Chapter 1 – INTRODUCTION

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CHAPTER 1
INTRODUCTION

1.1 GENERAL

Approximately one-third of the total land area of the United States is owned or controlled by the Federal Government. One of the world's largest highway networks has been constructed to serve these Federal lands.

Several Federal agencies are responsible for managing public lands and consequently are also responsible for managing a part of this vast network of Federal roads. The role of the Federal Highway Administration's (FHWA) Office of Federal Lands Highway in designing and constructing highway facilities on Federal and tribal lands is well defined in existing legislation and supplemental national interagency agreements.

The Office of Federal Lands Highway is headquartered at FHWA in Washington, D.C. and maintains three Federal Lands Highway (FLH) Division offices and various Regional Project Offices (RPO). Exhibit 1.1–A shows the geographical breakdown of FLH offices. For more than 100 years, FLH and its predecessor offices have offered their expertise to other Government agencies for the planning, location, design, and construction of Federal and tribal transportation facilities in and adjacent to the Federal and tribal domain. Many foreign countries have also been assisted in the development and construction of road systems.

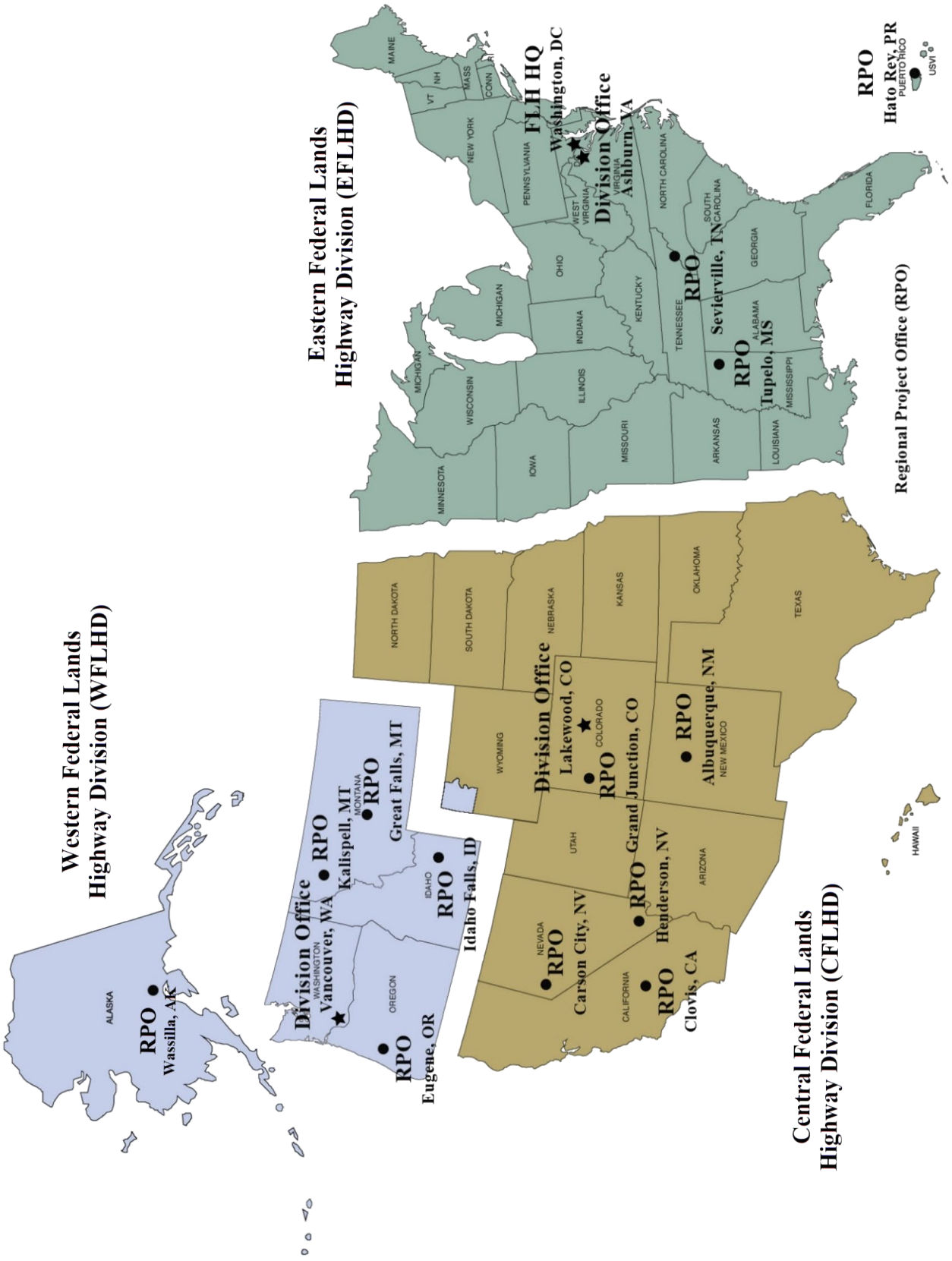
One primary goal of the FLH program is to provide safe, cost-effective, and environmentally sound highways and roads to serve the nation's Federal lands. FLH uses context sensitive solutions (CSS) and sound engineering practice to achieve this goal. This requires a collaborative, interdisciplinary approach to roadway planning, design, and construction. FLH also involves partners, stakeholders, and the public to ensure that transportation projects are in harmony with communities and that they preserve environmental, scenic, aesthetic, and historic resources. The effective application of CSS techniques and the *PDDM* achieves these goals while providing safe and efficient access to the nation's Federal lands.

Refer to [EFLHD – CFLHD – WFLHD] Division Supplements for more information.

1.1.1 PURPOSE

The *PDDM* provides information and guidance to internal employees, partner and stakeholder agencies, and consultants involved with the project development and design of highways. It is a key reference tool that is useful, to both the veteran manager and the entry-level designer, encouraging an interdisciplinary team, or cross functional team (CFT), approach. Additionally, the *PDDM* serves as a portal for numerous external technical manuals and reports using links to other websites. The manual identifies policies, standard practices, criteria, guidance, and references approved for use in carrying out the highway and bridge design responsibilities in the Federal Lands Highway Programs (FLHP). In this regard, the following definitions will be used:

Exhibit 1.1–A FEDERAL LANDS HIGHWAY DIVISION OFFICES



1. **Policy**. Guiding principle; general course of action to be followed without exception. Where policy is cited the source of the policy is also referenced, when applicable and appropriate. Policy statements are presented in **bold** type.
2. **Standard**. A fixed reference to guide the outcome and content (product) of the work. FLH Standards are fixed references imposed to guide the content of FLH products. Standards are established where there is a consistent level of risk or a consistent technical or performance expectation for a specific product to work well in most cases. FLH standards are based on successful past performance on FLH projects after meeting goals of risk management, quality, and efficiency. The *PDDM* provides guidance on how to select appropriate standards for specific project types and/or conditions. Variances to FLH Standards are not uncommon, but they always need to be justified in writing. Guidance on justifying and documenting variances to FLH Standards is included in this manual.
3. **Criteria**. Tests or indicators, in addition to standards, used to measure/judge achievement of applicable policy or standard objectives. Criteria may vary from project-to-project. The *PDDM* provides typical criteria, with guidance on how to select criteria for specific project types and/or conditions.
4. **Standard Practice**. FLH Standard Practices are established methodology imposed to guide the approach to the work which will generally produce a consistent outcome that meets FLH expectations. Standard Practices are established where a certain process or method is necessary, in addition to or as assurance, for achieving a sufficient end result product (see Standard). FLH Standard Practices have a history of demonstrated quality and successful use. Variances from FLH Standard Practices may sometimes be appropriate but require written justification.
5. **Guidance**. Suggested actions to meet policies and standards, and expectations for applying discretion. Considerations for selecting appropriate standards and design criteria are included in the manual.
6. **Discretion**. Where the practitioner is expected to exercise professional judgment to apply an optimum technique or solution that is within an acceptable range of values.

Policies, standards, and criteria are condensed and written for the user. Where appropriate, relevant procedures, instructional aids, and publications are referenced. References to specific computer programs, AASHTO guidelines, manuals, and regulations are included in this manual. It is expected that the user will be knowledgeable in the use of the referenced items. The *PDDM* does not detail technical methods or procedures. Users are expected to consult the documents referenced and TGMs for such purposes and stay informed of current technologies.

Compliance with all policies and standards in the *PDDM* is essential to ensure consistency in project development throughout FLH. Although policy cannot be compromised, flexibility of standards is sometimes necessary to meet project specific objectives. Deviation from standards cited within this manual will require formal justification and approval. Division variances in standards, criteria, and guidance are typically found in the Division Supplements within various chapters.

1.1.2 PHILOSOPHY AND TECHNICAL POLICIES

Policies presented in the *PDDM* are interpretations of agency directives and objectives, based on legislation and federal regulations relating to the FHWA and FLH programs. Always follow FLH project development philosophy and technical policies while doing project development work on FLH projects. Section 1.2 lists the sources for these philosophy and technical policies.

Technical activities for FLH project development can be very challenging. Since projects are located from the Atlantic to the Pacific and from the tropics to the arctic the natural settings and technical issues vary tremendously. An equal challenge comes from the variety of projects and stakeholders. Some projects are multi-lane divided highways and bridges, but typically the work deals with low volume roads on resource sensitive public lands. These areas have significant and diverse stakeholders, regulations, management goals, environmental resources, cultural resources, wildlife, scenic beauty, and intrinsic value. Furthermore, FLH is a partner with Federal Land Management Agencies (FLMAs) and other government property managers and owners but does not own or manage Federal land or the improvements it designs and constructs. Upon successful completion, another agency accepts FLH projects and agrees to maintain them. Technical work should embrace the following key FLH project delivery objectives:

- Be respectful of the land, partner agency goals, tribal values, cultural significance of landforms and sites, wildlife, and habitat;
- Provide a safe passage for residents, travelers, visitors, tourists, recreationists, and wildlife;
- Minimize impacts to existing features and conditions in a “lightly on the land” manner; blend improvements into the setting with as little impact as possible; and
- Complete quality work within budget constraints, recognizing that funding is often comparatively less for low-volume, rural public access roads serving Federal lands than for higher volume state and municipal projects.

The combination of protecting cultural and environmental resources, accommodating public lands stakeholders and their values/regulations, providing safety and quality, and working within limited funding means searching for technical solutions that are both context-sensitive and cost effective. Dealing with the variability of FLH projects, terrains, climates, and partner agency constraints requires flexibility, resourcefulness, and collaboration. Section 9.1.5 further describes FLH roadway design philosophy and context sensitive solutions.

This section provides guidance in identifying and planning appropriate levels of technical practice to fit the unique circumstances and challenges posed by FLH projects. The highest-level guidance is in the form of policy, which is followed without exception. The following FLH *technical policies* represent the FLH project development philosophy to be followed by the technical practitioner:

1. **Support the mission, vision, and program management objectives of FLH and FHWA.** The technical practitioner satisfies this policy by performing work consistent with prevailing laws and regulations, executive orders, DOT orders, FHWA regulations and administrative rules, and FLH mission and vision statements. This is the ultimate technical policy, and the other technical policies help to fulfill it.

2. **Meet the technical scope requirements defined by this PDDM.** FLH policy is to follow the standards and guidance presented in this PDDM regarding project development activities. Project development and technical work include investigation, analysis, reporting, plan specification and estimate (PS&E) development, construction support, technical support, and fulfilling other agency needs.

3. **Advance the state of practice by seeking and implementing new technology.** FLH policy is to evaluate, promote, and implement new technology, and to continually update technical capabilities.

4. **Demonstrate compliance with environmental requirements in planning and designs.** FLH policy is to perform technical investigations and develop design recommendations that minimize environmental impacts and demonstrate environmental, cultural, and natural resource stewardship while meeting other project objectives. Chapter 4 provides further environmental guidance.

5. **Conduct work safely and seek safety improvement solutions.** FLH policy is to conduct work in a manner that is safe for workers and the public, and to seek solutions that improve safety and minimize roadside hazards on Federal and tribal lands. Appropriate safety applications are to be incorporated while respecting the associated natural resource impacts and historic, cultural, and community values. Following this policy protects the general public, FHWA personnel, contractors, and public and private property. It applies to work conducted as part of technical activities from planning through construction, as well as the safety of the completed project with respect to technical issues. Some partner agencies may have standards and requirements that could limit the implementation of safety features. The FLH Safety Philosophy 2008 describes the philosophy of working cooperatively to integrate safety as a basic business principle in all activities. The practitioner or technical discipline leadership will seek clarification within FHWA when confronted with situations that are not adequately defined. Section 8.1.1 presents more detail about the FLH safety philosophy.

6. **Achieve quality through established quality control, quality assurance, and oversight procedures.** FLH strives for quality through established quality control and quality assurance (QA/QC) procedures and through oversight of technical work performed by others. This technical policy includes performing QA/QC and managing outsourced work. A quality control and assurance program must be maintained and applied to all project work. Every functional discipline is responsible for the technical adequacy of their project development and design activities. Technical consultants shall also follow an established QA/QC process, either their own approved process or a FLH internal QA/QC process. Unless specific arrangements are made to the contrary, FLH does not provide QA/QC of consultant work, but still retains responsibility for oversight for the project delivery, including that QA/QC is being completed and work products conform to FLH standards, procedures, and comply with the contract.

7. **Demonstrate financial stewardship and workforce and resource management.** FLH policy is to coordinate and manage project development work by multi-disciplinary and multi-agency project teams and within jointly established scopes, schedules, budgets, quality, and project criteria. Usually more than one option exists to achieve the functional requirements for the project. Evaluations of design options include the assessment of risk

and consequences, and performance and cost. This process includes assessing risk, planning, and overseeing the project development work, and managing both personnel and technical resources.

1.1.3 RISK

Risk is inherent in the delivery and operation of FLH projects and can have positive or negative impacts to the project. Practitioners are responsible for identifying risks through analysis of pertinent issues, communicating these risks to the CFT and partners, and helping to evaluate whether the risks are tolerable. Risks are more tolerable when they have a low probability of occurrence or when the negative impact is low relative to the potential benefit of the action incurring the risk. For most FLH projects the risk assessment is not a complicated quantitative process but rather a simplified qualitative assessment based on experience, professional judgment, and historical standard of practice on previous partner agency projects.

It is neither feasible nor intended for highway projects to be entirely risk-free, as there are potential rewards to the project when risk is taken. Understanding the physical, traffic, and safety conditions for each project, and the basis and assumptions underlying the standards, is essential for understanding the risks associated with the selection and application of the standards and criteria. To the extent possible, risks should be quantified based on their potential probability and consequences or impact.

Evaluating risk and benefit is a collaborative, interdisciplinary effort that requires involvement of the CFT and stakeholders, as appropriate, as described in Chapter 3. The PM typically leads this process, working with the CFT and stakeholders to reach consensus on acceptable risk levels. The Division leadership will normally oversee and endorse the level of risk taken to achieve a consistent, office-wide level of risk acceptance over time. The endorsement of the PM, Division Functional Managers, Division Branch Chiefs, Directors, or Division Engineer may be necessary when risks are elevated.

1.1.4 ABOUT THE PDDM

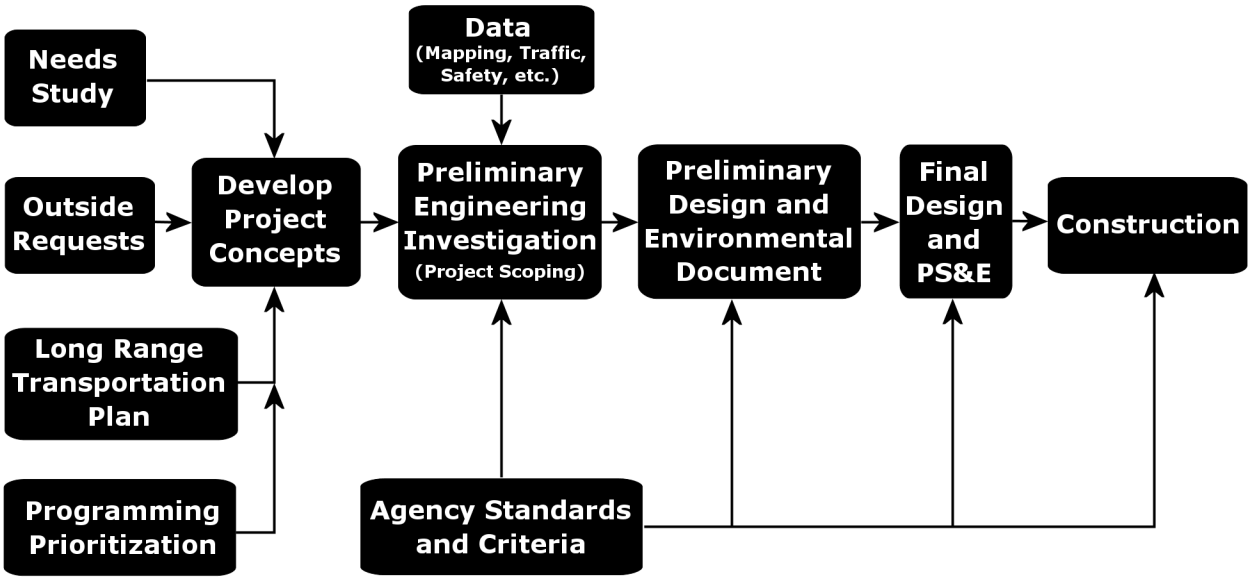
The *PDDM* consists of thirteen chapters that outline the major categories of work during project development. Exhibit 1.1–B shows the project development work process. Each chapter contains a table of contents showing the chapter sections. Policy and criteria are presented in each chapter related to the project development topic:

1. Introduction
2. Planning and Programming
3. Project Management
4. Environmental Compliance and Permitting
5. Surveying and Mapping
6. Geology and Geotechnical
7. Hydrology and Hydraulics
8. Safety and Traffic Design
9. Highway Design
10. Structural Design

11. Pavements
12. Right of Way and Utilities
13. Design Feedback

Links are provided throughout the manual to outside resources and are shown with a solid underline. Links within a chapter are shown with a dotted underline.

Exhibit 1.1–B PROJECT DEVELOPMENT WORK PROCESS



1.1.4.1 Revisions and Approval

The version of the PDDM posted at https://highways.dot.gov/federal-lands/pddm is the official version of the PDDM. Use this version for internal project development and in contracts with A/E consultants.

The Engineering Resources Coordinator and the FLH Discipline Champions (the "Champions") are responsible for maintaining the *PDDM* and its contents. As changes in policies, standards and/or criteria occur, modifications will be made. *PDDM* users may contribute improvement suggestions by providing the appropriate Champion and associated team with reasons why the change is needed, what precipitated the change, and provide a description of the change either with new text or redline/strikeout of existing text and/or exhibits, links, etc.

Minor modifications such as adding links to new FHWA guidance, improving linkages between chapters, and other minor content or editorial changes that have full support of the affected disciplines, will be processed by the applicable Champion and Engineering Resource Coordinator with no additional approvals required.

Otherwise, the Champion and discipline team evaluate the proposed change by assessing its consequences, including any conflicts, benefits, risks, cost, and feasibility. Outside resources may be consulted when necessary. Once the discipline team reaches an agreement to make the

change, the Engineering Resources Coordinator sends the proposed revision to all the affected Branch Chiefs for their review and approval. Once approved, the Engineering Resources Coordinator distributes the PDDM Modification Approval Form for signatures and final approval by the FLH Chiefs of Engineering and the Director of Office of Federal Lands Programs.

The PDDM is a living document, with chapters and revisions occurring as needed. These updates may be published independently and will include revision dates. Each chapter is developed in coordination with others, incorporating the links, references, and shared content to ensure consistency and reflect the interconnected nature of the manual.

1.1.4.2 Technical Guidance Manuals

Several technical disciplines have developed Technical Guidance Manuals (TGMs) to support the work conducted by the Federal Lands Highway (FLH). While the PDDM outlines the overarching policy, philosophy, and standards, the TGMs focus on technical methods and procedures. They serve as practical tools for interpreting and applying the policies, standards, and criteria.

Each TGM is designed to align with and support the policies and practices presented in the PDDM. Additionally, TGMs offer guidance in areas where established standards may not yet exist and provide direction for adopting emerging technologies. In essence, the PDDM defines what should be done, while the TGMs offer guidance on how to do it.

TGMs are not standalone documents; they reference policies and standards as needed to clarify their application. In the event of a conflict between a TGM and the PDDM, the guidance in the PDDM takes precedence.

1.1.4.3 Division Supplements

FLH strives for alignment between Divisions whenever practical. However, each Division has its own organizational structure and its own base of institutional experience developed through years of work within its region of the country, with state and county partners, and with the regional representation of the FLMAs. Additionally, each Division has minor variations in the project development and design processes, as well as differences in the utilization and management of contracted A/E consultant services. The Division Supplements listed throughout the PDDM detail these differences. These supplements should be used within the Divisions and by their consultants whenever applicable.

Links to the Supplements are provided at the end of each major section where supplements exist.

Supplements are written in a format like the PDDM and reference the applicable PDDM section. The Supplement will indicate the issuing Division with the format “xFLHD Supplement”. The Division issuing the Supplement will inform the other Divisions about the availability of new Supplements.

Refer to [EFLHD – CFLHD – WFLHD] Division Supplements for more information.

1.2 GUIDANCE AND REFERENCES

The *PDDM* supplements Federal laws and regulations relative to the development and design of highways. It is intended to be used in conjunction with current engineering practices and procedures issued by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), State highway agencies, FLMAs, and other select organizations. Applicable laws are set forth in Title 23, United States Code (USC) "Highways". The governing regulations are found in Title 23, Code of Federal Regulations (CFR). Additional guidance on applicable policy and standards may be found in *A Guide To Federal-Aid Programs and Projects*, national and project interagency agreements, and AASHTO or other recognized publications.

1.2.1 CODE OF FEDERAL REGULATIONS (CFR)

The *Code of Federal Regulations* is a codification of the general and permanent rules published in the *Federal Register* by agencies of the Federal Government. The code is divided into 50 titles representing broad areas of Federal regulations. Title 23 CFR "Highways" is the volume representing those current regulations applicable to FHWA and the FLH Program. The following are the parts of 23 CFR that are most relevant to the development and design of highways:

- Part 620, Subpart A. Highway Improvements in the Vicinity of Airports.
- Part 625, Design Standards for Highways.
- Part 626, Pavement Policy.
- Part 627, Value Engineering.
- Part 630, Preconstruction Procedures.
- Part 636, Design-Build Contracting.
- Part 650, Bridges, Structures and Hydraulics.
- Part 652, Pedestrian and Bicycle Accommodations and Projects.
- Part 655, Traffic Operations.
- Part 660, Special Programs (Direct Federal) Forest Highways and Defense Access Roads.
- Part 668, Subpart B, Emergency Relief Program: Procedures for Federal Agencies for Federal Roads.
- Part 752, Landscape and Roadside Development.
- Part 771, Environmental Impact and Related Procedures.
- Part 772, Procedures for Abatement of Highway Traffic and Construction Noise.
- Part 777, Mitigation of Impacts to Wetlands and Natural Habitat.
- Subchapter L, Federal Lands Highways.

1.2.2 FEDERAL-AID POLICY & GUIDANCE

The *Federal-aid Highway Program Policy & Guidance Center (PGC)* provides a central location for laws, policies, and guidance about the Federal-aid Highway Program, including legal documents, links to relevant legislation, memos, directives, and guidance to support the Federal Highway Administration's mission and goals. The PGC also contains program directives relative to administration of the Federal Lands Transportation Program (FLTP).

1.2.3 NATIONAL INTERAGENCY AND PROJECT AGREEMENTS

Agency agreements are required whenever FHWA performs work for another agency or when work is performed by another agency with funds administered by FHWA. National agreements have been executed between FHWA and principal FLMAs such as the National Park Service (NPS), Forest Service (FS), Bureau of Indian Affairs (BIA), Fish and Wildlife Service (FWS). Project agreements are executed between Division offices and another agency to detail project specifics that cannot be covered by a national agreement (e.g., project funding, geometrics, right-of-way acquisition, utility relocation, construction, and maintenance responsibilities). Agreements are discussed in Chapter 2.

1.2.4 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) POLICY AND GUIDES

AASHTO was organized in 1914 and is composed of representatives from all 50 State highway transportation agencies, the Commonwealths of Puerto Rico and the Northern Mariana Islands, the District of Columbia, six Canadian Provinces, two Territories, and the Federal Highway Administration.

The organization brought together Federal, state, and other highway engineers for discussion of problems, planning of concerted action, and adoption of uniform practices. Its objective is to foster the development, operation, and maintenance of a nationwide integrated system of highways to adequately serve the transportation needs of the country.

AASHTO publishes recommended specifications, guides, and standards on highway design and construction that generally prescribe good practices or criteria considered adequate to provide safe and cost-effective highway facilities. These approved standards and guides as listed herein may be used in conjunction with this manual. Design standards for highways are listed in 23 CFR Part 625.

AASHTO publications may be purchased online.

1.2.5 FEDERAL LANDS HIGHWAY REFERENCES

1. 23 USC 203. Federal lands transportation program
2. 23 USC 204. Federal lands access program
3. 23 USC 308. Cooperation with Federal and State agencies and foreign countries
4. 23 USC 202. Tribal transportation program
5. 25 CFR 170. Tribal Transportation Program Final Rule
6. Green Book. *A Policy on Geometric Design of Highways and Streets*, AASHTO. Current Edition.
7. Park Road Standards. US Department of the Interior, National Park Service, 1984.
8. FLH Safety Philosophy
9. Special Report 214. *Designing Safer Roads, Practices for Resurfacing, Restoration and Rehabilitation*, TRB, 1987.
10. FLH Standard Drawings. Federal Lands Highway Standard Drawings. Current edition.
11. EFL Standard Drawings. Eastern Federal Lands Highway Division Standard Drawings
12. CFL Standard Drawings. Central Federal Lands Highway Division Standard Drawings
13. WFL Standard Drawings. Western Federal Lands Highway Division Standard Drawings
14. FP-XX. Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, DOT, FHWA. Current edition.
15. EFL LOS. Eastern Federal Lands Highway Division Library of Supplemental Specifications
16. CFL LOS. Central Federal Lands Highway Division Library of Supplemental Specifications
17. WFL LOS. Western Federal Lands Highway Division Library of Supplemental Specifications
18. AASHTO HDG. AASHTO Highway Drainage Guidelines, Current Edition.
19. AASHTO MDM. AASHTO *Model Drainage Manual*, Current Edition.
20. SHS. *Standard Highway Signs*, DOT, FHWA. Current Edition.
21. MUTCD. *Manual on Uniform Traffic Control Devices for Streets and Highways*, DOT, FHWA. Current Edition

22. RDG. *Roadside Design Guide*, AASHTO. Current Edition.

23. AASHTO Materials Manual. Parts I and II, AASHTO, Current Edition.

24. Materials Manual. *Federal Lands Highway Field Materials Manual*. Current edition.

25. Construction Manual. *Federal Lands Highway Construction Manual*

26. GPO Style Manual *Government Printing Office Style Manual*.

1.3 PARTNERS, PROGRAMS, AND PLANNING

FLMAs are Federal agencies established under laws and regulations and delegated the authority to administer and manage the vast national resources on federally owned or controlled lands within the United States and its territories. The FLH Partners have the responsibility for constructing and maintaining a public roads system within these lands.

FLH also works with other Federal and State government agencies upon request.

FLH's mission when working with these land management agencies usually entails all phases of project development and design. See FLH Programs for information about authorizing language supporting the range of Federal lands programs. 23 USC 308 contains authorizing language that allows FLH to deliver engineering services.

Project development begins with planning and programming. See FLH Planning Programs for information about these focus areas.

1.4 GLOSSARY

1.4.1 ABBREVIATIONS

Whenever these abbreviations are used, they will have the following meaning:

3R Resurfacing, Restoration and Rehabilitation (RRR)

4R Resurfacing, Restoration, Rehabilitation, and Reconstruction Projects

– A –

A/E Architectural and Engineering Consultant

AADT Annual Average Daily Traffic

AASHTO American Association of State Highway and Transportation Officials

ACAA American Coal Ash Association

ACHP Advisory Council on Historic Preservation

ACI American Concrete Institute

ACPA American Concrete Pavement Association

ADA Americans with Disabilities Act

ADAAG Americans with Disabilities Act Accessibility Guidelines

ADT Average Daily Traffic

AISI American Iron and Steel Institute

AMG Automated Machine Guidance

ANSI American National Standards Institute

ARTBA American Road and Transportation Builders Association

ASCE American Society of Civil Engineers

ASPRS American Society of Photogrammetry and Remote Sensing

ASTM American Society for Testing and Materials

AWPA American Wood Protection Association

AWS American Welding Society

AWWA American Water Works Association

– B –

BIA Bureau of Indian Affairs

BIP Bridge Inspection Program

BLM Bureau of Land Management

BMP Best Management Practice

– C –

CAA Clean Air Act

CAAA Clean Air Act Amendments

CADD Computer Aided Design and Drafting

CE Categorical Exclusion

CEQ Council on Environmental Quality

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CFL Central Federal Lands Highway Division

CFR Code of Federal Regulations

CFT Cross Functional Team

CMF Crash (also Accident) Modification Factor

CO Contracting Officer

CP Control Point

CSD Context Sensitive Design

CSS Context Sensitive Solutions

CWA Clean Water Act

CZMA Coastal Zone Management Act

– D –

DAB Development Advisory Board

DAR Defense Access Road

DHV Design Hourly Volume

DO-12 Director's Order 12 (National Park Service)

DOT Department of Transportation

DSD Decision Sight Distance

DSR Damage Survey Report

DTM Digital Terrain Model

– E –

EA Environmental Assessment

E-CAL Electronic Centralized Agreement Library

EDM Electronic Distance Measuring

EDTS Environmental Document Tracking System

EFH Essential Fish Habitat

EFL Eastern Federal Lands Highway Division

EIS Environmental Impact Statement

EO Executive Order

EPA Environmental Protection Agency

ERFO Emergency Relief for Federally Owned Roads

ESA Endangered Species Act

– F –

FAA Federal Aviation Administration

FAPG Federal-Aid Policy Guide

FAR Federal Acquisition Regulations

FDR Forest Development Roads

FEMA Federal Emergency Management Agency

FHWA Federal Highway Administration

FLH Federal Lands Highway

FLMA Federal Land Management Agency

FLTP Federal Lands Transportation Program

FONSI Finding of No Significant Impact

FPPA Farmland Protection Policy Act

FP-XX Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (The year of issuance 19xx or 20xx)

FS U. S. Forest Service

FTA Federal Transit Administration

FWS U. S. Fish and Wildlife Service

– G –

GCDB Geographic Coordinate Data Base

GEC Geotechnical Engineering Circular

GIS Geographic Information System

GNSS Global Navigation Satellite System

GPS Global Positioning System

GSA General Services Administration

– H –

HAL High Accident Location

HCM Highway Capacity Manual

HEC Hydraulic Engineering Circular

HES Homestead Entry Survey

HOV High Occupancy Vehicle

HSM Highway Safety Manual, AASHTO

– I –

IDT	Interdisciplinary Team
IHSDM	Interactive Highway Safety Design Model
ISD	Intersection Sight Distance
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System

– L –

LiDAR	Light Detection and Ranging
LOS	Level of Service
LOS	Library of Supplemental Specifications
LWCF	Land and Water Conservation Fund

– M –

MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MUA	Multi-attribute Utility Analysis
MUTCD	Manual on Uniform Traffic Control Devices for Streets and Highways

– N –

NAAQS	National Ambient Air Quality Standards
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NGS	National Geodetic Survey
NHPA	National Historic Preservation Act
NHS	National Highway System

NHTSA National Highway Traffic Safety Administration

NIST National Institute of Standards and Technology

NMFS National Marine Fisheries Service

NOAA National Oceanic and Atmospheric Administration

NPDES National Pollutant Discharge Elimination System

NPS National Park Service

NR National Register

NRCS Natural Resources Conservation Service

NRHP National Register of Historic Places

NWS National Weather Service

– O –

OHWM Ordinary High Water Mark

OSHA Occupational Safety and Health Administration

– P –

PCA Portland Cement Association

PCCP Portland Cement Concrete Pavement

PCI Precast/Prestressed Concrete Institute

PDDM Project Development and Design Manual

PDG Office of Real Estate Services Project Development Guide

PE Preliminary Engineering

PIH Plan in Hand

PL Public Law

PLSS Public Land Survey System

PM Project Manager

PMIS Program Management Information System

PRMS Program and Resource Management System

PRP Park Roads and Parkway Program (may also be PRPP or § PRA)

PRT Perception Reaction Time

PS&E Plans, Specifications and Estimates

PSD Passing Sight Distance

– Q –

QA Quality Assurance

QC Quality Control

– R –

RDG Roadside Design Guide, AASHTO

Reclamation Bureau of Reclamation

RGL Regulatory Guidance Letter

RIP Road Inventory Program

ROD Record of Decision

RPM Raised Pavement Marker

RRP Refuge Roads Program

RSA Roadside Safety Audit

RSRAP Roadside Safety Resource Allocation Program

– S –

SADT Seasonal Average Daily Traffic

SCR Special Contract Requirement

SDWA Safe Drinking Water Act

SHA State Highway Agency

SHPO State Historic Preservation Office

SHS Standard Highway Signs

SI International System of Units (also referred to as Metric)

SIP State Improvement Plan

SSD Stopping Sight Distance

STARS Service-wide Traffic Crash Reporting System

SUE Subsurface Utility Engineering

SWPPP Stormwater Pollution Prevention Plan

– T –

T&E Threatened and Endangered

TAR Transportation Acquisition Regulations

TCP Traffic Control Plan

TE Transportation Enhancement

TGM Technical Guidance Manual

TMDL Total Maximum Daily Load

TMP Transportation Management Plan

TNM Traffic Noise Model

TRB Transportation Research Board

TSM Transportation System Management

TTC Temporary Traffic Control

TTP Tribal Transportation Program

TWLTL Two-Way Left-Turn Lane

– U –

USACE United States Army Corps of Engineers

USC United States Code

USCG United States Coast Guard

USDA United States Department of Agriculture

USGS United States Geological Survey

– V –

VA Value Analysis

VE Value Engineering

VLVLR Very Low Volume Local Road

VPH Vehicles per Hour

– W –

WFL Western Federal Lands Highway Division

1.4.2 DEFINITIONS

Many of the following terms are used throughout the *PDDM*:

– A –

Acceleration Lane – A speed change lane to enable a vehicle entering a roadway to increase its speed to merge with through traffic.

Accuracy – The degree of agreement between a measured value and its established true value.

Aesthetics – A branch of philosophy dealing with beauty and the beautiful and judgments of taste concerning them. In highway engineering, aesthetic judgments relate primarily to the highway and roadsides as a whole and includes maximizing pleasant views and screening out unpleasant views.

Aggradation – General and progressive raising of the streambed by deposition of sediment.

Architectural Features – As used in roadside enhancement, these may include stepped retaining walls to minimize the visual impact of massive walls, rock sculpturing to blend disturbed areas into the natural terrain, and special treatment of bridge abutments and culvert headwalls to blend them into the landscape.

Asphalt – A dark brown to black cementitious material in which the predominate constituents are bitumens which occur in nature or are obtained in petroleum processing.

Automated Machine Guidance (AMG) – An application that can be applied to highway construction projects to provide construction efficiencies through enhanced location referencing. AMG involves using construction equipment mounted with onboard computers. Using a

combination of 3D modeling data along with GPS technology, AMG provides horizontal and vertical guidance in real time to construction equipment operators.

Auxiliary Lane – The portion of the roadway adjoining the traveled way for weaving, truck climbing, speed changing or for other purposes supplementary to through-traffic movement.

Average Daily Traffic (ADT XXXX) – (1) The current or projected average two-way daily traffic for a specified year. (2) (ADT YY) The projected average two-way daily traffic for a specified future period, usually 20 years after the anticipated completion of construction.

Average Running Speed – The average speed of all vehicles over a specified highway section, which is the sum of the distances traveled by vehicles on the highway section during a specified time period divided by the sum of their running times.

– B –

Backfill – Material used to replace, or the act of replacing material removed during construction. Also, material placed or the act of placing material adjacent to structures.

Backslope – In cuts, the slope from the bottom of the ditch to the top of the cut.

Base – The lift or lifts of material placed on a subbase or a subgrade to support a surface course.

Bedrock – Rock of relatively great thickness and extent in situ.

Bench Mark – A temporary or permanent marker of known elevation with reference to a specific datum plane.

Bituminous – Containing or treated with bitumen (e.g., bituminous pavement, bituminous concrete)

Brake Reaction Distance – The distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the instant the brakes are applied.

Braking Distance – The distance required to stop the vehicle from the instant brake application begins.

Breakaway (Yielding) Supports – A support for a roadside device that yields or collapses readily when struck by a vehicle.

Bridge – A structure including supports erected over a depression or an obstruction (such as water, highway, or railway), having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes. It may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

Broken Back Curve – An arrangement of curves in which a short tangent separates two curves in the same direction.

Bypass – A highway that permits traffic to avoid part or all of an urban area.

– C –

Cadastral – Pertaining to extent, value, and ownership of land. Cadastral maps show property corners and property boundaries.

Cadastral Survey – A survey made to determine the lengths and directions of boundary lines and the area of land bounded by these lines. It may also be a survey made to establish these boundary lines on the ground. Also known as a Property Survey.

Calcareous – Material containing or similar to calcium carbonate or lime.

California Bearing Ratio (CBR) – The ratio of the force required to penetrate a soil mass with a circular piston to the force required to penetrate a mass of high quality crushed stone with the same piston. The rate of penetration in both cases is identical.

Camber – A slight arch designed or built into a structure to compensate for the natural deflection after loading.

Centerline – For a two-lane highway the centerline is the middle of the traveled way, and for a divided highway the centerline may be the center of the median. For a divided highway with independent roadways, each roadway has its own centerline.

Channel – A course along which water flows. The course can be natural or artificial, open or closed. The flowing water can be confined by soil-based bed and banks, such as those in a natural river or stream or in an artificial ditch or canal; or by an artificial conduit, such as a pipe or flume.

Channelization – The separation of traffic flow into definite paths, by means of traffic markings, barriers, or islands.

Channelized Intersection – A grade intersection where traffic is directed into definite paths by islands.

Clay – A fine-textured soil, usually plastic and sticky when wet, which usually breaks into hard lumps when dry. When the moist soil is pinched between the thumb and finger, it will form a long, flexible ribbon.

Clear Zone – The portion of the roadside, including the shoulder, available for use by an errant vehicle.

Climbing Lane – An additional traffic lane provided for slow moving vehicles on the up-grade side of a highway.

Cohesionless Soil – A soil that, when unconfined, has little or no strength when air-dried, and little or no cohesion when submerged. Sand is an example of cohesionless soil.

Cohesive Soil – A soil that when unconfined has considerable strength when air-dried and that has significant cohesion when submerged.

Compressibility – The property of a material that enables it to remain compressed after compaction.

Compressive Stress – The stress produced in a member when the forces acting on it tend to push the particles together.

Construction Limits – The limits that establish the area disturbed by construction operations and beyond which no disturbance is allowed.

Construction Survey – A survey executed to locate or lay out engineering works. In highway construction applications, this survey is used to set grading elevation stakes, reference points, slope stakes, and other such controls.

Contour – A line that depicts equal elevation on a land surface. The line representing this on a map.

Contour Grading Plan – A drawing showing an arrangement of contours intended to integrate construction and topography.

Contour Interval – The elevation difference between adjacent contours.

Contract Document Hierarchy – There are five essential parts to a contract. The FAR, TAR, Special Contract Requirements (SCR), plans, and Standard Specifications are contract documents. A requirement in one document is binding as though occurring in all the contract documents. The contract documents are intended to be complementary and to describe and provide for a complete contract. In case of discrepancy, calculated and shown dimensions govern over scaled dimensions. The contract documents govern in the following order:

- FAR;
- TAR;
- SCR;
- Plans; and
- Standard Specifications.

Control Data – The horizontal and vertical values used to define the relative position of a control point.

Control Point – An established point on the ground with known horizontal and vertical positioning. This point is normally used as a basis for gathering field measurements and placing construction stakes.

Control Survey – A survey made to establish the horizontal and vertical positions of a series of control points. In highway applications, a control survey is generally the first survey performed on

a project. Other aspects of the surveying process base their measurements on the control points established during the control survey.

Cooperator – A State or local government agency that has jurisdiction over and/or maintenance responsibility for highways.

Coordinates – A set of numbers used in describing the location of a point on a surface or in space.

Corridor – A strip of land between two termini within which traffic, topography, environment, and other characteristics are evaluated for transportation purposes.

Countermeasure – A measure intended to prevent, delay, or reduce the severity of a problem.

Crashworthy – A highway feature is crashworthy if it has been successfully crash tested under applicable standards defined in MASH, the NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features,* or approved through analysis by FHWA based on similarity to other crashworthy features.

Crash Cushion (Impact Attenuator) – A device placed in front of a fixed roadside object to absorb and dissipate collision energy.

Creep – The slow movement of a material under stress, usually imperceptible except to observations of long duration.

Crest Vertical Curve – A vertical curve having a convex shape in profile.

Critical Length of Grade – That combination of gradient and length of grade that will cause a designated vehicle to operate at some predetermined minimum speed.

Cross Section – A vertical section of the ground or structure at right angles to the centerline or baseline of the roadway or other work.

Crosswalk – Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by signs, lines, or other markings.

Crown – The highest point of the surface of a tangent traveled way in cross section.

Crushed Gravel – The product resulting from the crushing of ordinary gravel with substantially all fragments having one or more faces resulting from fracture.

Crushed Stone – The product resulting from the crushing of fragments of bedrock or large stones with all fragments having all faces resulting from fracture.

Culture or Cultural Features – General term used in mapping to describe manmade features.

Culvert – A structure that is comprised of one or more barrels beneath an embankment, designed structurally to account for soil-structure interaction that does not meet the definition of a bridge.

Curb – A structure with a vertical or sloping face placed on roadways to form islands, gutters, etc. and to protect pavement edges.

Curve Widening – The widening of the highway traveled way on sharp curves to compensate for the fact that the rear wheels of a vehicle do not follow exactly in the track of the front wheels.

Curvilinear Alignment – A flowing alignment in which the majority of its length is composed of circular and spiral curves.

– D –

Data Collector – A recording device that electronically records surveying measurements and field notes. The information stored in these collectors is downloaded into a computer for later processing.

Day – A calendar day beginning and ending at midnight.

Deceleration Lane – A speed-change lane that enables a vehicle to slow to a safe exit speed when making an exit turn.

Degradation – General and progressive lowering of the longitudinal profile of a channel by erosion.

Delineator – A visual device for defining the alignment of a roadway.

Depletion – The progressive withdrawal of water from surface or ground water reservoirs at a rate greater than that of replenishment.

Design Discharge – The volume rate of runoff that a hydraulic structure is designed to safely pass. The rate depends on the characteristics of the watershed and the flood frequency selected for the design, which in turn, depends on the importance of the roadway, and the risk of failure one is willing to accept.

Design Headwater – The elevation of the water surface above a structure inlet, for a given structure type, size, and design discharge.

Design Hourly Volume (DHV) – The future two-way hourly traffic volume for use in design, usually the 30th highest hourly volume of the design year (30 HV).

Design Lane – The lane on which the greatest number of equivalent 18,000 lbs, single-axle loads are expected. Normally, this will be either lane of a two-lane highway or the outside lane of a multilane highway.

Design Load – The loads that must be supported by a structure.

Design Speed – A selected speed used to determine the various geometric features of the roadway.

Design Year – The future year used to estimate the probable traffic volume for which a highway is designed. A time 10 to 20 years from the start of construction is usually used.

Differential Leveling – Establishing elevations based on a known point based on an instrument that reads exclusively on a horizontal plane.

Divided Highway – A highway with separated roadways for traffic in opposite directions.

Division Standard Drawings – Division-specific drawings that are used on a repetitive basis within each FLH Division. These are issued by Division offices for routine use on projects within the Division and may be used individually or to supplement applicable FLH Standard Drawings.

Division Supplements – Supplements to this manual detailing differences in practice among the Divisions. These are issued by Division offices for use within the Divisions and by their consultants, whenever applicable.

Drainage Basin – The area of land contributing surface runoff to a given location. Large basins are commonly referred to as watersheds.

Drawings – Design sheets or fabrication, erection, shop drawing, or construction details submitted to the CO by the Contractor according to FAR Clause 52.236-21 Specifications and Drawings for Construction. Also refers to submissions and submittals.

Driveways – Minor roadway connections that fall into three categories:

- Private,
- Commercial, and
- Public.

– E –

Elasticity – That property of a material that permits it to return approximately to its original dimensions upon the removal of an applied load.

Electronic Distance Measuring Instrument (EDM) – A device that transmits and receives a modulated microwave, infrared, or visible light signal and computes the distance between the instrument and the reflector or retransmitter.

Elevation – The vertical distance of a point above mean sea level or above another datum.

Elongation – The increase in gauge length of a tension test specimen, usually expressed as a percentage of the original gauge length.

Embankment – A raised earth structure on which the roadway pavement structure is placed.

Embankment Foundation – The material below the original ground surface, the physical characteristics of which affect the support of the embankment.

Emergency Vehicle – (1) A vehicle belonging to the armed forces, civil defense, or police. (2) Any ambulance rescue unit vehicle. (3) Any designated vehicle used for answering emergency calls for assistance.

Empirical – Developed from experience or observations without regard to science and theory.

Emulsified Asphalt – A mixture of asphalt cement and water mixed with an emulsifying agent.

Energy Dissipator – A structure placed at a drainage outfall to dissipate the energy of flowing water in order to reduce scour and erosion of the receiving channel bed and/or banks.

Environment – The totality of man's surroundings (i.e., social, physical, natural, manmade).

Environmental Design – The location and design of a highway that includes consideration of the impact of the facility on the community or region based on aesthetic, ecological, cultural, sociological, economic, historical, conservation, and other factors.

Equivalent Single Axle Load (ESAL) – The effect on pavement performance of any combination of axle loads of varying magnitude, equated to the number of reference single-axle loads required to produce an equivalent number of repetitions of an 18,000 lb single axle.

Erosion – The progressive removal of a surface by the action of wind or water.

Estuary – That portion of a river channel occupied at times or in part by both sea and river flow in appreciable quantities. The water usually has brackish characteristics.

Excavation – (1) The act of taking out material. (2) The materials taken out. (3) The cavity remaining after materials have been removed.

Expressway – A multilane, divided highway designed to move large volumes of traffic at high speeds under free-flow conditions. Expressways have full control of access with grade-separated interchanges.

– F –

Federal Lands Highway Division – A Federal Lands Highway field office, responsible for the administration of the Federal Lands Highway program within a predetermined geographic area. See Exhibit 1.1–A.

- The Eastern Federal Lands Highway Division (EFLHD) office headquartered in Ashburn, Virginia.
- The Central Federal Lands Highway Division (CFLHD) office headquartered in Lakewood, Colorado.
- The Western Federal Lands Highway Division (WFLHD) office headquartered in Vancouver, Washington.

Flexible Pavement – A pavement structure that maintains intimate contact with and distributes loads to the subgrade, and depends on aggregate intergranular particle friction and cohesion for stability.

Flood – (1) An overflow or inundation that comes from a river or other body of water and causes or threatens damage. (2) A relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. (3) A relatively high flow as measured by either gauge height or discharge quantity.

Flood Frequency – . The probability of a flood of a certain magnitude occurring at a specific location within a given time period.

Floodplain – Normally dry land areas that are adjacent to a natural stream or watercourse and that are temporarily inundated during floods.

Flow Line – The lowest flow path through a designed channel, culvert, or other engineered conveyance structure.

Footing – Portion of the foundation of a structure that transmits loads directly to the soil or bedrock.

Foreslope – The slope from the edge of the surfaced shoulder to the top of the subgrade or the bottom of the ditch in cuts.

Foundation – Lower part of a structure that transmits loads directly to the soil or bedrock.

Free Water – Water that can move through the soil by force of gravity.

Freeboard – The vertical distance between the level of the water surface at design flow and a specified point (e.g., a bridge beam, levee top, location on a highway grade).

Frontage Road – A road contiguous to a controlled access highway, so designed as to (1) intercept, collect and distribute traffic desiring to cross, enter, or leave the controlled access highway, and (2) furnish access to adjacent property.

Functional Classification – The grouping of individual roads in a road system according to their purpose and the type of traffic they serve.

– G –

Gaging Station – A location on a stream where measurements of stage or discharge are customarily made.

Geodetic Control – Monument points of known global horizontal and/or vertical position.

Geometric Design – The arrangement of the visible elements of a road (e.g., alignment, grades, sight distance, widths, slopes).

Global Navigation Satellite System (GNSS) – A system of navigation that uses a global network of satellites to provide autonomous geospatial positioning. The network of satellites includes the United States' GPS system, Russia's GLONASS, China's BeiDou, and Europe's Galileo.

Global Positioning System (GPS) – The American specific global navigation satellite system.

Gradation – A general term used to describe the composition of an aggregate, soil, or other granular material. Gradation is usually expressed as the proportions (percents) of the aggregate that will pass each of several sieves of different sizes.

Grade – (1) The profile of the center of the roadway or its rate of ascent or descent. (2) To shape or reshape an earth road by means of cutting or filling. (3) To arrange according to size. (4) Elevation.

Grade Intersection – An intersection where all roadways join or cross at the same level.

Grade Separation – A structure that provides for highway traffic to pass over or under another highway or the tracks of a railroad.

Gradient – The rate of rise or fall with respect to the horizontal distance.

Grading – (1) Construction of the earthwork portion of the highway; (2) planing or smoothing the surface of various parts of a roadbed.

Gravel – Aggregate composed of hard, durable stones or pebbles, crushed or uncrushed, often intermixed with sand.

Ground Control – An accurate ground survey of targets or other features visible in aerial photographs to ensure the accuracy of photogrammetric mapping.

Ground Cover – Herbaceous vegetation and low-growing woody plants that form an earth cover.

Groundwater – Free water contained in the zone below the water table. The source of water in wells, springs, etc.

Grout – Mortar of sand, cement, and water with a consistency that allows it to be easily worked.

Guardrail – A protective cable or rail device placed along the roadway edge for the purpose of redirecting vehicles that have left the roadway at a point of hazard.

Gutter – A paved and generally shallow waterway provided for carrying surface drainage.

– H –

Headwall – A wall or structure constructed at the end of a culvert to prevent earth from spilling into the channel.

Hinge Point – The point where the slope rate changes.

Horizontal Curve – A circular or transitional curve by means of which a highway can change direction to the right or left.

Hot Mix – A general term used for hot plant mixed asphalt concrete mixtures manufactured and laid at temperatures ranging from 200°F to 320°F [95°C to 160°C].

Humidity (Relative) – The amount of moisture in the air compared with the amount that the air could hold if saturated at that temperature.

Humus – A brown or black material formed by the partial decomposition of vegetable or animal matter; the organic portion of soil.

Hydraulics – The physical characteristics that describe the movement or flow of water, oil, or other liquid, over, through, in, or around any surface.

Hydrograph – A graph showing stage, discharge, velocity, or other property of surface water, with respect to time, for a given location.

Hydrology – (1) The science encompassing the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground. (2) The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

– I –

Impact Attenuator – A device placed in front of a fixed roadside object to absorb and dissipate collision energy.

Independent Alignments – Each roadway of a divided highway is designed and located to take full advantage of the terrain. The median need not be of uniform width, and the two roadways need not be at the same level.

Indigenous – Produced, growing, or living naturally in a particular region or environment.

Infiltration – The flow of a fluid into a substance through pores or small openings. It connotes flow into a substance in contradistinction to the word percolation, which connotes flow through a porous substance.

Interchange – 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.

Intersection – The area common to two or more highways that come together at an angle.

Intersection Angle – The angle between two intersection legs.

Inundate – To cover or fill, as with a flood.

Invert – The lowest point of the internal cross section of a closed conduit or channel.

– K –

– L –

Landscaping – Enhancing the natural features of the land through the design and use of vegetation and other materials.

LandXML – A general data exchange format based on XML (extensive markup language) for horizontal construction data that provides support for surface, alignment, cross-section, pipe network, and point data types.

Lane – A portion of the traveled way providing for a single line of traffic in one direction.

Left Turn Lane – A traffic lane within the normal surfaced width of a roadway, or an auxiliary lane adjacent to or within a median, reserved for left-turning vehicles at an intersection.

Leveling Course – The layer of material placed on an existing surface to eliminate irregularities prior to placing an overlaying course.

Level of Detail (LOD) – A measure of the extent to which the design intent is reflected in the 3D model. The LOD typically refers to the design features that are included in the 3D model, the types of 3D model entities that represent the features, and the density of data points along the features at which the intended location is accurately depicted.

Lift – When placing and compacting soils, aggregates, or pavement; a lift is a single, continuous layer of material that is uniformly compacted.

Lime – A general term that includes the various chemical and physical forms of quicklime, hydrated lime, and hydraulic lime used for any purpose.

– M –

Median – The portion of a divided highway separating the traveled ways for traffic in opposite directions.

Median Barrier – A longitudinal system used to prevent an errant vehicle from crossing the median of a divided highway.

Modulus of Elasticity – The ratio of stress to strain for a material under given loading conditions.

Modulus of Rupture – A measure of the strength of concrete when it is broken by bending.

Moisture Content – The percentage, by mass, of water contained in soil or other material, usually based on the dry mass.

Monument or Reference Point – A permanent or semi-permanent reference point set during the survey or construction of a highway so that the survey can be reestablished later.

Mortar – A mixture of cement, sand, lime/fly ash, and water.

Mulch – Material placed on exposed earth to provide more desirable moisture and temperature relationships for plant growth. It is also used to control the occurrence of unwanted vegetation.

– N –

National Geodetic Vertical Datum of 1929 – The vertical datum used for survey and mapping established in 1929.

North American Vertical Datum of 1988 – The North American vertical datum used for survey and mapping established in 1988. At the time of this writing, this is the current vertical datum.

Noise Barrier – A barrier of earth, stone, concrete, or wood placed adjacent to the highway to reduce the noise level on abutting property.

– O –

Office of Federal Lands Highway – A FHWA headquarters office located in Washington, DC with the responsibility for the direct Federal program that is administered through division field offices.

Operating Speed – The speed at which drivers are observed traveling in fair weather during off-peak, free-flow conditions.

Optimum – The best quantity, number, or condition.

Ordinary High Water Mark – The line on the shore established by the fluctuations of water, indicated by physical characteristics**.**

Overburden – The mass of soil that overlies a source of rock, gravel, or other road material. This material is removed before the materials are quarried to avoid contamination.

Overlaying Course (Overlay) – An asphalt surface course, either plant mixed or road mixed.

Overlook (Scenic Overlook) – A roadside area provided for motorists to stop their vehicles, primarily for viewing the scenery.

Overpass – A grade separation where the highway passes over an intersecting highway or railroad.

– P –

Parcel – A tract of private or public land.

Passing Opportunity – A section of two-lane highway where the clear passing sight distance allows a safe passing maneuver to be performed.

Passing Sight Distance – Minimum sight distance on two-lane highways sufficient to enable the driver of one vehicle to pass another safely and comfortably, without interfering with the speed of an oncoming vehicle traveling at the design speed should it come into view after the overtaking maneuver is started.

Pavement Structure – The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Peat – A fibrous mass of organic matter in various stages of decomposition.

Pedestrian Crossing (Crosswalk) – An area reserved and clearly marked for the passage of pedestrians at street junctions or other locations where drivers must yield the right-of-way by stopping to enable pedestrians to cross safely.

Perception Reaction Time – The time required by a driver to perceive and react that a speed change or stop is necessary.

Permeability – The properties of a soil that allow the passage of any fluid and depend on grain size, void ratio, shape, and arrangement of pores.

pH – A scale of numbers from 0 to 14 that indicate the acidity or alkalinity of a solution. Numbers below seven indicate acidity and numbers above seven indicate alkalinity.

Phase – A part of a signal cycle during which a specific traffic movement (and concurrent nonconflicting movements) receives the right-of-way. It includes the change and clearance intervals associated with those movements.

Photogrammetry – The science and art of obtaining three-dimensional data from photographs. It produces dimensional data for mapping, cadastral purposes, design, and computation of quantities.

Plane Coordinate System – A cartographic projection that, by accepting small variations of scale, permits describing the position of points on the surface of the earth by their plane coordinates on a cylindrical or conical surface.

Planimetric Map – A map that presents horizontal but not vertical data for the features represented. Drainages, coastlines, land cover, and cultural elements are usually shown.

Planimetrics – All features both manmade and natural of significant value to the design of a proposed highway.

Plans – The contract plans furnished by the Government showing the location, type, dimensions, and details of the work.

Pollution – Contamination of any component of the total environment by harmful substances, sounds, smells, or sights degrading or injurious to humans and other living organisms.

Pool – A small and rather deep body of quiescent water (e.g., as a pool in a stream).

Portland Cement – Hydraulic cement consisting of compounds of silica, lime, and alumina.

Precision – The variance of repeated measurements of a characteristic from their average.

Prestressed Concrete (Pretensioned) – Reinforced concrete in which base, wires or cables are held in a stretched condition during placing of the plastic concrete until the concrete has hardened. The concrete compresses as the tension on the reinforcing steel is released.

Prestressed Concrete (Posttensioned) – Reinforced concrete in which the prestressing wires or tendons are placed in tubes before the concrete is cast. After the concrete has hardened, the wires or tendons are stretched to a predetermined tension by jacking and are wedged in this position. The tubes may also be pressure-grouted.

Prime Coat – An asphalt material applied to an absorbent surface, preparatory to any subsequent treatment, for the purpose of hardening or toughening the surface and promoting adhesion between it and the superimposed construction.

Profile – A longitudinal section of a highway, drainage course, etc.

Profile Grade – The line formed by a vertical plane intersecting a particular surface of a roadway, usually along the longitudinal centerline at the top of finished pavement. Depending on context, profile grade refers to either the elevation or gradient of this line.

Project Specific Detail (Detail) – Project specific special drawings included in the plans to describe items of the work, consistent with the FP-XX. Project Specific Details can be used individually, or to supplement applicable FLH Standard Drawings, Division Standard Drawings, or both.

– R –

Railroad Grade Crossing – The intersection of a highway and a railroad at the same elevation.

Reaction Time – The time required for a driver to apply foot pressure to the brake after perception that a stop must be made.

Reclamation – The restoration of borrow and aggregate pits to a natural form that may include replacement of topsoil and vegetation (seeding).

Recurrence Interval (Return Period) – The average interval of time within which the given flood will be equaled or exceeded.

Refuge Island – (1) An island in a wide intersection to provide refuge for pedestrians. (2) A place for transit passengers to load and unload from a bus.

Regional Factor – A numerical factor expressed as a summation of the values assigned for precipitation, elevation, and drainage. This factor is used to adjust the structural number.

Reinforced Concrete – Concrete where steel reinforcement is embedded so that the steel and concrete act together in resisting stress.

Residential Area – That portion of a municipality or an area within the influence of a municipality in which the dominant land use is residential development, but where small business areas may be included.

Rest Area – A roadside area with parking facilities separated from the roadway providing motorists with opportunities to stop and rest for short periods.

Resurfacing – The placing of one or more new courses on an existing surface.

Reverse Curve – A curve consisting of two arcs of the same or different radii curving in opposite directions and having a common tangent or transition curve at their point of junction.

Right of Way (R/W) – Real property, or interests therein, acquired, dedicated, or reserved for the construction, operation, and maintenance of a highway in which Federal-aid or direct Federal highway funds are or have been involved in any stage of development. Lands acquired under 23 USC 319 shall be considered to be highway right-of-way.

Right Turn Lane – An auxiliary lane or designated lane provided at grade intersections for right-turn movements.

Riparian – Relating to or living or located on the bank of a natural watercourse (such as a river or stream) or sometimes of a lake or a tidewater.

Riprap – A protective covering of graded stones, with or without mortar, to prevent erosion.

Road (Highway or Street) – A general term denoting a public way primarily designed for purposes of multimodal travel.

Road Approaches – Rural and suburban minor connections to a highway or frontage road from adjoining properties. These approaches can be private, public, or commercial.

Roadbed – The graded portion of a road or highway prepared as a foundation for the pavement structure and shoulders.

Roadside – The area between the outside shoulder edge and the right-of-way limits. The area between roadways of a divided highway may also be considered roadside.

Roadside Barrier – A longitudinal system used to shield vehicles from hazards on the roadside.

Roadside Development (Roadside Enhancement) – Treatment of the roadside to (1) conserve, enhance and effectively display the natural beauty of the landscape through which the highway passes; (2) provide safety, utility, economy, and highway-related recreation facilities by means of proper location, design, construction, and maintenance of highways.

Roadside Obstacle – Any non-recoverable or non-traversable slope, or any feature or fixed object outside of the lane, that increases the likelihood or severity of a crash for a vehicle that departs the traveled way.

Roadway – The portion of a highway, including shoulders, primarily for vehicular use. A divided highway has two or more roadways.

Roadway Prism – The area between the original and the final design cross-section.

Rounding – The removal of the angle where cut and fill slopes intersect the natural ground, and the substitution of a gradual transition or rounded surface.

Rumble Strip – A rough textured surface, constructed for the purpose of causing the tires of a motor vehicle driven over it to vibrate audibly as a warning to the drivers.

Runoff – The portion of precipitation on land that ultimately reaches streams often with dissolved or suspended material.

Running Speed – The speed over a specified section of highway, equal to the length of the highway section divided by the running time, or the time that a vehicle is in motion to travel through the section.

– S –

Sag Vertical Curve – A vertical curve having a concave shape in profile.

Scale – The ratio of the size of the image or representation of an object on a map or photograph to its true size. Scale may be expressed as a representative fraction (1/10,000) or ratio (1:10,000) or as the number of units on the ground represented by the same type of units on the map or photograph (1 in to 100 ft).

Scour – The result of erosive action of running water primarily in streams, excavating and carrying away material from the bed and banks.

Screening – The use of trees, shrubs, fences, or other materials to obscure an objectionable view or to reduce an objectionable sound.

Seal Coat – An asphalt coating, sometimes with cover aggregate, applied to the surface of a pavement for the purpose of waterproofing and preserving the surface, altering the surface texture of the pavement, or providing resistance to traffic abrasion.

Sediment – Fragmentary material that originates from weathering of rocks and is transported by, suspended in, or deposited by water or wind.

Sedimentation – The action or process of depositing particles of waterborne or windborne soil, rock, or other materials.

Service Road – A road, generally unimproved, used to transport personnel, materials, or equipment for the operation or maintenance of utilities located on a highway right-of-way.

Serviceability – A concept where pavements are judged on their ability to serve traffic. Longitudinal smoothness is a primary factor in this judgment.

Shoulder – The portion of the roadway contiguous with the traveled way that accommodates pedestrians, bicycles, stopped vehicles, and emergency use; and is used for lateral support of subbase, base, and surface courses.

Shrub – A small, woody multi-stemmed plant.

Side Slopes – Slopes along the side of the roadway identified by their distance from the traveled way, their slope rate, and their height.

Sidewalk – That portion of a street or highway between the curb line or edge of the roadway, and the adjacent right-of-way line constructed specifically for pedestrians.

Sight Distance – The length of roadway ahead, visible to the driver.

Signal System – A system of visual signals used to control the movement of traffic, usually on city streets.

Silt – Material passing a No. 200 sieve that is non-plastic or very slightly plastic and exhibits little or no strength when air dried.

Site Map – A large-scale map of a specific small area (e.g., bridge site).

Skew – Oblique, not at right angles.

Skew Angle – The complement of the acute angle between two centerlines that cross.

Sliver Fill – A thin embankment slope that is roughly parallel to the natural slope of the hillside.

Slope – Any ground whose surface creates an angle with the plane of the horizon.

Slope Rate – The steepness of the slope - usually the ratio of the vertical change divided by the horizontal distance.

Slump – The measure of the consistency of portland cement concrete by consolidating in a slump cone, removing the cone, and allowing the concrete to settle under its own mass.

Soil – Sediments or other unconsolidated accumulation of solid particles produced by the natural physical and chemical disintegration of rocks, and which may or may not contain organic matter.

Soil Classification – The arrangement of soils into classes according to their physical properties.

Soil Stabilization – Measures taken to eliminate or minimize the erosion of soil or to improve its supporting capacity.

Specifications – The written requirements for performing work.

- Standard Specifications. The Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects approved for general application and repetitive use and designated as FP-XX (e.g., FP-24, or simply FP).
- FLH Supplemental Specifications. Additions and revisions to the Standard Specifications that have been approved for use on all FLH projects, or all FLH projects with a particular item or character of work. FLH Supplemental Specifications normally consist of the same standard language in all the Divisions' Libraries of Supplemental Specifications.
- Division Supplemental Specifications. Additions and revisions to the Standard or FLH Supplemental Specifications that have been approved by a Division.
- Library of Supplemental Specifications (LOS). The compilation of all FLH Supplemental Specifications and Division Supplemental Specifications. Each Division maintains its own LOS.
- Unique Project Specifications. Additions and revisions to the Standard Specifications or LOS that are developed and used on an individual project basis. Unique Project Specifications are normally written by the project team to address a unique requirement for a single project.
- Special Contract Requirements (SCRs). All additions and revisions to the Standard Specifications used on an individual project. The SCRs are included in the contract for a project and include all FLH Supplemental Specifications, Division Supplemental Specifications, and Unique Project Specifications applicable to that project.

Spillway – A surface apron or trough for conducting water down a relatively steep slope.

Stabilization – Modification of soils or aggregates by incorporating materials that will increase load-bearing capacity, firmness, and resistance to weathering or displacement.

Stage – The height of a water surface above an established datum plane; also gage height.

Stage Construction – The construction of a highway by stages or increments.

Standard Drawings – Drawings issued and approved by the Federal Lands Highway Office for repetitive use.

State Plane Coordinates – The American system of plane rectangular coordinate zones, which are defined individually for each state or zone within a state. Within each state plane zone a cartesian (x,y) coordinate system describes geographic locations at a datum plane.

Station – A measure of distance used for highways and railroads. A Metric station is equal to 1000 m. A US Customary station is equal to 100 ft.

Stone – Rock material produced from a quarry (i.e., nongravel material).

Stop Line – A white line placed transversely on the pavement (at an intersection) to indicate where the vehicle must stop when obeying a traffic signal or stop sign.

Stopping Sight Distance – The distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the roadway becomes visible. It includes the distance traveled during the perception and reaction times, as well as the vehicle braking distance.

Storm Drain – A system of catch basins and underground conduits for collecting, concentrating, and conveying water to a disposal point.

Stratigraphy – The study of rock strata, generally by analyzing rock outcrops or drill cores.

Stress-Strain Diagram – A diagram where corresponding values of the stress and strain are plotted.

Subbase – The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course.

Subgrade – The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.

Superelevation – The elevation of the outside edge of a curve to partially offset the centripetal force generated when a vehicle rounds the curve.

Superelevation Runoff – The transition distance between a section with level cross slope on half, or the entire, roadway and the fully superelevated roadway.

Surface Course – The top lift or lifts of a pavement structure designed to accommodate the traffic load and resist skidding, traffic abrasion, and weathering.

Surface Treatment – An application of asphalt material and cover aggregate.

Sustained Grade – A continuous highway grade of appreciable length and consistent or nearly consistent gradient.

– T –

Tack Coat – An application of asphalt material to an existing surface to provide bond with a superimposed course.

Target (Aerial) – A contrasting symmetrical pattern centered around a point on the ground to facilitate locating and measuring to the image of the point in a photograph. Generally, the horizontal and vertical coordinates are known.

Temporary Traffic Control Signal – A signal that is designed to be operated for a limited time. (It normally consists of the necessary signal faces, a control unit, the necessary electrical cables, and a power supply).

Terrain – The topographic and physical features of a tract of land, geographic area, or territory.

Toe of Slope – The intersection of a roadway embankment side slope with the original ground surface.

Topographic Map – A three-dimensional map within an associated terrain model.

Topographic Survey – A survey conducted to determine the existing geometry of the ground.

Topsoil – A surface soil that is predominately a loose, friable, free draining sandy loam with some organic matter, which is free of subsoil, refuse, stamps, roots, and rocks larger than 2 in in diameter.

Total Station – A vertical and horizontal angle-measuring theodolite with an electronic distance measuring instrument integral with the theodolite's telescope. The theodolite converts angular measurements into a digital form. Such theodolites display the slope and horizontal distance as well as the elevation difference between the instrument point and a remote point.

Traffic Barriers – Roadside barriers, median barriers, crash cushions, and bridge parapets intended to guide or protect traffic from roadside hazards, including collision with other vehicles.

Traffic Control Devices – Signs, signals, markings, and devices placed or erected for the purpose of regulating, warning, or guiding traffic.

Traffic Markings – A traffic control device consisting of lines, patterns, words, symbols or colors on the pavement.

Traffic Volume – The number of vehicles passing a given point during a specific period of time.

Transition – A section of variable pavement width required when changing from one width of traveled way to a greater or lesser width; or a section of variable cross slope such as from normal crown to full superelevation.

Transition Curve (Spiral) – A curve of variable radius intended to provide a smooth transition from tangent to curved alignment.

Transverse – At right angle to the longitudinal direction.

Traveled Way – The portion of the roadway designated for the movement of vehicles, not including the shoulders.

Traverse – In surveying, a series of interconnected straight lines. The lengths of the lines and the angles of deviation between them are measured as the traverse develops.

Trigonometric Leveling – Determining elevation difference by measuring the slope distance, vertical angle, and difference in instrument heights between two points.

Turning Path – The path of a designated point on a vehicle.

Turning Radius – The radius of the path of the outer front wheel of a vehicle.

– U –

Underdrain – Porous or perforated pipe, or graded aggregate installed to provide subsurface drainage.

Underpass – A grade separation where the highway passes under an intersecting highway or railroad.

– V –

Vertical Curve – A parabolic curve on the longitudinal profile of a road to provide for change of gradient.

– W –

Water Table – The top of the zone of permanent soil saturation. The water table may rise or fall seasonally, or it may be drawn down by removal of water.

Weathering – The decomposition of rock, shale, etc., resulting from any chemical or mechanical process caused by exposure to weather.

Weep hole – A hole through an abutment or retaining wall to relieve hydrostatic pressure.