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# ADVANCES IN TRANSPORTATION STUDIES

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# Development of a context sensitive multimodal functional classification system

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**Abstract**

The modern Functional Classification System (FCS) was developed in the 1970s as a basis for communication between designers and planners. It sought to establish a common framework for classifying roadways based on mobility and access. Since its inception, the application of the FCS has expanded, and is now used throughout the entire project development process and influences all transportation project development phases, from programming and planning through design and into maintenance and operation decisions. However, the focus of the FCS is narrow; it balances only mobility and access. The limited contextual definitions (urban and rural), do not provide the dynamic range of design elements and guidance needed to balance other competing project needs. This research aimed to develop a flexible framework that replaces the FCS and facilitates optimal geometric design solutions that take into account context, functions, and user needs. The proposed FCS expanded context in order to recognize the lack of suburban and rural community (Main Street) contexts and addressed the lack of balancing modal needs through consideration of driver, bicyclist and pedestrian needs. The correlation of context, roadway types, and users results in the Expanded FCS matrix. This allows for the development of a multimodal, context-based design with some degree of flexibility.

*Keywords – functional classification, contextual design, multimodal, highway design*

## 1. Introduction

The Functional Classification System (FCS) as contained in *Policy for Geometric Design of Highways and Streets*, or Green Book [1] was developed in the 1970s as a basis for communication between designers and planners [2]. The system sought to establish a common framework for classifying roadways based on automobile centric mobility and access. Since its inception, the application of the FCS has expanded. It is now used throughout the entire project development process, influencing all work phases, from programming and planning through design and into maintenance and operation decisions. Within design functions in particular, the FCS is often used to define the range of permissive or desired design elements, such as lane width, shoulder width or design speed. The limited range of functional classes, in addition to the severely limited contextual categories (urban and rural), often yields unresponsive designs focused solely on auto-centric travel. Standards based on the FCS often severely limit design choices when developing a transportation solution intended to: 1) meet the purpose and needs of today's multimodal transportation projects, and 2) be adapted to the context in which they are expected to be successful. The FCS has been very useful in the past when the focus was on the automobile and the system was being addressed from a more regional system perspective.

In recent years, a significant emphasis has been placed on the development and expansion of flexibility in highway design to address competing project needs. Flexible design has been the primary goal of Context Sensitive Design/Context Sensitive Solutions (CSS), Practical Solutions, and Performance Based Practical Design (PBPD) initiatives have been adopted by many state Departments of Transportation (DOTs) in recent years. CSS and PBPD approaches attempt to find "right-sized" transportation solution for roadway users; the goal is for the solution to fit within the roadway environment. These approaches examine varying design elements needed to balance the unique requirements of the project, including the multimodal needs to be incorporated. The narrow focus of the FCS, which considers only automobile-centric mobility and access, as well as its limited and sometimes vague contextual definitions (urban and rural), does not provide the dynamic range of design elements and guidance needed to balance other competing needs. While there is a range of design values available, practically speaking, the existing FCS does not consider other users nor set priorities for the adjustment of the geometric design in order to achieve an innovative or successful project taking into account context, user needs, and function.

NCHRP Project 15-52 was initiated with the objective of developing a flexible framework to replace the FCS that will facilitate optimal geometric design solutions while accounting for context, user needs, and functions. The new system communicates improved information to the designer so that balanced designs can be achieved through documented analysis of roadway users' needs.

## 2. Background information

### *2.1. Functional classification: definition and uses*

Functional classification groups streets and highways into classes or categories based on two transportation functions of roads: *mobility* to and between locations and *access* to specific places or facilities from the road [3]. There are three primary classifications in the conventional system: arterial, collector, and local roads. This basic taxonomy has evolved since its first uses. For most applications there are several subcategories, but each remains tied to a basic set of definitions for each of the three road types:

- *Arterials* serve a primary function of vehicle mobility, generally for longer trips at a more regional scale.
- *Collectors* serve a balance of regional and local trips and function, especially as transitions between local access streets and arterial mobility streets.
- *Locals* are oriented primarily toward access. As a rule, they tend to be designed for lower speeds and often (though not always) a more limited range of vehicles.

The development and formalization of the National Highway System (NHS) led to the establishment of a more standard functional classification system to drive funding allocations and decisions. Functional classification was increasingly used as a management tool during this period, with state transportation agencies adopting functional classification as the basis for defining statewide systems that included roads outside of those on the nationally-recognized system [3]. The functional classification labeling used at the federal level today reflects an expansion of the FCS model, so that it now recognizes more precise definitions of functions within each of the three primary classes. These distinguish between access-controlled and full-access roadways, urban and rural land use and development characteristics, and major and minor (or principal and secondary) status. This expanded definition helps roadway designers distinguish between different general purposes, but more specifically differentiates roadway types eligible for Federal-aid funding assistance.

Over the years, functional classification has come to assume additional significance beyond its purpose as a framework for identifying the role of a roadway in moving motor vehicles through a network of highways. Functional classification carries with it expectations about roadway design, including its speed, capacity, design controls and criteria, and relationship to existing and future land use development. Federal legislation continues to use functional classification to determine eligibility for funding under the Federal-aid program. Transportation agencies describe roadway system performance, benchmarks, and targets by using functional classifications.

*2.2. Functional classification issues*

As part of the NCHRP 15-52 Project, a survey of state DOTs and planning and transportation professionals was prepared. A total of 187 individual responses were gathered with 73 responses from state DOTs representing over 38 states. The survey was used to identify the breadth of uses for the current FCS and to identify potential issues related to its use in practice as it relates to delivering context sensitive projects. A summary of those responses is provided below.

1. Urban/Rural designs result from the designation of the roadway, which do not reflect the land use or development along the corridor. Frequently this necessitates higher design speeds that may conflict with community goals and needs.
2. The FCS requires the use of design exceptions to address roadway context. State and FHWA regional engineers may not see this favorably.
3. Practitioners use the FCS as a shortcut to select design values and this often conflicts with the roadway context. This in turn could result in contextual designs incompatible with community plans and land use goals.
4. Lane widths in rural areas are seen as fairly restrictive (as per the Green Book). This results in issues with local communities, especially where highways with a rural classification traverse built-up areas and where the community desires a less rural design.
5. There is a lack of modal balance that specifically addresses the need for bicycles, pedestrians, and transit. Take for example a high-speed arterial through a main street with on-street parking and significant pedestrian traffic — this complicates the inclusion of bicycle lanes or dedicated transit facilities.
6. Classification complicates and may even prohibit measures aimed at reducing speeds, such as medians with trees or gateway islands where a rural route enters a village.
7. There is no classification for suburban context.
8. There is no recognition of the Main Street concept for small rural communities, where, for example, a narrower cross section may be required to accommodate existing buildings and desired street parking, wider sidewalks, landscaping, and seating areas.

This information was used in conjunction with previous research on context sensitive solutions to develop the new classification system.

These issues have been raised in recent literature as well. One issue of concern with the FCS is that the decisions about the functional classification for a particular roadway are made typically in planning or programming stages and thus well in advance of fully understanding the project context and constraints. Classifying a roadway within a specific category occurs during the planning stages of the project based on network-wide needs and therefore represents its importance within the system-wide transportation needs of the area. But the FCS does not reflect the community goals and objectives at the local scale. Defining design elements by establishing the functional classification this early in the process runs counter to flexible and context sensitive design approaches, which gradually refine the design as the purpose and need, context, and constraints are refined throughout the entire project development process [4]. Moreover, as the FHWA [5] established, "States should assign functional classifications according to how the roadway is functioning in the current year only." However, this is in direct conflict with the highway design projects, which strive to meet demands for future years, whether that entails growing the system to increase the connectivity of a roadway segment or diminishing the importance of a road in the overall system because it will soon be bypassed.

One of the prevailing trends of the FCS – a system originally established to organize highways by the auto traffic they are expected to accommodate – has been its linkage to geometric design standards. This has become the default position, with variations achieved through administrative waivers and the granting of design exceptions.

Another primary issue of concern with the FCS is its singular focus on automobile-centric travel. The FHWA's Livability in Transportation Guidebook praises efforts to build a world class automobile travel system, though it states "we have not yet put the same effort into completing a system that works as well for walking, wheeling, or taking transit in most communities" [6]. With recent refocusing on public spaces – including streets as activity centers, as well as the recent growth in pedestrian, bicycle, and transit usage for mobility – the limited view of roadways is insufficient. Vehicular modes typically receive priority because the FCS is so pervasive throughout the entire project development process and existing systems tend to dampen its influence. Fifteen percent of respondents to the NCHRP 15-52 survey indicated that their home state utilized an alternative classification scheme with the majority identifying the desire to: 1) accommodate other modes, and 2) introduce context definitions for urban and suburban areas. For example, Idaho has incorporated the ITE recommendations in designing urban thoroughfares [7] and redefined their classification system to be more responsive to various users [8].

In summary, as the role of flexible design in the project development process increased – with community needs viewed through the prism of context sensitive design/solutions and economic and system performance understood through Practical Design – the need to accommodate a wider range of design parameters has become apparent. At the heart of this issue is the recognition that streets and roads play a much larger role in the community and have a far greater impact, one that reaches beyond the edges of the pavement. This includes the demand to accommodate other modes such as pedestrian, bicycle, and transit as well as activity zones that serve commercial centers in the roadside environment. As the FCS dictates design, both directly through policy documents such as the Green Book and individual state policies, as well as indirectly by influencing practitioners' design choices, such as the FCS falls short of addressing today's transportation needs. This is evidenced by its lack of recognition of other modes of transportation, and through the limited context definition provided by the urban/rural classification. While some procedures are in place to address these issues, such as the use of design exceptions, it is clear that these are used sparingly.

To develop the alternative classification system, a two-phased approach was employed. The first phase involved a literature review, a survey of transportation agencies/practitioners, identification of existing alternative systems, and an evaluation of those existing alternative systems and their components through the use of a Working Advisory Group (WAG) of experts. Work during this phase identified promising elements to be considered for inclusion in the proposed system. In the second phase, the proposed alternative was fully developed, its implications for design documented, and the effects on other areas highlighted. The research team produced a new alternative classification system to aid designers in developing contextual designs that balance a range of user's needs.

## 3. Alternative classification schemes

A total of 17 alternative systems were reviewed by the project team, listed here:

1. Arterial Streets Towards Sustainability (ARTISTS), European Union;
2. AustROADS Design Guide, Australia and New Zealand;
3. City of Charlotte, Urban Street Design Guidelines, North Carolina;
4. City of Chicago, Complete Streets Chicago, Illinois Department of Transportation;
5. ITE-CNU Designing Walkable Urban Thoroughfares, Institute of Transportation Engineers and Congress for New Urbanism;
6. Massachusetts, Project Development and Design Guide, Highway Division of the Massachusetts Department of Transportation (MassHighway);
7. Minnesota, Guide under Development, Minnesota DOT;
8. NACTO Urban Street Design Guide, National Association of City Transportation Officials (NACTO);
9. Oregon, Highway Design Manual, Oregon DOT;
10. Pennsylvania and New Jersey, Smart Transportation Guidebook, Pennsylvania and New Jersey DOTs;
11. Abu Dhabi, Urban Street Design Manual, Abu Dhabi, United Arab Emirates;
12. California, Main Street California: A Guide for Improving Community and Transportation Vitality, California DOT (Caltrans);
13. Connecticut, Highway Design Manual, Connecticut DOT;
14. Los Angeles, LA Model Design Manual for Living Streets, LA County Department of Public Health;
15. United Kingdom, UK Manual for Streets, UK Department of Transport;
16. Vermont, Vermont State Design Standards, Vermont Agency of Transportation; and
17. Washington, Guide under development, Washington DOT.

These classification systems were reviewed and evaluated based on their ability to meet the overall objectives of the study established by the NCHRP Panel, Project Team and the WAG. Three primary objectives were identified as necessary to meet the identified deficiencies of the existing system:

- Improved context definition – the group recommended these elementary factors be considered for context definition: density, land use and activity, and access level.
- Ability for multi-modal prioritization – the modes to be considered include vehicles, pedestrians, bicycles, and transit.
- Ease of use – this concept considers data availability requirements to pursue classification, ability to be straightforward and widely understood, and capability for systematic application.

The following are the issues raised form the 17 systems reviewed:

- *Multimodal Priorities*. Several systems meet the objective of balancing multimodal priorities. Some systems, such as both the Pennsylvania and New Jersey DOTs Smart

Transportation Guidebook [9] accommodate modes such as pedestrians and bicycles based on the context definition of a road. This can then be balanced with the system-level function of the roadway. Other systems explicitly state a commitment to multimodal priorities, such as Abu Dhabi's [10], which places pedestrian priority at the top and vehicle traffic at the bottom. Still others address multimodal needs independently, such as the Chicago [11] systems, which designate modal needs street by street according to system needs, or the ITE-CNU system [7], which discerns modal needs through the community visioning process and CSS design approach. It is clear that a method of establishing modal priorities is necessary to counter the mono-modality of the FCS.

- *Context Definition.* All elements expand on the existing urban/rural dichotomy to further refine the land use context definition. While some states have chosen to merely define an additional third class of suburban, others expand this practice by including up to 13 different land use contexts. The key to the success of the existing system has been in its simplicity, even though that simplicity still causes confusion regarding the context and function definition of the roadway. Therefore, care must be taken in establishing another system to balance simplicity with the wide range of land uses that are present in the built and natural environment. One must consider not only the various contexts, but also the implied design parameters that may exist completely outside of the normal range of design flexibility. As the review of literature and state practices revealed, a minimum set of contexts for design may be considered as:
    1. Rural;
    2. Rural Main Street;
    3. Suburban;
    4. Urban; and
    5. Urban Core.
- *Ease of Use.* Of all the objectives, ease of use was only met by one alternative, the Pennsylvania/New Jersey system. While the total number of new context definitions is significant (seven) it was not identified by the WAG as overly burdensome. In addition, the primary driver of its ease of use is its heavy reliance on pictures to relate context and land use/built form environment. While WAG members from various states saw some elements that did not match their landscape, there was a consensus that each picture was successful in defining their specified elements. It will be imperative to provide this level of clarity graphically and descriptively for whichever choice is made.

## 4. Proposed functional classification

The literature review, the evaluation of current alternative systems, and the findings from the WAG pointed toward the development of a system that provides better definitions of context, which transcend the urban/rural dichotomy, and fully considers modal priorities.

The Expanded FCS is designed to improve information for the planner/designer so that balanced designs can be achieved through documented analysis of roadway users needs [12]. The Expanded FCS delivers enhanced information to better inform the design decision process. This is achieved by providing increased resolution of the roadway's design context to understand the role the roadway plays within the community; identifying the role of the roadway within the local, city, and regional transportation network; and identifying the multiple roadway user groups and their network needs within the design corridor.

### *4.1. Context*

Five distinct contexts are identified in the Expanded FCS that have been determined to represent unique land use environments. It is recognized that a more diverse set of contexts may be identified within the built and natural environments. The five categories proposed provide general guidance so that they are applicable to a wide variety of states and agencies and they identify distinctions that require wholly different geometric design practices in terms of desired operating speeds, mobility/access demands, and user groups (Fig. 1). The primary factors considered within each category are:

- density (existence of structures and structure types);
- land uses (primarily residential, commercial, industrial, and/or agricultural); and
- building setbacks (distance of structures to adjacent roadways).

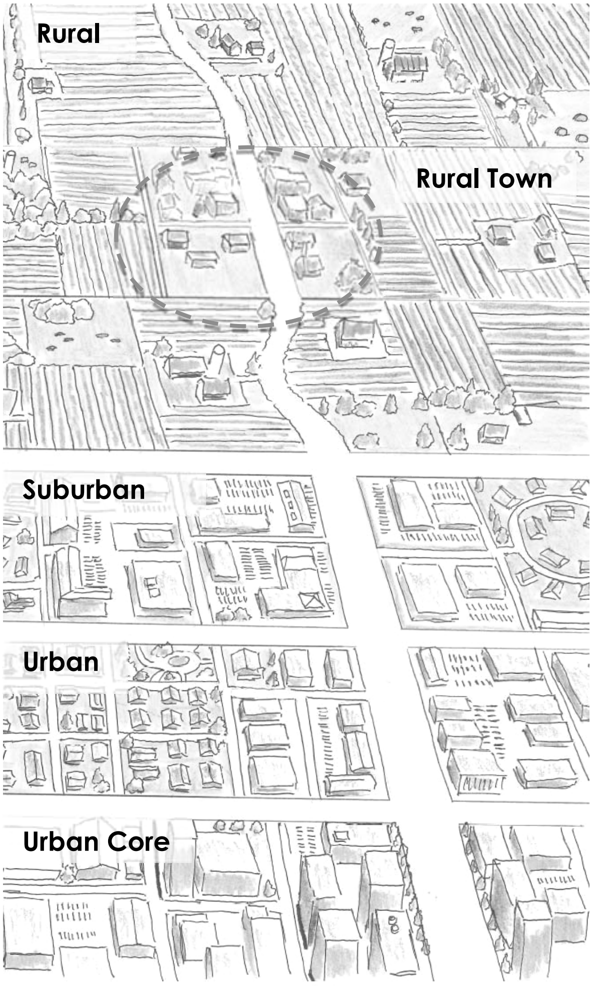


Fig. 1 - Expanded FCS context categories [12]

Tab. 1 - Expanded FCS Context Categories [12]

| 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 predominately 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 with some sidewalks 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 sidewalks 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 |

The continuum is not perfectly gradual for the determining factors among the five categories and therefore some degree of situational analysis, experience, and professional judgment is required. Furthermore, in real-world situations, discontinuities will exist even when the overall assessment is clear. The Expanded FCS context assessment does not rely on a quantitative analysis (neither persons per square mile nor building square footage) and can be used in states with broad comparative development differences between urban cores or rural areas. These differences are largely a matter of scale and intensity (the activity patterns may vary significantly). The Expanded FCS does not provide quantitative guidance for transitional areas between categories. However, this remains an important design consideration impacting safety, function, and design detail. This is an issue that needs to be addressed at the project level and associated treatments need to be considered at that level. The context category decision becomes a possible starting point that leads to geometric design choices, as they will be influenced by the road type. These two choices—context and road type—will define the modes to be considered and their interactions. A robust CSS process (involving all stakeholders) can assist the project team in understanding the various project issues and modal needs in order to develop a contextually appropriate design. The five Expanded FCS categories and their primary factors are shown in Tab. 1.

### *4.2. Roadway types*

Functional classification has, for decades, relied on three general thoroughfare types for classification: arterials, collectors, and locals (more recently, arterials have been further subdivided into *principal* and *minor*, resulting in four classification types currently being used). Decades of familiarity with these terms, and many Federal funding mechanisms being based in whole or in part on these four classifications, has resulted in continued use of the same labels.

The roadway types used in Expanded FCS are based on their network function and the connectivity they provide among various centers of activity. Network function is defined based on the regional and local importance of the roadway as it pertains to vehicle movement. Connectivity identifies the types of activity centers and locales that are connected with the particular roadway. The proposed roadway types are as follows:

1. Interstates/Freeways/Expressways: Corridors of national importance connecting large centers of activity over long distances.
2. Principal Arterials: Corridors of regional importance connecting large centers of activity.
3. Minor Arterials: Corridors of regional or local importance connecting centers of activity.
4. Collectors: Roadways of lower local importance providing connections between arterials and local roads.
5. Locals: Roads with no regional or local importance; for local circulation and access only.

It should be noted that the Expanded FCS does not address context types for Interstates, Freeways, and Expressways, since their designs are based on federally developed standards.

It is noted that the primary difference between the Expanded FCS and the existing functional classification system is the absence of differentiation between minor and major collectors. These roadway types were combined due to the inability to sufficiently distinguish design, operating, and modal characteristics of the two classes. Therefore, existing classifications may be readily transferred from one system to the other, though special attention may be needed in addressing minor collectors. In some cases, it may be applicable to define these roadways as local roads as opposed to collector facilities. It is also noted that the major/minor collector definition currently serves as the dividing line between eligible and non-eligible roadways within rural areas for Federal-aid. Adoption of the proposed Expanded FCS will have to address this issue when providing a new definition for Federal-aid and non-Federal-aid eligible roadways.

### *4.3. Other transportation networks*

The two other networks that are of primary importance beyond that for drivers are those for bicyclists and pedestrians. Additional transportation networks may need to be addressed by a project including transit and freight and those are treated as overlays in the Expanded FCS, discussed further below.

#### 4.3.1. Bicycle networks

Classifications for bicycles are also proposed to confer structure and priority for bicycle networks. Similar to automobile roadway type classifications, these facilities are categorized based on the network connectivity a facility provides. However, the network scale is modified to reflect shorter travel ranges.

Three classifications of bicycle facilities are proposed. These are:

- Citywide Connector (CC)—providing citywide connections, connections to major activity centers, or regional bike routes that stretch over several miles and attract a high volume of use as they serve a primary commute or recreational purpose.
- Neighborhood Connector (NC)—providing neighborhood or sub-area connection, which establishes connections to higher order facilities or local activity centers such as neighborhood commercial centers.
- Local Connector (LC)—providing local connections of short lengths, internal connections to neighborhoods, or to higher order facilities.

4.3.2. Pedestrian networks

While other modes readily lend themselves to a network planning strategy for incorporated areas, pedestrian activity accommodations may be defined by the individual context of the area. This is in part due to the relatively short range of typical pedestrian activity, and the need for more inclusive accommodation of pedestrians in urban areas. Moreover, pedestrian facilities may be even more localized, such as at a storefront or at a surrounding a bus stop, and not extend throughout the entire context area.

However, in denser urban areas, pedestrian activity may also cross contexts or land use boundaries, requiring the routing of pedestrian traffic through a context area to another major area of activity. For example, a corridor connecting a university campus with a downtown area may require enhanced sidewalks even if the immediate context may not demand such treatment. In addition, for larger context zones, such as suburban areas, pedestrian facilities may be focused on connecting areas of potential or anticipated pedestrian activity, such as connecting a residential subdivision to another subdivision or a nearby shopping center to a transit stop. As such, it may not be necessary to continue the sidewalk or path for the entire length of the roadway but have the potential to make more meaningful connections between compatible land uses. For example, a corridor with a suburban context may not require continuous pedestrian facilities if the centers of activity with potential pedestrian traffic are discontinuous.

### *4.4. Expanded FCS matrix*

The correlation of context, roadway types and users results in the Expanded FCS matrix (Fig. 2). This allows for the development of a multimodal, context-based design with some degree of flexibility. Each matrix cell defines the various users (drivers, bicyclists, and pedestrians) and identifies which characteristics are to be balanced.

The classification of the roadway types for the driver and bicycles are considered across the entire network, and their combination will provide the required coverage to address and balance their needs, based on the roadway context. Pedestrian needs are also defined based on the roadway context but there is no specific network classification for facilities to accommodate their needs. It should be also noted that a corridor may transition into different contexts over its length and this will be reflected in the design considerations and cross sections.

Proper contextual roadway designs require an understanding of how the roadway functions in its context and the needs of the potential roadway users. Each matrix cell provides a range of design options based on the defined context zone and roadway type. The Expanded FCS matrix can be used to identify preliminary requirements that should be given due consideration when assessing current and future roadway context and user needs. Once the roadway type/context cell is identified, the modal needs and volumes must be considered to further narrow the range of design options. During this step, the needs of the driver, bicyclist, and pedestrian, should be determined and examined. Potential accommodations based on the concepts defined for each user in the previous section should be developed. In a general project development approach, this process can assist with providing input and refining the purpose and need document, which establishes the framework for the design to be developed.

### *4.5. Special network overlays*

While corridor planning and design efforts often directly address the inclusion of auto, bicycle, and pedestrian users, other users, such as transit and freight, may exist.

| Context / Roadway | User | Rural | Rural Town | Suburban | Urban | Urban Core |
|---|---|---|---|---|---|---|
| Principal Arterial | | H speed<br>H mobility-L access | L/M speed<br>M mobility-H access | M/H speed<br>M mobility-M access | L/M speed<br>M mobility-M access | L speed<br>M mobility-M access |
| | | LC: L separation;<br>NC: M separation;<br>CC: H separation | LC: L separation;<br>NC, CC: M separation | LC: L separation;<br>NC: M separation;<br>CC: H separation | LC: L separation;<br>NC: M/H separation;<br>CC: H separation | LC: L separation;<br>NC, CC: M separation |
| | | P1: *; P2: Min;<br>P3, P4: Wide | P2: Min; P3: Wide ;<br>P4:Enhanced | P1: *; P2: Min;P3: Wide;<br>P4: Wide | P2: Min; P3: Wide;<br>P4: Enhanced | P3: Wide; P4:Enhanced |
| Minor Arterial | | H speed<br>H mobility-M access | L/M speed<br>M mobility-H access | M speed<br>M mobility-M access | L/M speed<br>M mobility-M/H access | L speed<br>M mobility-M/H access |
| | | LC: L separation;<br>NC: M separation;<br>CC: H separation | LC: L separation;<br>NC, CC: M separation | LC: L separation;<br>NC: M separation;<br>CC: H separation | LC: L separation;<br>NC, CC: M separation | LC: L separation;<br>NC, CC: M separation |
| | | P1, P2: Min<br>P3, P4: Wide | P2: Min; P3: Wide ;<br>P4:Enhanced | P1: *; P2: Min;P3: Wide;<br>P4: Wide | P2: Min; P3: Wide;<br>P4: Enhanced | P3: Wide; P4:Enhanced |
| Collector | | M speed<br>M mobility-M access | L speed<br>M mobility-H access | M speed<br>M mobility-H access | L speed<br>M mobility-H access | L speed<br>M mobility-H access |
| | | LC: L separation;<br>NC, CC: M separation | LC, NC: L separation;<br>CC: M separation | LC: L separation;<br>NC, CC: M separation | LC: L separation;<br>NC, CC: M separation | LC, NC: L separation;<br>CC: M separation |
| | | P1, P2: Min;<br>P3, P4: Wide | P2: Min; P3: Wide ;<br>P4:Enhanced | P1: *; P2: Min;P3: Wide;<br>P4: Wide | P2: Min; P3: Wide;<br>P4: Enhanced | P3: Wide; P4:Enhanced |
| Local | | M speed<br>M mobility-M access | L speed<br>M mobility-H access | L speed<br>L mobility-H access | L speed<br>L mobility-H access | L speed<br>L mobility-H access |
| | | LC, NC, CC: L<br>separation | LC, NC, CC: L<br>separation | LC, NC, CC: L<br>separation | LC, NC, CC: L<br>separation | LC, NC, CC: L<br>separation; |
| | | P1, P2: Min;<br>P3, P4: Wide | P2: Min; P3: Wide ;<br>P4:Enhanced | P1: *; P2: Min;P3: Wide;<br>P4: Wide | P2: Min; P3: Wide;<br>P4: Enhanced | P3: Wide; P4:Enhanced |

Speed, Mobility, Accessibility and Separation levels: H: High; M: Medium; L: Low
Bicycle Connectors: LC: Local; NC: Neighborhood; CC: Citywide
Pedestrian traffic levels: P1: rare/occasional; P2: low; P3: medium; P4: high
Pedestrian facility width: *: site specific considerations; Min: minimum; Wide: greater than minimum; Enhanced: wide for large congregating pedestrian groups
Pedestrian facility separation should be considered in conjunction with driver target speeds

Fig. 2 - Expanded FCS multimodal matrix by context and roadway type [12]

These users may then be applied to the corridor as overlays that add to the understanding of the total users for the roadway. When considering the application of transit and/or freight network overlays, information regarding the frequency, use, and importance of the individual routes within the overlay network is essential, as discussed below.

4.5.1. Transit networks

Transit routes are typically fixed and well-defined by the local transit agency to meet the demands of ridership. Additional resources are available to determine the best network and routing plans for transit facilities as well as guides to aid in the design of transit facilities [13]. It is imperative to incorporate transit facilities into the overall transportation network so that they can be considered in the context of the overall transportation network and not be viewed separately.

Increased recent ridership trends may require a closer examination of such overlays and their potential impacts on design. A closer coordination with transit agencies, which typically are independent from DOTs, is essential to properly define transit overlays for roadways where transit either exists or is anticipated to be located.