CHAPTER 1
FUNCTIONAL AND CONTEXTUAL HIGHWAY CLASSIFICATIONS

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1.0 INTRODUCTION

The function of a highway is to provide a facility that allows the movement of people, goods, and services. Different types of facilities are needed for various vehicle travel movements. To differentiate between the types of highways, functional and contextual classifications have been developed so that engineers, administrators, and the general public can communicate about highways. A functional classification is a roadway descriptor determining hierarchal status within the transportation network and the expectational service provided, whereas a context classification system provides guidance regarding appropriate design accommodation using the characteristics of the roadway's surrounding environment. The state of the practice is supplementing the functional classification system with a process to consider context and user needs. By determining the functional and context classifications, designers can have a better understanding of the criteria necessary to accommodate user's needs and safety. The *2018 Roadway Design Guide's* primary focus for standards and roadway considerations is based on Functional Classifications. However, the contextual framework provided in *NCHRP Report 855* **(3)** can assist in making contextually appropriate design decisions.

1.1 FUNCTIONAL CLASSIFICATIONS

Definitions of highway facilities in urban and rural settings are described below and provide additional information on the range of mobility and access each classification serves. Ramps and other non-mainline roadways should be assigned the functional classification of the highest functional classification of the intersecting mainline that serves the ramp or other facility. The functional classifications exist in both the urban and rural areas. The functional classifications are:

- Arterials
    - Principal Arterials. Principal Arterials serve a large percentage of travel between cities and activity centers. Principal arterials are typically roadways with high traffic volumes and are the frequent route for intercity busses and trucks. Principal Arterials provide a high degree of mobility and carry a high percentage of travel for long distance trips including those that go directly through or bypass activity centers. Principal Arterials are stratified into three classifications:
        - Interstate. 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 Interstate by the Secretary of Transportation and are considered Principal Arterials.
        - Other Freeways & Expressways. Roadways in this category with full access control look similar to Interstates. By definition, Freeways are characterized by full access control with access points limited to on/off ramps and 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 mobility over access with this being truer for Freeways than Expressways.

        - Other Principal Arterials. These roadways serve activity centers and provide a high degree of mobility. These roadways 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 and radiate out from the urban center. 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 Arterial roadways, and have higher connectivity to the Principal Arterials. In urban settings, they interconnect and supplement the Principal Arterial system, connect communities, and may carry many bus routes. In rural settings, they are typically designed to provide higher travel speeds with minimum interference to the trough movement.

- Collector Roads and Streets. Collectors provide the connection from Local Roads to the Arterial systems. Collectors may be subdivided into Major and Minor Collectors in both the urban and rural areas. A major part of the rural highway system consists of two-lane collector highways. The rural collector routes generally serve travel of primarily intra-county rather than statewide importance and constitute those routes on which predominant travel distances are shorter than on arterial routes. An urban collector street is a public facility that includes the entire area within the right of way. The urban collector street also serves pedestrian and bicycle traffic and often accommodates public utility facilities within the right of way.

    - Major Collector. Major Collectors are typically longer in length, have lower connecting driveway density, higher posted speeds, higher traffic volumes and may have 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, and have signalized intersections, provide service to smaller communities not served by Arterials, and link locally important traffic generators with rural surroundings.

- Local Roads and Streets. Local Roads 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, business, or other abutting property. Some such roads properly include geometric design and traffic control features more typical of Collectors and Arterials to encourage the safe movement of through traffic. On these roads, the through traffic is local in nature and extent rather than regional, intrastate, or interstate. Local Roads are typically classified by default; once all other roads have been classified as Arterial or Collector, the remainder are Local Roads.

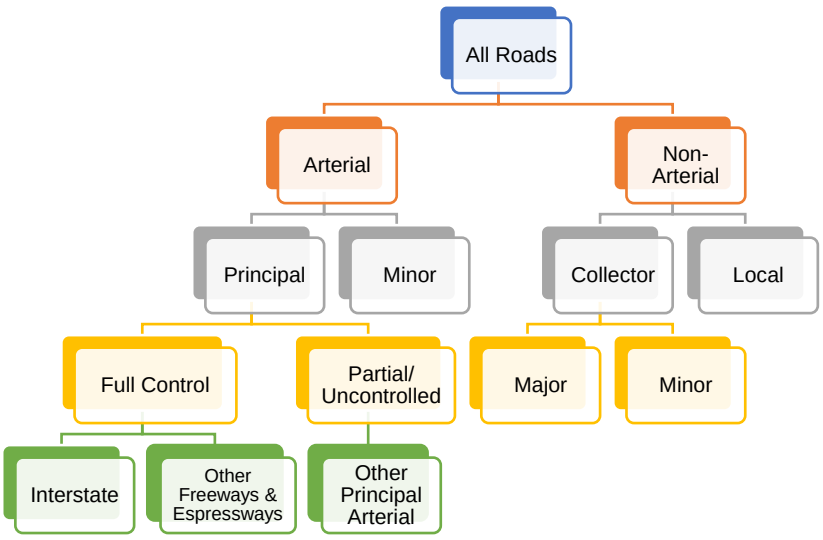

Figure 1-1 (Figure 3-4 of Highway Functional Classification Concepts, Criteria and Procedures (5)) Federal Functional Classification Decision Tree

Functional classification determination for urban and rural designation is tied to the census, which is taken every ten years. Following the census, the urban boundaries are realigned. That realignment mostly affects off-system roads. Because there is a set percentage of roadway that can be on the National Highway System (NHS), new roadways are seldom added. Sometimes there are requests to change the functional classification, such as the rare instance in which significant construction has upgraded a collector to an arterial or a two lane is made into a four or six lane. The planning agencies –Transportation Planning Regions and Metropolitan Planning Organizations (TPRs and MPOs) – work with CDOT, which then takes the request to the Transportation Commission and the Federal Highway Administration (FHWA). Classification changes are made prior to design.

The key factor the designer needs to determine is whether the project is on a federal-aid highway, and if so, where the project lies on the system. The *CDOT Online Transportation Information System (OTIS)* **(1)** website contains the CDOT GIS data map.

If funding has been accepted, a construction contract is awarded, or a project is underway, the functional classification cannot be changed.

The basic concepts required for understanding the functional classification of highway facilities and systems are discussed at length in Chapter 1 of the *PGDHS* **(2)**.

1.2 CONTEXT CLASSIFICATIONS

Contextual settings can be used to identify distinctions which require different practices or approaches during design. The general context considerations include density, land use, and building setback. The Context Classifications system may be used in combination with the Functional Classifications to provide a matrix approach to design based on speed, mobility, access, and user safety/needs. The distinct context settings are:

- Rural. The rural context range includes areas of no to little development, commonly used for farming, mineral extraction, or recreation. Very few residential or commercial structures exist. Pedestrians are few, bicycles are likely used for recreational purposes and not commuter, and transit is limited. Building setbacks are generally large.
- Rural Town. The rural town context includes areas of low density, but with some concentration of development. Rural towns are usually incorporated, but may have limited services. Rural towns are comprised of both residential and commercial structures. Rural towns may have a main street corridor, and commonly have on-street parking and sidewalks. Pedestrians and bicycle commuters are common, but transit is limited. Building setbacks are generally small. Roadways must accommodate through travelers as well as residents.
- Suburban. The suburban context includes areas of medium density usually of residential, commercial, and light industrial structures. These structures usually accommodate off-street parking. In most instances, sidewalks are present and sometimes bike lanes. Multi-use developments may include town centers and multi-family housing. Suburban settings are usually around urban areas. Pedestrians, bicyclists, and some transit may be common, however; the dominant mode of travel is by passenger vehicles. Building setbacks vary.
- Urban. The urban context includes areas of high density usually of residential, commercial, and light and heavy industrial multi story structures. Urban areas host prominent destinations including sporting or conference venues. Parking is usually both on and off-street on surface lots or parking structures. Pedestrian and bicycle use is high and transit options are abundant. Building setbacks are varied.
- Urban Core. The urban core context includes areas of the highest density usually of residential and commercial high-rise structures. The urban core is the business center of a metropolitan area. Parking is either on-street and time restricted, or off-street in parking structures. Pedestrian and bicycle use is high and transit options are abundant. Building setbacks are usually less than in the urban context.

Table 1.1 illustrates characteristics of each context category. See the *NCHRP Report 855* **(3)** for additional context classification information.

Category	Density	Land Use	Setback
Rural	Lowest (few houses or other structures)	Agricultural, natural resource preservation and outdoor recreation uses with some isolated residential and commercial	Usually large setbacks
Rural Town	Low to medium (single family houses and other single purpose structures)	Primarily commercial uses along a main street (some adjacent single family residential)	On-street parking and sidewalks with predominantly small setbacks
Suburban	Low to medium (single and multi-family structures and multi-story commercial)	Mixed residential neighborhood and commercial clusters (includes town centers, commercial corridors, big box commercial and light industrial)	Varied setbacks and mostly off-street parking
Urban	High (multi-story, low rise structures with designated off-street parking)	Mixed residential and commercial uses, with some intuitional and industrial and prominent destinations	On-street parking and setbacks with mixed setbacks
Urban Core	Highest (multi-story and high-rise structures)	Mixed commercial, residential and institutional uses within and among predominately high-rise structures	Small setbacks with sidewalks and pedestrian plazas

Table 1-1 (Table 1 of the *NCHRP Report 855*) Context Category Descriptions

1.3 ROADWAY USERS

The primary categories of roadway users and associated design considerations are:

- Automobiles. Automobile design accommodations include operating speed, mobility, and accessibility. Speed and mobility are the highest in a rural context and lowest in an urban core context. The opposite is true for accessibility. Similarly, speed and mobility are highest in a higher functional classification whereas access decreases for higher functional classifications. Automobiles consist of passenger cars, motorcycles, and light trucks.
- Bicyclists. Bicycle design accommodation is generally categorized based on the level of separation provided from motor vehicle traffic. Bicycle network functional classifications include citywide connectors, neighborhood connectors, and local connectors. For higher order bicycle routes, or higher order roadways, more separation from traffic is generally recommended (see the *NCHRP Report 855* **(3)** for additional information).

- Pedestrians. Pedestrian design accommodation is categorized primarily using the width of the facility provided. Pedestrian facilities can be divided into four categories which are based on the expected level of use. When increased pedestrian volumes are expected, wider facilities should be provided (see the *NCHRP Report 855* **(3)** for additional information).

1.4 PERFORMANCE BASED PRACTICAL DESIGN

Performance based practical design (PBPD) is a process in which design decisions are data driven from performance analysis. The quantitative performance analysis guides decision-making throughout the project development process. Ideally, stakeholder consensus is achieved on the desired project performance outcomes (goals) in the planning phase. Using these goals as a guide through project development allows for greater focus on optimizing system level needs while meeting clearly defined project level needs. For example, a PBPD opportunity may present itself in the form of a scenario where 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.

With many sample intended project outcomes offered in *NCHRP Report 785* ***(4),*** safety performance is a prevalent project performance goal evaluated in PBPD. The six PBPD project examples in *NCHRP Report 785* ***(4)*** demonstrate the prevalence of considering predicted safety performance in design alternatives selection. The *Highway Safety Manual's* (HSM) **(6)** role in all *NCHRP Report 785* ***(4)*** project examples reflects the improved and powerful understanding of the relationship between design dimensions and future safety performance.

CDOT's PBPD procedures will evolve as the prevailing PBPD methodologies and relevant technologies advance. The CDOT designer's current role in the process is namely to understand PBPD's potential benefits to their project, PBPD's potential benefits to the overall system and know who to contact for project specific application. The CDOT designer should contact their Region Traffic Representative as early in project lifecycle as possible to begin PBPD coordination.

For example, in a scenario where safety performance is a project performance goal, coordination would be required to enable traffic to provide predicted KAB (fatal crash, incapacitating injury crash, and non-incapacitating injury crash) crashes for the various design alternatives being contemplated within timeframes where the crash forecasts can still factor into design alternative selection. Another application would be to conduct safety performance analysis to understand how a proposed design dimension prompting a design variance request is predicted to relate to future safety performance. In addition to safety performance forecast data, corresponding benefit to cost analysis can be used to evaluate the feasibility of the design variance.

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6. AASHTO. *The Highway Safety Manual*, American Association of State Highway Transportation Professionals, Washington, D.C., 2010