Chapter 1
New Framework for Geometric Design

Legend

	Multimodal Application Example
	Context-Sensitive Solutions Application Example
	Performance-Based Practical Design Application Example
	Multimodal (MM)
	Context-Sensitive Solutions (CSS)
	Performance-Based Practical Design (PBPD)
	Web link for additional information
	AASHTO-Specific Information

Chapter

1

1 New Framework for Geometric Design

1.0 Introduction

The Colorado Department of Transportation (CDOT) Roadway Design Guide 2023 (Guide) establishes a new framework for designing roads; streets; and freeways, expressways, and interstates that move people and goods in Colorado. It is a fresh approach to design that considers a facility's functional classification, its surrounding physical environment (context), and how it will accommodate people using various travel modes.

The Guide is consistent with current industry practice.

- The American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets* (the Green Book) (2018 AASHTO GDHS) (AASHTO, 2018) encourages flexibility in design, emphasizing the role of the planner and designer in determining appropriate design elements and dimensions based on project-specific conditions and existing and future roadway performance, more than on meeting specific nominal design criteria.
- The Transportation Research Board (TRB) *Highway Capacity Manual, Seventh Edition: A Guide for Multimodal Mobility Analysis* (*Highway Capacity Manual*) (TRB, 2022) includes information about assessing traffic operations for all transportation modes.
- The AASHTO *Highway Safety Manual* (AASHTO, 2010) highlights the relationship of geometric design features to crash frequency and severity.
- The National Cooperative Highway Research Program (NCHRP) Report 855, An Expanded Functional Classification System for Highways and Streets (NCHRP, 2018), describes how to incorporate a project purpose and need and how to accommodate all transportation modes, including transit and freight.

- The NCHRP Report 785, Performance-Based Analysis of Geometric Design of Highways and Streets (NCHRP, 2014) presents the trending approach to identify the desired outcomes of a project, selecting performance measures that align with the desired outcomes, and using data driven geometric decisions that will deliver those outcomes.

This Guide builds on these industry tools with information that is specific to Colorado's diverse range of environments and transportation modes. It briefly describes CDOT's Project Development Process and the relationship of project planning and budgeting to the design process. It then presents an integrated approach to design that uses a range of considerations to define the overall context of a facility, leading to the geometric design criteria necessary to meet purpose and need of a project and accommodate user needs and safety.

1.1 Project Development Process

The project development process for the new framework for geometric design follows the concepts of CDOT's Project Development Process that is described in the CDOT *Project Development Manual* (CDOT, [2013] 2022).

Use this link to access CDOT's Project Development Manual:
https://www.codot.gov/business/designsupport/bulletins_manuals/2013-project-development-manual

1.1.1 Scoping, Budgeting, and Programming

The idea for a project is vetted through CDOT's statewide planning process coordinated by CDOT's Division of Transportation Development. Participants in the process include internal and external planning partners and the public across the state. The results of this process are a Statewide Transportation Plan that incorporates the Statewide Transit Plan, Regional Transportation Plans, the Strategic Transportation Safety Plan, the Colorado Freight Plan, the Statewide Bicycle and Pedestrian Plan, and a 10-Year Vision Plan. The Statewide Transportation Improvement Program (STIP) is updated and adopted by the Colorado Transportation Commission annually and includes projects that are scoped and funded for the next four years. A longer list of identified projects in a 10-Year Strategic Project Pipeline informs which projects move into the STIP as funding becomes available.

A project must be included in the STIP before design and construction can begin. Projects in the STIP are not typically defined beyond preliminary engineering and a budget estimate.

Use these links to access CDOT's planning process:
https://www.codot.gov/programs/planning and
https://www.codot.gov/programs/planning/planning-process

Use this link to access CDOT's Scenic & Historic Byways Corridor Management Plan:
Microsoft Word - CDOTByways.CMPTemplate_FINAL.docx (codot.gov)

1.1.2 Project Development/Design

The designer may or may not be involved in a project's planning phases where the purpose and need and budget are determined. However, the role of the designer is to take the initial project definition and thoughtfully apply the process defined in Chapter 1 and Chapter 2 of this Guide to consider the relevant characteristics and facility needs. The context classification process results in defining a facility type (Road; Street; or Freeway, Expressway, Interstate) with project-specific geometric design criteria that serve a distinct set of user needs.

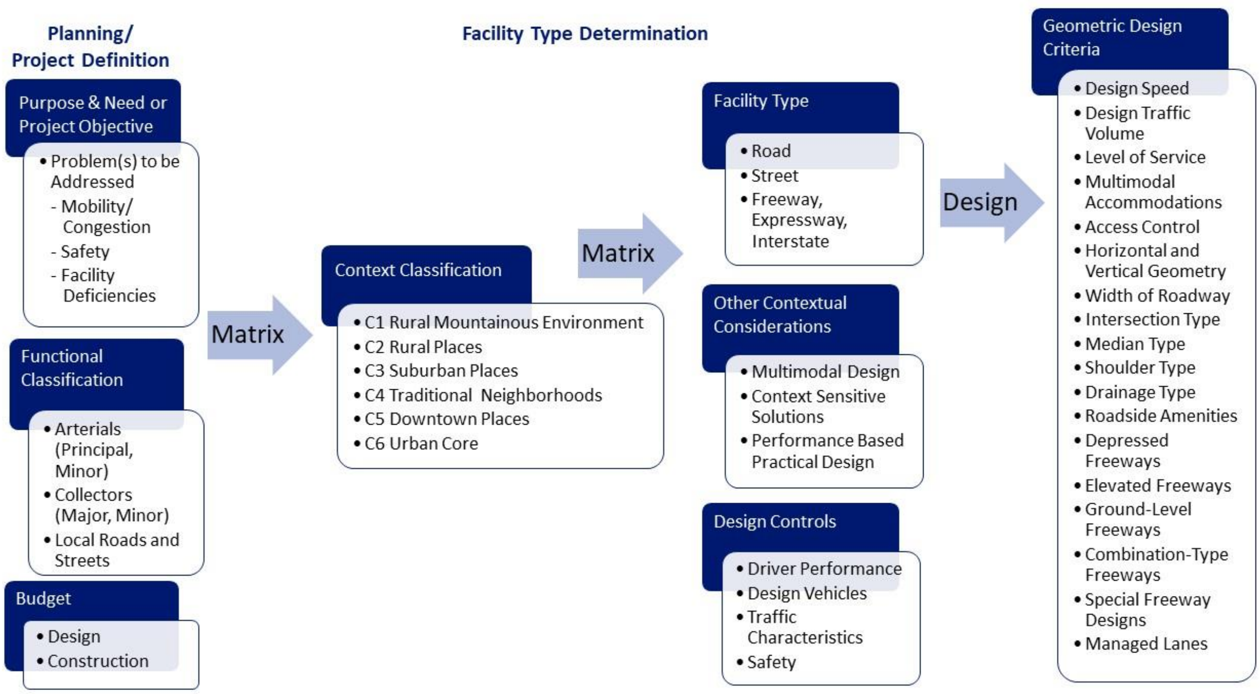
The steps in the design process are as follows and illustrated in Figure 1-1. A detailed step-by-step process with how to use this Guide is provided in Section 1.9.

- Review and update the preliminary scope, purpose and need, and budget that were determined during the planning phases.
- Identify the facility's functional classification, using CDOT's Online Transportation Information System (OTIS), that characterizes a roadway by its hierarchy in the transportation network and the type of service it provides to travelers.

Use this link to access CDOT's OTIS online tool:
https://dtdapps.coloradodot.info/otis

- Determine the context classification that characterizes a facility by its surrounding environment and how the facility fits into the community (Section 1.3 of this Chapter).
- Identify the facility type from the context classification: Road; Street; or Freeway, Expressway, Interstate that determines the project's geometric design criteria (Section 1.6 of this Chapter).
- Evaluate design controls that further describe the facility's conditions at a high level (Chapter 2 of this Guide). These may include:
  - Driver Performance
  - Design Vehicles
  - Traffic Characteristics
  - Safety Performance
- Examine additional design considerations that help to define the context for the design. These include:
  - *Multimodal Design.* Consideration of all transportation modes (motor vehicle, pedestrians, bicycles, transit, etc.).
  - *Context Sensitive Solutions.* A collaborative, interdisciplinary decision-making process and design approach to develop a transportation facility that fits its physical setting.
  - *Performance-Based Practical Design.* A decision-making approach that helps agencies better manage transportation investments and serve system-level needs using a data driven analysis and performance priorities.

Figure 1-1 Design Process Workflow



Note: "Matrix" refers to the Context Classification to Facility Type Matrix introduced in Section 1.6.

1.2 Planning/Project Definition

1.2.1 Project Purpose and Need or Objective

A project purpose and need (or objective) is developed at the beginning of the Project Development Process. This excerpt from the AASHTO 1.2 – Project Purpose and Need describes what it is and how it is used.

"The design of every road or street improvement project should begin with an explicit statement developed by the roadway agency that indicates why the project is being undertaken and what the project is intended to accomplish. This statement may be in the form of the purpose and need statement used in National Environmental Policy Act (NEPA) analyses, a formal statement of objectives for the project, or a combination of the two approaches. Either separately or collectively, these statements set out the purpose and need for the project and the objectives that the project should satisfy in fulfilling that purpose and need. In the remainder of this discussion, these two types of documents collectively will be referred to as the purpose and need statement.

The purpose and need statement informs priorities on what will, and what will not, be undertaken in the project. The designer should refer to this purpose and need statement in determining the scope of geometric design changes to include in the

> project and assessing whether any geometric design changes suggested by others are germane to the project purpose and need.
>
> The purpose and need statement for a project should be built around an assessment of past performance for all transportation modes of the roads and streets within the project limits and a forecast of future performance if no project is undertaken. The purpose and need statement should address the project context and how each transportation mode should be accommodated. The purpose and need statement should also indicate what aspects of performance should be improved and, in some cases, may also set targets for how much performance should be improved. Thus, improvement needs should be based on specific performance issues that are identified by the agency as in need of improvement. Both quantitative and qualitative performance measures may be used in defining the purpose and need for projects. The roadway agency should involve other stakeholders in establishing the project purpose and need." (2018 AASHTO GDHS)

A fundamental change from the AASHTO guidance quoted above is the practice of incorporating data-driven Performance-Based Practical Design considerations into the development of a project purpose and need. NCHRP and TRB are conducting studies in support of this change to include in the next edition of the 2018 AASHTO GDHS and in other state departments of transportation guidance documents. A data-driven safety analysis (DDSA) of past and future performance of the roadway facility, including the contextual elements that it supports, will define the purpose and need for the project with goals or targets for the design. Taking the context of the project into consideration at this early stage helps establish overall project goals.

1.2.2 Budget

The initial budget is determined during the statewide planning processes described in Section 1.1.1.

1.2.3 Functional Classification

Functional classifications define the range of mobility and access of the roadway facility. The basic concepts related to the functional classification of roadway facilities and systems are discussed in the 2018 AASHTO GDHS. There are three general functional classifications:

- *Arterials* are roadways that provide a high level of mobility.
- *Collectors* provide a balance of mobility and access.
- *Local Roads and Streets* provide a high level of land accessibility.

Each functional classification can be found in both urban and rural areas. Urban and rural designations for each of the functional classifications are tied to U.S. Census data, which is taken every ten years.

Functional classification is a required overlay to align with federal guidance and requirements, for evaluation of access requirements in the State Highway Access Code, and for general reporting in CDOT's form 463 Design Data. This is used as a stepping stone to move ahead in context classifications for design.

Because there is a set percentage of roadways that can be on the National Highway System (NHS), new roadways are seldom added to the NHS. It is also rare that a roadway functional classification will change, and the request must be reviewed and accepted by the Colorado Transportation Commission and the Federal Highway Administration (FHWA).

Use this link to access FHWA's Highway Functional Classification Concepts, Criteria and Procedures (FHWA, 2013): *https://www.fhwa.dot.gov/policyinformation/hpms/hfcccp.cfm*

The functional classifications as defined in the 2018 AASHTO GDHS are:

Arterials

Principal Arterials. Principal Arterials serve a large percentage of travel between cities and activity centers. Principal Arterials are the frequent route for intercity busses and trucks. They are generally designed for higher-speed, higher-volume, and long-distance travel that may pass directly through or bypass activity centers. Principal Arterials have three classifications:

Arterials carry high traffic volumes between population and activity centers.

- *Interstates.* Interstates are the highest classification of Arterials and are designed and constructed for mobility and long-distance travel. Roadways in this category are officially designated as an "Interstate" by the U.S. Secretary of Transportation.
- *Other Freeways & Expressways.* Freeways & Expressways with full access control are similar to Interstates. By definition, Freeways are characterized by full access control with access points limited to on/off ramps and with no at-grade intersections. Expressways are more common in rural settings where at-grade intersections are permitted to varying degrees depending on context. In general, these types of roadways favor through movements over access, particularly Freeways.
- *Other Principal Arterials.* Other Principal Arterials serve activity centers and allow more access than Interstates and Freeways & Expressways. They provide additional access to parcels and have at-grade intersections. Other Principal Arterials provide similar service in both urban and rural areas; the primary difference in urban areas is the quantity of arterials serving a particular urban area. Rural areas would typically be served by one Arterial.

Minor Arterials. Minor Arterials provide service for moderate length trips, serve geographic areas that are smaller than the Principal Arterials, and have higher connectivity to the Principal Arterials. In urban settings, they interconnect and supplement the Principal Arterial system, connect communities, and may carry bus routes. In rural settings, they are typically designed to provide higher travel speeds with minimum interference to the through movement.

Collector Roads and Streets

Collectors provide the connection from Local to the Arterial systems. Collectors may be subdivided into Major and Minor Collectors in both the urban and rural areas. A large proportion of the rural roadway system consists of two-lane Collector Roads. The rural roadways generally serve short-distance, intra-county movement rather than long-distance, inter-county or statewide movement. The urban Collector Street typically offers more mobility options than an Arterial, includes facilities for pedestrians and bicycles, and often accommodates public utility facilities within the right of way.

Collector Roads and Streets are primarily used to travel shorter distances at slower travel speeds.

- *Major Collector.* Major Collectors are typically longer in length, balance through movement and access, and may have higher posted speeds and traffic volumes and more travel lanes than the Minor Collector.
- *Minor Collector.* Minor Collectors serve both land access and traffic circulation, penetrate residential neighborhoods for short distances, operate at lower posted speeds, provide service to smaller communities not served by Arterials, and link locally important traffic generators with rural surroundings.

Local Roads and Streets

Local Roads and Streets account for the largest percentage of roadways in terms of mileage and are typically designed to discourage through traffic. A local road or residential street primarily serves as access to a farm, residence, or other abutting property.
On these roadways, the through traffic is local in nature and extent rather than regional, intrastate, or interstate. Local roadways are typically classified by default; once all other roadways have been classified as Arterial or Collector, the remainder are Local roadways.

Local Roads and Streets provide access to properties and typically have traffic control measures.

1.2.3.1 Functional Classifications in Colorado

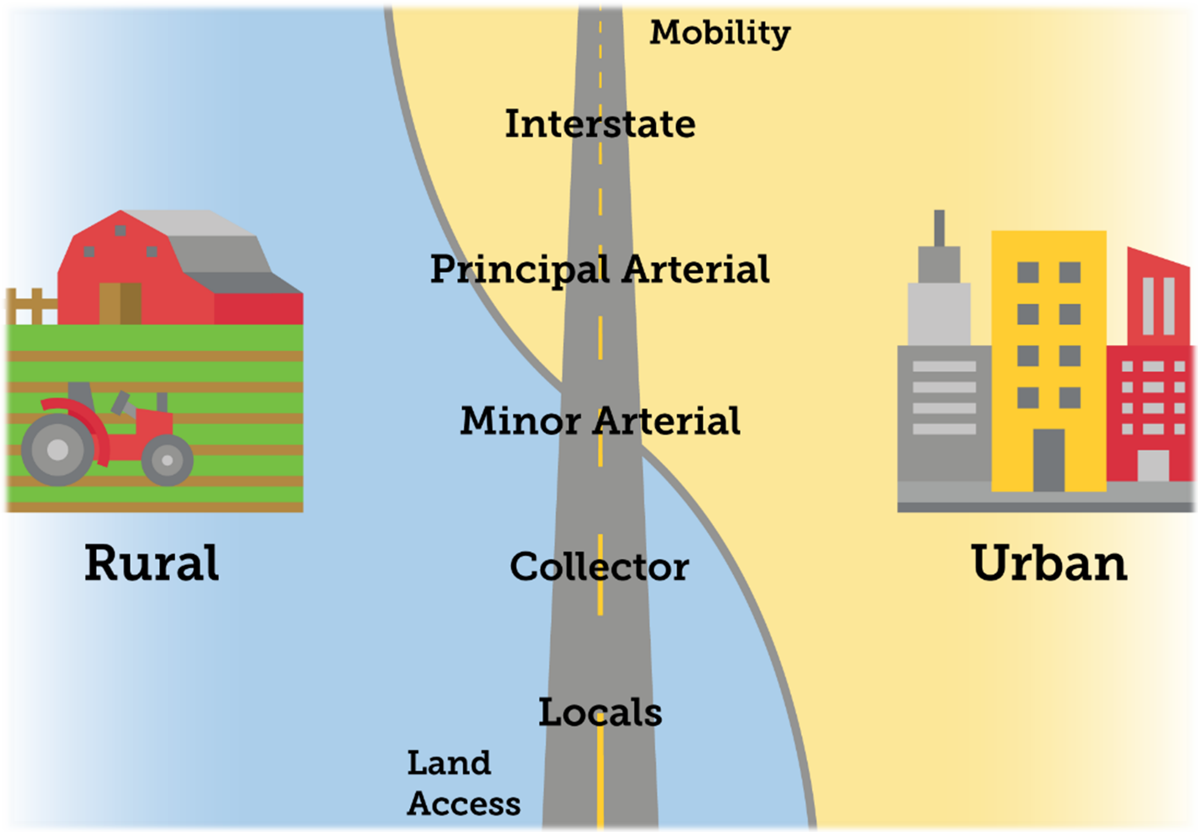
The functional classification for existing facilities in Colorado is already defined and can be found on the CDOT Online Transportation Information System (OTIS)

(CDOT, n.d.). OTIS shows the system classifications of the roadways, such as the administrative class, the functional classification, the NHS designation, and other special system classifications. Ramps and other non-mainline roadways are assigned the functional classification of the highest functional classification of the intersecting mainline that serves the ramp or other facility.

Use this link to access CDOT's OTIS data: [CDOT-OTIS Online Transportation Information System | Home (coloradodot.info)]

Figure 1-2 aids in the vision of transportation of Urban Mobility and Rural Land Access. The classifications between them help categorize the area of context that they may fit.

Figure 1-2 Mobility and Land Access



1.3 Context Classification

The context classifications defined in this Guide are related to the context classifications of Rural, Rural Town, Suburban, Urban, and Urban Core described in Chapter 1, Section 1.5, of the 2018 AASHTO GDHS.

“Context classification” is a land use term that describes a geographic location based on its population density and natural or built environment characteristics. There are six context classifications ranging from rural to urban (C1 through C6). The C1 context classification is the least populated and is characterized as a natural, unchanged landscape or a remote mountainous area. The C6 context classification is the most heavily populated in a built-out, human-made urban environment.

The context classification and the transportation modes a facility supports influence roadway design. A roadway facility can traverse one or more context classifications. For example, US 6 in Colorado moves from rural eastern plains to heavily populated urban areas, and then on to remote or small-town mountainous areas before entering the high deserts of western Colorado. Its design has very different functional characteristics in each geographic area.

1.3.1 Special Traffic Generators Within Context Classifications

There are special traffic generators within context classifications. Special traffic generators are unique land uses that may generate traffic that is not typical for the context classification. The following land uses are special traffic generators to consider within a specific context classification:

- Major Industrial
- Schools
- Hospitals
- Ski Areas
- Sport Complexes
- Major Warehouses
- Seasonal Events
- Airports
- Colleges
- Military Installations

For additional information, refer to NHCRP 855 Report, An Expanded Functional Classification System for Highways and Streets (NCHRP, 2018).

1.3.2 Context Classifications in Colorado

The classifications used to define context in Colorado are as follows:

C1 - Rural Mountainous Environment. C1 is characterized by wilderness or forested areas that may include mountains, canyons, and rivers. The challenging geographic and environmental conditions in these areas have a strong influence on the alignment, design, and performance of a highway. The roadways may have right of way and environmental constraints. They may be in more remote areas with access to outdoor recreation, such as bicycling, mountain biking, skiing, hiking, river activities, and camping. There may also be interregional transit in areas where towns and business centers tend to be interspersed across rural geographic areas. Roadways may have passenger vehicles, freight transport, recreational vehicles, and the occasional bicyclist. Examples of roadways in a C1 context classification include I-70 through Glenwood Canyon and US 550 between Durango and Ouray.

C1 – Rural Mountainous Environment

C2 - Rural Places. C2 is characterized by agricultural lands, ranches, rural towns, or farming areas. Roadways may have passenger vehicles, freight vehicles, interregional transit, and occasional bicycle and pedestrian activity. Oversized agricultural equipment may regularly use the roadway to travel to fields. Examples of roadways in a C2 context classification include US 285 in the San Luis Valley and CO 71 north and south of Brush, Colorado.

C2 - Rural Places

C3 - Suburban Places. C3 is characterized by housing areas and strip commercial development just outside of larger urban cores or small pockets of housing outside of rural town cores. In the Denver area, Highlands Ranch is considered suburban; in Grand Junction, the Redlands is considered suburban. Roadway uses in this context classification can vary depending upon the density of development the roadway supports, and the uses may evolve as the area grows and becomes more populated. Roadways may have passenger vehicles, buses, freight transport, trains, pedestrians, and bicyclists.

C3 - Suburban Places

C4 - Traditional Neighborhoods. C4 is characterized by well-connected or established streets and blocks with a range of housing types, amenities, schools, and businesses. It is often located in or adjacent to an urban area and is closer to the downtown core than a suburb. Traditional neighborhoods are found in large urban areas and rural towns. Travel between the Traditional Neighborhood and an Urban Core may occur by foot, bicycle, or transit, in addition to vehicular travel. In Denver, the Washington Park neighborhood would be considered a Traditional Neighborhood. In Greeley, the Glenmere/Cranford neighborhood would be an example of a Traditional Neighborhood.

C4 - Traditional Neighborhoods

C5 – Downtown Places. C5 is characterized by retail, office, and other business activity in both large and small towns, with main streets or civic spaces like town squares. Its roadways support a greater percentage of bus transit, pedestrian, bicycle, and passenger vehicle activity, as well as some freight and delivery traffic. The variability of this context classification is demonstrated by downtown Lamar or Alamosa, larger city centers in Grand Junction or Fort Collins, or town squares in the mountain communities of Aspen or Steamboat Springs. C5 is generally located very close to a C4.

C5 - Downtown Places

C6 – Urban Core. C6 is characterized by a primarily built environment with a mix of multiuse buildings (office, residential, retail), civic spaces, and cultural or entertainment districts in large, densely populated cities. Numerous amenities are available within walking distance to those who live or work in the Urban Core. Downtown Denver and downtown Colorado Springs are examples of this context classification. Roadways accommodate multiple uses with complex interrelationships. This context classification has the highest level of pedestrian, bicycle, bus and light rail transit, and freight and delivery activity of all the context classifications. C4 may circle a C6 or be located within walking distance to that core.

C6 - Urban Core

1.4 Facility Type

The new framework for geometric design uses three facility types, defined as:

Road

Context Classifications: C1 Rural Mountainous Environment, C2 Rural Places, C3 Suburban Places.
A facility generally characterized by shoulders and roadside ditches, mainly found in rural, low-density settings.

Street

Context Classifications: C3 Suburban Places, C4 Traditional Neighborhoods, C5 Downtown Places, C6 Urban Core.
A facility generally characterized by the inclusion of curb and gutter, sidewalks, and storm sewers in more urban contexts, which may include on street parking, bike lanes, and transit stops.

Freeway, Expressway, Interstate

Context Classifications: C1 Rural Mountainous Environment, C2 Rural Places, C3 Suburban Places, C4 Traditional Neighborhoods, C5 Downtown Places, C6 Urban Core.
A facility generally characterized by more restrictive access controls. Access is managed at specific locations that are sufficiently spaced apart to facilitate effective free flow travel.

1.5 Other Contextual Considerations

1.5.1 Multimodal

This term can be defined as a planning and design approach that results in an efficient and equitable transportation system for all facility users and modes. The designer needs to evaluate and understand the context of the facility and local multimodal plans to establish design controls and criteria that will accommodate the identified modes of transportation that will use the facility.

Use this link for FHWA multi-modal approach: https://highways.dot.gov/complete-streets

Example Multimodal Application

A highway has begun to see more traffic and needs an overlay and widening. The highway approaches a suburban area where bicyclists and pedestrians use regional trail systems, transit, and other modes of transportation for recreation and commuting. The designer needs to take all user modes into consideration, investigate local plans for multimodal development, along with purpose and need and context, to set the design controls and criteria for the project.

1.5.2 Performance-Based Practical Design (PBPD)

PBPD is a decision-making framework that helps an agency improve its management of transportation investments while fulfilling systemwide needs and performance priorities with limited resources. PBPD involves the application of a performance management framework to make decisions about how best to address purpose and need and project performance goals. In Colorado, Data Driven Safety Analysis plays a large role in PBPD.

PBPD is a process in which quantitative performance analysis guides decision-making throughout the project development process. Ideally, stakeholder consensus is achieved in the planning phase on the desired project performance outcomes (goals). Using the performance-based goals as a guide through project development, the designer focuses on optimizing system-level needs while meeting clearly defined project-level needs. For example, if meeting full design standards for a geometric element comes at significant cost to the system without adding notable performance value relevant to the project's goals, PBPD may be used to establish more project-appropriate design standards.

Use this link to access Performance Based Practical Design information on FHWA's website: https://www.fhwa.dot.gov/design/pbpd/

In the NCHRP Report 785, Performance-Based Analysis of Geometric Design of Highways and Streets (NCHRP, 2014), safety performance is a prevalent project performance goal evaluated in PBPD. The six PBPD project examples in NCHRP Report 785 demonstrate the importance of considering predicted safety performance in design alternatives development and selection. AASHTO's *Highway Safety Manual* (AASHTO, 2010) role in all NCHRP Report 785 project examples emphasizes the importance of the powerful relationship between design dimensions and predicted future safety performance.

CDOT's PBPD procedures are evolving as the prevailing PBPD methodologies and relevant technologies advance. The designer's role is to understand how data-driven analysis can benefit a project and the overall transportation system. The designer should coordinate with the Region Traffic Engineer early in project development to identify opportunities to apply a Data Driven Safety Analysis.

For example, in a scenario where safety performance is a project performance goal, the Region Traffic Engineer can provide predicted KABCO injury scale statistics (fatal crash(K), incapacitating injury crash(A), non-incapacitating injury crash(B), possible injuries(C), no apparent injuries(O)) for the various design alternatives under consideration within specified timeframes so that the forecasts can be considered in decisions regarding design alternative selection.

Use this link to access the KABCO Injury Classification Scale and Definitions table: https://safety.fhwa.dot.gov/hsip/spm/conversion_tbl/pdfs/kabco_ctable_by_state.pdf

Another application would be to conduct a safety performance analysis to understand how a proposed design modification, or a design variance request, is predicted to influence future safety performance. In addition to using safety performance forecast data, a benefit-cost analysis can be performed to evaluate the realized benefits of the proposed design modification or variance. For more information on PBPD, refer to the 2018 AASHTO GDHS.

Example PBPD Application

An existing roadway with a low volume of traffic and no crash history is proposed to be widened to improve shoulders and repaved due to age of pavement. There are currently 4-foot gravel shoulders. Using Data Driven Safety Analysis (DDSA), it could be determined that 4-foot gravel shoulders may be adequate for this type of roadway to meet the purpose and need, and shoulder widening is not necessary.

1.5.3 Context Sensitive Solutions (CSS)

The principles of Context Sensitive Solutions (CSS) apply to any transportation project aiming to bring the full range of stakeholder values to the table and actively incorporate them into the design process and results.

"CSS is a collaborative, interdisciplinary decision-making process and design approach that involves all stakeholders to develop a transportation facility that fits its physical setting."
Source: FHWA https://highways.dot.gov/research/innovative-program-delivery/innovation-life-cycle/ongoing-planning-environment-realty-research

Use this link to access FHWA's Context Sensitive Solutions and Design page:
https://www.fhwa.dot.gov/planning/css/

Use this link to understand how CSS approaches can be used to establish design controls and criteria:
https://www.fhwa.dot.gov/planning/css/design/controls/index.cfm

CSS is a public engagement and stakeholder engagement process that begins early and continues throughout the project development process—from project concept development; through alternative studies, design and construction; and beyond into maintenance and monitoring improvements. CSS means maintaining commitments to communities. CSS applies essentially anywhere and everywhere because every project has a context defined by terrain and topography, communities, users, and surrounding land use.

Use this link to access information on how CSS is being applied on the I-70 Mountain Corridor:
https://www.codot.gov/projects/i70mountaincss/assets/docs/css

Example CSS Application

A project area is in need of a wider roadway to accommodate an increase in vehicular traffic. There are many businesses and accesses along the roadway. The agency is working with project stakeholders to develop a plan and purpose and need to accommodate the widening within the context of the area. The designer uses the project purpose and need to develop design controls and criteria that meet the intent of desired context-sensitive solutions.

1.6 Context Classification to Facility Type Matrix

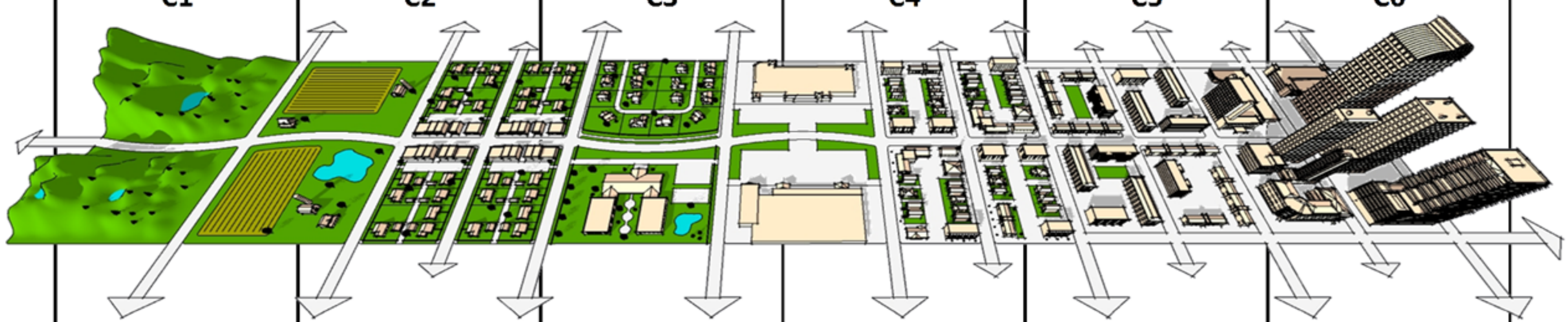
The Context Classification to Facility Type Matrix beginning on the next page uses the existing roadway data elements (typical section, average daily traffic, etc.), context of the surrounding area the facility serves, and other elements and characteristics of a facility to determine the facility type.

The designer is asked to check off elements on the matrix that apply to the facility being designed. This helps guide the designer to determine if the facility type is a Road; Street; or Freeway, Expressway, or Interstate; and in what contextual classification the facility is located. The facility type and the contextual classification are the basis for discussion around what travel modes need to be considered or accommodated in the design.

Context Classification to Facility Type Matrix

Industrial Area

	C1	C2	C3	C4	C5	C6
	Rural Mountains	Rural Places	Suburban Places	Traditional Neighborhoods	Downtown Places	Urban Core



FACILITY ELEMENTS (ROAD)

	C1	C2	C3	C4	C5	C6
Facility Location						
Urban			STREETS			
Rural	ROADS					
Annual Average Daily Traffic						
0-500						
500 - 5000						
5000 to >50,000						
Number of Access Points per Mile						
1/2-mile spacing minimum						
1 access per parcel						
Number of Lanes						
2						
2 to 4						
4 or more						
Intersection Type						
Stop Controlled Intersection						
Roundabout or Signal						
Grade-separated Interchange						
Median Type						
Painted Separator						
Painted and/or Depressed						
Raised and/or Barrier						
Shoulder Type						
Gravel						
Paved						
Curb and Gutter						
Drainage Type						
Roadside Ditch						
Storm Sewer						
Overlays						
Attached Sidewalk						
Detached Sidewalk / Trail						
Bike Lane						
Transit Stop						
On-street Parking						

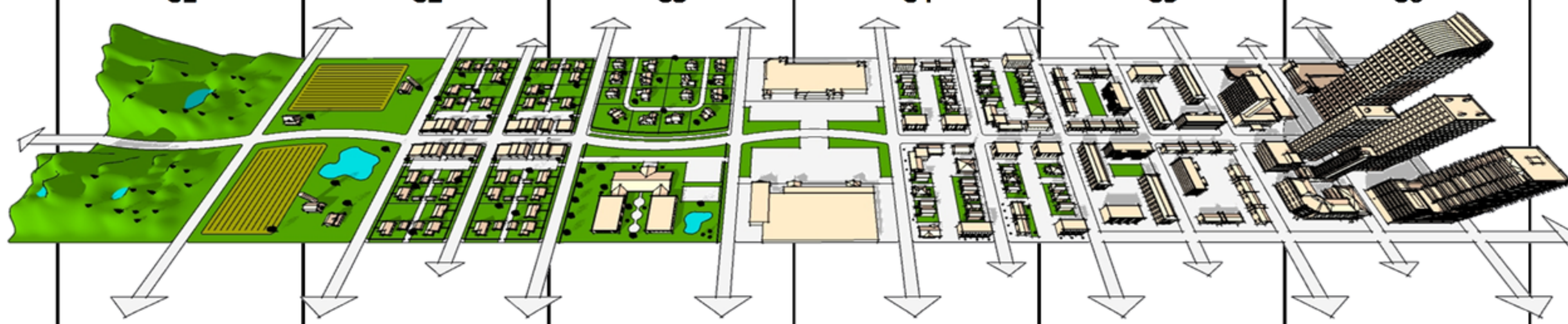
FACILITY ELEMENTS (STREET)

	C1	C2	C3	C4	C5	C6
Facility Location						
Urban			STREETS			
Rural	ROADS					
Annual Average Daily Traffic						
500 - 5000						
5000 - 10,000						
10000 to >50,000						
Number of Access Points per Mile						
1 access per parcel						
>1 access per parcel						
Number of Lanes						
2 to <4						
4 or more						
Intersection Type						
Stop Controlled Intersection						
Roundabout or Signal						
Grade-separated Interchange						
Median Type						
Painted Separator						
Painted and/or Depressed						
Raised and/or Barrier						
Drainage Type						
Roadside Ditch						
Storm Sewer						
Overlays						
Attached Sidewalk						
Detached Sidewalk / Trail						
Bike Lane						
Transit Stop						
Bus Rapid Transit Lane						
On-street Parking						

Context Classification to Facility Type Matrix

Industrial Area

	C1	C2	C3	C4	C5	C6
	Rural Mountains	Rural Places	Suburban Places	Traditional Neighborhoods	Downtown Places	Urban Core



FACILITY ELEMENTS (FREEWAY, EXPRESSWAY, INTERSTATE)

	C1	C2	C3	C4	C5	C6
Facility Location						
Urban			STREETS	STREETS	STREETS	STREETS
Rural	ROADS	ROADS	ROADS			
Annual Average Daily Traffic						
0 - 5000	↕	↕	↕			
5000 - 10,000		↕	↕	↕		
10,000-50,000			↕	↕	↕	↕
>50,000				↕	↕	↕
Number of Access Points per Mile						
Minimum 1-mile spacing	↕	↕	↕	↕		
<1 mile spacing					↕	↕
Number of Lanes						
4		↕	↕			
4 or more			↕	↕	↕	↕
Intersection Type						
Stop Controlled Intersection	↕	↕				
Roundabout or Signal			↕	↕		
Grade-separated Interchange	↕	↕	↕	↕	↕	↕
Median Type						
Painted Separator						
Painted and/or Depressed	↕	↕	↕			
Raised and/or Barrier			↕	↕	↕	↕
Drainage Type						
Roadside Ditch	↕	↕	↕	↕		
Storm Sewer			↕	↕	↕	↕
Overlays						
Attached Sidewalk						
Detached Sidewalk / Trail	↕	↕	↕	↕		
Bike Lane						
Transit Stop						
Bus Rapid Transit Lane			↕	↕	↕	
On-street Parking						

1.7 Design Controls

Driver performance, design vehicles, traffic characteristics, and safety are some of the design controls to consider. Chapter 2 of this Guide covers these elements, as well as others, in more detail. Refer to the design controls and criteria described in Chapter 2 of this Guide when using the matrix.

1.8 Geometric Design Criteria

The end results of the design process are the geometric design criteria that will be used to design the project. There is general design criteria information in Chapter 2 of this Guide, and more specific design criteria information for roads; streets; and freeways, expressways, and interstates in Chapters 3, 4, and 5 of this Guide, respectively. Specific information on design criteria for other modes and facilities can be found in other chapters of this Guide.

1.9 Roadway Design Guide Step by Step Process

The following steps include details about the steps to complete to design a project.

Step 1: Identify Project Purpose and Need / Context of Project

- Team communication with Project Manager.
- What is the scope and budget of the project?
  - What is the scale of the project based on geographic size and budget?
  - What type of project is it?
    - Widening / Overlay.
    - Intersection.
    - Corridor Design.
    - Interchange.
- What is the timeframe that the project will be constructed?

Step 2: Determine Functional Classification

- Identify the facility's functional classification using CDOT's Online Transportation Information System (OTIS).
  - This is a classification assigned by CDOT and will aid in identifying the facility type through the Context Classification to Facility Type Matrix.
  - Use functional classification to help fill out CDOT form 463 (Design Data).
  - If this is a new facility, discuss the appropriate functional classification to use in the Form 463 with the Project Manager.
- Team communication with Project Manager.

Step 3: Determine Context Classification

- Use the Context Classification to Facility Type Matrix to help determine context area of project.

- Review the project area geography and future development to help identify the appropriate context classification (C1 to C6).
- Team communication with Project Manager.

Step 4: Determine Facility Type

- Use the Context Classification to Facility Type Matrix to help determine facility type.
  - Use facility elements of each facility type to validate the facility type.
  - Use data for current facility to check off the elements to verify that the correct context classification and facility type are selected.
  - Identify facility type (Road; Street; Freeway, Expressway, Interstate) through the above steps.
- Refer to respective facility type chapter in the Guide once the facility type has been determined.
- Team communication with Project Manager.

Step 5: Design Process of Project

- Use the appropriate facility type chapter and references within the chapter to begin shaping the design parameters for the project.
- Evaluate additional design considerations, including multimodal design, context sensitive solutions, and performance-based practical design.
- Use Chapter 6 (Elements of Design) to aid and guide decisions for elements of design.
- Use Chapter 7 (Cross Section Elements) to aid and guide in development of project cross section.
  - Use the cross section elements based on the context determined in the previous steps.
- Team communication with Project Manager.