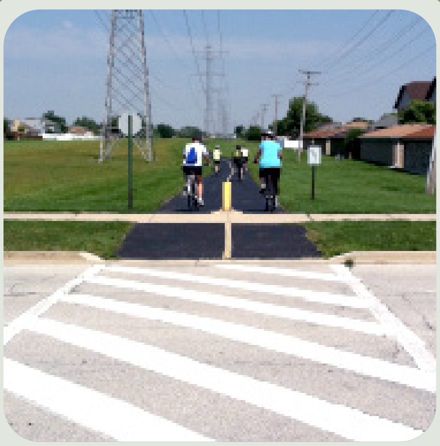
Complete Streets

Overall Design Concepts and Considerations

March 2015



This document is one component of the Complete Streets Toolkit, which is the result of a collaboration between the Chicago Metropolitan Agency for Planning, Active Transportation Alliance, and the National Complete Streets Coalition. The Toolkit is a guide for incorporating a Complete Streets approach into local planning, design, and construction. The entire Toolkit consists of seven components:

1) Complete Streets: The Basics
2) Policy Development and Adoption
3) Policy Implementation
4) Overall Design Concepts and Considerations
5) Facility Types
6) Select Treatments
7) Additional Resources

For more information and access to additional components of the Complete Toolkit, please visit the homepage at: http://www.cmap.illinois.gov/programs-and-resources/local-ordinances-toolkits/complete-streets.

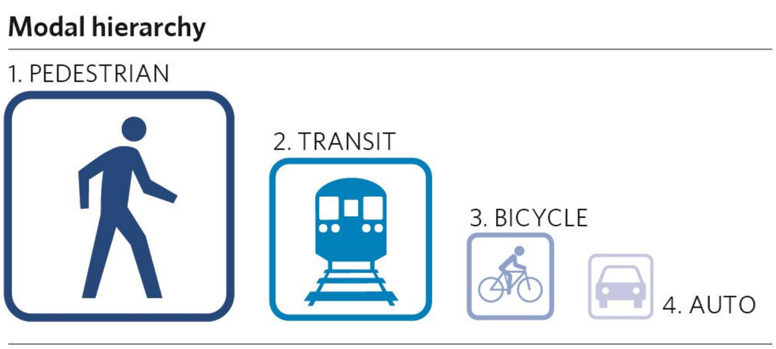
Table of Contents

Overall design concepts and considerations

Once a Complete Streets policy is adopted and a plan for implementing the policy is in place, a large part of the work and responsibility for making Complete Streets a reality shifts from policy makers to transportation planners and engineers. Successful implementation of Complete Streets entails rethinking roadway design concepts and considerations to fully accommodate all anticipated users. Such concepts represent "starting points" in the design process and are crucial to implementing a policy and achieving Complete Streets.

Modal Hierarchy and Prioritization

Modal hierarchy is a ranking of the relative importance of travel modes, determined in the initial phase of a roadway project, to clearly establish and state priorities for accommodation in design. While all travel modes must be considered when designing a street, the practice of assigning a mode hierarchy can assist the application of engineering judgment to design decisions, and help planners to address tradeoffs in different design alternatives. For example, limitations in right-of-way can force a planner to decide between a wider sidewalk and a buffered bike lane, or reducing the width of travel lanes to accommodate safer crossings. By determining a mode hierarchy at the project start, planners will have guidance on how to make those decisions based on overall project goals and scope. This practice serves as an alternative to traditional methods of roadway design optimization measures, such as vehicular capacity and Level of Service (LOS).



Source: City of Chicago, Complete Streets Chicago — Design Guidelines (2013).

There are two basic approaches to mode prioritization. One approach is to adopt a default modal hierarchy that is applied to all transportation projects within a jurisdiction. Each mode is ranked according to overall community goals such as mode-shift, safety, and community livability. Under this approach, deviating from default hierarchy would require special authorization.

Example of modal prioritization by context zone

AUTO BIKE TRANSIT WALK

CONTEXT ZONE MODE PRIORITIZATION	OVERALL			
	1	2	3	4
Urban Commercial/Mixed Use	WALK	TRANSIT	BIKE	AUTO
Urban Residential	WALK	BIKE	AUTO	TRANSIT
Urban Single Use	BIKE	AUTO	WALK	TRANSIT
Suburban Commercial	AUTO	TRANSIT	WALK	BIKE
Suburban Residential	WALK	AUTO	BIKE	TRANSIT
Suburban Mixed-Use	WALK	BIKE	TRANSIT	AUTO
Suburban Single Use	BIKE	AUTO	WALK	TRANSIT
Rural Residential/Agricultural	AUTO	BIKE	WALK	TRANSIT
Rural Village	WALK	AUTO	BIKE	TRANSIT

Source: Active Transportation Alliance.

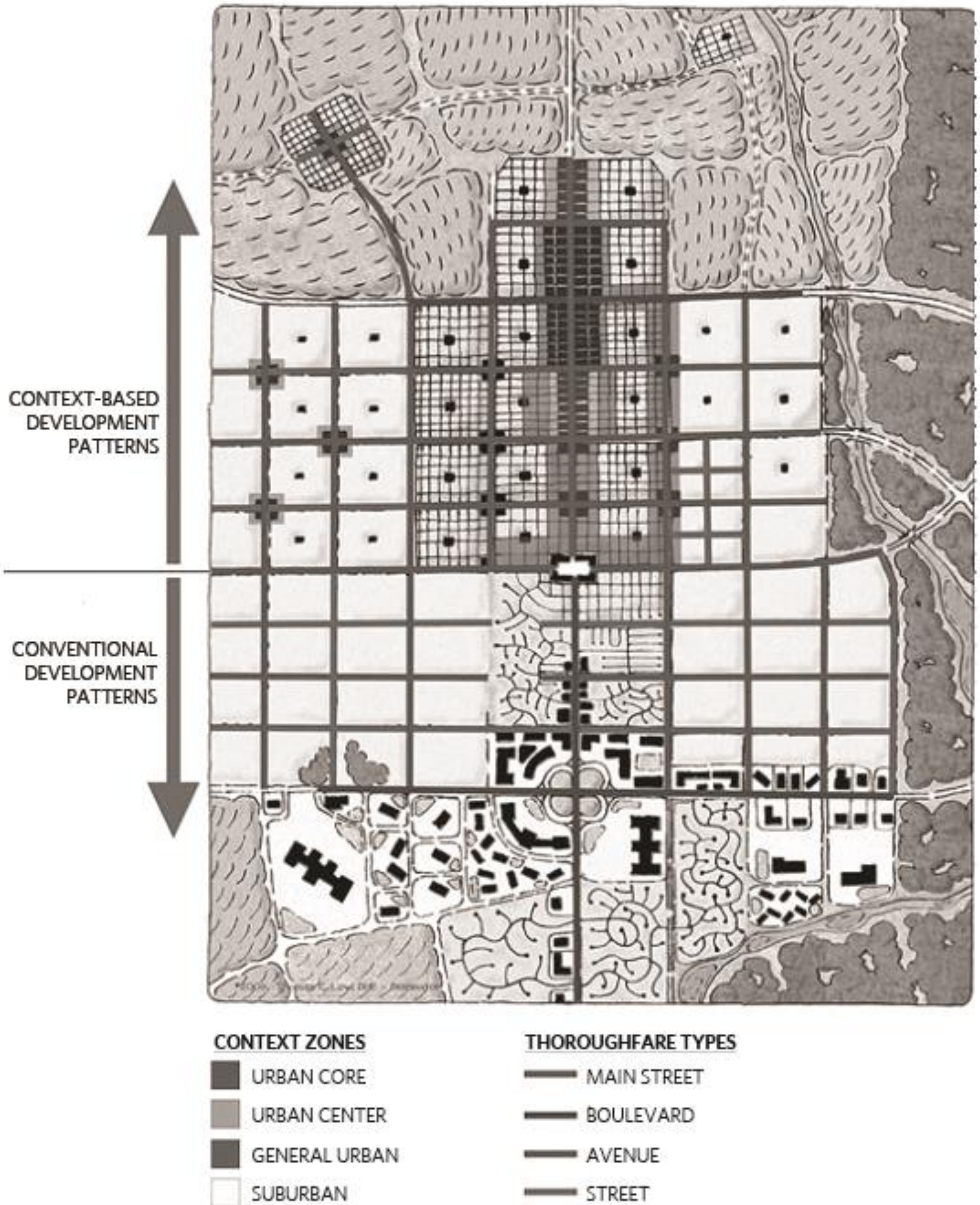
The second approach is to assign a mode hierarchy for each corridor on a project-by-project basis. Under this approach, land use context, street typology, and overall project goals are used to make this decision prior to design development. See below for resources on right-of-way allocation based on roadway typologies and land use context. The priority assignment represents a continuum of design considerations, not an absolute determinant.

Context Zones

Context zones are categories of development patterns that describe the general form, pattern, and character of a given area. Categories are based on land use density, intensity, massing, and other physical characteristics. There is a natural transition and progression of lot size, building spacing, and street patterns and density between rural and urban areas. For example, a rural development pattern tends to have more open space and distance between buildings, while a dense urban core has much less open space. Between these extremes, development patterns are divided into more subtle context zones, or transects: Natural to Rural, Suburban, Neighborhood, Center and Transit Oriented, and Downtown Core and Entertainment[1]. These land use context zones are the starting point for Complete Streets design; they help determine why and how people use any given roadway. They are also the first point of reference for determining a roadway typology.

[1] For more information on transects, see the ITE "Factsheet on the use of Context Zones and Thoroughfare Type in Design," at http://www.ite.org/css/FactSheet4.pdf.

Context Zone - ITE Designing Walkable Urban Thoroughfares

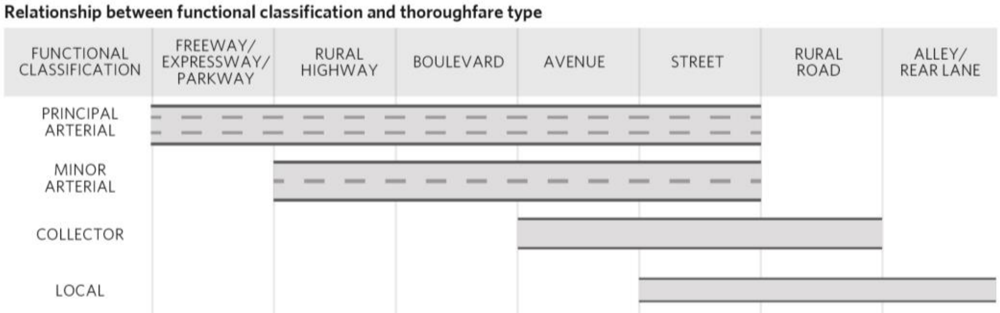


Sources: Thomas Low (DPZ) and Digital Media Productions.

Roadway Typologies

The assignment of roadway typologies supports design decisions that consider all modes, and can also help to determine mode hierarchy on a project-by-project basis. Traditionally, roadway typologies come in the form of functional classification. That is, a naming scheme is used to indicate the average daily traffic (ADT) and vehicle speeds, and to establish right of way. However, the Complete Streets approach goes further to assign typologies that reflect multimodal design implications. Naming schemes vary, but typically include Boulevards, Avenues, and Streets.

Relationship between functional classification and thoroughfare type



Source: Institute of Transportation Engineers (ITE), *Designing Walkable Urban Thoroughfares*.

Boulevard

- Higher vehicle capacity
- Faster vehicle speeds imply need for mode separation
- Wider roads offer opportunity for robust facilities

Avenue

- Moderate to high vehicle capacity
- Commercial corridors with on-street parking
- Space for simple facilities like bike lanes and sidewalks

Street

- Local, multi-movement facility
- Residential, or connectors to commercial areas
- Lighter traffic and slower speeds afford for simpler facilities

When considered together, context zone, roadway typology, and modal hierarchy are three core design concepts that assist in the design of roadways that accommodate all users and meet community Complete Streets goals.

General design characteristics of boulevards, avenues, and streets

URBAN THOROUGHFARE TYPE	BOULEVARD	MULTIWAY BOULEVARD	AVENUE	STREET
NUMBER OF THROUGH LANES	4 to 6	4 to 6	2 to 4	2
DESIGN SPEED (MPH)	35-40	30-40 (20 IN ACCESS ROADWAY)	30-35	30
OPERATING SPEED (MPH)	30-35	25-35	25-30	25
INTERSECTION SPACING	660 to 1,320 FEET	660 to 1,320 FEET (400 to 600 FEET FOR ACCESS LANES)	300 to 660 MILE	300 to 600 FEET
TRANSIT SERVICE EMPHASIS	EXPRESS AND LOCAL	EXPRESS AND LOCAL	LOCAL	LOCAL
MEDIAN	REQUIRED	REQUIRED	OPTIONAL	OPTIONAL
CURB PARKING	OPTIONAL	YES ON ACCESS ROADWAY	YES	YES
BICYCLE FACILITIES	BIKE LANES OR PARALLEL ROUTE			
FREIGHT MOVEMENT	REGIONAL TRUCK ROUTE	REGIONAL ROUTE/ LOCAL DELIVERIES ONLY ON ACCESS ROADWAYS	LOCAL TRUCK ROUTE	LOCAL DELIVERIES ONLY

Source: Institute of Traffic Engineers, Designing Walkable Urban Thoroughfares.

More information about modal hierarchy, land use context, and roadway typology can be found in Chapter 2 of the Active Transportation Alliance's Complete Streets Complete Networks design manual: http://atpolicy.org/Design.

Design Controls

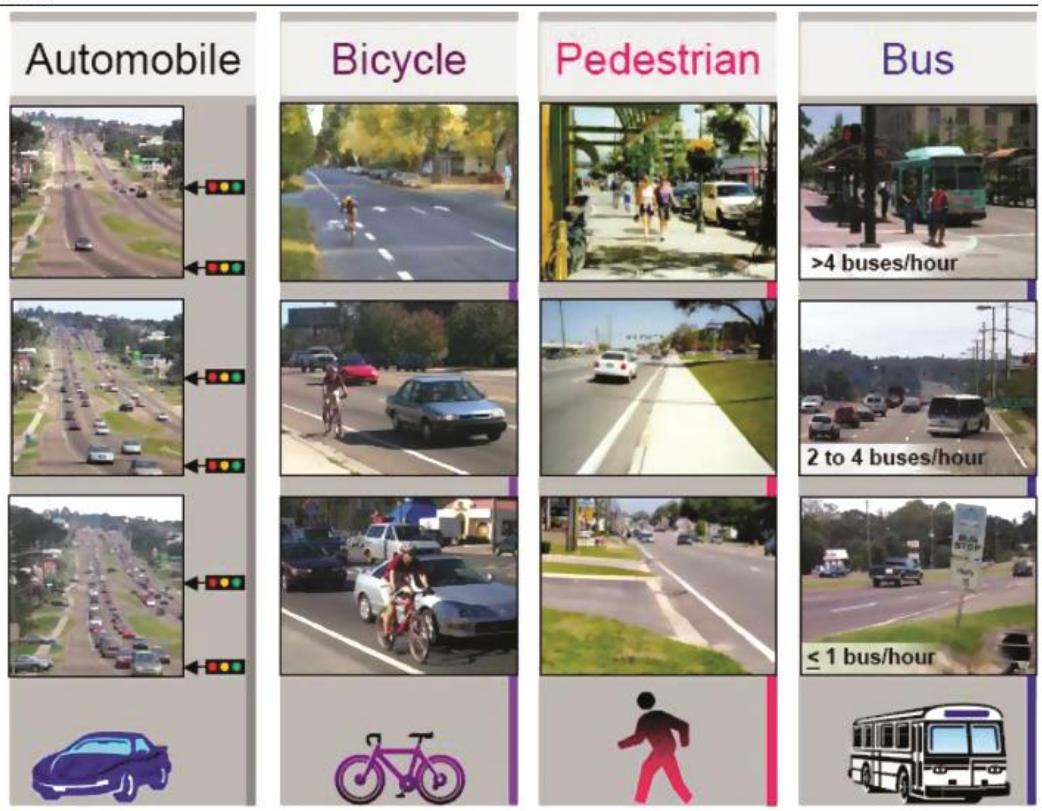
Design controls are the parameters around which engineers select geometrics for roadways. These parameters and how they are used may be different for each project, but should generally reflect community-wide goals and standards. For example, when a community adopts a Complete Streets policy, a crash reduction goal, or mode shift target, they may wish to establish project design controls and define their utilization and function in a manner that maximizes walkability.

One example of a common design control is that of "design vehicle." That is, the vehicle-type for which an engineer selects geometrics for lane widths and turning radii. Larger vehicles require wider turning radii than smaller vehicles do. However, a wider turning radius can encourage all traffic to speed around corners, creating unsafe crossing conditions for pedestrians. While the conventional approach would be to promote maximum vehicular throughput by selecting a large design vehicle, the Complete Streets approach is to use a smaller design vehicle, whenever possible, based on the land use context.

Other types of design controls include:

- Design speed (replaced by *target speed* in a Complete Streets approach.[2])
- Functional classification (replaced, in part, by *street typologies* in a Complete Streets approach, see above)
- Vehicle performance (acceleration and deceleration)
- Driver performance (age, reaction time, driving task, guidance and so forth)
- Traffic characteristics (volume and composition)
- Capacity and vehicular level of service
- Access control and management
- Pedestrians and bicyclists
- Safety

For more information about context sensitive approach to establishing design controls, please see Chapter 7 of the ITE's *Designing Walkable Urban Throroughfares: A Context Sensitive Approach* at http://www.ite.org/css/online/DWUT07.html.



Multimodal LOS

Source: FDOT Quality/Level of Service Handbook.

[2] See the discussion of design and target speed on page 100 of the City of Dallas' Complete Streets Design Manual. (draft), at http://dallascityhall.com/development_services/pdf/DCS-Design-Manual_DRAFT_091713.pdf.

Street and Lane Widths

The Complete Streets design approach encourages narrower vehicle lanes and street widths, where possible and appropriate, to create a safer street network for active travel. Wide streets and vehicle lanes typically encourage high vehicle speeds, which subsequently increases the severity of crashes when they occur. These conditions also present significant barriers to walking and biking. Crossing wide roads with multiple lanes and traveling alongside fast moving vehicle traffic creates real and perceived dangers for pedestrians, especially children and people with disabilities.

Over-built roads are a result of an auto-centric focus in transportation systems design. For several decades, transportation planners have routinely discouraged narrower lane width based on an assumption that narrow lanes will cause traffic congestion and delay and/or are unsafe. However, increasingly, research indicates that there is, in most cases, no significant difference in safety (crash rate) or delay when going from the (common standard) 12 foot wide lane down to an 11 or even, in certain cases, 10 foot wide lanes on multilane urban arterials where operating speeds are 45 mph or lower. Moreover, the source often cited by engineers for using 12 foot lanes – AASHTO's *Green Book* – acknowledges that narrower (10 and 11 foot) lanes are typically adequate for such roads, and in fact offer advantages for pedestrians, cyclists, and even motor vehicles.[3] Another reason for narrower lanes that some agencies and municipalities find compelling is the cost savings resulting from less material when constructing or rehabilitating/repaving roads. Communities that want to create a network of Complete Streets should look to street and lane width as an opportunity for traffic calming and for better accommodating walking and bicycling in routine resurfacing projects. Establishment of pedestrian friendly street width standards in the regulation of new residential and commercial developments will also promote walkability goals.

More in-depth discussion of street and lane widths can be found at the Project for Public Spaces website: http://www.pps.org/reference/rightsizing/, and in the article, "The Influence of Lane Widths on Safety and Capacity: A Summary of the Latest Findings" at http://nacto.org/docs/usdg/lane_widths_on_safety_and_capacity_petritsch.pdf.

[3] See the article, "The Influence of Lane Widths on Safety and Capacity: A Summary of the Latest Findings" by Theodore Petritsch, P.E. PTOE at http://nacto.org/docs/usdg/lane_widths_on_safety_and_capacity_petritsch.pdf. See also the study, "Relation of Lane Width to Safety for Urban and and Suburban Arterials," by I. Potts, D. Harwood, and K. Richard, at http://www.smartgrowthamerica.org/documents/cs/resources/lanewidth-safety.pdf. For a more informal argument for narrow lanes, see J. Speck's article for The Atlantic CityLab, at http://www.citylab.com/design/2014/10/why-12-foot-traffic-lanes-are-disastrous-for-safety-and-must-be-replaced-now/381117/.

Source: National Association of City Transportation Officials (NACTO), *Urban Street Design Guide*.

Connectivity and Block Length

A strong network of Complete Streets provides short, direct walking routes and ample opportunities for safe street crossings. This is best facilitated by a gridded street pattern of short block lengths. Intersections are the most natural place for crosswalks, and streets with longer block lengths provide fewer intersections and fewer opportunities for pedestrians and bicyclists to safely cross.

Long block lengths commonly form the border around conventional suburban subdivisions. Within those subdivisions, streets often consist of long, winding segments and cul-de-sacs. This street pattern increases travel distance for residents who need to access destinations outside their neighborhoods such as schools and retail shopping, regardless of their transportation mode. With poor street connectivity, reaching a destination just a few hundred feet away, as the crow flies, could require a journey of a half mile or more.

Furthermore, on a busy and/or wide corridor with infrequently spaced intersections, a pedestrian standing directly across the street from his or her destination may have to walk a quarter mile or more down the road to reach a safe crossing. Mid-block crosswalks can be a solution, but they often require multiple, more robust treatments to emphasize the presence of pedestrians and bicyclists to motorists and to achieve reasonable safety for them – especially on higher volume, higher speed corridors.

An important part of implementing Complete Streets in local communities involves the establishment of connectivity standards in the regulation and review of new development. See below for further resources.

Additional discussion and helpful links related to connectivity and block length can be found on the NCSC's website at:
http://www.smartgrowthamerica.org/complete-streets/implementation/factsheets/networks/

Examples of a conventional suburban network and a traditional urban grid network

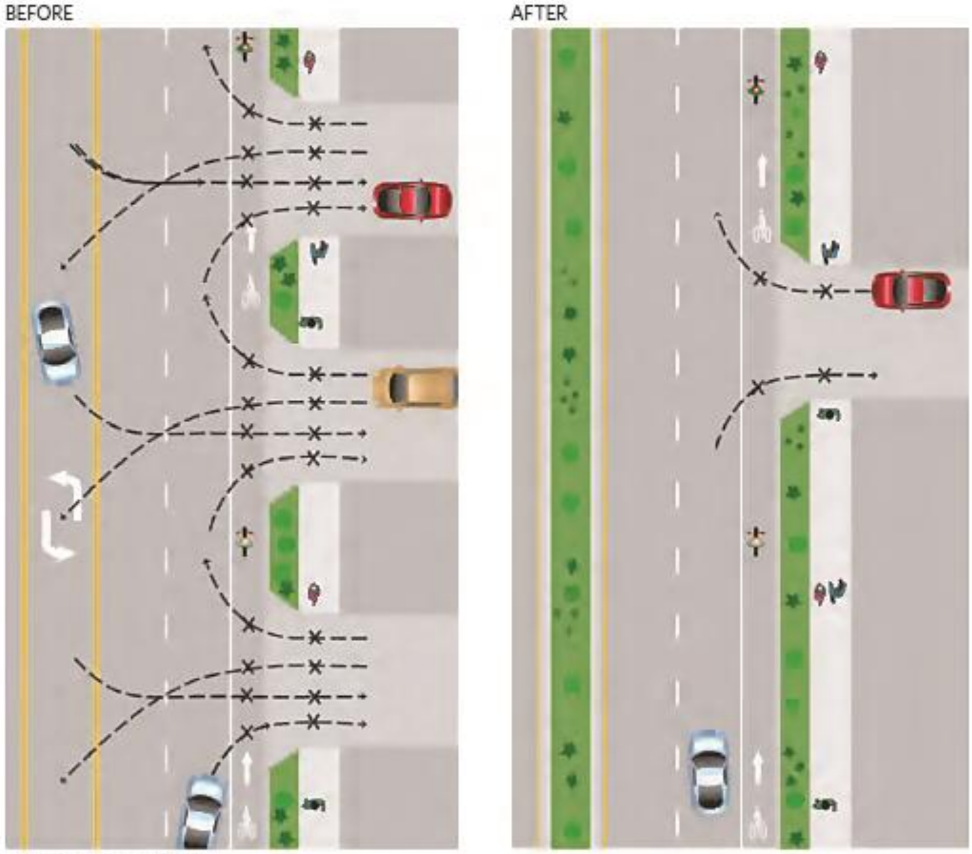
Source: Active Transportation Alliance.

Access Management

Access management is a technique for reducing conflict points between pedestrians, bicyclists, and motorists at driveways and intersections. There are two main approaches for access management.

The first approach is focused on simply limiting the number of driveways and parking lot access points that carry vehicular traffic across sidewalks and/or bikeways as these roadways enter commercial or other types of developments. For example, consolidating (i.e. creating shared) driveways at larger shopping centers or designing the shopping centers with parking at the rear of buildings can reduce the number of conflict points between pedestrians, bicyclists, and motor vehicles.

Another approach to access management is to limit turning movements (especially left turns) through the construction of physical barriers such as raised center medians or through regulatory signage. Medians that limit some or all vehicle access can still maintain connectivity for people on foot or bike. For example, a raised median could prevent vehicles from turning off of a busy avenue onto a residential side street, but still provide a human scale cut-through for pedestrian or bicycle access. These strategies are particularly useful for communities that are encouraging new development.



Source: Michael Weisbart.

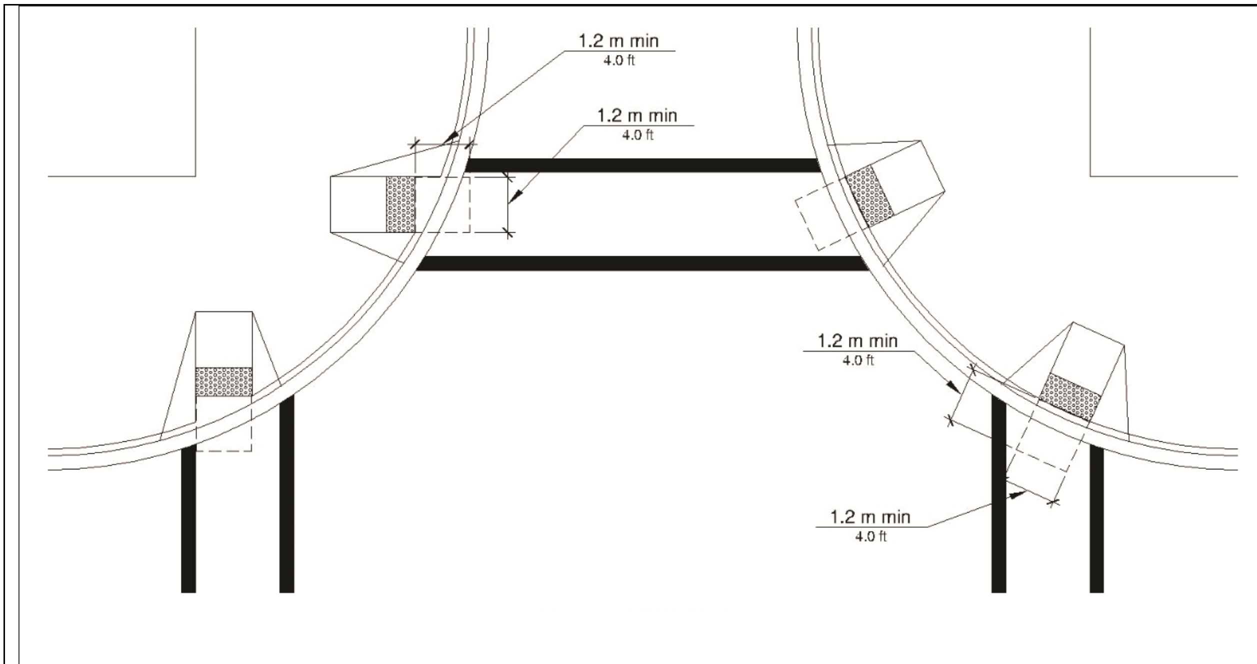
More information on access management is available at the FHWA website: http://www.ops.fhwa.dot.gov/access_mgmt/.

ADA Accessibility

Designing a facility for pedestrians means designing it for people with disabilities or mobility impairments. Such impairments can be temporary, such as might result from a broken leg or other injury, or permanent. The Illinois Compiled Statutes, in the Pedestrians with Disabilities Safety Act, defines a pedestrian with a disability as any person, "who may require the use of a mobility device (support cane, walker, crutches, wheelchair, scooter, or other device), service animal, or white cane to travel on the streets, sidewalks, highways, and walkways of this State."[4] Under the 1990 American's with Disabilities Act (ADA), any new or altered facilities must be made accessible, and any municipality with 50 or more employees is required to

[4] See http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=3252&ChapterID=49.

develop a Transition Plan, to bring their community into compliance.[5] Compliance with the ADA is inherent in the Complete Streets project development approach, which rests on the principle that transportation agencies and their partners should create roadway designs that serve all anticipated users.



Source: United States Access Board (USAB), *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right of Way.*

One of the most common examples of ADA considerations in roadway design is the accessible curb ramp. To support access by people using wheelchairs and other assistive devices, a curb ramp's running slope should not exceed 8.33 percent. There should be a level landing at both the top and bottom of the ramp, which are large enough for a wheelchair to safely turn and maneuver. Tactile strips with truncated domes should be properly placed to alert people with vision impairments of their proximity to vehicle travel lanes and of the transition from pedestrian zone to motor vehicle travel way.

U.S. Census data from the American Community Survey indicates that approximately 5.3 percent of residents in northeastern Illinois have an ambulatory disability. When all other forms of disability (hearing, vision, cognitive, etc.) are added in, then the percentage rises to 9.4 percent. Moreover, many more persons have temporary disabilities due to accidents.

For more resources and information on ADA, see the following websites:

The U.S. Department of Justice houses resources and design standards on their website at: http://www.ada.gov/

[5] See CMAP's Community Briefing Paper on ADA Transition Plans, available online at http://www.cmap.illinois.gov/programs-and-resources/local-ordinances-toolkits/ada-transition-plans.

The U.S. Access Board has proposed Public Rights-of-Way Accessibility Guidelines (PROWAG), which are recommended best practice by FHWA. The proposed guidelines can be viewed at http://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way.

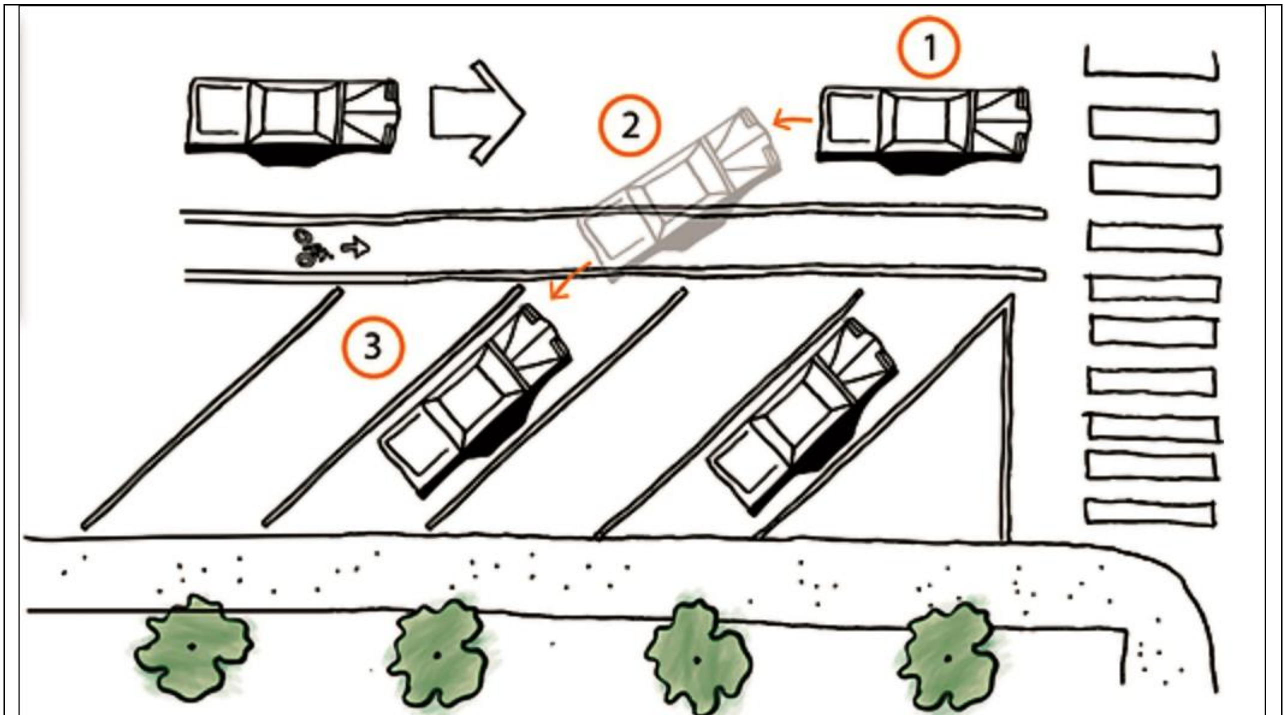
CMAP's community briefing paper "ADA Transition Plans for Your Community" can be downloaded at http://www.cmap.illinois.gov/programs-and-resources/local-ordinances-toolkits/ada-transition-plans.

America Walks also provides a number of supporting resources online: http://americawalks.org/advocates/best-practices-and-advocacy-tips/planning/#1

On-street parking

The public ROW at a curb dedicated to on-street vehicle parking – which can have both pros and cons for communities – deserves careful design and policy consideration in the context of Complete Streets. Parking is critical to support local businesses, and on-street parking is more valuable than off-street parking because the same space can serve multiple users and multiple businesses. Parked cars along a busy roadway offer protection for pedestrians and increase the feeling of safety by providing a physical barrier or buffer area to the moving vehicles. On-street parking can also function as a traffic calming measure on roads that are excessively wide.

When road width, characteristics, and context allow for it, back-in/reverse-angle parking is particularly useful for traffic calming, as it eliminates the parking blind spot and allows drivers to see the traffic that they are pulling out into, making it safer for bicyclists and other roadway users. On wide streets with high parking demand, changing from parallel parking to angled parking can increase supply by as much as 50 percent. While head-in angled parking is more familiar to most motorists than reverse-angle parking, it is more dangerous for bicyclists, requires drivers to blindly back into traffic, and places people loading the trunk close to the path of moving vehicles. If located too close to an intersection, parked vehicles – whether angled or parallel –can potentially block access to crosswalks and prevent pedestrians from having a clear view of traffic, or from being seen.



Source: City of Boulder, Colorado

Striping parallel parking spaces may make it easier for drivers, but it will take away from the total supply, since striped spaces are larger than the typical vehicle. The placement of parallel parking should consider the safety of cyclists who may ride between moving traffic and parked cars in the "door zone" of the parked vehicles. Drivers may not check for bicyclists before opening their car door, which can result in serious or even fatal bicycle crashes

The overall design and management of parking affects the safety and comfort of cyclists and pedestrians. The most important parking management tool is ensuring parking availability by setting appropriate prices for high-demand spaces using meters, kiosks, mobile phone apps, and/or permits. Prices that are too high will deter potential drivers from using the spaces, which can result in losing the protective barrier for pedestrians, and encourage drivers to speed. Prices that are too low will result in a lack of parking availability, which harms businesses and can add to traffic congestion as drivers circle the block in search of a space. Simply increasing the amount of parking, without consideration of demand and pricing, can encourage more driving, leading to congestion, more crashes, air pollution, and fewer people walking, cycling, and taking transit. Balancing the needs of automobile drivers, including parking, with the needs of bicyclists and pedestrians can help create a more Complete Street.

More information on parking management strategies can be found here:
http://www.cmap.illinois.gov/programs-and-resources/local-ordinances-toolkits/parking

More information about back-in angled parking can be found in this paper:
http://www.hampdenhappenings.org/HCC_WEB/Zoning_Pdf/RAP/San_Francisco.pdf

Transit

Transit systems represent more than just a mode of travel; because most transit trips are also walking trips, every transit stop is a destination in and of itself that must be accessible to pedestrians, including those with disabilities. Access to transit is also supported when transitways link to local bikeway routes, when secure bike parking is provided at transit stations, or when transit agencies enable passengers to bring their bicycles with them onto buses or trains.

Source: National Association of City Transportation Officials (NACTO), *Urban Street Design Guide*.

There is great need for coordination on service stop placement and safe, convenient street crossing locations. For most round-trip bus journeys, a passenger boards a bus on one side of a street, and then alights on the opposite side at the end of their return trip. This can be problematic with service stops placed at mid-block, without a safe crossing nearby. The placement of bus stops and crosswalks are crucial to passenger safety. Every bus stop should be treated as a crossing location for passengers.

Prioritizing access to transit and safe, convenient connections for pedestrians can be challenging because most transit systems are not owned and operated by the municipalities they serve, particularly in suburban communities. Thus, the agencies planning transit routes and stops are not the same ones building the sidewalks and the crossings that transit riders need. Additionally, many transit shelters are owned and maintained by private firms that sell advertising space on the structures, creating a third entity with whom to coordinate.

Communities that are committed to Complete Streets should foster partnerships with transit agencies to ensure that any new service stops are planned to boost safety and access for transit users, to maximize any potential funding opportunities, and to communicate priorities and access standards for privately owned transit shelters.

More discussion and helpful links are available at the NCSC's transit web page: http://www.smartgrowthamerica.org/complete-streets/complete-streets-fundamentals/factsheets/public-transportation/.

In addition, see Pace Suburban Bus' recently published "Transit Supportive Guidelines" at: http://pacebus.com/guidelines/index.asp

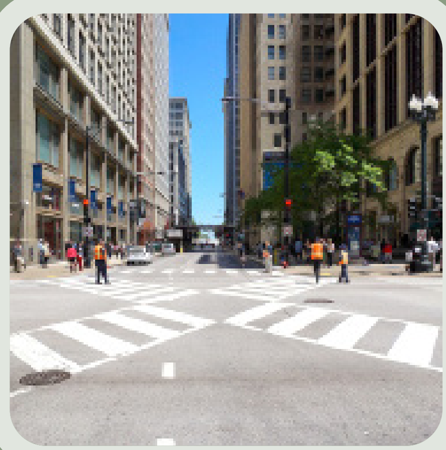
For an example of the successful integration of a transit rail system with bicycle travel, see the Bay Area Rapid Transit (BART) "Bikes on BART" web page, at http://www.bart.gov/guide/bikes.

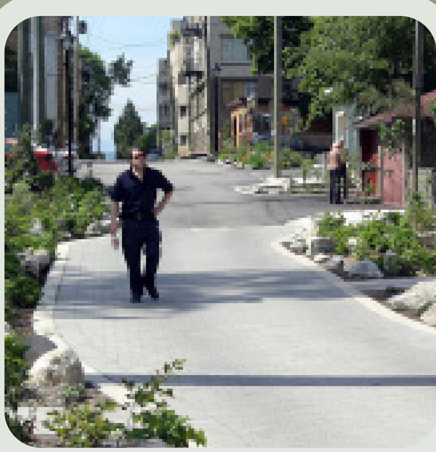
Chicago Metropolitan
Agency for Planning

233 South Wacker Drive, Suite 800
Chicago, IL 60606

312-454-0400
info@cmap.illinois.gov

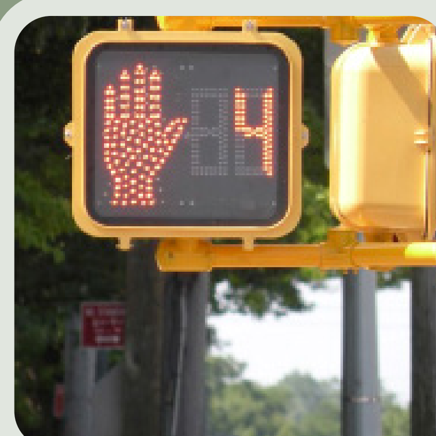
www.cmap.illinois.gov





Front cover image credits, top to bottom:
Dan Burden, pedbikeimages.org; Dan Burden, pedbikeimages.org; Flickr, Complete Streets; Active Transportation Alliance; Peter Speer, pedbikeimages.org; Dan Burden.

Back cover image credits, top to bottom:
paulkimo9, Flickr; National Association of City Transportation Officials (NACTO) Bike Design Guide; Ron Bloomquist, pedbikeimages.org; Zolk, Flickr; Dan Burden, pedbikeimages.org; Flickr, NYC Department of Transportation.



FY15-0085