 8 of the Minnesota Department of Transportation's (MnDOT's) Districts and all 87 counties in the State develop these plans. Central to this strategy is the use of traffic volume data, AADT, which is integral to State funding decisions.

Traffic Data Collection and Application

The Office of State Aid plays an indispensable role in this data ecosystem, supporting the periodic collection, analysis, and application of traffic data to enhance the State's performance monitoring, as well as to support safety. The Office of State Aid, in close collaboration with key personnel at local entities, emphasizes the importance of AADT as a metric that influences State funding decisions. This includes an established 4-year cycle goal to collect traffic data for non-MnDOT roads that also draw funding from the State.

MnDOT's data collection standards are rooted in guidance from HPMS and the TMG. The collaboration between MnDOT Central Office and local Districts fosters an environment where data are processed efficiently. Despite centralized guidelines that dictate how data are collected throughout the State, MnDOT operates with flexibility, accepting data from all sources provided it aligns with their format, whether it be collected by DOT staff, city/county/MPO staff or consultants. MnDOT Central Office staff maintain a common and accessible counting station location dataset and coordinates counting responsibility across all parties contributing data. MnDOT District Traffic Offices work with local agencies in coordinating potential counting needs.

Other potential future efforts include revising historical sampling methods on non-MnDOT and non-State Aid roads, which are based on default values from three decades ago, with newer, more accurate counts. This effort is contingent on future funding becoming available. MnDOT is also planning to form deeper relationships with regional planning agencies and propose cost sharing mechanisms with the DOT. Furthermore, data collected by different business units within MnDOT can all be used to support traffic monitoring and safety, such as volumes MnDOT Central Office staff harvest from the ramp and loop sensors maintained by MnDOTs Operations division. This flexible approach has allowed MnDOT to access reliable traffic data for a majority of paved public roads in the State.

Supporting Vulnerable Road User Safety

MnDOT's Office of Transit and Active Transportation (OTAT) is helping the State improve its analysis capabilities with respect to bicyclists, pedestrians, and other VRUs. OTAT is planning to set up a network of pedestrian and bicycle counts to support traditional traffic counts and analysis. These data will be supported by statistical modeling that could potentially provide non-motorist volume estimates where counts are unavailable in the State.

Supporting Safety

Minnesota's LRSPs are devised with specific objectives: to prioritize safety projects by route and location, to analyze crash data, to foster project development through stakeholder consensus, and to provide traffic safety education to stakeholders. This involves coordination among the 4 E's: Engineering, Education, Enforcement, and Emergency services, and the planning effort considers all modes of transportation. Minnesota's robust collection of MIRE data supports statewide safety planning, including identification of crash trends and systematic application of safety countermeasures on State and local roads.

Nevada

Background

The foundation of effective transportation data collection and management lies in accurate and timely asset data extraction. For the Nevada Department of Transportation (NDOT), this meant extracting and processing complex statewide asset, imaging, and positional data from several sources. Although traditional methods such as LiDAR and image data collection vehicles operated by NDOT provide high quality data, they also proved to be costly and require significant staff time. Conventional methods were not only cost-intensive, but they also lacked scalability essential to achieve NDOT's goals for coverage across the State's entire road network. This case study highlights NDOT's process to develop an efficient, accurate, and scalable solution to support its safety data program.

Process

Incorporating LiDAR and Imagery Technology

A notable advancement was the integration of vehicles that captured both LiDAR and street-level imagery. LiDAR is a remote sensing method that uses light in the form of a pulsed laser to measure distances to objects. NDOT both owned and operated this vehicle fleet with technical assistance provided through a third-party contractor. These vehicles boasted:

- Dual LiDAR heads, offering a capture rate of over 1.4 million data points per second with an accuracy level of +/- 2cm for up to 100+ meters.
- Strategically positioned dual cameras to optimize data capture.
- Advanced GPS and GNSS to ensure location accuracy.
- An efficient data capture framework, complemented by post-processing measures to further enhance data accuracy.
- Ability to capture data at up to 70 MPH.

NDOT uses these vehicles to methodically cover State-maintained and functionally classified local roadways in a 3-year cycle.

Strategic Academic Collaboration and Leveraging Open-Source Machine Learning

Recognizing the value of academic expertise, NDOT forged a collaboration with a university partner. Central to this partnership was the university's expertise in roadside LiDAR data collection and analysis. This extensive experience, combined with close collaborative ties with local transportation agencies, provided a unique blend of theoretical and practical expertise to NDOT's MIRE data collection efforts.

This partnership led NDOT to explore machine learning solutions through image processing. NDOT employed the You Only Look Once (YOLO) package, an open-source, real-time object detection mechanism. YOLO excels at the ability to efficiently detect over 9,000 object categories. Specifically, YOLO processes 155 frames per second while still achieving double the Mean Average Precision (mAP) of other real-time detectors. By harnessing the capabilities of YOLO and training it on diverse open-source datasets, NDOT achieved remarkable efficiency in detecting vital assets ranging from sign inventories and traffic control devices to intersection geometries.

Supporting Safety

Between mobile data collection and image classification through machine learning, Nevada was strategically positioned to support numerous safety-related initiatives:

- Establishment of a comprehensive MUTCD sign database.
- Leveraging LiDAR to unveil key safety elements, including stopping sight distances and signs.

- Systematic detection of midblock pedestrian crossings through aerial mapping.
- Detailed pedestrian crosswalk mapping, identifying over 11,000 crosswalks.

Conclusion

Nevada's strategy underscores the importance of leveraging technology and expertise in transportation data collection and management. By partnering with academic institutions, embracing emerging technologies and integrating open-source machine learning systems like YOLO, NDOT was able to address its immediate data challenges and lay a foundation for expanding the agency's capabilities with its existing resources. NDOT's approach is a practical framework for other transportation agencies aiming to streamline their asset management processes for collecting MIRE FDEs.

North Carolina

Background

The North Carolina Department of Transportation's (NCDOT's) Traffic Safety Unit (TSU) needed an intersection inventory for all public roads in the State to support a suite of safety analysis needs:

- Average crash rates based on intersection attributes.
- Predictive SPFs based on intersection attributes.
- Enhanced ability to apply systemic safety treatments.
- Project evaluations, including creating peer groups and cross-sectional studies.
- Provide insights into where various types of intersections, such as roundabouts, are located throughout the State – a previously unattainable capability.
- Support more advanced network screening to identify potentially hazardous locations.
- Support research projects that use North Carolina intersection data.

This case study focuses on the State's process to develop an intersection inventory, as well as the use cases that the State has supported with it.

Process

To create this inventory, the State ran an initial review using GIS and estimated that there were over 400,000 road-to-road intersections, as well as over 20,000 road-to-rail and road-to-greenway intersections (i.e., midblock crossings). Collecting MIRE FDEs for these sites using manual street view reviews would take substantial effort and staff resources. In response, the NCDOT automated that process with simple Python scripts using the State's existing roadway characteristics GIS data and LRS. First, the State determined that intersections were a confluence of routes; this allowed the State to use

Route IDs as the mechanism for identifying intersections, rather than geospatial location. This approach reduced their dependence on GIS-based proximity and positioning for two reasons: 1) the digital data can sometimes be inaccurate, and 2) such data may not always capture the real-world operational dynamics of the intersection.

To accommodate complex intersection geometries, as well as intersections with more than one conflict (e.g., quadrant or reduced conflict intersections), the State applied a multi-level reporting structure. This included:

- **Nodes**, or the simplest point that represents the intersection of two or more centerlines.
- **Intersections**, or the point or combination of points that represent a single functional intersection or conflict point between road users.
- **Intersection Groups**, or two or more intersections that have dependent traffic operations that could be analyzed as separate intersections or as one system (i.e., quadrant intersections).

TSU also applied existing datasets to refine the State's existing roadway data. This included information on structures, railroad crossings, land parcels, and greenway databases, as well as specialized datasets for All-Way Stop Controlled intersections, roundabouts, and Reduced Conflict Intersections. Open-source roadway data also supported identification of major driveways that may not be included in a State's public road inventory.

Supporting Safety

With an initial version of the intersection inventory, the NCDOT was able to practically apply these MIRE elements in safety analysis. This included internal support for NCDOT division staff, as well as support for county and MPO agencies:

- Identified intersections with a high proportion of nighttime crashes for a suburban county.
- Provided intersections to a NCDOT Division with a high-level of skew for potential all-way stops.
- Screened intersections that met warrants for the frequency of bicycle and pedestrian crashes.
- Supported an MPO by developing a high injury network outside of the core city limits.
- Developed a dashboard of innovative intersection designs and their location around the State to demonstrate design work in the State that can be deployed elsewhere.

The State anticipates several future uses of the data, including identifying intersections with high proportion of angle cashes, determining crash performance at roundabouts, calculating crash rates at intersections by categories of traffic control, and identification of counties that have the highest and lowest usage of innovative intersection designs.

Conclusion

North Carolina's experience is an example of how States can derive meaningful insights from safety data while continuing to improve that data over time. NCDOT TSU completed the initial inventory in May 2023. Although this is just the first version of the inventory, it is still delivering practical results and the State will enhance the data elements over time. In the future, a framework for maintaining the inventory through the State's new crash database in development, the NC Crash Reporting Information System, could be developed.

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Appendix A: Overview of Commonly Used Collection Methods

The following descriptions provide an overview of various data collection methods mentioned in this guide that States can use to gather the essential information needed for safety management and analysis. Understanding these methods will enable States to select the most appropriate techniques for their specific needs, ultimately enhancing their ability to identify potential safety issues, evaluate countermeasures, and make informed decisions for roadway improvements.

Table 6 provides an overview of the common sources of data for States and the data collection methods typically associated with each source, and table 7 provides some general recommendations on methods relevant to each MIRE data element. By understanding the available options, States can make informed decisions on the most appropriate data collection methods and sources to use in their specific contexts.

Table 6. Collection methods by potential data source.

Data Source	Data Collection Method
Tribal, State DOT, or Other State Agencies	• Field surveys • Construction records • Other DOT records (e.g., financial) • Aerial imagery • Aerial LiDAR • Mobile street-level imagery • Mobile LiDAR • Traffic count • Travel demand model estimate • Other agency data (e.g., Data submitted to the NBI and HPMS) • Statistical estimates
Local Government Agencies	• Field surveys • Construction records • Aerial imagery • Mobile street-level imagery • Mobile LiDAR • Traffic counts • Travel demand model estimate • Other agency data (e.g., land use records, zoning ordinances and maps)
Federal Agencies	• Aerial imagery • Aerial LiDAR • Traffic count • Field surveys (e.g., Federal Lands or other subject matter experts) • Other agency data (e.g., Census or USGS data)
Private Business or Non-Governmental Agency	• Aerial imagery • Aerial LiDAR • Mobile street-level imagery • Mobile LiDAR • Probe/connected vehicle data
Universities and Research Institutions	• Statistical models/estimation
Public and Community Input	• Field surveys (e.g., Road Safety Audits) • Community input maps

Table 7. Collection methods for data elements.

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Route Number	--	--	--	--	--
Route/Street Name	--	--	--	--	--
Begin Point Segment Descriptor	--	--	--	--	Derive from LRS
End Point Segment Descriptor	--	--	--	--	Derive from LRS
Type of Governmental Ownership	--	--	--	--	--
Segment Identifier	--	--	--	--	--
Segment Length	--	--	--	--	Derive from LRS
Direction of Inventory	--	--	--	--	Derive from LRS
Functional Class	--	--	--	--	--
Rural/Urban Designation	--	--	--	--	--
Federal-Aid	--	--	--	--	--
Route Type	--	--	--	--	--
Access Control	Imagery	--	Construction Records	--	--
Surface Type	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Number of Through Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Annual Average Daily Traffic (AADT)	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
AADT Year	--	--	--	--	Record date & time; Statistical Estimates
One/Two-Way Operations	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Sign/Signal Inventories	--	--
County Name	--	--	--	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
County Code	--	--	--	--	--
Highway District	--	--	--	--	--
Specific Governmental Ownership	--	--	--	--	--
City/Local Jurisdiction Name	--	--	--	--	--
City/Local Jurisdiction Urban Code	--	--	--	--	--
Route Signing	--	--	--	--	--
Route Signing Qualifier	--	--	--	--	--
Coinciding Route Indicator	--	--	--	--	--
Coinciding Route Indicator – Minor Route Information	--	--	--	--	--
Total Paved Surface Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Surface Friction	--	Field Survey; Mobile Street Level Imagery	--	--	Statistical Estimates
Surface Friction Date	--	--	--	--	Record date & time
International Roughness Index	--	Field Survey; Mobile Street Level Imagery	--	--	--
International Roughness Index Date	--	--	--	--	Record date & time
Pavement Condition (Present Serviceability Rating)	--	Field Survey; Mobile Street Level Imagery	--	--	--
Pavement Condition (PSR) Date	--	--	--	--	Record date & time
Outside Through Lane Width	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Inside Through Lane Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Cross Slope	--	Field Survey; Mobile LiDAR	Construction Records	--	--
Auxiliary Lane Presence/Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Auxiliary Lane Length	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Managed Lane Operations Type	--	Field Survey	Construction Records	--	--
Managed Lanes	--	Field Survey	Construction Records	--	--
Reversible Lanes	--	Field Survey	Construction Records	--	--
Presence/Type of Bicycle Facility	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Width of Bicycle Facility	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Number of Peak Period Through Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Right Shoulder Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Right Shoulder Total Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Right Paved Shoulder Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Right Shoulder Rumble Strip Presence/Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Left Shoulder Type	Imagery; LiDAR	Field Survey; Mobile LiDAR;	Construction Records	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
		Mobile Street Level Imagery			
Left Shoulder Total Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Left Paved Shoulder Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Left Shoulder Rumble Strip Presence/Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Sidewalk Presence	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Curb Presence	--	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Curb Type	--	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median Barrier Presence/Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median (Inner) Paved Shoulder Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median Shoulder Rumble Strip Presence/Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median Sideslope	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--
Median Sideslope Width	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Median Crossover/Left-Turn Lane Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Roadside Clear zone Width	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Right Sideslope	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--
Right Sideslope Width	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--
Left Sideslope	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--
Left Sideslope Width	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--
Roadside Rating	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	--	--	--
Tapered Edge	--	Field Survey; Mobile LiDAR	Construction Records	--	--
Major Commercial Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--
Minor Commercial Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--
Major Residential Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--
Minor Residential Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--
Major Industrial/Institutional Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--
Minor Industrial/Institutional Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--
Other Driveway Count	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Terrain Type	LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
AADT Annual Escalation Percentage	--	--	--	--	Statistical Estimates
Percent Single Unit Trucks or Single Truck AADT	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Percent Combination Trucks or Combination Truck AADT	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Percentage Trucks or Truck AADT	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Total Daily Two-Way Pedestrian Count/Exposure	--	Field Survey	Traffic Count	Probe or connected vehicle	Statistical Estimates
Bicycle Count/Exposure	--	Field Survey	Traffic Count	Probe or connected vehicle	Statistical Estimates
Motorcycle Count or Percentage	--	Field Survey	Traffic Count	Probe or connected vehicle	Statistical Estimates
Hourly Traffic Volumes (or Peak and Off peak AADT)	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
K-Factor	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Peak Hour Directional Factor	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Speed Limit	--	Field Survey; Mobile Street Level Imagery	Construction Records	--	Statutory or regulatory defaults
Truck Speed Limit	--	Field Survey; Mobile Street Level Imagery	Construction Records	--	Statutory or regulatory defaults
Nighttime Speed Limit	--	Field Survey; Mobile Street Level Imagery	Construction Records	--	Statutory or regulatory defaults
85th Percentile Speed	--	Field Survey	--	Probe or connected vehicle	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Mean Speed	--	Field Survey	--	Probe or connected vehicle	--
School Zone Indicator	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code; School Board Inventories	--	--
On-Street Parking Presence	Imagery	Field Survey; Mobile Street Level Imagery	--	--	--
On-Street Parking Type	Imagery	Field Survey; Mobile Street Level Imagery	--	--	--
Roadway Lighting	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records; Utility Providers	--	--
Toll Charged	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Toll Type	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Edgeline Presence/Width	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Centerline Presence/Width	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Centerline Rumble Strip Presence/Type	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Passing Zone Percentage	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Bridge Numbers for Bridges in Segment	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records; NBI Records	--	--
Unique Junction Identifier	--	--	--	--	--
Location Identifier for Road 1 Crossing Point	--	--	--	--	Derive from LRS
Location Identifier for Road 2 Crossing Point	--	--	--	--	Derive from LRS

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Intersection/Junction Geometry	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	Derive from LRS
Intersection/Junction Traffic Control	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records/Local Databases; Sign/Signal Inventories	--	--
Type of Intersection/Junction	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Greenway/Trail Records; Railroad Crossing Inventory (e.g., FRA)	--	--
Location Identifier for Additional Road Crossing Points	--	--	--	--	Derive from LRS
Intersection/Junction Number of Legs	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records/Local Databases	--	Derive from LRS
School Zone Indicator	Imagery	Field Survey; Mobile Street Level Imagery	Parcel Data; Zoning Code; School Board Inventories	--	--
Railroad Crossing Number	--	--	Railroad Crossing Inventory (e.g., FRA)	--	--
Intersecting Angle	Imagery	Field Survey	--	--	Derive from LRS
Intersection/Junction Offset Distance	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Signalization Presence/Type	--	Field Survey; Mobile Street Level Imagery	Construction Records; Signal Plans	--	--
Intersection/Junction Lighting	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records; Utility Providers	--	--
Circular Intersection - Number of Circulatory Lanes	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection - Circulatory Lane Width	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Circular Intersection - Inscribed Diameter	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection - Bicycle Facility	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Unique Approach Identifier	--	--	--	--	--
Intersection Identifier for this Approach	--	--	--	--	--
Approach AADT	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Approach AADT Year	--	--	--	--	Record date & time; Statistical Estimates
Approach Mode	Imagery	Field Survey; Mobile Street Level Imagery	Greenway/Trail Records; Railroad Crossing Inventory (e.g., FRA)	--	--
Approach Directional Flow	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Sign/Signal Inventories	--	--
Number of Approach Through Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Left-Turn Lane Type	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Number of Exclusive Left-Turn Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Amount of Left-Turn Lane Offset	Imagery; LiDAR	Field Survey	Construction Records	--	--
Right-Turn Channelization	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Traffic Control of Exclusive Right-Turn Lanes	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Sign/Signal Inventories; Signal Plans	--	--
Number of Exclusive Right-Turn Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Length of Exclusive Left-Turn Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Length of Exclusive Right-Turn Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Median Type at Intersection	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Approach Traffic Control	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Sign/Signal Inventories; Signal Plans	--	--
Approach Left-turn Protection	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Signal Plans	--	--
Signal Progression	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records; Signal Plans	--	--
Crosswalk Presence/Type	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Pedestrian Signal Activation Type	--	Field Survey; Mobile Street Level Imagery	Construction Records; Signal Plans	--	--
Pedestrian Signal Presence/Type	--	Field Survey; Mobile Street Level Imagery	Construction Records; Signal Plans	--	--
Crossing Pedestrian Count/Exposure	--	Field Counts; Mobile LiDAR, Terrestrial Imagery	Traffic Counts	--	Statistical Estimates (based on Parcel Data, Zoning Code, or other community-level data)

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Left/Right-Turn Prohibitions	--	Field Survey; Mobile Street Level Imagery	Construction Records; Sign/Signal Inventories	--	--
Right-Turn-On-Red Prohibitions	--	Field Survey; Mobile Street Level Imagery	Construction Records; Sign/Signal Inventories	--	--
Left-turn Counts/Percent	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Year of Left-turn Counts/Percent	--	--	--	--	Record date & time; Statistical Estimates
Right-Turn Counts/Percent	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Year of Right-Turn Counts/Percent	--	--	--	--	Record date & time; Statistical Estimates
Transverse Rumble Strip Presence	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Entry Width	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Number of Entry Lanes	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Presence/Type of Exclusive Right-Turn Lane	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Entry Radius	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Exit Width	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Number of Exit Lanes	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Exit Radius	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Circular Intersection – Pedestrian Facility	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Crosswalk Location	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Circular Intersection – Island Width	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Unique Interchange Identifier	--	--	--	--	--
Interchange Type	Imagery	--	Construction Records	--	--
Ramp Length	Imagery	--	--	--	Derive from LRS
Ramp AADT	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Year of Ramp AADT	--	--	--	--	Record date & time; Statistical Estimates
Roadway Type at Beginning Ramp Terminal	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Location Identifier for Roadway at Beginning Ramp Terminal	--	--	--	--	Derive from LRS
Roadway Type at Ending Ramp Terminal	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Location Identifier for Roadway at Ending Ramp Terminal	--	--	--	--	Derive from LRS
Interchange Location Identifier for Road 1 Crossing Point	--	--	--	--	Derive from LRS
Interchange Location Identifier for Road 2 Crossing Point	--	--	--	--	Derive from LRS
Interchange Location Identifier for Additional Road Crossing Points	--	--	--	--	Derive from LRS

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Interchange Lighting	Imagery; LiDAR	Field Survey; Mobile Street Level Imagery	Construction Records; Utility Providers	--	--
Interchange Entering Volume	--	--	Traffic Count	Probe or connected vehicle	Statistical Estimates
Interchange Identifier for this Ramp	--	--	--	--	--
Unique Ramp Identifier	--	--	--	--	--
Ramp Acceleration Lane Length	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Ramp Deceleration Lane Length	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Ramp Number of Lanes	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Ramp Metering	Imagery; LiDAR	Field Survey; Mobile LiDAR; Mobile Street Level Imagery	Construction Records	--	--
Ramp Advisory Speed Limit	--	Field Survey; Mobile Street Level Imagery	Construction Records	--	Statutory or regulatory defaults
Roadway Feature at Beginning Ramp Terminal	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Location of Beginning Ramp Terminal Relative to Mainline Flow	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	Derive from LRS
Roadway Feature at Ending Ramp Terminal	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	--
Location of Ending Ramp Terminal Relative to Mainline Flow	Imagery	Field Survey; Mobile Street Level Imagery	Construction Records	--	Derive from LRS
Curve Identifiers	--	--	--	--	--

Data Element	Aerial	Terrestrial	Database Records	Vehicle Data	Statistical, Regulatory, and Miscellaneous
Curve Feature Type	Imagery	Field Survey	Construction Records	--	Derive from LRS
Horizontal Curve Degree or Radius	--	Field Survey;	Construction Records	--	Derive from LRS
Horizontal Curve Length	--	Field Survey	Construction Records	--	Derive from LRS
Curve Superelevation	LiDAR	Field Survey; Mobile LiDAR	Construction Records	--	--
Horizontal Transition/Spiral Curve Presence	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	--
Horizontal Curve Intersection/Deflection Angle	Imagery	Field Survey; Mobile LiDAR	Construction Records	--	Derive from LRS
Horizontal Curve Direction	--	--	--	--	Derive from LRS
Grade Identifiers and Linkage Elements	--	--	--	--	--
Vertical Alignment Feature Type	LiDAR	--	Construction Records	--	Derive from Existing Digital Terrain Models
Percent of Gradient	Imagery; LiDAR	--	Construction Records	--	Derive from Existing Digital Terrain Models
Grade Length	--	--	Construction Records	--	Derive from LRS
Vertical Curve Length	--	--	Construction Records	--	Derive from LRS

Appendix B: MIRE Changes Over Time

Table 8. Changes over time – segments.

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Route Number	8	8	1	ID changed in MIRE 2.1
Route/Street Name	9	9	2	ID changed in MIRE 2.1
Begin Point Segment Descriptor	10	10	3	ID changed in MIRE 2.1 Attribute changed in MIRE 2.1 to "Begin point defined by the user agency."
End Point Segment Descriptor	11	11	4	Attribute in MIRE 2.0 changed to "End point will be defined by the user agency. Generally, this will be based on homogeneity of chosen attributes throughout the segment). End point segment descriptors can be either linked to a Linear Reference System (e.g., Route-beginning milepoint, Route-ending milepoint) or to a spatial data system (i.e., longitude/latitude for begin and end points). Street address could also possibly be used for urban areas. The descriptor types used must be common across all MIRE files and compatible with crash data location coding." ID changed in MIRE 2.1 Attribute changed in MIRE 2.1 to "End Point defined by the user agency"
Type of Governmental Ownership	4	4	5	ID changed in MIRE 2.1 Recommended numerical codes changed in MIRE 2.1
Segment Identifier	12	12	6	ID changed in MIRE 2.1
Segment length	13	13	7	ID changed in MIRE 2.1
Direction of Inventory	18	18	8	Attributes in MIRE 2.0 changed to "Predominate compass direction (e.g. North, South, East, West) – if roads are inventoried in each direction usually due to different characteristics on each roadway" and " Both – if inventoried in only one direction (e.g. the inventory applies to both directions of a single-carriageway roadway)" ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				"Predominate compass direction (e.g. North, South, East, West)" and "both" attributes changed to "Predominate compass direction of travel (e.g., North, South, East, West)" and "Both directions of travel" in MIRE 2.1
Functional Class	19	19	9	ID changed in MIRE 2.1
Rural/Urban Designation	20	20	10	ID changed in MIRE 2.1 "Urban (population > 5,000)" attribute changed to "Urban" in MIRE 2.1
Federal Aid	21	21	11	ID changed in MIRE 2.1 Description changed to "Indicator that the route is eligible for the Federal-aid Highway Program" in MIRE 2.1
Route Type	-	22	12	Added in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "National Highway System (NHS) route type" in MIRE 2.1
Access Control	22	23	13	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Surface Type	23	24	14	ID changed in MIRE 2.0 "Unpaved" attribute changed to "Unpaved (Dirt, gravel, other)" in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Surface type on a given section" in MIRE 2.1 Surface Type Attribute Group values added in MIRE 2.1
Number of Through Lanes	31	32	15	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description Changed to "The total number of lanes designated for through traffic in the off-peak period" in MIRE 2.1
Median Type	54	55	16	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Annual Average Daily Traffic (AADT)	79	81	17	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				"Vehicles per day" attribute changed to "Average vehicles per day" in MIRE 2.1
AADT Year	80	82	18	ID changed in MIRE 2.0 ID changed in MIRE 2.1
One/Two-Way Operations	91	93	19	ID changed in MIRE 2.0 ID changed in MIRE 2.1
County Name	1	1	20	ID changed in MIRE 2.1
County Code	2	2	21	ID changed in MIRE 2.1 "Census defined County FIPS code or equivalent entity where the roadway segment is located" attribute changed to "Census defined County FIPS code" in MIRE 2.1
Highway District	3	3	22	ID changed in MIRE 2.1
Specific Governmental Ownership	5	5	23	ID changed in MIRE 2.1
City/Local Jurisdiction Name	6	6	24	ID changed in MIRE 2.1 Description changed in MIRE 2.1 to "The applicable name of the city or local jurisdiction/agency where the segment is located."
City/Local Jurisdiction Urban Code	7	7	25	ID changed in MIRE 2.1
Route Signing	14	14	26	ID changed in MIRE 2.1 Recommended numerical codes changed in MIRE 2.1 Attribute "None of the above" removed in MIRE 2.1 Attributes "Bureau of Indian Affairs," "Other," "Unknown," and "Not Signed" added in MIRE 2.1
Route Signing Qualifier	15	15	27	ID changed in MIRE 2.1 "Truck route" and "None of the above" attributes changed to "Truck" and "Other" in MIRE 2.1
Coinciding Route Indicator	16	16	28	ID changed in MIRE 2.1
Coinciding Route – Minor Route Information	17	17	29	ID changed in MIRE 2.1
Total Paved Surface Width	24	25	30	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Surface Friction	25	26	31	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Surface Friction Date	26	27	32	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Date surface friction was last measured" in MIRE 2.1
International Roughness Index (IRI)	27	28	33	ID changed in MIRE 2.0 Name changed to "IRI" in MIRE 2.0 ID changed in MIRE 2.1
International Roughness Index (IRI) Date	28	29	34	ID changed in MIRE 2.0 Name changed to "IRI Date" in MIRE 2.0 ID changed in MIRE 2.1
Pavement Condition (Present Serviceability Rating)	29	30	35	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Descriptive rating of pavement condition" in MIRE 2.1
Pavement Condition (PSR) Date	30	31	36	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Outside Through Lane Width	32	33	37	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Inside Through Lane Width	33	34	38	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Average lane width of all inside through lanes, not including outside through lane (i.e., *Outside Through Lane Width*)" in MIRE 2.1
Cross Slope	34	35	39	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Auxiliary Lane Presence/Type	35	36	40	ID changed in MIRE 2.0 "Part-time shoulder use", "Part-time lane use", & "Special use lane" added to MIRE 2.0 ID changed in MIRE 2.1
Auxiliary Lane Length	36	37	41	ID changed in MIRE 2.0

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				ID changed in MIRE 2.1
Managed Lane Operations Type	37	38	42	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Name changed in MIRE 2.1 to "Managed Lane Operations Type" Description changed to "The type of managed lane operations (e.g., HOV, HOT, ETL, etc.)" in MIRE 2.1 "No HOV lanes", "Has exclusive HOV lanes", "Normal through lanes used as HOV at specified times", and " Shoulder/parking lanes used as HOV at specified times" attributes changed to "Full-time Managed Lanes", "Part-time Managed Lanes – Normal Lanes", and "Part-time Managed Lanes – Shoulder or Parking Lanes" in MIRE 2.1
Managed Lanes	38	39	43	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Name changed in MIRE 2.1 to "Managed Lanes" Description changed to "Maximum number of managed lanes in both directions on the segment" in MIRE 2.1 Attribute changed to "Number of managed lanes" in MIRE 2.1
Reversible Lanes	39	40	44	ID changed in MIRE 2.0 ID changed in MIRE 2.1 "No reversible lanes", "One reversible lane", "Two reversible lanes", and "More than two reversible lanes" attributes changed to "Number of lanes" in MIRE 2.1
Presence/Type of Bicycle Facility	40	41	45	ID changed in MIRE 2.0 ID changed in MIRE 2.1 "Separate parallel bicycle path" removed in MIRE 2.1 "Buffered bicycle lane (i.e., horizontal separation only)," "Separated bicycle lane (i.e., horizontal and vertical separation)," and "Sidepath" added in MIRE 2.1
Width of Bicycle Facility	41	42	46	ID changed in MIRE 2.0

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				ID changed in MIRE 2.1
Number of Peak Period Through Lanes	42	43	47	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Right Shoulder Type	43	44	48	ID changed in MIRE 2.0 "Barrier curb exists; no shoulder in front of curb" added to MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The predominant shoulder type on the right (i.e., outside) side of road (i.e., consistent with the Direction of Inventory)" in MIRE 2.1 "Surfaced shoulder exists - bituminous concrete (AC)" and "Surfaced shoulder exists – PCC surface" attributes changed to "Surfaced shoulder exists – asphalt pavement" and "Surfaced shoulder exists – concrete pavement" in MIRE 2.1 "Barrier curb exists; no shoulder in front of curb" attribute changed to "Curb exists; no shoulder in front of curb" in MIRE 2.1
Right Shoulder Total Width	44	45	49	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The total width of the right (i.e., outside) shoulder including both paved and unpaved parts" in MIRE 2.1
Right Paved Shoulder Width	45	46	50	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The width of paved portion of right (i.e., outside) shoulder" in MIRE 2.1
Right Shoulder Rumble Strip Presence/Type	46	47	51	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Presence and type of rumble strips on the right (i.e., outside) shoulder" in MIRE 2.1
Left Shoulder Type	47	48	52	ID changed in MIRE 2.0

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				"Barrier curb exists; no shoulder in front of curb" added to MIRE 2.0 ID changed in MIRE 2.1
Left Shoulder Total Width	48	49	53	ID changed in MIRE 2.0 ID changed in MIRE 2.1 “Surfaced shoulder exists - bituminous concrete (AC)” and “Surfaced shoulder exists – PCC surface” attributes changed to “Surfaced shoulder exists – asphalt pavement” and “Surfaced shoulder exists – concrete pavement” in MIRE 2.1 “Barrier curb exists; no shoulder in front of curb” attribute changed to “Curb exists; no shoulder in front of curb” in MIRE 2.1
Left Paved Shoulder Width	49	50	54	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to “The width of the paved portion of left shoulder (i.e., outside shoulder on the opposing direction of travel)” in MIRE 2.1
Left Shoulder Rumble Strip Presence/Type	50	51	55	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to “Presence and type of rumble strips on the left shoulder (i.e., outside shoulder on the opposing direction of travel)” in MIRE 2.1
Sidewalk Presence	51	52	56	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Curb Presence	52	53	57	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Curb Type	53	54	58	ID changed in MIRE 2.0 ID changed in MIRE 2.1 “Vertical (barrier) curb” attribute changed to “Vertical curb” in MIRE 2.1
Median Width	55	56	59	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Median Barrier Presence/Type	56	57	60	ID changed in MIRE 2.0 "Positive Barrier-unspecified", "Positive Barrier flexible", "Positive Barrier semi-rigid", & "Positive Barrier rigid" added and "Rigid barrier system", "Semi-rigid barrier system", "Flexible barrier system", & "Rigidity unspecified" removed from MIRE 2.0 ID changed in MIRE 2.1
Median (Inner) Paved Shoulder Width	57	58	61	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The width of the paved shoulder on the median (i.e., inside) side of the roadway" in MIRE 2.1
Median Shoulder Rumble Strip Presence/Type	58	59	62	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Median Sideslope	59	60	63	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Median Sideslope Width	60	61	64	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Median Crossover/Left-Turn Lane Type	61	62	65	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Roadside Clear Zone Width	62	63	66	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Right Sideslope	63	64	67	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The sideslope (foreslope or backslope) on the right side of roadway immediately adjacent to the travel lane, shoulder edge or drainage ditch based on the Direction of Inventory" in MIRE 2.1 "Not applicable – protected by roadside barrier" and "Not applicable – other (e.g., city center street)" removed in MIRE 2.1
Right Sideslope Width	64	65	68	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				Description changed to "The width of the sideslope on the right side of roadway immediately adjacent to the travel lane, shoulder edge or drainage ditch based on the Direction of Inventory" in MIRE 2.1
Left Sideslope	65	66	69	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The sideslope (foreslope or backslope) on the left side of roadway immediately adjacent to the travel lane, shoulder edge or drainage ditch based on the Direction of Inventory" in MIRE 2.1 "Not applicable – protected by roadside barrier" and "Not applicable – other (e.g., city center street)" removed in MIRE 2.1
Left Sideslope Width	66	67	70	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The width of the sideslope on the left side of roadway immediately adjacent to the travel lane, shoulder edge or drainage ditch based on the Direction of Inventory" in MIRE 2.1
Roadside Rating	67	68	71	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "A qualitative rating of the safety of the roadside, ranked on a seven-point categorical scale from 1 (best) to 7 (worst)" in MIRE 2.1
Tapered Edge	-	69	72	Added in MIRE 2.0 ID changed in MIRE 2.1
Major Commercial Driveway Count	68	70	73	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Minor Commercial Driveway Count	69	71	74	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Major Residential Driveway Count	70	72	75	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Minor Residential Driveway Count	71	73	76	ID changed in MIRE 2.0

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				ID changed in MIRE 2.1
Major Industrial/Institutional Driveway Count	72	74	77	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Minor Industrial/Institutional Driveway Count	73	75	78	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Other Driveway Count	74	76	79	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Terrain Type	75	77	80	ID changed in MIRE 2.0 ID changed in MIRE 2.1
AADT Annual Escalation Percentage	81	83	81	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Percent Single Unit Trucks or Single Truck AADT	82	84	82	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Percent Combination Trucks or Combination Truck AADT	83	85	83	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Percentage Trucks or Truck AADT	84	86	84	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Total Daily Two-Way Pedestrian Count/Exposure	85	87	85	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Bicycle Count/Exposure	86	88	86	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Motorcycle Count or Percentage	87	89	87	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Hourly Traffic Volumes (or Peak and Off peak AADT)	88	90	88	ID changed in MIRE 2.0 ID changed in MIRE 2.1
K-Factor	89	91	89	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to “The design hour volume (the 30th largest hourly volume for a given calendar year) as a percentage of total AADT” in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Design Hour Directional Factor	90	92	90	ID changed in MIRE 2.0 Changed to "Peak Hour Directional Factor" in MIRE 2.0 ID changed in MIRE 2.1 Changed to "Design Hour Directional Factor" in MIRE 2.1 Description changed to "The percent of design hour volume (often the 30th largest hourly volume for a given calendar year) flowing in the higher volume direction" in MIRE 2.1 Attribute changed to "Design hour directional factor" in MIRE 2.1
Speed Limit	92	94	91	ID changed in MIRE 2.0 ID changed in MIRE 2.1 "No posted or legally mandated speed limit" attribute removed from MIRE 2.1 Description changed to "The daytime regulatory speed limit for automobiles posted or legally mandated (i.e., statutory)" in MIRE 2.1
Truck Speed Limit	93	95	92	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Nighttime Speed Limit	94	96	93	ID changed in MIRE 2.0 ID changed in MIRE 2.1
85th Percentile Speed	95	97	94	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Mean Speed	96	98	95	ID changed in MIRE 2.0 ID changed in MIRE 2.1
School Zone Indicator	97	99	96	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Indication of whether the segment is located at least partially within a school zone" in MIRE 2.1
On-Street Parking Presence	98	100	97	ID changed in MIRE 2.0

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				ID changed in MIRE 2.1
On-Street Parking Type	99	101	98	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Roadway Lighting	100	102	99	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Toll Charged	101	103	100	ID changed in MIRE 2.0 Attributes changed to "Toll charged in one direction only", "Toll charged in both directions", and "No toll charged" in MIRE 2.0 ID changed in MIRE 2.1
Toll Type	-	104	101	Added in MIRE 2.0 ID changed in MIRE 2.1
Edgeline Presence/Width	102	105	102	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Presence and width of marked edgeline" in MIRE 2.1 "No marked edgeline", "4 inch marked edgeline", "6 inch marked edgeline", "8 inch marked edgeline", "Greater than 8 inch marked edgeline" attributes changed to "Width (inches)" in MIRE 2.1
Centerline Presence/Width	103	106	103	ID changed in MIRE 2.0 ID changed in MIRE 2.1 "No marked centerline", "4 inch marked centerline", "6 inch marked centerline", "8 inch marked centerline", "Greater than 8 inch marked centerline" attributes changed to "Width (inches)" in MIRE 2.1
Centerline Rumble Strip Presence/Type	104	107	104	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Passing Zone Percentage	105	108	105	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Bridge Numbers for Bridges in Segment	106	109	106	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				Description changed to "The official structure number for each bridge in a segment" in MIRE 2.1
Number of Signalized Intersections in Segment	76	78	-	ID changed in MIRE 2.0 Removed in MIRE 2.1 – redundant with Intersection/Junction Traffic Control data element
Number of Stop-Controlled Intersections in Segment	77	79	-	ID changed in MIRE 2.0 Removed in MIRE 2.1 – redundant with Intersection/Junction Traffic Control data element
Number of Uncontrolled/Other Intersections in Segment	78	80	-	ID changed in MIRE 2.0 Removed in MIRE 2.1 – redundant with Intersection/Junction Traffic Control data element
Curve Identifiers	107	193	190	ID changed in MIRE 2.0 "and Linkage Elements" removed from name in MIRE 2.0 ID changed in MIRE 2.1
Curve Feature Type	108	194	191	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Horizontal Curve Degree or Radius	109	195	192	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The horizontal degree or radius of the curve" in MIRE 2.1 "Numeric, feet if radius" attribute changed to "Horizontal curve degree or radius (feet)" in MIRE 2.1
Horizontal Curve Length	110	196	193	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Curve Superelevation	111	197	194	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Horizontal Transition/Spiral Curve Presence	112	198	195	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Horizontal Curve Intersection/Deflection Angle	113	199	196	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Horizontal Curve Direction	114	200	197	ID changed in MIRE 2.0

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				ID changed in MIRE 2.1
Grade Identifiers and Linkage Elements	115	201	198	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Vertical Alignment Feature Type	116	202	199	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Percent of Gradient	117	203	200	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Grade Length	118	204	201	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Vertical Curve Length	119	205	202	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Table 9. Changes over time – at-grade intersections.

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Unique Junction Identifier	120	110	107	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Location Identifier for Road 1 Crossing Point	122	112	108	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Location Identifier for Road 2 Crossing Point	123	113	109	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Intersection/Junction Geometry	126	116	110	ID changed in MIRE 2.0 "Non-conventional intersection" removed in MIRE 2.0 "Restricted crossing U-turn intersection", "Median U-turn intersection", "Displaced left-turn intersection", "Jughandle intersection", "Continuous green T intersection", "Quadrant intersection", & "Other" added to MIRE 2.0 ID changed in MIRE 2.1
Intersection/Junction Traffic Control	131	121	111	ID changed in MIRE 2.0 "Signalized (with ped signal)" & "Signalized (w/o ped signal)" combined to "Signalized" in MIRE 2.0 "Pedestrian Hybrid Beacon" and "Flash Beacon" added to MIRE 2.0 ID changed in MIRE 2.1
Type of Intersection/Junction	121	111	112	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Type of junction based on converging modes" in MIRE 2.1 Attribute numerical codes changed in MIRE 2.1
Location Identifier for Additional Road Crossing Points	124	114	113	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Intersection/Junction Number of Legs	125	115	114	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				Description changed to "The number of legs carrying traffic entering and/or exiting an at-grade intersection/junction" in MIRE 2.1
School Zone Indicator	127	117	115	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Railroad Crossing Number	128	118	116	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Railroad crossing number if intersection includes a railroad grade crossing" in MIRE 2.1
Intersecting Angle	129	119	117	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Intersection/Junction Offset Distance	130	120	118	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Signalization Presence/Type	132	122	119	ID changed in MIRE 2.0 "No signal" removed in MIRE 2.0 "Unsignalized" added in MIRE 2.0 "Railroad crossing signal" modified to "Railroad crossing signal (signal, gates, bells) in MIRE 2.0 ID changed in MIRE 2.1 "Progressive coordination (with several signals along either road)" changed to "Coordinated progressive" in MIRE 2.1 "System coordination (e.g., real-time adaptive systemwide)" changed to "Coordinated real-time adaptive" in MIRE 2.1 "Unsignalized" changed to "No signal systems exist" in MIRE 2.1
Intersection/Junction Lighting	133	123	120	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Number of Circulatory Lanes	134	124	121	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Circular Intersection - Circulatory Lane Width	135	125	122	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Average width of lanes in the circular intersection" in MIRE 2.1
Circular Intersection - Inscribed Diameter	136	126	123	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Bicycle Facility	137	127	124	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Table 10. Changes over time – intersection legs.

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Unique Approach Identifier	139	129	125	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Intersection Identifier for this Approach	138	128	126	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "The unique junction identifier assigned to the intersection in element, Unique Junction Identifier, that includes this approach" in MIRE 2.1
Approach AADT	140	130	127	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Approach AADT Year	141	131	128	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Approach Mode	142	132	129	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Approach Directional Flow	143	133	130	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Number Of Approach Through Lanes	144	134	131	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Left-Turn Lane Type	145	135	132	ID changed in MIRE 2.0 ID changed in MIRE 2.1
No. of Exclusive Left-turn Lanes	146	136	133	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Number of exclusive left-turn lanes on this approach" in MIRE 2.1
Length of Exclusive Left-turn Lanes	151	141	134	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Amount of Left-Turn Lane Offset	147	137	135	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Right-Turn Channelization	148	138	136	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Traffic Control of Exclusive Right-Turn Lanes	149	139	137	ID changed in MIRE 2.0 "Signal" attribute removed in MIRE 2.0 Attributes added to MIRE 2.0: "Unsignalized," "Permissive signal," "Protected all day(s)," "Protected, peak hour only," "Protected - permissive with green arrow/green ball (all day)," "Protected - permissive with green arrow/green ball (peak hour only)," "Protected - permissive with flashing yellow arrow (all day)," "Protected - permissive with flashing yellow arrow (peak hour only)" ID changed in MIRE 2.1
No. of Exclusive Right-Turn Lanes	150	140	138	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Length of Exclusive Right-Turn Lanes	152	142	139	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Approach Median Type	153	143	140	ID changed in MIRE 2.0 Changed to "Approach Median Type" in MIRE 2.1 ID changed in MIRE 2.1
Approach Traffic Control	154	144	141	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Approach Left-turn Protection	155	145	142	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Signal Progression	156	146	143	ID changed in MIRE 2.0 "System coordination" attribute changed to "System coordination (time of day, traffic responsive and traffic adaptive)" in MIRE 2.0 ID changed in MIRE 2.1
Crosswalk Presence/Type	157	147	144	ID changed in MIRE 2.0 "Raised crosswalk" attribute added to MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				“Marked crosswalk” attribute changed to “Marked cross walk and style (parallel bars, continental, etc.)” in MIRE 2.1
Pedestrian Signal Activation Type	158	148	145	ID changed in MIRE 2.0 Name revised to “Pedestrian Signal Activation Type” in MIRE 2.0 "Constant activation by traffic signal (e.g., ped recall)" added to MIRE 2.0 ID changed in MIRE 2.1 “Passive detection” attribute added to MIRE 2.1
Pedestrian Signal Presence/Type	159	149	146	ID changed in MIRE 2.0 Name revised to “Pedestrian Signal Presence/Type” in MIRE 2.0 "Pedestrian Signal with countdown indicator (with Accessible Pedestrian Signal (APS))", "Pedestrian Signal with countdown indicator (w/o APS), Pedestrian Signal without countdown indicator (with APS)", and "Pedestrian Signal without countdown indicator (w/o APS)" added in MIRE 2.0 “Other” attribute removed in MIRE 2.0 ID changed in MIRE 2.1
Crossing Pedestrian Count/Exposure	160	150	147	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to “Count or estimate of average daily pedestrian flow crossing perpendicularly across the approach” in MIRE 2.1
Left/Right-Turn Prohibitions	161	151	148	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Added “Not applicable” and “No prohibitions” attributes to MIRE 2.1
Right-Turn-On-Red Prohibitions	162	152	149	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				"Not Applicable" attribute added to MIRE 2.1
Left-turn Counts/Percent	163	153	150	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Year of Left-turn Counts/Percent	164	154	151	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Right-Turn Counts/Percent	165	155	152	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Year of Right-Turn Counts/Percent	166	156	153	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Transverse Rumble Strip Presence	167	157	154	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Entry Width	168	158	155	ID changed in MIRE 2.0 ID changed in MIRE 2.1 "(i.e., in the direction of travel)" added to description in MIRE 2.1
Circular Intersection - Number of Entry Lanes	169	159	156	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection – Presence/Type of Exclusive Right-Turn Lane	170	160	157	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Entry Radius	171	161	158	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Exit Width	172	162	159	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Number of Exit Lanes	173	163	160	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Exit Radius	174	164	161	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection - Pedestrian Facility	175	165	162	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Type of facility for pedestrians perpendicularly crossing this approach" in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Circular Intersection - Crosswalk Location	176	166	163	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Circular Intersection – Island Width	177	167	164	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Table 11. Changes over time – interchange/ramps.

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Unique Interchange Identifier	178	168	165	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Interchange Type	182	172	166	ID changed in MIRE 2.0 "Diverging Diamond," "Double roundabout," "Single roundabout," and "Quadrant" attributes added to MIRE 2.0 ID changed in MIRE 2.1 Attribute numerical codes changed in MIRE 2.1
Ramp Length	187	177	167	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Attribute changed to "Ramp length (miles)" in MIRE 2.1
Ramp AADT	191	181	168	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Year of Ramp AADT	192	182	169	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Roadway Type at Beginning Ramp Terminal	195	185	170	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Type of roadway intersecting with the ramp at the beginning terminal" in MIRE 2.1
Location Identifier for Roadway at Beginning Ramp Terminal	197	187	171	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Roadway Type at Ending Ramp Terminal	199	189	172	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to "Type of roadway intersecting with the ramp at the ending terminal" in MIRE 2.1
Location Identifier for Roadway at Ending Ramp Terminal	201	191	173	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Interchange Location Identifier for Road 1 Crossing Point	179	169	174	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
				Name changed in MIRE 2.1 to "Interchange Location Identifier for Road 1 Crossing Point"
Interchange Location Identifier for Road 2 Crossing Point	180	170	175	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Name changed in MIRE 2.1 to "Interchange Location Identifier for Road 2 Crossing Point"
Interchange Location Identifier for Additional Road Crossing Points	181	171	176	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Name changed in MIRE 2.1 to "Interchange Location Identifier for Additional Road Crossing Points"
Interchange Lighting	183	173	177	ID changed in MIRE 2.0 "Continuous lighting on one or more approach roads " attribute removed in MIRE 2.0 "Full interchange-area lighting" attribute split into " Full interchange-area lighting (high mast)" and " Full interchange-area lighting (other)" attributes in MIRE 2.0 ID changed in MIRE 2.1
Interchange Entering Volume	184	174	178	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Interchange Identifier for this Ramp	185	175	179	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Unique Ramp Identifier	186	176	180	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Ramp Acceleration Lane Length	188	178	181	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Ramp Deceleration Lane Length	189	179	182	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Ramp Number of Lanes	190	180	183	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Ramp Metering	193	183	184	ID changed in MIRE 2.0 ID changed in MIRE 2.1

Data Element Name (MIRE 2.1)	MIRE 1.0 #	MIRE 2.0 #	MIRE 2.1 #	Changes
Ramp Advisory Speed Limit	194	184	185	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Roadway Feature at Beginning Ramp Terminal	196	186	186	ID changed in MIRE 2.0
Location of Beginning Ramp Terminal Relative to Mainline Flow	198	188	187	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to “Identifies the side of the roadway flow intersected by the beginning ramp terminal” in MIRE 2.1
Roadway Feature at Ending Ramp Terminal	200	190	188	ID changed in MIRE 2.0 ID changed in MIRE 2.1
Location of Ending Ramp Terminal Relative to Mainline Flow	202	192	189	ID changed in MIRE 2.0 ID changed in MIRE 2.1 Description changed to “Identifies the side of the roadway flow intersected by the ending ramp terminal” in MIRE 2.1

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For more information:
https://highways.dot.gov/safety/data-analysis-tools/mire-fde/model-inventory-roadway-elements-mire

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